SPECIAL PROVISIONS
FROM THE VICINITY OF ROUTE 36 STA 100+00
TO THE VICINITY OF OCEAN AVENUE STA 129+44.73
CONTRACT NO. 012961654
GRADING, PAVING AND STRUCTURES
BOROUGH OF HIGHLANDS AND SEA BRIGHT
MONMOUTH COUNTY

AUTHORIZATION OF CONTRACT
The Contract for this Project is authorized by the provisions of Title 27 of the Revised Statutes of New Jersey and supplements thereto, and Title 23 of the United States Code - Highways.

SPECIFICATIONS TO BE USED
The 2001 U.S. Customary English Standard Specifications for Road and Bridge Construction, of the New Jersey Department of Transportation as amended herein will govern the construction of this Project and the execution of the Contract.

These Special Provisions consist of the following:

Pages 1 to 412 inclusive for General, Road, and Bridge Provisions.


Payroll Requirements for 100 Percent State Projects, dated January 2007.


The Contractor shall pay the minimum wage rates determined by the New Jersey Department of Labor.

State wage rates may be obtained from the New Jersey Department of Labor (Telephone: 609-292-2259) or by accessing the Department of Labor’s web site at http://www.nj.gov/labor/lsse/lspubcon.html The State wage rates in effect at the time of award will be made a part of this Contract, pursuant to Chapter 150, Laws of 1963 (NJS A 34:11-56.25, et seq.).

In the event it is found that any employee of the Contractor or any subcontractor covered by the Contract, has been paid a rate of wages less than the minimum wage required to be paid by the Contract, the State may terminate the Contractor’s or subcontractor’s right to proceed with the Work, or such part of the Work, as to which there has been a failure to pay required wages and to prosecute the Work to completion or otherwise. The Contractor and its sureties shall be liable to the State for any excess costs occasioned thereby.
DIVISION 100 - GENERAL PROVISIONS

SECTION 101 - GENERAL INFORMATION

101.01 General.

THE FOLLOWING IS ADDED:

Pursuant to NJSA 27:1B-21.6, the Commissioner intends to enter into a multi-year contract for the advancement of the Project. Although the multi-year contract will pledge funds anticipated to be appropriated for the Project by the Legislature, payment of the moneys pledged is subject to the availability of funds in the fiscal year (FY) in which the funds are to be appropriated. Only amounts appropriated by law may be expended.

The Commissioner intends to proceed expeditiously with the Project. However, there is no assurance that the Annual Appropriations Act will contain an appropriation for the Project. The Legislature has no legal obligation to make such an appropriation. Failure by the Legislature to appropriate funds sufficient to advance the Project will not constitute a default under, or breach of, any contract entered into by the State for the construction of the Project. However, if the State terminates the Contract or suspends work under the Contract because the Legislature has failed to appropriate sufficient funding to advance the Project, the parties to the Contract will retain their rights pursuant to the suspension of work and termination of Contract Provisions of the Project specifications; except as indicated below.

The Contractor shall not expend or cause to be expended any sum in excess of the amount allocated in the current fiscal year's Capital Program (as specified below). The Department will notify the Contractor when each level of additional funding has been appropriated by the Legislature. Any expenditure by the Contractor that exceeds the amount actually appropriated is at the Contractor's risk and the Contractor waives any right to recover any sum in excess of that appropriated amount even if the State terminates or suspends work under the Contract because the Legislature has failed to appropriate sufficient funds to advance the Project.

It is anticipated that 18,171,000 million dollars will be available for construction of this Project during State FY2008.

It is anticipated that 45,010,000 million dollars in additional funds will be provided during State FY 2009.

It is further anticipated that the balance of the funds necessary to complete the Project will be provided during State FY2010

It should be noted that the State FY begins July 1 of the previous calendar year.

101.03 Terms.

THE FIRST SENTENCE IS CHANGED TO:

When the following terms are used in the Contract Documents, the intent and meaning shall be strictly construed as follows:

THE FOLLOWING TERMS ARE ADDED:

ADDITIONAL COMPENSATION. A monetary payment(s), sought by the Contractor, premised upon (1.) an adjustment or modification to the Contract pay item(s) for particular work or (2.) any or all forms of compensation over and above that which is specifically provided under the various individual Contract Pay Items or Contract payment provisions.

COMPLETION OF THE CONTRACT. The event termed “Completion of the Contract”, under the Specifications and the Contractual Liability Act NJSA 59:13-1 et seq., shall be deemed to have occurred as of the date the Contractor accepts or accepts with reservation of specific claims, in writing in accord with forms supplied by the Department, the Final Certificate issued by the Department or the 31st day after issuance of said Final Certificate by the Department, whichever event may be the first to occur.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
CLAIM. The Contractor has reason to believe it is entitled to additional compensation and/or an extension of contract time, in accordance with and subject to the Contract Documents and the provisions of the Contractual Liability Act, N.J.S.A. 59:13-1 et seq., arising out of or relating to the happening of an event, thing or occurrence or an act or failure to act by the Engineer. A claim accrues when it arises, meaning when a situation or occurrence takes place or comes about which has or possesses the potential to support or become the basis for additional compensation and/or an extension of time.

DISPUTE (AS TO A CLAIM). A disagreement between the Department and the Contractor with regard to the Work or Contract Documents arising out of a claim by the Contractor for additional compensation or an extension of time.

FINAL CERTIFICATE. It is the final payment document that sets forth the total amount payable to the Contractor, including therein an itemization of said amount segregated as to Pay Item quantities, Extra Work, and any other basis for payment; it also includes therein any retainage to be released and all deductions made or to be made from prior payments as required pursuant to the provisions of the Contract Documents, which may result in either a Final Payment to the Contractor or a Credit (payment) due the Department.

NON-BINDING MEDIATION. The fourth and final step in the Department’s Contractual Claim Resolution Process for claims arising under the Contract utilizing a non-binding mediation forum wherein an independent mediator is engaged in an attempt to resolve a claim presented by a Contractor.

PARCEL. Property to be acquired for transportation purposes, described by metes and bounds.

SECRETARY, DEPARTMENT CLAIMS COMMITTEE. The individual employed by the Department who gathers information and provides administrative assistance to the members of the Department Claims Committee. This individual is the conduit between the Department Claims Committee members and the Contractor. Contact by the Contractor regarding any issue involving the Claims Committee or Mediation shall be through the Secretary.

THE FOLLOWING TERMS ARE CHANGED:
DEPARTMENT CLAIMS COMMITTEE. A contractual body available to review and resolve claims that arise under the Contract. The Committee consists of three voting members with the Director of Design Services as the chairperson, one member is the Department’s Chief Financial Office, and one member is selected from the other directors within Capital Program Management. Additional non-voting members are a Deputy Attorney General, the Secretary of the Department Claims Committee, and a member of the Federal Highway Administration (for federally funded projects).

DESIGN UNIT. The term “Design Unit” means the Department’s consultant engineering firm, the in-house design unit(s), or both that prepared the Contract Documents for a project. The design unit(s) for any particular project shall be as designated by letter to the awarded Contractor.

EXTREME WEATHER CONDITIONS. When, solely as a result of adverse weather, the Contractor is not able to work, the Contractor is entitled to claim that progress of the Work has been affected by extreme weather conditions and may seek an extension of Contract Time consistent with the provisions of Subsection 108.11.

HOT MIX ASPHALT (HMA) PAVEMENT. The combination of base course, intermediate course, and surface course of hot mix asphalt.

ON-DUTY POLICE. The term “on-duty” with regard to municipal police shall mean that the work of providing traffic safety services shall be an extension of regular employment for, and sanctioned by, the municipality, even if it is on an overtime pay rate basis. The municipal police, while so working, shall be covered by the municipality’s liability insurance coverage; and must have successfully completed a traffic safety program approved by the Department.

PAVEMENT STRUCTURE. The combination of surface, intermediate and base courses, and when specified, a subbase course, placed on a subgrade to support the traffic load and distribute it to the roadbed (see Figure 101-1). These various courses are defined as follows:

1. Surface Course. One or more layers of specified material of designed thickness at the top of the pavement structure.
2. *Intermediate Course.* One or more layers of specified material of designed thickness placed on the base course.
3. *Base Course.* One or more layers of specified material of designed thickness placed on the subgrade or subbase.
4. *Subbase.* One or more layers of specified material of designed thickness placed on the subgrade.

**PLANS.** The approved plans, profiles, typical sections, cross-sections, approved working drawings, and supplemental drawings, or exact reproductions thereof, which show the location, character, dimensions, quantities, and details of the Work to be done. This includes the latest version of all Standard Construction Details in effect at the time of Advertisement. Certified working drawings are not plans and not part of the Contract Documents.

**PROPOSAL:** The term “Proposal” means the offer of a Bidder, properly signed and guaranteed, to perform the Work for the prices quoted therein.

**PROPOSAL FORM:** The term “Proposal form” means the Department approved proposal form produced from the Expedite software downloaded from the Department’s Bid Express web site at http://www.bidx.com, prepared and submitted for the Work.

**REGIONAL DISPUTE BOARD.** A three-member Board, comprised of one member from the Division of Project Management, one member from the Bureau of Construction Engineering, and the Regional Construction Engineer (Chairperson), that is available under the terms of the Contract to review Disputes which have not been resolved by the Resident Engineer.

**REMEDIATE.** The term “remediate” means the process that is approved by the New Jersey Department of Environmental Protection to address all regulated discharges.

**SPECIFICATIONS.** The compilation of provisions and requirements for the performance of prescribed work contained in the Standard Specifications, as supplemented by the Supplemental Specifications and Special Provisions, and modified by Addenda which, before the receipt of bids, are transmitted to prospective Bidders.

1. *Standard Specifications.* The term “Standard Specifications” means the 2001 Standard Specifications for Road and Bridge Construction of the New Jersey Department of Transportation, which has been approved for general application and repetitive use.
4. *Electrical Materials Specifications.* Approved standards for electrical materials, equipment, and installations that are in addition to the above specifications.

**SUBSTANTIAL COMPLETION.** The term “Substantial Completion” means the point at which the performance of all Work on the Project has been completed except landscaping items (including the planting of trees, shrubs, vines, ground covers, and seedlings), final cleanup, and repair of unacceptable work, and provided the Engineer has solely determined that:

1. The Project is safe and convenient for use by the public, and
2. Failure to complete the Work and repairs excepted above does not result in the deterioration of other completed Work; and provided further, that the value of landscaping work remaining to be performed, repairs, and cleanup is less than two percent of the Total Adjusted Contract Price.

**THE FOLLOWING TERMS ARE DELETED:**

**ADDENDA**

**COMPUTER DISK**

**CLAIMS REVIEW BOARD**

**DISPUTE**

**ROUTE 36 OVER THE SHREWSBURY RIVER**

**HIGHLANDS BRIDGE**

**MONMOUTH COUNTY**
101.04 Inquiries Regarding the Project.
THE FOLLOWING IS ADDED:

Inquiries regarding the various types of work of this Contract shall be directed to the following representatives of the Department having offices at P.O. Box 600, Trenton, New Jersey 08625, or such other individuals as may hereafter be designated:

1. Before Award of the Contract. All inquiries shall be e-mailed directly to the Bureau of Quality Assurance at QATEAM6@dot.state.nj.us

All inquiries shall include the following:
   a. Name of the company;
   b. Contract number and project description
   c. Specifics of the inquiry, including anticipated impacts.

The deadline for submitting inquiries will be 12:00 noon on the 3rd STATE BUSINESS DAY prior to the bid date.

The Department will investigate the information provided in the inquiry and then respond through an addendum only.

Requests for postponement of bids will not receive a response. The Department will issue an addendum postponing bids if warranted.

2. After Award of the Contract. All inquiries shall be directed to the Resident Engineer through the following Regional Construction Office:

   Central
   Mr. John Szafranski, Regional Construction Engineer
   100 Daniels Way
   Freehold, NJ 07728
   Telephone: 732-308-4074

SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS
THE ENTIRE SECTION IS CHANGED TO:

102.01 Qualifications to Bid.
The Department will not accept bids from Bidders who fail to meet all of the following criteria:

1. The Bidder has been prequalified according to Regulations Covering the Classification of Prospective Bidders as required by N.J.S.A. 27:7-35.1 et seq.
2. Before delivery of the bid the Bidder has disclosed ownership as required by N.J.S.A. 52:25-24.2.
3. At the time the bid is delivered, the Bidder has an effective maximum and project ratings of not less than the amount of its bid.
4. If the Bidder is a corporation not incorporated in the State, the Bidder has been authorized to do business in the State as required by N.J.S.A. 14A:15-2 et seq.
5. For wholly State funded projects, the Bidder is in compliance with N.J.S.A. 19:44A-20.13 et seq. (P.L. 2005, c.51).
6. For wholly State funded projects, the Bidder has a valid business registration with the Division of Revenue in the New Jersey Department of Treasury as required by N.J.S.A. 52:32-44.
7. For wholly State funded projects, the Bidder has a valid, current registration with the New Jersey Department of Labor, Division of Wage and Hour Compliance as required by “Public Works Contractor Registration Act,” N.J.S.A. 34:11-56.48 et seq.

The New Jersey Department of Transportation has established a new work type, #39, which reads:

#39 – Precast Segmental Bridge Construction

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
This work shall consist of construction of a precast segmental box girder superstructure, precast box piers, and associated bridge work. The construction shall be performed by the balanced cantilever method of construction. The contractor must demonstrate experience in having constructed at least one precast segmental concrete box girder bridge by the balanced cantilever method within the last ten years and have on their payroll or have a letter of intent to employ, three individuals with the following requirements:

- Project Manager or Assistant Project Manager who has constructed a precast segmental concrete box girder superstructure and precast box piers in the past ten years.

AND,

- Erection Superintendent or Assistant Erection Superintendent who has erected a precast segmental concrete box girder superstructure and precast box piers in the past ten years.

AND,

- Casting Superintendent who has managed the production of precast concrete box girder segments and precast pier segments in the past ten years.

In order to be eligible to submit a bid proposal for this project, a contractor must be prequalified under this new work type #39 classification. The contractor’s work type #39 classification must be in effect as of the bid opening date, or the bid will not be accepted.

- Contractors are reminded that the effective date of classification is fifteen (15) days after receipt of all the required information, in accordance with N.J.S.A. 27:7-35.5 and N.J.A.C. 16:44-1.9. Contractors interested in this project are encouraged to apply for work type #39 classification as early as possible to ensure that classification is in effect as of the bid opening.

Contractors who demonstrate segmental bridge construction experience with a letter of intent to employ any of the personnel listed above, must provide the NJDOT with proof that such individuals have been hired and are on the Contractor’s payroll before the Contract is awarded.

102.02 Bidder Registration and Downloading of the Bid Documents.

This project is being bid by use of an electronic bidding process. Electronic bidding information is available on the Department’s website. Registration and a subscription fee are required to access the bid documents. The Bidder shall download the bidding software. When installing the bid program the Bidder enters its Vendor code assigned by the Department.

The Bidder shall download all Bid Documents from the Department’s website. The bid shall consist of the completed Bid Documents that are submitted by the Bidder to the Department at the time for the opening of bids. The Department assumes no responsibility for errors or omissions in the downloaded documents except as specifically provided for in the Contract. The Bidder shall address questions or problems with downloading or using the electronic files, not the requirements of the Contract, to the contacts on the website.

The Proposal Form states the location and description of the Project, and shows the estimate of the various quantities and kinds of Work to be performed. The Proposal includes a schedule of Pay Items for which bid prices are invited, and the date and time of the opening of bids. The Special Provisions state the number of days or date in which the Project shall be completed. Other documents of the Contract are considered part of the bid whether attached or not. The Bidder is required to submit the bid via the Internet using the appropriate software. No alteration to that software is permitted.

102.03 Examination of Contract and Site of Project.

The Bidder shall carefully examine the site of the proposed Project, the Contract, and all other information before submitting a bid. If site conditions are inconsistent with the Contract or there are discrepancies, errors, omissions or patent ambiguities within the Contract, the bidder shall immediately notify the Department as specified in 101.04. The Bidder shall evaluate subsurface conditions as necessary to determine how these conditions may affect the methods and cost of construction. The Bidder shall evaluate, with respect to possible material sources, the quality and quantity of material available, applicable regulatory requirements, and the type and extent of processing that may be required to produce material conforming to the requirements of the Contract. It is understood and agreed that the Bidder has considered in its Proposal all of the permanent and temporary utility facilities in their present, new, or relocated positions to the extent required by the Contract and as revealed by its own investigations; and is aware that utility service
demands, adverse field conditions and emergencies may affect the Utility’s ability to comply with the proposed schedules for utility work. Submission of a bid is confirmation that the Bidder has made such independent evaluation and examination, including the information specified below, and is fully aware of the requirements of the Contract, including all restrictions. Further, the Bidder warrants that the proposed contract prices in the bid include all costs to complete the Work.

The Bidder shall provide written notice to the Regional Construction Engineer as specified in the Special Provisions, at least 24 hours in advance of any visits to the site. The Bidder shall ensure staff at the site has proper identification.

Items 1 through 3 below are not a part of the Contract and are made available for information only. The boring logs and pavement cores are part of the Contract, but any reports or interpretations of them are considered information. The Department makes no representation, warranty, or guarantee, expressed or implied, by making available such information. It is the Bidder’s responsibility to obtain such information.

1. Evaluation of Subsurface and Surface Conditions. The Bidder may inspect the records of the Department’s subsurface investigation through the Department’s Engineering Documents Unit, 1035 Parkway Avenue, P.O. Box 600, Trenton, New Jersey 08625. This investigation is not a substitute for the Bidder’s own evaluation or judgment in preparing a bid. The Bidder should not rely on any estimates and quantities included in these investigations. The conditions indicated by such investigations or records thereof, and as shown by the cross-sections in the Plans, may not be representative of those existing throughout such areas, and materials other than, or in proportions different from those indicated, may be encountered.

The soil and rock descriptions shown on the boring logs are determined by a visual inspection of samples from the various explorations, unless otherwise noted. The Department may make these samples available for nondestructive examination. The observed water levels and other water conditions indicated on the boring logs are as recorded at the time of the exploration. These levels and other conditions may vary considerably, with time, according to the prevailing climate, rainfall, and other factors. If a generalized soil profile is described in the text, it is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples.

The Bidder is charged with knowledge of the State’s physical geography, and in performing its site evaluation shall be fully aware of the available publications on that subject matter.

Pavement core record will be provided in the Special Provision for the Contractor’s information only.
# NEW JERSEY DEPARTMENT OF TRANSPORTATION
# PAVEMENT CORE RECORD

**PROJECT/ROUTE & SECTION:** Route 36 (Bridge Over Shrewsbury River Replacement)

**DRILLER:** Bob Ware & Jake Harris

**INSPECTOR:** Bob Sidorski

**COUNTY/TOWNSHIP:** Monmouth / Highlands & Sea Bright

**DATE STARTED:** 4/1/05    **DATE COMPLETED:** 4/15/05

<table>
<thead>
<tr>
<th>CORE NUMBER</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROUTE</td>
<td>36</td>
<td>36</td>
<td>Bay Ave</td>
<td>Sandy Hook Gateway National Recreation Area</td>
<td>Ramp M</td>
</tr>
<tr>
<td>DIRECTION (N, E, S, W)</td>
<td>West</td>
<td>East</td>
<td>North</td>
<td>North</td>
<td>North</td>
</tr>
<tr>
<td>MILE POST (MP or Station)</td>
<td>104+57</td>
<td>106+71</td>
<td>108+12</td>
<td>515+42</td>
<td>505+80</td>
</tr>
<tr>
<td>LANE NO. (Left to Right)</td>
<td>Lane 2</td>
<td>Lane 2</td>
<td>Lane 1</td>
<td>Lane 2</td>
<td>Lane 1</td>
</tr>
<tr>
<td>SHOULDER (Inside or Outside)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>CORE DIAMETER (Inches)</td>
<td>3.5”</td>
<td>3.5”</td>
<td>3.5”</td>
<td>3.5”</td>
<td>3.5”</td>
</tr>
<tr>
<td>TOTAL CORE DEPTH (Inches)</td>
<td>13”</td>
<td>12”</td>
<td>13”</td>
<td>12.5”</td>
<td>8”</td>
</tr>
<tr>
<td>CORE DRILLED TO</td>
<td>4’</td>
<td>4’</td>
<td>4’</td>
<td>4’</td>
<td>4’</td>
</tr>
<tr>
<td>SURFACE TYPE (AC/PC)</td>
<td>AC</td>
<td>AC</td>
<td>AC</td>
<td>AC</td>
<td>AC</td>
</tr>
<tr>
<td>AC THICKNESS (Inches)</td>
<td>4.6”</td>
<td>3”</td>
<td>4”</td>
<td>4”</td>
<td>8”</td>
</tr>
<tr>
<td>PC THICKNESS (Inches)</td>
<td>8.5”</td>
<td>9”</td>
<td>9”</td>
<td>8.5”</td>
<td>--</td>
</tr>
</tbody>
</table>

* Lane 1 is the left lane in the direction of travel.

The pavement information shown herein was obtained for State design and estimate purposes. It is made available to the authorized users only that they may have access to the same information available to the State. It is presented in good faith, but is not intended as a substitute for investigations, interpretation or judgment of such authorized users.
2. **Utility Agreements.** In addition to what is specified in 105.09, the Bidder may inspect or order the Utility agreements, modifications and orders relating to the Project through the Department’s Division of Project Management, 1035 Parkway Avenue, P.O. Box 600, Trenton, NJ 08625-0600. The Bidder shall obtain existing information and proposed construction documents through the Utility for its respective work.

3. **Existing Plans and As-Builts.** The Bidder may inspect as-built plans of Department-owned facilities or order copies upon written request through the Engineering Documents Unit. Contour maps may be available for some Projects and the Bidders may inspect such maps or the Bidder may obtain copies for their use upon written request to the Engineering Documents Unit. The Bidder shall obtain plans of municipal-owned or County-owned facilities through the municipality or county. The Bidder shall verify any information obtained from the existing documents with regard to its application for bidding and completing the Project. The Department will provide a list of existing structures within the Project on the Plans. The Department will list the existing plans and as-builts used in the development of Contract in the Special Provisions. Existing Plans and As-builts used are as follows:

**Existing Plans**

Shrewsbury River Bridge, 1931  
Rte 36 Section 3  
Atlantic Highlands & Sea Bright  
Monmouth County

NJDOT Redecking of Four Bridges, 1960  
Rte 36 Section 3A  
Bridge over Shrewsbury River  
Miscellaneous Plans

Rte 36 Section 3F, 1994  
Bridge over Shrewsbury River  
Abatement of PEOSHA Violations and  
Electrical/Mechanical Rehabilitations  
Boroughs of Highlands & Sea Bright

**As Builts**

Miscellaneous American Bridge Co. Shop Drawings, 1932  
Shrewsbury River Bridge  
Rte 36 Between Highlands & Sea Bright

Rte 36 Section 3D, 1971  
From Third Ave to Ocean Ave  
Widening , Resurfacing, Island Closing and Bridge  
Boroughs of Atlantic Highlands, Highlands and Sea Bright  
Monmouth County

4. **ROW Availability.** Parcels 122 and 123 are in the process of being acquired. The parcels are anticipated to be available for use by the Contractor on March 30, 2008.

102.04 **Interpretation of Quantities in the Proposal Form.**

The quantities appearing in the Proposal Form are estimates and are used for the comparison of bids. The Department may increase or decrease the scheduled quantities of Work, or may eliminate Pay Items in their entirety, in its sole discretion.

The Department will pay only for the quantities of Work completed as specified in the Contract. The Department will make payment at the original unit prices for the quantities of Work accepted by the RE.
102.05 “If and Where Directed” Items.

The Proposal Form may include Pay Items that may be incorporated into the Project “if and where directed” by the RE. Such items may or may not be shown on the Plans. The estimated quantities set out in the Proposal Form for “if and where directed” items are presented for the purpose of obtaining a representative bid price, but are not indicative of the Department’s intent regarding incorporation into the Project. The Department may or may not incorporate “if and where directed” items into the Project, in its sole discretion. If the Department incorporates such “if and where directed” items, the actual quantity may be many times the estimated quantity or only a fraction thereof.

102.06 Preparation of the Proposal Form.

The Bidder shall submit a Proposal Form produced from the software that was downloaded from the Department’s electronic bidding website. The Bidder shall include all addenda on the Proposal Form. The Bidder shall specify a price in figures for each Pay Item. The Bidder shall insert the price solely in the box provided for the lump sum item under the column designated as “Amounts.” For unit price items, the Bidder shall insert the per unit price under the column designated “Unit Price” in the appropriate box at the location provided therefore. When the Bidder intends to bid zero ($0.00) for a Pay Item, the Bidder shall insert a “0” in the “Unit Price” and “Amounts” columns for unit price items or in the “Amounts” column for lump sum items. When the Proposal Form contains alternate items, the Bidder shall insert only the unit price and amount for the lowest priced alternate item. When alternate items in the proposal have a lump sum pay quantity, the Bidder shall insert only the amount for the lowest priced alternate item. The Bidder shall construct the alternate item for which a price has been provided. When the proposal contains alternate groups of items, the Bidder shall insert only the unit price and amount for each item within the lowest priced alternate group. The Bidder shall construct the alternate group of items for which a price has been provided.

The only entries permitted in the proposal form will be the unit or lump sum prices for items that shall be bid. The software will perform all extensions of the unit or lump sum prices and calculate the total bid amounts.

The Bidder shall check the bid before submission using the software. The Bidder shall select “tools” and then select “check bid” and ensure there are no errors prior to submitting the electronic bid. For bids submitted by Joint Ventures select “tools” from the software menu and mark the electronic bid as “Joint Bid.” The Bidder may print a completed Proposal Form for their records after completing the bid.

Where no figure is provided by the Bidder in either the “Unit Price” or the “Amount” columns for one or more Pay Items, or where no figure is provided in the “Amount” column for one or more lump sum Pay Items, the Department will consider the amount bid to be zero ($0.00) for that item.

102.07 Balanced Bids.

The Bidder shall reflect in each Pay Item the actual cost the Bidder anticipates incurring for the performance of that particular item, together with a proportional share of the Bidder’s anticipated profit, overhead, and costs to perform work for which no Pay Item is provided.

102.08 Proposal Bond.

The Proposal Bond guarantees execution of the Contract by the Bidder receiving the award. With the bid submission, the Bidder shall complete the included electronic bond form. The Bond must be satisfactory to the Department and for a sum of 50 percent of the total bid amount. The Bidder shall ensure that the Proposal Bond is properly completed and furnished by a surety company or companies authorized to do business in this State as are listed and authorized to issue bonds in at least the amount of the Proposal bond as established by the current US Treasury Department Circular 570 as of the date for receipt of bids for the particular Project. The Bidder shall ensure that the Proposal Bond has a power of attorney executed by the surety company or companies. The power of attorney shall set forth the limits of authority of the attorney-in-fact who has signed the bond on behalf of the surety company to bind the company and shall further certify that such power is in full force and effect as of the date of the bond.

Proposal Bonds that do not comply in all respects with the provisions of N.J.A.C. 16:44-5.1(d) and that are not substantiated by a valid power of attorney executed by the surety company will not be accepted.

102.09 Revisions Before Submitting a Bid.

Any written, graphic, or electronic information to clarify, correct, or change the Bid Documents, Contract, or bidding notices will be issued only as addenda (or “addendum” can be used interchangeably) posted on the website.
before the opening of bids. The Department will post no addenda less than 24 hours before the time set for the receipt of bids, with the exception of addenda postponing the bid opening date and time.

Acknowledgment thereof shall be made by the Bidder for all addenda posted through the Department’s website. All addenda shall be acknowledged or the Department will not accept the bid. It is the obligation of the bidder to check the Department’s website for addenda.

102.10 Submission of Bids.

Once the Bidder has completed its bid and made all desired changes, the Bidder shall submit the electronically signed bid via the Internet. The Bidder shall ensure delivery of its bid with all required components and attachments, including, but not limited to the following:

1. Schedule of items
2. Updated Financial Statement form DC-74B
3. Addenda acknowledgement
4. For wholly State funded contracts, acknowledgement of compliance with the two registrations as specified in 102.01
5. For wholly State funded contracts, acknowledgement of compliance with N.J.S.A. 19:44A-20.13 et seq.
6. Proposal Bond form
7. Other related documents as specified in the Contract

When the Bidder submits bids for two or more Projects on which bids will be accepted on the same day, a single Updated Financial Statement is acceptable instead of a separate statement for each Project.

The Bidder is solely responsible for any and all errors and for timely submission of the bid, all components thereof, and all attachments thereto, through the electronic bidding system; the Department assumes no responsibility for any claim arising from the failure of any Bidder or of the electronic delivery system to cause any bid, bid component, or attachment to not be delivered to the Department on or before the time set for bid opening.

102.11 Withdrawal of Bids.

A Bidder may withdraw a bid after it has been submitted to the Department, provided the request for such withdrawal is received by the Department, in writing or fax, before the time set for opening bids.

The Bidder may not withdraw a bid after the time designated for the public opening of such bid, except that when bids for more than one project are to be opened at the same time, a Bidder, at its option, may submit a written request to withdraw its bid for the second or succeeding project before the time set for opening of those bids.

102.12 Public Opening of Bids

The Department will open and read bids publicly at the time and place indicated in the Advertisement or such other time and place as may be established by addenda. The Department invites Bidders, their authorized agents, and other interested parties to be present.

102.13 Consideration of Proposals.

The Department reviews proposals for conformity with the Contract and compares proposals on the basis of the correctly determined summation of the correctly determined products of all the quantities for Pay Items shown in the Proposal multiplied by the unit prices bid together with the sums bid for lump sum Pay Items. The Department will make the total bid amount for all bids available.

102.14 Irregular Bids.

The Department will consider bids irregular and will reject bids if the Department determines that the bid contains a material defect.

102.15 Disqualification of Bidders.

The Department will disqualify a Bidder and reject a bid submitted by that Bidder if the Bidder is determined by the Department to lack responsibility. Factors demonstrating a lack of responsibility include but are not be limited to:

1. Evidence of collusion among Bidders.
2. Uncompleted work, which in the opinion of the Department, might hinder or prevent completion of additional work if awarded.
3. Failure to satisfy the pre-award requirements for Disadvantaged Business Enterprise (DBE) or Emerging Small Business Enterprise (ESBE) as specified in the Special Provisions for federally funded contracts.
4. Failure to satisfy the pre-award requirements for Small Business Enterprise (SBE) as specified in the Special Provisions for wholly State funded contracts.
5. Materially unbalanced bid.
6. Lack of competency or lack of adequate machinery, plant, or other equipment.
7. Unsatisfactory performance on previous or current contracts.
8. Questionable moral integrity as determined by the Attorney General of New Jersey or the Department.
9. Any other outward actions or lack of action that demonstrates the Bidder is not responsible.

102.16 Rejection of All Bids.
The Department may reject all bids when the Department deems it advisable to do so in the best interest of the State or public.

SECTION 103 - AWARD AND EXECUTION OF CONTRACT
THE TEXT OF THE ENTIRE SECTION IS CHANGED TO:

103.01 Consideration of Proposals.

THE CONTENT OF THIS SUBSECTION HAS BEEN DELETED AND IT IS INTENTIONALLY LEFT BLANK

103.02 Award of Contract.
The Department will award the Contract to the lowest responsible Bidder whose bid conforms in all respects to the requirements set forth in the Contract. The Department will make Award on the basis of the Total Contract Price. The Department will award the Contract or reject all bids within 30 State Business Days after the bids are received. The Department may make a Conditional Award pending the approval of the Federal Government, another State governmental body, or private party. If the Department does not award the Contract or conditionally award the Contract within 30 State Business Days, all Bidders have the right to withdraw their bids. However, the Department and the lowest responsible Bidder, the second lowest responsible Bidder, or both can agree to extend the time within which the Department may make an award or conditional award by mutual consent.

At the time of Award or Conditional Award to a Bidder not a resident of the State, such Bidder shall appoint, on the form furnished by the Department, a proper agent in the State on whom service can be made in event of litigation of any type arising under the Contractor or as a result of performance of the Contract. Said agency shall remain in effect during the performance of the Contract and for 6 years following Acceptance.

The Award or Conditional Award is not binding upon the Department until the Department has executed the Contract. No person shall perform any Work in furtherance of the Contract until notified that the Contract has been executed, and then only as specified in 108.03.

The term “State Business Day” as used in this Subsection is synonymous with the term “Working Day” as used in N.J.S.A. 27:7-31 and N.J.S.A. 27:7-33 and is any day exclusive of Saturdays, Sundays, State recognized legal holidays, and such other holidays or State office closings as declared by the State.

103.03 Cancellation of Award.
The Department reserves the right to cancel an Award or Conditional Award at any time before the execution of said Contract by all parties without incurring any liability of any kind.

103.04 Release of Proposal Bond.
The Department will release all Proposal Bonds except those of the 2 lowest Bidders within 5 days after receipt of bids.

The Department will release the Proposal Bond of the lowest and next lowest Bidders when the Contract and Performance Bond and Payment Bond have been executed and delivered as specified in 103.06, or, if not executed, when other disposition of the matter has been made by the Department.

ROUTE 36 OVER THE SHEREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY

Page 12
103.05 Performance Bond and Payment Bond.

Within ten State business days of the date of Award or Conditional Award, the Bidder to whom the Contract has been awarded shall complete and deliver a Performance Bond and a Payment Bond on forms furnished by the Department.

Each bond shall be the sum of not less than the Total Contract Price less the lump sum bid for the Pay Item “Performance Bond and Payment Bond” and shall be maintained by the Contractor until Acceptance. In the event of the insolvency of the surety or if the Performance Bond and Payment Bond have not been properly authorized or issued by the Surety company, the Contractor shall furnish and maintain, as above provided, other surety satisfactory to the Commissioner.

All alterations, extensions of Contract Time, extra and additional work, and other changes authorized by the Contract Documents may be made without securing the consent of the surety or sureties of the bonds. The surety corporation bonds shall be furnished by only those sureties listed in the US Treasury Department Circular 570 and authorized to do business in the State. The bonds shall be accompanied by a certification as to authorization of the attorney-in-fact to commit the surety company and a true and correct statement of the financial condition of said surety company. Reinsurance is prohibited pursuant to NJAC 16:44-6.1(b)6.

Payment for the Performance Bond and the Payment Bond will be made upon commencement of work on the basis of the lump sum bid or the actual cost (gross premium), whichever is less, upon submission of a paid bill and the report of execution issued by the Surety showing the gross premium of the bonds and the broker’s fee. Upon Completion, the Department’s payment for the Performance and Payment Bond will be adjusted to reflect any increase or decrease in the actual cost of the bonds. Any increase will be based upon the rate schedule certified by the Surety and submitted by the Contractor at the beginning of the Project. If the certified schedule and the paid bill are not submitted at the beginning of the Project, no adjustment will be made. Any increase or decrease in the actual cost of the bonds otherwise known as the adjustment of less than one hundred dollars will be disregarded. The adjustment will be calculated on whichever of the following methods results in the lowest adjustment:

1. The difference between the actual cost paid by the Contractor before the commencement of work and the paid final bill submitted by the surety company or agent.
2. The difference between the actual cost paid by the Contractor before the commencement of work and the final amount as calculated by using the certified schedule submitted at the beginning of the Project.

If the amount of this final bill reflects an increase in the cost of the Performance and Payment Bonds, the Department will pay the Contractor the amount as determined above in the final payment to be made to the Contractor after Acceptance. If the amount of the final bill reflects a decrease in the cost of the Performance and Payment Bonds, the Department will deduct that amount from the final payment made to the Contractor after Acceptance.

Any increase in the construction layout ratio will not be included in the Surety adjustment.

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERFORMANCE BOND AND PAYMENT BOND</td>
<td>LUMP SUM</td>
</tr>
</tbody>
</table>

103.06 Execution of the Contract.

Within 14 days of the date of Award or Conditional Award, the Bidder shall properly and duly execute the Contract and deliver to the Department with the following:

1. Performance Bond and Payment Bond as specified in 103.05.
2. Request for Authorization Form (RFA) for the New Jersey Pollutant Discharge Elimination System (NJPDES) Stormwater General Permit for Construction and Mining Activity when specified for the Contract.
3. Proof of the two registrations as specified in 102.01 for the Department of Treasury and the Department of Labor.
5. If the case of non-resident Bidders, the completed form regarding “Appointment of Agent” for compliance with N.J.S.A. 14A:15-2 et seq.

If said Contract is not executed by the Department within 60 days following receipt from the successful Bidder of the executed Contract and Payment Bond and Payment Bond, the successful Bidder may, at its discretion, withdraw its bid without penalty. Where the Bidder chooses not to withdraw before the Department executing said Contract, the Bidder shall be deemed to have waived any claim for additional payment or for an extension of time. The Contract does not become effective until it has been fully executed by all parties.
103.07 Failure to Execute Contract.

Failure on the part of the Bidder, whom the Contract has been awarded, to execute and deliver the Contract, Performance Bond and Payment Bonds, and other documents as specified in 103.06, in the manner and within the time specified, is just cause for annulment of the Award or Conditional Award and for the exclusion of the Bidder from bidding on subsequent projects for such period as the Department may deem appropriate. If the Award is annulled for the above reasons, the Proposal Bond, as specified in 102.08, shall become forfeited and the Department may proceed to recover under the terms and provisions of the Proposal Bond. The Department may award to the next lowest responsible Bidder, or may readvertise and construct the Work under contract, or otherwise, as the Department may decide in its sole discretion. The successful Bidder may file with the Department a written notice, signed by the Bidder or the Bidder’s authorized representative, stating that the Bidder refuses to execute the Contract. The filing of such notice has the same force and effect as the failure of the Bidder to execute the Contract and furnish a Performance Bond and Payment Bond within the time specified in 103.06.

103.08 Acquisition of Documents.

After the Award, additional sets of the Plans or additional copies of the Special Provisions are available to subscribers through the Department’s website or upon request to the Department’s Engineering Documents Unit, at a charge according to the Department rate.

SECTION 104 - SCOPE OF WORK

104.01 Intent.
THE FIRST PARAGRAPH IS CHANGED TO:

The intent of the Contract Documents is to describe a functionally complete and aesthetically acceptable Project to be constructed and completed by the Contractor in every detail according to the Contract Documents. Any work that may be reasonably inferred from the Contract Documents as being required to produce the intended result shall be supplied whether or not specifically called for. The Contractor is responsible to provide such elements to complete the Work under the pay items of the Contract for no Additional Compensation as provided under Subsection 109.02. However, as specified in the respective Subsections, adjustments may be allowed when the Department determines there is a discrepancy, error, omission, or latent ambiguity. It is understood that only the best construction practice is to prevail and only materials and workmanship of the first quality are to be used.

104.02 Changes
THE SECOND SENTENCE OF THE NINTH PARAGRAPH IS CHANGED TO:

Attention is directed to Subsections 102.07 and 107.27.

104.05 Increased or Decreased Quantities.
THE FOLLOWING IS ADDED:

Those Pay Items listed below shall be considered as major Pay Items even though their Contract value may not be more than ten percent of the Total Contract Price:

104.07 Changes in Character of Work.

104.11 Value Engineering
THE FOLLOWING SHALL PRECEDE THE FIRST PARAGRAPH:

It is the goal of the Department to ultimately receive a durable and low maintenance precast segmental concrete box girder bridge. The Contractor is advised to take into account that the current design reflected in the Plans is the result of an extensive Public Outreach Program as well as detailed coordination with numerous environmental permit agencies. This outreach and coordination efforts influenced the current design in areas such as aesthetics (i.e. pier column design), bridge spans arrangement, minimization of environmental impacts including land use and habitat, minimization of impact on the existing bridge structures during construction and many other factors as described elsewhere in greater detail. The Contractor is encouraged to diligently review the public and environmental commitments that have been made relative to the current design as described in the Plans and the environmental permit documents prior to contemplating and developing a Value Engineering Proposal for the Department’s further...

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
consideration. The completeness of the Contractor’s Value Engineering Proposal in addressing the aforementioned commitments will facilitate the Department’s review process which will include required coordination with affected public stakeholders and environmental permit agencies prior to rendering an acceptance or denial of the Contractor’s Proposal for Project Use.

All proposals submitted by the Contractor will be considered except that the Department will not consider any Value Engineering Proposals that change the horizontal alignment and/or the vertical profile of the bridge and roadway sections of the Project.


THE LAST TWO PARAGRAPHS ARE CHANGED TO:

The proposal shall not change the Contract’s original design criteria, merely eliminate work, be based on an unknown factor, or delay the Project.

All proposals for changes to bridges and structures shall conform to the current AASHTO Standard Specifications for Highway Bridges as modified by the NJDOT Design Manual for Bridges and Structures.

SECTION 105 - CONTROL OF WORK

105.03 Plans and Specifications.

THE ENTIRE TEXT IS CHANGED TO:

The Contract Documents are essential parts of the Contract, and a requirement occurring in one is as binding as though occurring in all. All components are complementary and describe and provide for the general completion of the Project. The Contractor shall keep one set of Plans, Special Provisions, Addenda, Standard Specifications, Supplemental Specifications, and Standard Details available on the Project site at all times.

In case of discrepancy, calculated dimensions will govern over scaled dimensions; Plans will govern over Specifications; Contract Documents will govern over Working Drawings, Right-of-Way Plans will govern over Plans when setting monuments; Special Provisions will govern over Supplemental Specifications; and Supplemental Specifications will govern over Standard Specifications.

The Contractor shall not take advantage of any apparent discrepancy, error, omission, or patent ambiguity in the Contract Documents. In the event the Contractor discovers any discrepancy, error, omission; or patent ambiguity in the Contract Documents, or if there is any doubt or question as to the intent or meaning of the Contract Documents, the Contractor shall immediately notify the Resident Engineer in writing with sufficient detail. The Department will promptly make, in writing, such corrections and interpretations as deemed necessary. The Contractor shall not be relieved of the obligation of completing an item of Work because of any discrepancy, error, omission, or patent ambiguity, and shall complete the Work as directed with adjustments as specified in Section 104. The Contractor shall not commence with any changes to the Work as provided under the Contract Documents without written authorization from the Department.

105.04 Working Drawings.

THE SECOND SENTENCE OF THE THIRD PARAGRAPH IS CHANGED TO:

Those provisions shall not apply to the review and approval of the design for proprietary walls, noise barriers, temporary sheeting, sheeting left in place, temporary structures, cofferdams, erection plans, traffic control/staging plans and precast concrete culverts or any other items where conceptual plans were included in the Contract Documents and the Contractor is required to complete the final design plans.

THE FOLLOWING IS ADDED TO THE ELEVENTH PARAGRAPH:

The design unit(s) shall be as designated for each Contract by letter from the Department.

THE FOLLOWING IS ADDED TO THE END OF THE SEVENTEENTH PARAGRAPH:

22. Precast Concrete Arch Structures

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
23. Design calculations for bridge demolition including but not limited to temporary supports and/or bracing systems, stability of existing structures during demolition staging and sequence of demolition plans.
24. Design calculations and working drawings for static load test reaction frames.
25. Design calculations and working drawings for float in cofferdams.
26. Design calculations and working drawings for dolphins.
27. Design calculations and working drawings for temporary construction access on land and in water.
28. Design calculations and working drawings for Temporary Earth Retaining Systems
29. Design calculations and working drawings for permanent sheeting.
30. Design calculations and working drawings for lifting, transport of piles, and temporary supports during pile driving as detailed in the Special Provisions.
31. Design calculations and working drawings for Variable Message Signs as detailed in the Special Provisions.

THE FOLLOWING IS ADDED TO THE END OF THIS SECTION:

The State will endeavor to return corrected and/or approved drawings with a minimum of delay. In order to expedite approval of critical drawings, the Contractor should indicate in his submittal his order of preference for the review and return of drawings and should submit all drawings in the order of their importance to his construction program.

105.07 Coordination of Contract Documents.
The subsection heading and text are changed to:

105.07 Purchase of Contract Documents.
The content of this subsection has been deleted and it is intentionally left blank to maintain subsequent numbering.

105.09 Cooperation with Utilities.
The entire text is changed to:

A. General. It is understood and agreed that the Contractor has considered in its Proposal all of the permanent and temporary utility facilities in their present, new, or relocated positions to the extent required by the Contract Documents and as revealed by its own investigations; is aware that utility service demands, adverse field conditions and emergencies may affect the Utility’s ability to comply with the proposed schedules for utility work; is cognizant of the limited ability of the Department to control the actions of the Utility(s), and has made allowances in its Proposal that it is not entitled to any Additional Compensation by reasons of delays, inconvenience or damage sustained by the Contractor due to any interference from utility facilities or the operation of moving or installing them. Similarly, the Contractor is deemed to understand that only limited extensions of time may be granted as specified in Subsection 108.11.

The Contractor shall notify, in writing, the Utility(s) involved of the nature and scope of the Project, and of its operations that may affect their facilities or property. The notice shall include an inquiry for all information required to determine the location of the existing utility facilities and the Contractor shall also provide the portion of the approved Preliminary Schedule relative to that respective Utility. Two copies of such notices and the Utility’s responses shall be sent to the Resident Engineer prior to the start of Construction Operations. The Contractor shall also attend a Utility preconstruction conference prior to the start of Construction Operations.

The Contractor shall provide each Utility the portion of the approved Baseline CPM Schedule related to the respective Utility and any approved updates or revisions that affect that Utility.

Information on the Utility(s), including the work to be performed by the Utility(s) on the Project, will be provided in the Special Provisions.

The Contractor shall contact JCP&L at 1-800-665-3115 to request work order number and inspection for each of the locations requiring electric service. JCP&L requires two (2) weeks lead time prior to providing inspection services and performing any work at each locations.

The corporations, companies, agencies, or municipalities owning or controlling the utilities, and the name, title, address, and telephone number of their local representative are as listed below:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Electric
Jersey Central Power & Light
1 River Center
331 Newman Springs Road
Building 3
Red Bank, New Jersey 07701
William E. Eullner - Engineering Supervisor
Telephone: (732) 212-4246

Telephone
Verizon
5100 Belmar Blvd.
Farmingdale, NJ 07727
Rafal Gisicz - Outside Plant Engineer
Telephone: (732) 751-0912

Cable-TV
Comcast Cable
751 Brick Blvd.
Brick, NJ 08723
Andy Cortes - Area Construction Supervisor
Telephone: (732) 380-7145

Gas
New Jersey Natural Gas
1415 Wycoff Road,
PO Box 1464
Wall, NJ 07719
Tamara H. Brown - Design Engineer
Telephone: (732) 938-1179

Water
New Jersey American Waterway Company
661 Shrewsbury Avenue
Shrewsbury, NJ 07702
Kevin T. Keane - Network Superintendent
Telephone: (732) 933-5924

Sanitary Sewer
Sea Bright Borough
Maser Consulting, PA
1 River Centre
331 Newman Springs Road
Building 2
Red Bank, NJ 07701
Mr. David Hoder - Borough Engineer
Telephone: (732) 383-1950

Sanitary Sewer
Borough of Highlands
T&M Associates
11 Tindall Road
Middletown, NJ 07748-2792
Robert W. Bucco, Jr. - Borough Engineer
Telephone: (732) 671-6400

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Utility Work and Time Frames

General Notes:
1. State's resident engineer will provide the utility with notices called for in the schedules.
2. State will provide the utility with survey control. The state and the utility shall jointly verify the location of the facilities prior to installation.
3. Utility schedules are estimated time frames for this utility owner only and do not include work performed by other utility owners sharing joint facilities.
4. Utility schedules are based on project traffic control and staging plan for each utility mobilization. Utility service demands, field and weather conditions may alter these schedules. State (contractor) changes to the traffic control and staging plan require reestablishing utility schedules.
5. Where joint facilities are proposed, the utility shall coordinate its work with the joint owners.
6. Existing facilities can only be removed after the relocated facilities have been installed and are in operation.
7. Distances, stations, offsets, lengths, or units on the utility plan are approximate (plus or minus).

Utility Work to be Performed

Electric Facilities

Existing Facilities
Primary and Secondary Electric Facilities

Work Performed by Contractor

1. Rte. 36 Sta. 102+40 LT 31' (Pole #BT 206) To Portland Road Sta. 11+1.58 RT (Pole #JC310) Install 1 Poles, Transfer Existing Aerial Facilities to New Pole #BT40008HB, #BT188, #BT1871, #JC310.

2. Portland Road Sta. 11+2 RT (Pole #JC 310 HB). Remove 1 Abandoned Pole.

3. Bay Ave Sta. 906+44 LT (Pole# JC 442 HB). Install 1 Pole and Transfer Existing Aerial Facilities.

4. Bay Ave Sta. 906+29 LT (Pole# JC442 HB) Remove 1 Abandoned Pole.

5. Bay Ave Sta. 904+66 (Pole #40050HB) Provide Electric Service by JCP&L.

6. Rte. 36 Mile Post 14.05 (Pole #BT5363 MDT) Provide Electric Service JCP&L.

7. Rte. 36 Mile Post 13.18 (Pole #JC2501 MDT) Provide Electric Service JCP&L.

8. Rt. 36 Mile Post 6.15 (Pole #JC2210 MDT) Provide Electric Service by JCP&L.

9. Rte 36 Sta. 128+42 LT (Pole #JC235 SBR). To Ocean Ave Sta. 504+91 RT (Pole #JC238 SBR) Install 2 poles, aerial primary and secondary wires.

10. Rte. 36 Sta. 128+42 LT (Pole #JC235 SBR) To Ocean Ave Sta. 504+91 RT (Pole #JC238 SBR). Remove 2 Poles and Abandoned Electric Facilities.

11. Ramp L Sta. 200+89 (Pole #JC430SB) to Ramp K/L Sta. 304+58 (Pole #JC429SB). Remove 7 Poles and Abandoned Electric Facilities.
12. Route 36 Sta. 120+20 LT (Pole #JC627SB) to Sta.124+1 LT (Pole #JC431) Remove 4 Poles, Aerial Primary and Secondary Wires.


14. Ocean Ave Sta. 509+44 RT (Pole #JC244SBR) to Sta. 512+91 LT Install 1 Poles, Aerial Primary and Secondary Wires.

15. Ocean Ave Sta. 509+44 RT (Pole #JC244SBR) to Sta. 512+91 LT Remove 1 Pole And Abandoned Electric Facilities.

16. Ocean Ave Sta.521+51 LT (Pole No#) To Sta.527+0Lt (Pole No#). Install 3 Poles, Aerial Primary and Secondary Wires.

17. Ocean Ave Sta.521+51 LT (Pole No #) To Sta.527+0 LT (Pole No #) Remove 2 Poles And Abandoned Electric Facilities.

18. Ocean Ave Sta. 500+40 RT (Pole #JC236SBR) Provide Electric Service by JCP&L.

19. Ocean Ave Sta. 512+91 (Pole #JC 245-1) Provide Electric Service by JCP&L.

20. Ocean Ave Sta. 521+55 (Pole #JC 8332 MD) Provide Electric Service by JCP&L for Toll Plaza.


Schedule: Included in state contractor's overall construction operations of the project. The utility requires two (2) weeks notice to provide inspection and supervision.

Notes: a. The state's construction plans, specifications, and special provisions section 624 for the project indicate this work.

b. Utility will supply all materials to perform the work as outlined above and in the contract plans and specifications.

Highlands Borough –Sanitary Sewer

Existing Facilities
Manholes and 8 inch clay pipes within the project

Work Performed by Contractor

1  Rte 36 Sta. 103+69 RT to Sta. 104+23 RT install 1 new MH and 51+-/- feet of 8" PVC pipe; reconstruct 1 existing MH.

2  Rte 36 Sta. 103+69 RT to Sta. 104+23 RT remove 1 existing MH and 39+-/- feet of existing 8" clay pipe.

3  Rte 36 Sta. 104+25 LT reconstruct 1 existing manhole.

4  Rte 36 Sta. 105+00 RT to Sta. 105+31 LT install 1 new MH and 29+-/- feet of 8" PVC pipe; reconstruct 1 existing manhole.

5  Rte 36 Sta. 105+00 RT to Sta. 105+31 LT remove 29+-/- feet of 8" existing clay pipe and 1 existing manhole.
6  Rte 36 Sta. 105+55 LT reconstruct 1 existing manhole.
7  Rte 36 north ramp Sta. 53+39 reset 1 existing manhole.
8  Rte 36 north ramp Sta. 53+56 LT reset 1 existing manhole.
9  Rte 36 north ramp Sta. 53+56 LT reset 1 existing manhole.
10 Bay Ave Sta. 904+41 LT reset 1 existing manhole.
11 Bay Ave Sta. 906+23 LT reset 1 existing manhole.
12 Bay Ave Sta. 905+40 to Rte 36 Sta. 110+12 LT install 1 unit temporary sanitary sewer house connection and 241 feet +/- of 4” PVC temporary sanitary service pipe.
13 Bay Ave Sta. 905+84 to Rte 36 Sta. 110+12 LT abandon 1 unit existing sanitary sewer house connection and remove 178 +/- feet of existing 4” PVC sewer service pipe.
14 Bay Ave Sta. 905+40 to Sta. 111+34 abandon 1 unit temporary sanitary service connection and 241 +/- feet of temporary 4” PVC service pipe and 124 +/- feet of existing 4” PVC service pipe after terminating sewer service.

Schedule: Included in state contractor's overall construction operations of the project. Highlands Borough requires one (1) week notice to provide inspection and supervision by the borough engineer.

Notes: The state's construction plans, specifications, and special provisions section 622 for the project indicate this work.

Sea Bright Borough --Sanitary Sewer

Existing Facilities
Manholes and 10 inch ACP pipes within the project

Work Performed by Contractor

1. Rte 36 Sta. 126+76.0' RT install 1 new manhole.
2. Rte 36 Sta. 125+84' RT to Sta. 126+76.0' RT abandon 1 existing manhole; remove 90 +/- foot existing 10” ACP.
3. Rte 36 Sta. 128+9’ RT reset 1 existing manhole.

Schedule: Included in state contractor's overall construction operations of the project. Sea Bright Borough requires one (1) week notice to provide inspection and supervision by the borough engineer.

Notes: The state's construction plans, specifications and special provisions section 622 for the Project indicate this work.

New Jersey Natural Gas (NJNG)

Existing Facilities
2 inch and 4 inch gas mains within the project

Work Performed by NJNG

1. Route 36 Sta. 103+88 to Portland Road Sta. 11+29. Install 150 +/- feet of new 4” HP steel gas main.
2. Route 36 Sta. 103+88 to Portland Road Sta. 11+29. Remove abandoned 150+/- foot gas main.

3. Bay Ave sta. 905+92 to Sta. 906+24 Install 30+/- feet of new 2" HP plastic gas main.

4. Bay Ave sta. 905+92 to Sta. 906+24 Remove abandoned 30+/- foot gas main.

Schedule: New Jersey Natural Gas requires a minimum of 12 weeks written notice prior to the start of any relocation work. The Contractor is to also provide written notification 3 weeks prior to start to confirm that the schedule date has not changed.

Note: New Jersey Natural Gas is going to require that all necessary clearing and grading work be done by the state’s contractor prior to their starting work.

Verizon

Existing Facilities
Overhead facilities within the project

Work Performed by Contractor

1. Ocean Ave Sta. 523+95 LT install 45 feet of 2" RMC conduit for telephone cable.

Schedule: Included in state contractor's overall construction operations of the project.

Note: The state's construction plans for the project indicate this work.

Work Performed by Verizon

1. Rte 36 Sta. 102+40 LT (pole #BT 206HB) to 103+86.6 LT (pole #JC62) install guy wire from pole #JC62 to pole # BT206 and place down guy wire and anchor from pole #JC62.

2. Rte 36 Sta. 102+40 RT (pole #BT206HB) remove abandoned guy wire and anchor.

3. Rte 36 Sta. 103+21 RT (pole #BT4008HB) to Portland Road Sta. 11+1.58 RT (pole #JC310HB) replace pole #BT4008HB and anchor and guy with new pole and new anchor and guy; replace pole #BT188; transfer existing telephone cables to new poles.

4. Rte 36 Sta. 103+21 RT (pole #BT4008HB) to Portland Road Sta. 11+1.58 RT (pole #JC310HB) remove abandoned poles.

5. Rte 36 Sta. 105+01 LT (pole #BT1871HB) relocate pole #BT1871HB behind the proposed curb lines.

6. Rte 36 Sta. 105+01 LT (pole #BT1871HB) remove existing abandoned pole.

7. Bay Ave Sta. 904+93 LT to Sta. 906+15.5 RT (pole #JC244) install 1 pole, guy wire, and anchor.

8. Bay Ave Sta. 904+93 LT to Sta. 906+15.5 RT (pole #JC244) install temporary cable to existing bridge columns to maintain control booth service.

9. Bay Ave Sta. 904+93 LT to Sta. 906+15.5 RT (pole #JC442) remove 2 poles and guy wires and anchor; remove existing bridge control booth service cable.

10. South Ramp Sta. 82+67 RT (pole #JC128) to Sta. 82+71 RT (pole #JC58) install down guy wire and anchor; install guy wire.
11. Bay Ave 907+15 RT (pole #JC245) install anchor and down guy wire.

12. Ocean Ave Sta. 523+95 LT install 45+/- feet of buried telephone cable.

13. Ocean Ave Sta. 524+40 LT remove pedestal with terminal.

Schedule: Verizon utility work requires 60 days notice and 40 working days to complete the work.

Note: Trench and conduit for Item 12 to be provided by State Contractor.

New Jersey American Water

Existing Facilities
6 inch, 8 inch and 12 inch water mains within the project

Work Performed by Contractor

1. Rte 36 Sta. 102+46 to Portland Road Sta. 11+15 Install 301+/- feet of new 6" water main and 23+/- feet of new water service pipes. Install 2 Air Blow-off Assemblies and 2 Tapping Sleeves and Valves. Reset 1 existing water meter boxes.

2. Rte 36 Sta. 102+46 to Portland Road Sta. 11+15 Remove 301+/- feet of abandoned existing 6" water main and 23+/- feet of existing water service pipe. Remove 1 existing water meter.

3. Bay Ave Sta. 905+19 to Sta. 906+43 install 123+/- feet of new 12" DICL water main.

4. Bay Ave Sta. 905+19 to Sta. 906+43 Remove 123+/- feet of abandoned existing 12" DICL water main.

5. Rte 36 Sta. 102+43 LT Install 55+/- feet of 1" copper water service pipe and 1 water valve.

6. Rte 36 Sta. 102+43 LT Remove 55+/- feet of abandoned existing water service pipe and 1 water valve.

7. Rte 36 Sta. 103+51.5 LT to North Ramp Sta. 50+84 LT Install 26+/- feet of 1" copper service pipe and reset 1 water valve.

8. Rte 36 Sta. 103+51.5 LT to North Ramp Sta. 50+84 LT Remove 26+/- feet of abandoned existing 1" copper service pipe.

9. Bay Ave Sta. 904+67 LT Reset 2 existing water valves.

10. Ocean Ave Sta. 500+16 RT to Sta. 505+36 LT Install 544+/- feet of new 8" DICL water main. Install 2 Air Blow-off Assemblies and 2 Tapping Sleeves and Valves.

11. Bay Ave Sta. 905+40 LT Install 1 unit temporary water service connection, 21+/- feet of 1" temporary copper service pipe, and 1 temporary water meter box.

12. Bay Ave Sta. 905+40 LT Remove 1 unit temporary water service connection, 21+/- feet of 1" temporary copper service pipe, and remove 1 temporary water meter box.

13. Ocean Ave Sta. 500+00 RT to Sta. 505+36 LT Install 544+/- feet of abandoned existing 8" water main. Install 2 Air Blow-off Assemblies and 2 Tapping Sleeves and Valves.
14. Ocean Ave Sta. 500+00 RT to Sta.505+36 LT Remove 544+/- feet of abandoned existing 8" water main.

15. Ocean Ave Sta. 510+48 LT to Sta. 512+94 LT Install 251+/- feet of new 8" DICL water main. Install 2 Air Blow-off Assemblies and 2 Tapping Sleeves and Valves.

16. Ocean Ave Sta. 510+48 Lt To Sta. 512+89 LT Remove 251+/- feet of abandoned existing 8" water main.

17. Ocean Ave Sta. 513+25 to Sta. 514+00 Install 85+/- feet of new 2" copper service pipe.

18. Ocean Ave Sta. 513+25 to Sta. 514+00 Remove 65+/- feet of abandoned existing 2" cast iron service pipe. Remove 20'+/- feet of abandoned existing 1” copper service pipe.

Schedule: Included in state contractor's overall construction operations of the project. The utility requires two (2) weeks notice to provide inspection and supervision.

Notes: The state's construction plans, specifications, and special provisions section 622 for the project indicate this work.

Comcast Cable Television

Existing Facilities
Overhead facilities within the project

Work Performed by Comcast

1. Rte 36 Sta. 102+25 RT (pole #BT 40008) to Portland Road Sta.11+46 RT (pole #JC 310HB). Raise existing aerial coaxial and aerial fiber optic cables when poles are set by Verizon.

2. Rte 36 Sta.104+19 (pole #BT188) to Bay Ave Sta. 904+65.0 LT (pole #JC243HB). Raise existing aerial coaxial and fiber optic cables when poles are set by Verizon.

3. Rte 36 Sta. 104+26 LT 48’ to Sta. 105+22 LT 53’ (pole # BT1871 HB). install 100+/- feet of new cable, pedestal, modem, and pseudo address for CCTV.

4. Portland Road Sta.11+46 RT (pole #JC211 HB) to Bay Ave Sta. 906+15 LT (pole #JC442 HB). install 409+/- feet of new aerial coaxial cable.

5. Bay Ave Sta. 902+66 LT (pole #40051HB) and Bay Ave Sta. 906+15 LT (pole #JC442 HB). remove aerial coaxial cable.

6. Rte 36 mile post 14.5 (pole #bt3221mdt) to VMS structure. install 80+/- feet of new cable, pedestal, modem, address, and pseudo address for VMS.

7. Rte 36 mile post 13.18 (pole #JC 2501MDT) to VMS structure. install 185+/- feet of new cable, pedestal, modem, address, and pseudo address for VMS.

8. Route 36 mile post 6.05 (pole #BT2210) to VMS structure. install 425+/- feet of new cable pedestal, modem, address, and pseudo address for VMS.

9. Rte 36 Sta.128+62 LT (pole# JC235SBR) to Ocean Ave Sta. 502+87 LT (pedestrian structure). Install 250+/- feet of new cable for CCTV.

Schedule: Items 1 through 9 require 1 week notice and 12 business days to complete.
B. **Existing Facilities.** The Contractor shall not proceed with any excavation operations until it has determined the exact location of the existing utility facilities within the Project from examination of the Contract Documents and information provided in Subsection 102.03, through inquiries to the respective Utility(s), and through its own subsurface site investigations, including test pits. Test Pits shall be as specified in Subsection 207.04. The Contractor shall notify the Resident Engineer as specified in Subsection 105.03 if their examinations determine any conflicts to completing the Work.

The Contractor shall notify the Resident Engineer at least 10 State Business Days in advance of the excavation of any test pits, or other subsurface investigations. Bidders shall notify the Department in advance as specified in Subsection 102.03.

Electrical installations, including Intelligent Transportation Systems (ITS) facilities as specified in Section 706, of the Department constructed either before or as part of the Contract shall be considered a Utility, and all provisions of this Subsection and Division 700 shall be applicable.

Examination of Department documents available on existing electrical installations shall be as specified in Subsection 102.03. For any work in the vicinity of the Department’s fiber optic network, the Contractor shall submit a Traffic Operations Markout Form to the Traffic Operations location specified in the Special Provisions. The Contractor shall obtain and complete the form as specified on the Department’s web site, and provide the RE a copy of the form. The Department will complete the markout within 10 State Business days after Traffic Operations receives the form. The Contractor shall maintain the markout until construction operations in the vicinity of the Department’s fiber optic network are completed.

C. **Regulations.** The Contractor shall also comply with all other State and Federal rules, and regulations applicable to work on or in the proximity of utilities. Specific attention is made to:

1. The State’s Underground Facility Protection Act. The Contractor shall notify the State’s One Call System (1-800-272-1000) and identify itself as the State’s Contractor and specify the route and contract number of the Project before performing Work on the Project.
2. High voltage line requirements according to NJSA 34:6-47.1 to 47.9, 29 CFR 1926.550, and the Utility Accommodation Policy, NJSA 16:25. The Contractor shall obtain written approval from the Department of Labor, Office of Safety Compliance, and the respective Utility(s) if required, for any operations that do not provide the minimum clearances under these regulations. The Contractor shall be responsible for any proposed power outage or de-energization associated with their operations. A copy of the approvals shall be submitted to the Resident Engineer at least 5 State Business Days in advance of starting those operations.

D. **Notices.** The Contractor shall make a written request to the Resident Engineer at least 10 State Business Days in advance of the notice requirements provided in the Special Provisions for the Department to notify Utility(s) to proceed with the Utility(s) utility work. The Contractor shall be cognizant that where joint use poles or duct banks are used, the time frames for work performed by each user are cumulative. The Contractor shall guarantee the site availability for utility operations. The Department will notify the Utility(s) to proceed if in the Department’s opinion the site will be available for a particular item of utility work. The Contractor shall permit the Utility(s) or their agent’s access to their facilities at all times and shall cooperate with them in performing their work.

The Contractor shall cooperate with the Utility(s) concerned and shall notify them, through the Resident Engineer, not less than 10 State Business Days in advance of the time it proposes to construct any utility item or perform any work that may endanger or affect their facilities. The Contractor shall have the contractual obligation of coordinating its activities with those of the Utility(s). The Utility(s) shall be given the opportunity to inspect the actual material to be installed as well as the installation.

The Contractor shall provide 72 hour advance notice to the Resident Engineer of any meetings scheduled with Utility(s) and provide the Resident Engineer with a copy of any correspondence with the Utility(s).

The Contractor shall make separate written notifications, with a copy to the Resident Engineer, a minimum of 4 State Business Days prior to when work may impact or be adjacent to Department electrical
installations. For ITS facilities, notification shall be to the Bureau of Traffic Operations at the location and telephone number provided in the Special Provisions. For all other electrical installations, notification shall be made to the Regional Bureau of Electrical Maintenance at the location and telephone number provided in the Special Provisions. No Department-owned installation shall be accessed, modified, removed, or disturbed in any manner, without first making such notifications and attending a meeting with the Department if requested.

Bureau of Electrical Maintenance, South Region
One Executive Campus Route 70 West
Cherry Hill, NJ 08002
Telephone: 856-486-6627

Bureau of Traffic Operations, South Region (TOCS)
1 Executive Campus-Route 70 West
Cherry Hill, NJ 08002-4123
856-486-6650

E. Damages. The Contractor shall protect, support, and secure all in-place utility facilities so as to avoid damage to them and any interruption of service. The Contractor shall not temporarily move existing or completed utility facilities without the Utility(s) written consent, and the facilities shall be as safe and permanent at completion as they were before the Contractor’s involvement. In the event the Contractor damages a utility facility, including property service connections, the Contractor shall notify the Utility(s) immediately. The Utility(s) may complete the repairs or allow the Contractor to complete the repairs, with the Contractor responsible for any applicable time and expense. Repairs to Department electrical installations shall be as specified in Subsection 105.19 and the additional requirements for the fiber optic network of the Department ITS facilities as specified in this Subsection. The fiber optic network includes the conduit/cable, junction boxes/cabinets, and hubs.

Should the Contractor, for its own convenience, cause the Utility(s) to incur costs not covered by the utility agreement, or delay the Utility(s), or incur costs without prior written approval of the Resident Engineer, the Contractor shall be responsible for these costs and delays. The Contractor shall pay the Utility(s) within 30 days of the Utility(s) request for cost reimbursement of any repairs and other incurred costs. If payment has not been made within 30 days, the Department may reimburse the Utility(s) for the Contractor generated costs and deduct these expenses from partial or final payment due the Contractor.

105.11 Construction Stakes, Lines, and Grades.
A. For Projects with Construction Layout as a Pay Item.

THE FIFTH PARAGRAPH IS CHANGED TO:

The Contractor shall complete all utility work layouts required after approval of the insurance certificates as specified in Subsection 107.23 and the Safety and Health Program as specified in Subsection 107.10. The Contractor shall notify the Utility(s) as specified in Subsection 105.09.

THE FOLLOWING IS ADDED:

At the completion of the project the Contractor will notify the National Park Service to obtain the boundary markers to be installed as permanent markers.

105.15 Field Office.
1. Construction Field Offices.
   a Type A.

THE FIRST PARAGRAPH IS CHANGED TO:

Type A field office shall be of weatherproof construction located adjacent to the contractor’s field office having a floor area of not less than 576 square feet and a ceiling height of not less than
7½ feet, and having partitions and doors providing three communicating rooms, one with a floor area of not less than 288 square feet and two with a floor area of not less than 144 square feet each.

PART (1) IS CHANGED TO:

1. 8 multi-line touch-tone telephones and 3 telephone lines for use with the telephones installed as directed and operational in the Field Office and other facilities specified.
   a. 4 dedicated, operational telephone line(s) for Fax machines (s) and/or microcomputer system(s) with dial-up modem use installed as directed in the Field Offices specified.
   b. 6 portable hand held cellular phone(s) with two way capabilities. The cellular telephone plan shall provide for unlimited mobile to mobile usage, unlimited push-to-talk/walkie-talkie usage and an anticipated monthly usage of 900 any-time minutes. Each of the cellular phones shall have 1 megapixel picture capability. Each of the cellular phones shall have as a minimum the following features:
      1) Home rate with no roaming charges within the entire state
      2) 832 Channel Compatible
      3) Mute Function
      4) Back Light Display with Battery Saver
      5) Signal Strength Indicator
      6) Individual Call Length Timer
      7) Full Lock Function
      8) 30 Memory Number Feature
      9) Low Battery Warning
      10) 180 Minutes of Continuous Use
      11) 72 hours of Standby Mode
      12) Alphanumeric Display
      13) Transmission Power 0.6 Watt
      14) Passive Repeating Antenna for Vehicle
      15) Spare high capacity Battery Pack
      16) Home Charging Station
      17) Cigarette lighter power adapter /charger
      18) AC charging station
      19) Hands-Free headset
      c. multi line telephone answering machine or voice mail

PART (12) IS CHANGED TO:

12. 1 copy machine with letter, legal and ledger size capabilities. The copier also must have automatic document feed, 15 ppm, tray size, and variable reduce/enlarge capability features.

PART (14) IS CHANGED TO:

14. 1 digital camera with auto-focus, rechargeable batteries and charger, 256 MB memory card, USB Memory Card Reader compatible with camera and field office computer, 1.5 inch LCD monitor, 5 mega pixel resolution, 10X optical zoom lens, built in flash, image stabilization, computer connections, and a carrying case.

PART (17)
THE FIRST SENTENCE OF THE FIRST PARAGRAPH IS CHANGED TO:

17. A microcomputer system compatible with the Department’s “ACES” system, whether purchased new or previously used.

THE FIFTH PARAGRAPH IS CHANGED TO:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
The microcomputer system (after the project data has been erased from the hard drive by the Department), manuals, instructions, software, and literature shall be removed and retained by the Contractor when no longer required as determined by the Resident Engineer. The data cartridges and data diskettes will become the property of the State.

THE FOLLOWING ARE ADDED TO PART (17)

The microcomputer system shall include the following:

(a) 3 base computer system(s) with color laser printers, latest version, having at minimum:

1) Pentium IV Processor at 3.5 GHz or faster, Intel processor with Hyper Threading technology, with 1024 MB RAM, 512 MB Video RAM, mouse, mouse pad, 200 Gigabyte hard drive or larger (must be designated as drive C:), one DVD (+/-) Writer Drive, one CD-R Recordable Drive, and one 3½-inch, 1.44 MB floppy diskette drive with multi-media card reader installed as the “A” drive. System must be USB 2.0 compactable.
2) 56K baud data/fax modem. (e.g., 3Com U.S. Robotics 56K Fax modem, 3Com U.S. Robotics Courier V.Everything/V.34 - 56K ITU / x2 Technology, or Hayes Accura 56K).
3) One wireless network card for each base computer system specified, when more than one base computer is specified.
4) One wireless Ethernet Hub Switch with appropriate number of ports and cables (e.g. Lynksys) and a print server.
5) One dedicated telephone line per computer to be used in conjunction with each of the microcomputer modem.
6) One high-speed broad band connection with a minimum speed of 3 Megabytes per second (mbps) with dynamic IP address per field office (DSL, Cable, etc.) for the duration of the project.
7) 19 inch or larger Flat Screen LCD monitor with tilt/swivel capabilities.
8) 250 Megabyte or larger Zip Drive internal or external with backup software for MS-Windows and DOS, and fifteen corresponding formatted data cartridges corresponding to the tape drive size (e.g., Iomega Zip Drive or equivalent).
9) 10 USB 1 GB Flash/Stick/Jump Memory Drives. (e.g. SanDisk Cruzer Micro 1 Gigabyte).
10) One Flatbed USB version 2.0 or greater Color Scanner. (e.g. H.P. or Cannon) with automatic document feeder and latest version of Paper Port software.
11) Uninterruptible power supply (UPS) - OMNI 1000 or approved equal (e.g., APC-1000 - American Power Corporation).
12) Surge protector for the entire computer workstation to be used in conjunction with the UPS (e.g., Zero Surge Power, Inc. - Point of Use - 2R-15 amp/120 volts).
13) Static mat, floor type, 4 by 5 feet or larger with grounding capabilities.
14) Computer workstation, printer stand, and/or table having both appropriate surface and chair height.
15) Five boxes of 3½-inch floppy diskettes that match the drive density of the 1.44 MB floppy diskette drive (ten per box).
16) 150 CD-R 700 MB (or larger) recordable CD’s compatible to the CD drive and 100 recordable DVD’s.
17) One floppy diskette holder (holds 50, 3½-inch floppy diskettes), and dust covers for the microcomputer, monitor, keyboard, and printer.
18) Two head cleaner kit for 3½-inch floppy diskette drive.
19) One can of compressed air and screen cleaning solution every other month of the duration of the project.
20) Ensure at least one computer is equipped with a dial-up modem and has Microsoft Windows XP 32 (32 Bit O/S)
(b) Three base printers having at minimum:
   1) Color laser printer having HP PCL 5 emulation, with a minimum of 192 Megabytes of expanded memory, appropriate printer cable, and legal size paper tray (e.g., HP Color LaserJet 2500N or TN).
   2) One set of appropriate printer toner cartridges every other month for the duration of the construction project.
   3) One ten-ream carton of 8½" X 11" size paper (500 sheets per ream, weight: 2.2 ounces per square yard, color: white, grain: long, for laser printers and copiers) every two months for the duration of the construction project.
   4) One ten-ream carton of legal size paper (500 sheets per ream, weight: 2.2 ounces per square yard, color: white, grain: long, for laser printers and copiers) every three months for the duration of the construction project.

(c) Three software packages, on CD-ROM with documentation, including:
   1) Microsoft Windows, latest version with future upgrades for the duration of the entire project.
   2) Microsoft Office Professional latest version. Software package should contain the following: word processor, spreadsheet, and database.
   3) Norton’s System Works for Windows, latest version, or compatible software package with future upgrades and latest virus patches.
   4) Anti-Virus software, latest version with monthly updates for the duration of the entire project (e.g., McAfee Anti Virus, Dr. Solomon’s, or Norton’s Anti Virus).

(d) 3 base printer(s) for Primavera having at minimum:
   1) Color Inkjet printer of current technology, with appropriate printer cable.
   2) Ink cartridge replacements, one of each color, every other month for the duration of the construction project.
   3) One 10-ream carton of 8½ X 11 inches size paper (500 sheets per ream, weight: 22 ounces per square yard, color: white, grain: long, for laser printers and copiers) every three months for the duration of the construction project.

(e) 3 Primavera Project Planner (P3) or equivalent software, latest version.

To be approved as a Substitute or "Or Equal", the software must be completely compatible with the Department database that contains the Capital Program Management's design process schedule and budget, as well as the construction scheduling from design through construction. The software shall be compatible with the hierarchy of the coding and able to import and export data within the Department’s Capital Program Management's database without distortion of any coding or relationships contained in the database.

The Contractor shall only utilize equivalent or compatible software for a project, which has received written approval from the Department in accordance with the most current NJDOT Capital Program Management Construction Scheduling Standard Coding and Procedures for Designers and Contractors Manual. The approved equivalent/compatible software utilized shall not vary throughout the construction phase.

The following additional equipment shall be furnished by the Contractor for the exclusive use of the Resident Engineer. This equipment shall conform to the applicable ASTM designation, when appropriate, and be in good working condition. The Contractor shall repair or replace damaged equipment throughout the duration of the Contract. The equipment shall become the property of the Contractor after Acceptance:

THE FOLLOWING IS ADDED:

(18) 1 TV/VCR (Video Cassette Recorder) Combo with: 4-head VCR, crystal-clear-slow-motion, still frame, and frame advance, and index search.
(19) 1 Mini DV digital camcorder with 20X optical zoom, 2” LCD monitor, must be USB 2.0 compatible and provide USB 2.0 connections.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
(20) 3 electronic calculators, with trigonometric function capability and printout tape
(21) 2 illuminated measuring wheels
(22) 2 digital infrared remote read thermometers
(23) 2 surface thermometers
(24) 1 four foot Smart Level
(25) 2 asphalt thermometers
(26) 12–30’ steel measuring tapes
(27) 1–100’ cloth measuring tape
(28) 1–50’ cloth measuring tape
(29) 6–6’ folding rulers
(30) 6 lanterns with monthly battery replacements
(31) 8 sets of safety equipment consisting of the following: 360 degree reflectorized vests, hard hats, and eye and ear protection all meeting OSHA requirements. Safety vests are to be replaced yearly for the duration of the project.
(32) 8 sets of rain gear with reflective sheeting
(33) Concrete testing equipment to include one of each of the following: wheelbarrow, square tipped shovel, concrete scoop, slump cone and base set (rod, slump cone, base and funnel) tamping rod (12 inches long, 3/8 inch diameter with hemispherical ends), tamping rod (24 inches long, 5/8 inch diameter with hemispherical ends), 12” ruler, Forney air meter (complete set) or equivalent, one concrete thermometer, sponge and long handled scrub brush, rubber or rawhide mallet (2.25 lb ± 0.50 lb), pointed trowel and five-gallon bucket, concrete cylinder curing items in accordance with the governing specifications.

The Contractor shall provide a boat for the exclusive use of the Engineer and his representatives for inspection and survey purposes throughout the life of the contract. The boat shall be a minimum of 20 feet in length and certified by the Boating Industry Association (BIA) to carry the operator, four (4) passengers, and a minimum of 150 pounds of equipment and approved by the Engineer. The boat shall be equipped with a minimum of a 90 hp. outboard motor, all applicable BIA safety features, and all required Coast Guard safety equipment (including but not limited to life jackets, fire extinguishers, running lights, throwable flotation device, etc.). The boat shall also be equipped with a VHF radio, which is capable of communicating with marine-traffic, the bridge operators and Contractor’s superintendent. In addition, the boat shall comply with all applicable OSHA regulations.

The boat shall be kept in seaworthy, first class operating condition and ready for use at all times. In the event this boat becomes inoperable a comparable replacement boat satisfying all contract requirements shall be provided. The Contractor shall furnish the fuel necessary to operate the boat and pay the cost of all maintenance, licensing and repairs. The boat and motor shall become the property of the Contractor after the completion of the project.

The Contractor shall provide suitable, stable docking facilities in accordance with all Local, State and Federal ordinances for the Engineer’s inspection boat, which will permit safe boarding, and unloading by the Engineer’s representatives as approved by the Engineer. If nearby facilities are leased for this purpose, the Contractor shall maintain the facility in a good and safe condition or arrange with the owner to maintain.

The Engineer’s inspection boat and berthing facilities shall be maintained for the entire contract period or until the Engineer determines that they are no longer required at the project site. The Contractor shall be notified in writing that the services of the boat and dock facilities are no longer required and released. The Engineer and his representatives will operate or provide an operator for the boat until the boat is released.

105.17 Load Restrictions.
THE FOLLOWING IS ADDED TO THE END OF THIS SECTION:

The owner makes no guarantee as to the capacity of the existing structure to support construction loads or access to the work.

105.19 Maintenance During Construction.
THE THIRD PARAGRAPHS IS CHANGED TO:

Any damage to the Roadway due to the Contractor’s operations shall be repaired at no Additional Compensation, except as specified in Subsection 107.22. The Contractor shall complete within 24 hours specific repairs directed by the

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Department, except where the requirements are specified by a Subsection. Nothing in this Subsection shall be construed to limit or change the risks assumed by the Contractor as specified in Subsection 107.22.

THE SIXTH PARAGRAPHS IS CHANGED TO:

The Department may direct the Contractor to construct Bituminous Concrete Patch as specified in Section 402 to maintain sections of traveled way and shoulders in a smooth riding condition at all times including seasonal shutdowns. Payment for Bituminous Concrete Patch will be made as specified in Section 402 except for those areas that are damaged or created by the Contractor’s operations.

THE FOLLOWING IS ADDED TO THIS SUBSECTION:

It is imperative that the existing bridges and roadways adjacent to the Rt 36 construction remain open and unrestricted to traffic. The Contractor shall be responsible for the maintenance and repairs of the existing bridges, roadways, electrical and lighting systems for the duration of the project until Acceptance. During this period the Contractor shall be responsible for maintaining the existing bridges and other referenced facilities for uninterrupted use by vehicular and pedestrian traffic.

A. Routine Maintenance of Existing Facilities:

The Contractor shall maintain the existing electrical and structural components of the bridges and roadway in serviceable condition at all times throughout the construction of the project in order to maintain unrestricted normal traffic operations. The State will continue to maintain the operation of the bridge during Stage 1. At the start of Stage 2, when traffic is shifted to the north half of the existing bridge, the contractor will assume responsibility for the bridge operation and maintenance in accordance with Section 536 of these Special Provisions. Once traffic is removed from the bascule in Stage 3.1.2 the Contractor will be put on notice that the bridge will no longer be operable and available for Contractor movements. The Contractor must either remove the bascule immediately or secure it in the open position so as to not impede navigation. The routine maintenance of the bridge includes, but is not limited to, roadway lights, pavements, shoulders, guide rails, signage, minor spalls, minor bulkhead repairs, bridge railing, bridge lighting and any other routine bridge and roadway maintenance required for safe operation of these facilities. Maintenance of Bridge Operations will be in accordance with Section 536. The Contractor shall furnish and install any temporary equipment necessary to conform to the above requirements. The arrangement of any temporary facilities and controls shall be approved by the Engineer. Lane closures, if required, shall be in accordance with the requirements listed on the Traffic Control and Staging plan sheets.

Snow plowing and salt spreading on the highway will be done by the State except where essential to a bridge, roadway or electrical maintenance or repair activity required under this Special Provision.

Typical required bridge/roadway/electrical maintenance/repairs include but are not limited to the following:

**BRIDGE**

1. Routine repair of minor concrete deck repairs, minor concrete spalls, minor bulkhead repairs, bridge railing repairs, deck joints repairs, removal of debris or water which impedes traffic and temporary concrete barrier curb repairs.
3. Traffic control in accordance with the MUTCD and appropriate for protection of the traveling public during implementation of the corrective action to the structural elements.

**ROADWAY**

1. Repairs for both concrete and asphalt pavement structures, approach slabs, shoulders, pavement joints, crack sealing, embankment slopes, drainage facilities including inlets pipes, culverts, parallel ditches, slope drains, and curbs.
2. Pavement markings, signs, sign mountings, pavement graphics, delineators, RPMS, reflectors, and MRPMS.

**ELECTRICAL**

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Electrical Maintenance – The work shall include, but is not limited to the following tasks:
1. Relamping of street lights, navigational lights, bridge lights, traffic signals, and other lights as necessary.
2. Maintaining power supply lines, circuit protection devices, junction boxes, grounds, conduits, transformers, ballasts, insulators, cabinets, and like facilities.
3. Maintaining and/or replacing mounting poles.

B. Emergency Call-outs

1. Emergency Call-outs – This shall include all work required for maintaining the structural integrity and stability of the existing bridges. The emergency call-outs shall include but not be limited to any major structural repairs to concrete or steel bridge components (concrete deck, girders, diaphragms, bent caps, piles, etc.) including any necessary temporary supports shielding, and temporary concrete barrier curbs if necessary.

C. Materials and Workmanship:

All repair and maintenance materials used to correct bridge, roadway, and electrical equipment and its installation shall conform to the requirements of the 2001 NJDOT Standard Specifications and NJDOT Maintenance Standards, except as may be otherwise provided herein.

The Contractor shall coordinate all bridge and roadway maintenance and repairs with the Engineer, Traffic Operations Center – South, New Jersey State Police, and New Jersey DOT Maintenance Region – South.

All electrical work shall conform to the requirements of the current national electrical code, and to any applicable NJDOT and local rules and ordinances. The Contractor shall obtain any required permits and approvals of all departments or agencies having jurisdiction.

All equipment, materials and workmanship shall be manufactured and erected to the satisfaction of the Engineer.

The Contractor shall assume full responsibility for maintenance of the bridges, roadway and lighting/electric facilities immediately after the notice to proceed is issued for the project. Immediately after the notice to proceed is issued, the Contractor and Engineer will examine all the facilities on the bridges and roadway to establish their condition prior to the start of construction. After completion of the review of the existing bridges and roadway facilities, the Contractor will make arrangements to use his own forces or other parties to promptly make any required bridge or roadway repairs and/or maintenance operations.

Upon notification of an emergency call-out, the Contractor will report to the site to review the conditions, and discuss proposed options for correcting the existing bridge deficiency, defects, and/or damage. The Contractor will obtain direction of the Department’s Resident Engineer or his representative on actions to be taken. If an event results in restriction of traffic flow on the bridges or roadway for any reason, the Contractor is required to respond to the project site with sufficient emergency personnel and equipment within two (2) hours from the time notified that a condition has developed and immediate response is required to address the emergency condition and restore normal travel conditions in the least time possible.

The Contractor shall have available on call employees who are knowledgeable in bridge structures repairs and electrical troubleshooting and corrective actions. During construction period when the bridges and roadway are in use for traffic operations, the Contractor shall provide sufficient maintenance personnel during normal working hours to patrol, identify, and correct roadway pavement conditions or structural repairs on a schedule consistent with the priority established by the Resident Engineer. The bridges and roadway function 24 hours per day, every day of the year.

The Contractor shall be responsible for removal and disposal of all debris, contaminated waste, construction debris, and like materials deposited on the bridge and roadway surfaces at all times during the maintenance period in accordance with all applicable environmental regulation.

The existing bridges shall not be used for construction and/or demolition activities. These bridges have low sufficiency ratings and their ability to support construction/demolition loads has not been established.

The Contractor will also be held by the criteria, limits and boundaries set in subsection 505.04 subparagraph 5 of these Supplementary Provision. Accordingly any maintenance and/or repairs required on the existing bridges, roadways and facilities that result from the Contractor’s negligence or non conformance with the limits and boundaries set by these Contract Documents shall be performed at no additional cost to the State.

The Contractor shall provide notification to the 1st District U.S. Coast Guard at least 45 days prior to initiating any work over or in the waterway that may present an obstruction or hazard to navigation. Notification shall meet the requirements specified in Subsection 107.13 Construction Over or Adjacent to Navigable Waterways of the Contract Specifications.
Except for work noted in Section 536 which includes the work associated with Emergency Call-outs, all costs for normal routine maintenance during construction shall be included in the various Pay Items in the Proposal.

SECTION 106 – CONTROL OF MATERIAL

106.03 Materials, Inspections, Tests, and Samples.
THE SUBSECTION HEADING IS CHANGED to:
106.03 Materials, Inspections, Tests, Samples and Certified Training.

B. Sampling and Field Testing of Soil Aggregates.
THE SIXTH PARAGRAPH IS CHANGED TO:
Sampling and testing of aggregates by the Department that meet the Specifications and are used in the Work will be performed without cost to the Contractor.

THE FOLLOWING SUBPART IS ADDED:

D. Sharing of Pay-Adjustments for Portland Cement Concrete. Positive and negative pay-adjustments, as defined in Subsection 914.02, Subpart E, are awarded to encourage high quality construction and, when necessary, to recoup the anticipated extra costs to the Department resulting from poor quality construction. The manner in which positive and negative pay-adjustments are to be shared by the prime Contractor and Subcontractors or Producers is to be negotiated by the affected parties. A letter signed by both parties, stating that an agreement has been reached between the parties shall be provided to the Engineer before commencement of Work. Nothing contained herein shall create right of action either in law or equity against the Department.

106.06 Materials Field Laboratory
THE FOLLOWING IS ADDED AFTER THE FIRST PARAGRAPH:

The Contractor shall annually pay all fees necessary to procure and maintain a Uniform Code Type Four Fire Permit according to regulations of the New Jersey Department of Community Affairs. Additional information concerning the permit fees and processing of the application may be obtained by contacting the Bureau of Materials.

1. Laboratory.

b. THE FOLLOWING IS ADDED:

(19) Hands-Free headset

z.

THE FIRST SENTENCE OF SUBPART Z. IS CHANGED TO:

Equipment and test apparatus conforming to that listed in AASHTO T 310 when the Pay Item “Nuclear Density Gauge” appears in the Proposal.

SUBPART (1) IS CHANGED TO:

(1) Conformance to AASHTO T 310,

aa THE ENTIRE PART AA TEXT ARE CHANGED TO:

aa Microcomputer workstation hardware and software requirements as indicated. The microcomputer system shall include the following:

(1) One base computer system(s) having at minimum:

a) Pentium IV Processor at 3.5 GHz or faster, Intel processor with Hyper Threading technology, with 1024 MB RAM, 512 MB Video RAM, mouse,
mouse pad, 200 Gigabyte hard drive or larger (must be designated as drive C:), one DVD (+/-) Writer Drive, one CD-R Recordable Drive, and one 3½-inch, 1.44 MB floppy diskette drive with multi-media card reader installed as the “A” drive. System must be USB 2.0 compactable.

b) 56K baud data/fax modem. (e.g., 3Com U.S. Robotics 56K Fax modem, 3Com U.S. Robotics Courier V.Everything/V.34 - 56K ITU / x2 Technology, or Hayes Accura 56K).

c) One wireless network card for each base computer system specified, when more than one base computer is specified.

d) One wireless Ethernet Hub Switch with appropriate number of ports and cables (e.g. Lynksys) and a print server.

e) One dedicated telephone line per computer to be used in conjunction with each of the microcomputer modem.

f) One high-speed broad band connection with a minimum speed of 3 Megabytes per second (mbps) with dynamic IP address per field office (DSL, Cable, etc.) for the duration of the project.

g) 19 inch or larger Flat Screen LCD monitor with tilt/swivel capabilities.

h) 250 Megabyte or larger Zip Drive internal or external with backup software for MS-Windows and DOS, and fifteen corresponding formatted data cartridges corresponding to the tape drive size (e.g., Iomega Zip Drive or equivalent).

i) 10 USB 1 GB Flash/ Stick/ Jump Memory Drives. (e.g. SanDisk Cruzer Micro 1 Gigabyte).

j) One Flatbed USB version 2.0 or greater Color Scanner. (e.g. H.P. or Cannon)

k) Uninterruptible power supply (UPS) - OMNI 1000 or approved equal (e.g., APC-1000 - American Power Corporation).

l) Surge protector for the entire computer workstation to be used in conjunction with the UPS (e.g., Zero Surge Power, Inc. - Point of Use - 2R-15 amp/120 volts).

m) Static mat, floor type, 4 by 5 feet or larger with grounding capabilities.

n) Computer workstation, printer stand, and/or table having both appropriate surface and chair height.

o) Five boxes of 3½-inch floppy diskettes that match the drive density of the 1.44 MB floppy diskette drive (ten per box).

p) 150 CD-R 700 MB (or larger) recordable CD’s compatible to the CD drive and 100 recordable DVD’s.

q) One floppy diskette holder (holds 50, 3½-inch floppy diskettes), and dust covers for the microcomputer, monitor, keyboard, and printer.

r) Two head cleaner kit for 3½-inch floppy diskette drive.

s) One can of compressed air and screen cleaning solution every other month of the duration of the project.

(2) One base printer having at minimum:

a) Color laser printer having HP PCL 5 emulation, with a minimum of 192 Megabytes of expanded memory, appropriate printer cable, and legal size paper tray (e.g., HP Color LaserJet 2500N or TN).

b) One set of appropriate printer toner cartridges every other month for the duration of the construction project.

c) One ten-ream carton of 8½” X 11” size paper (500 sheets per ream, weight: 2.2 ounces per square yard, color: white, grain: long, for laser printers and copiers) every two months for the duration of the construction project.

d) One ten-ream carton of legal size paper (500 sheets per ream, weight: 2.2 ounces per square yard, color: white, grain: long, for laser printers and copiers) every three months for the duration of the construction project.

(3) One software package, on CD-ROM with documentation, including:
a) Microsoft Windows, latest version with future upgrades for the duration of the entire project.
b) Microsoft Office Professional latest version. Software package should contain the following: word processor, spreadsheet, and database.
c) Norton’s System Works for Windows, latest version, or compatible software package with future upgrades and latest virus patches.
d) Anti-Virus software, latest version with monthly updates for the duration of the entire project (e.g., McAfee Anti Virus, Dr. Solomon’s, or Norton’s Anti Virus).

Hardware and software shall be acceptable to the Regional Construction and Resident Engineers before purchase/installation. All software shall be compatible with the computer’s operating system.

The microcomputer system, whether purchased new or previously used, shall be installed in the materials field laboratory.

At the time of installation, the Contractor shall ensure that the system is fully operational and meets all Department requirements. All software listed above shall be installed by the Contractor and maintained in the materials field laboratory. The Contractor shall configure the software to operate with the hardware provided. Any accessories for the microcomputer shall be compatible with the microcomputer.

The Contractor will not be permitted to use this microcomputer system at any time. It is being supplied solely for the Department’s use.

The Contractor shall forward all manuals, instructions, software, and literature received with the microcomputer system to the Resident Engineer. The Contractor is responsible for maintaining the microcomputer system in good working condition. Any part of the microcomputer system that becomes inoperable or defective, during the duration of the construction project, shall be replaced by the Contractor within 48 hours.

The microcomputer system (after the project data has been erased from the hard drive by the Department), manuals, instructions, software, and literature shall be removed and retained by the Contractor when no longer required as determined by the Resident Engineer. The data cartridges and data diskettes will become the property of the State.

THE FOLLOWING IS ADDED:

   ee. A cylinder compression machine shall be included as part of the initial laboratory equipment.

THE LAST SEVEN PARAGRAPHS ARE CHANGED TO:

Setting up the materials field laboratory shall consist of furnishing the laboratory and enclosure complete with furniture, equipment, electricity, water, heating, air-conditioning, installation and activation of telephone lines, telephone sets (touch tone and cellular), pager units, sanitary facilities, and lavatory supplies.

Maintenance of the materials field laboratory, for the time required, shall consist of maintaining the furniture, equipment, and utilities which includes the cost of telephone fixed monthly service charges, cellular phone fixed monthly service charges for the plan specified and pager services, providing lavatory supplies, janitorial and waste disposal services weekly, restocking of the first aid box, and snow removal services. Maintenance of the materials field laboratory shall also include monthly rent.

Payment for nuclear density gauge will be made by the number of units supplied.
Payment for setting up the materials field laboratory will be made by the number of units.
Payment for the maintenance of the materials field laboratory will be made for each month or fraction thereof that the materials field laboratory is required, except that payment will not be made for any month or fraction thereof in which the Contractor is assessed liquidated damages according to Subsection 108.16.

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUCLEAR DENSITY GAUGE</td>
<td>UNIT</td>
</tr>
<tr>
<td>MATERIALS FIELD LABORATORY SET-UP</td>
<td>UNIT</td>
</tr>
</tbody>
</table>

ROUTE 36 OVER THE SHERWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
106.09 Storage and Handling of Materials.
THE ENTIRE TEXT IS CHANGED TO:

Materials shall be stored to ensure the preservation of their quality and fitness. Stored materials, even though approved before storage, may again be inspected before their use on the Project. Stored materials shall be located so as to facilitate their prompt inspection. With the approval of the Department, portions of the ROW may be used for storage purposes and for the placing of the Contractor’s plant and equipment, but any additional space must be provided by the Contractor at the Contractor’s expense. Equipment and materials shall be placed behind barriers or crash cushions, or stored more than 30 feet from the traveled way. The barriers and crash cushions must be approved before installation. Furnishing, placing, and removing the barriers and crash cushions shall be at no Additional Compensation. No materials shall be stored within restricted areas noted on the plans. No materials shall be stored within 10 feet, plus the extended boom length of the largest crane on site, of overhead high voltage power lines. The high voltage power line is defined as an aerial power line having a voltage differential in excess of 750 volts between any pairs of conductors or between any conductor and ground. The Contractor shall be responsible for any power outage or de-energization associated with the Contractor’s activity in the vicinity of the power lines. Private property shall not be used for storage purposes without written permission of the owner or lessee, and any other approvals, including those as specified in Subsection 107.05. Copies of such written permission shall be furnished to the Resident Engineer before storage. Storage sites shall be restored to their original condition at no Additional Compensation.

106.13 Fuel Price Adjustment.
THE FIFTH PARAGRAPH IS CHANGED TO:

The monthly fuel price index will be posted every month on the Department’s web site: www.state.nj.us/transportation/eng/CCEPM/PriceIndex.shtml.

THE FIRST SENTENCE OF THE SIXTH PARAGRAPH IS CHANGED TO:

The basic fuel price index will be the previous month’s fuel price index before receipt of bids.

THE EIGHTH PARAGRAPH IS DELETED:

SECTION 107 - LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

107.01 Legal Jurisdiction.
THE ENTIRE SUBSECTION IS CHANGED TO:

1. Applicable Law. This Contract shall be construed and shall be governed according to the Constitution and laws of this State.

2. Sovereign Immunity. The State by entering into this Contract does not waive its Sovereign Immunity, except as provided by the New Jersey Contractual Liability Act, NJSA 59:13-1 et seq. The rights or benefits provided the Contractor in this Contract which exceed those provided under the Act are contractual in nature and shall not be deemed to expand the waiver of Sovereign Immunity as set forth in that Act.

3. Litigation of Claims by Contractor. The Contractual Claims Resolution Process is not an administrative procedure but is contractual in nature, intended to review properly filed and documented claims. Pursuant to N.J.C.A. 16:45-1.3, exhaustion of the Claims Resolution Process as set forth under the Specifications is not a prerequisite to the filing of a legal action against the Department or State. The Contractor, however, must fully comply with all of the terms and conditions of the Contractual Liability Act, N.J.S.A. 59:13-1 et seq. prior to commencing a legal action. Therefore, where a Contractor brings a legal action, arising out of a Contract, against the Department or State or any officials or employees, thereof, arising out of or related, directly or indirectly, to a claim pending against the Department; the Contractual Claims Resolution Process, at any step, shall terminate as to that claim(s) or related claims being litigated, no matter which level of review the claim may be at when the legal action is filed. Furthermore, once the Contractor files a legal action any claim(s), related to that legal action will no longer qualify to be reviewed by the Claims Committee.
or to have the same claim(s) resolved under the Non-Binding Mediation Procedure or at any other Level of
review. Such claim(s) will, thereafter, be resolved under the legal action subject to the provisions of the
Contractual Liability Act, N.J.S.A. 59:13-1 et seq, unless and until the legal action is dismissed with or
without prejudice. The Contractor may submit to the Department for processing through the various steps of
the Contractual Claims Resolution Process any claims that are unrelated to the pending litigation subject
the terms of the Specifications and the Contractual Liability Act N.J.S.A. 59:13-1 et seq.

4. **Completion of the Contract.** The Completion of the Contract shall control as to any issue that may arise
regarding the particular point in time when a Contractor may be barred from recovering against the State as
provided under N.J.S.A. 59:13-5 et seq. The Contractual Claims Resolution Process and the various steps
thereof may continue beyond the Completion of the Contract; however, the Contractual Claims Resolution
Process will not in any manner, expressed or implied, extend any statute of limitation that may apply as to a
claim. The Contractor by entering into the Contract with the Department agrees no further notice to the
Contractor regarding the provisions stated in this Section are required. The Contractor also agrees to be
responsible for compliance with all statutes of limitation and compliance with the various provisions of the

5. **Subcontractor(s).** Pursuant to Subsection 108.02, the Department will not process or review any claims
submitted by a subcontractor(s) or supplier(s) at any tier. All claims submitted by the Contractor must be an
obligation or liability of the Contractor and cannot be merely a pass through of a claim by a subcontractor or
by a supplier.

107.02 **Notice of Potential Claim and the Administrative Process for the Resolution of Contract Disputes.**
THE HEADING AND THE ENTIRE SUBSECTION IS CHANGED TO:

107.02 **Notice of Claim and the Contractual Claim Resolution Process.**

1. **Notice.**
   a. **Obligations.** The various notice provisions set forth in this Contract are contractual obligations
      assumed by the Contractor by the act of executing the Contract. The Contractor shall be responsible to
      notify the Department in writing within the time frame as may be mandated in an applicable Subsection
      of the Specifications as well as within 90 days of any situation or occurrence which may potentially
      result in or be the basis of a belief that additional compensation or an extension of time is due from the
      State, except where permission to file a “late notice of claim” has been obtained by the Contractor from
      the Superior Court in accordance with N.J.S.A. 59:13-6. The Department is not authorized to expand,
      reduce or waive either the contractual or statutory time limitations within which a notice of claim is to be
      filed with the Department. Any required notice shall be given only on the Contractual Notice Form
      provided by the Department. Submission of a Contractual Notice Form is required in order to comply
      with the notice requirements of the New Jersey Contractual Liability Act, N.J.S.A. 59:13-5 et seq.,
      provided such notices are given within the time limits established by that Act. The Contractor, by
      executing the Contract, agrees that the only evidence of compliance with the notice provisions of the
      Contractual Liability Act, N.J.S.A. 59:13-5 et seq., and the Specifications shall be the filing of a fully
      completed (except that the amount of the claim need not be stated when unknown) Contractual Notice
      Form with the Department, and that no other documents sent or delivered to the Department or any of
      its officers or employees shall satisfy the statutory and/or contractual notice requirements.

   b. **Time.** The Contractor, by the act of executing the Contract, acknowledges that it will be forever barred
      from recovering against the State if it fails to give timely notice in accordance with N.J.S.A. 59:13-5 et seq.,
      on the Contractual Notice Form required under this Subsection of any happening of an event, thing,
      or occurrence or of an act or failure to act, by the Department and that the Contractor is solely
      responsible for complying with the various notice requirements and the timeliness of a claim as set forth

   c. **Notice Form.** The Contractual Notice Form shall be completed in its entirety for each and every claim
      and shall be signed by an authorized representative of the Contractor. Any Contractual Notice Form
      filed which does not provide all of the minimum information listed in this Subsection will be considered
      incomplete for the purpose of processing the claim under the Contractual Claim Resolution Process and
      no formal discussions or meetings concerning a claim filed on an incomplete Form will take place. A
      Contractual Notice Form which identifies the amount of the claim as being unknown may be considered
      by the Department as only satisfying the notice requirements as set forth under the Contractual Liability

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Act, N.J.S.A. 59:13-5 et seq., as long as the notice of claim is timely filed and provides all of the other minimum information on or attached to a properly executed Contractual Notice Form. However, for any claim requesting Additional Compensation, it shall not be sufficient to begin the Claim Resolution Process until the exact amount is provided according to 3.j. below. The Contractor’s act of executing the Contract shall be construed to be an acknowledgment by the Contractor that it understands that the processing of a claim by the Department at any step of the Contractual Claims Resolution Process shall not constitute a waiver by the State of any defense that a claim was filed out of time and is thereby barred under the terms of the Contractual Liability Act or of any defense that there is no merit to the “claim being asserted by the Contractor”.

2. **Steps of Review.** The Contractual Claim Resolution Process is sequential in nature and is composed of the following steps:

   - **Step I:** Review by the Resident Engineer;
   - **Step II:** Review by the Regional Dispute Board;
   - **Step III:** Review by the Department Claims Committee;
   - **Step IV:** Non-Binding Mediation.

Processing through the steps is subject to the following conditions:

a. No claim will be accorded a particular level of review unless and until the claim has been reviewed at the preceding step. Additionally, there will be no further review of the claim, unless and until the Contractor provides, in writing, that the decision of a review step within the specified timeframe is unacceptable and further requests that the claim be forwarded to the next step. Absent the written submittal of this information the claim will be considered withdrawn from the Contractual Claim Resolution Process. If at any step in the process, a claim is resolved, the Contractor must sign an unconditional release, furnished by the Department, as to any and all matters arising from the claim.

b. In order to begin the Contractual Claim Resolution Process the Contractor must state in writing that all documentation in support of the claim, as required under this Subsection, has been provided to the Department as part of or attached to the contractually required Contractual Notice Form and that the Contractor has requested that the review process, as outlined above, begin. The Resident Engineer will take no formal action until this notification is received and the Resident Engineer independently determines that the Contractor has in fact satisfied the requirements of this Subsection. If the documentation submitted by the Contractor is determined to be incomplete, the Resident Engineer will notify the Contractor that the review process cannot begin and include a list of missing components required to start the process. When the additional material is submitted, the Contractor is required to again notify the Resident Engineer in writing that all documentation in support of the claim has been provided and the Contractual Claim Resolution Process should begin. The Contractor shall be limited to the documentation provided to the Resident Engineer at the beginning of Step I, in support of a claim, throughout all steps of the Claim Resolution Process. The submission of additional information by the Contractor at any step beyond Step I, shall be cause for the claim to revert back to Step I for review at each and every Step. The Resident Engineer will provide written notice to the Contractor when Step I was begun.

c. When the value of the claim submitted by the Contractor is $20,000 or less, the Step II review will be the final step in the Contractual Claim Resolution Process. In such a case, the decision of the Regional Dispute Board will be final and there will be no further contractual review.

d. Where there has been a determination, at both Step I and Step II, that the specifications do not provide a contractual basis for the resolution of the claim submitted by the Contractor or that the Notice of Claim was filed late without obtaining permission of the Superior Court, the Department reserves the right to conclude the Contractual Claim Resolution Process at the end of the Step II review. In such instance, the Secretary of the Department Claims Committee will provide the Contractor with the reason(s) for the no further review determination and rejection of the claim. However, where the Claims Committee does review a claim, there shall not be deemed a waiver by the Department of any defense that the Notice was filed late or that there does not exists a contractual basis for resolution.

3. **Information Required.** As a minimum, all of the following information must accompany each claim and be incorporated into or attached to the contractually required Contractual Notice Form:

   a. A detailed factual statement of the claim providing all necessary dates, locations, and items of work affected by the claim.
   b. The date on which facts arose that gave rise to the claim. 
c. A copy of any notice given to the Department pursuant to any other Subsection of the Contract which relates to the matter giving rise to the claim.
d. The name, function, and activity of each State individual, official, or employee involved in or knowledgeable about the claim.
e. The specific provisions of the Contract which support or mitigate against the claim and a statement of the reasons why such provisions support or mitigate against the claim.
f. If the claim relates to a decision of the Department which the Contract leaves to the Department's discretion or as to which the Contract provides that the Department's decision is final, the Contractor shall set out in detail all facts supporting its contention that the decision of the Department was fraudulent, arbitrary or capricious.
g. The identification of any documents and the substance of any oral communications relating to such claim attaching same to the Form.
h. A statement as to whether the additional compensation or extension of contract time sought is based on the operation of the provisions of the Contract or an alleged breach of contract.
i. If an extension of contract time is sought, the specific days sought and the basis for such claim, supported by the Contractor’s approved baseline progress schedule and updates, as well as a fragment, which will include a time impact evaluation, depicting the delay according to Subsection 108.04.
j. If additional compensation is sought, the exact amount sought and a breakdown of that amount into the following categories:
   (1) Direct Labor
   (2) Direct Materials
   (3) Direct Overhead as specified in Subsections 109.03 and 109.04.
   (4) Subcontractor's Work
   (5) Other categories as specified by the Contractor.
   (6) The basis and manner of the Contractor’s calculations of the additional compensation claimed.

The Department will not determine liability separate and apart from damages. The Contractual Claims Resolution Process shall not be bifurcated. The Department shall review liability and damage valuation issues at the same time.

a. Step I, Resident Engineer Review. The Resident Engineer will render a written decision regarding the claim presented within 30 State Business Days of the Resident Engineer’s determination that the information provided by the Contractor on the Contractual Notice Form in support of the claim satisfied the requirements to begin Step I. This time limit may be extended by mutual agreement of the parties. Within 15 State Business Days of the receipt of the decision by the Resident Engineer, the Contractor shall either accept or reject the decision in writing; or upon failure to complete this, the claim will be considered withdrawn from the Contractual Claim Resolution Process and there will be no further review of the claim. If the Contractor accepts the decision, such acceptance shall include execution of an unconditional release furnished by the Department effective upon payment.
b. Step II, Regional Dispute Board Review. If the Contractor provides a written rejection of the Resident Engineer's decision and a request to forward the claim to Step II, the Resident Engineer will forward the claim and supporting information previously submitted by the Contractor to the Regional Dispute Board within five State Business Days. The Regional Dispute Board will schedule and hold a meeting to review the claim with the Contractor within 30 State Business Days of receipt of the said claim information from the Resident Engineer. This time limit may be extended by mutual agreement of the parties. The Regional Dispute Board will issue a written decision regarding the claim within 20 State Business Days of the meeting.

Within 15 State Business Days of receipt of the Regional Dispute Board decision, the Contractor shall either accept or reject it in writing; or upon failure to complete this, the claim will be considered withdrawn and the Contractual Claim Resolution Process shall be considered to be concluded for that particular claim. If the Contractor accepts the decision, such acceptance shall include execution of an unconditional release furnished by the Department effective upon payment.

The Director, Construction Services and Materials, may request an informal meeting with the Contractor to discuss the then pending claim(s) after the Step II decision has been issued and sent to the Contractor, but prior to the matter being reviewed at the next step, subject to the mutual consent of the Contractor and the Department.
c. **Step III, Claims Committee Review.** A written request for a Step III review of the claim is to be made to the Secretary of the Department Claims Committee, P.O. Box 600, Trenton, New Jersey 08625-0600 with a copy to the Director, Construction Services & Materials. The Contractor may request that the Department Claims Committee immediately review claims, which are unresolved after review by the Regional Dispute Board, when the following conditions are met:

1. A claim or the combination of claims exceed $250,000; or
2. It is mutually agreed to by the Contractor and the Department.

However, when a project becomes 75 percent complete by contract time or dollar amount, which ever first occurs, claims that are unresolved at Step II will be reviewed at a single session of the Department Claims Committee after the Completion of the Work.

Additionally, the Contractor may request at the time of issuance of the Final Certificate that all unresolved claims, with the exception of the exclusionary cases as provided for in this Subsection, that have gone through the Steps I and II of the Contractual Claim Resolution Process, and which have not been presented at Step III of the Contractual Claim Resolution Process, be reviewed by the Department Claims Committee as provided for in this Subsection. The Contractor's written request must accompany its exceptions to the Final Certificate, with a copy sent to the Secretary of the Department Claims Committee and shall be made no later than 30 State Business Days after the issuance of the Final Certificate.

The Secretary of the Department Claims Committee will schedule a Claims Committee meeting with representatives of the Contractor and the Region, to be held within 45 State Business Days of the receipt of the claim information. This time limit may be extended by mutual agreement of the parties. The Department Claims Committee will notify the Contractor in writing of its decision on the claim(s) within 45 State Business Days of the meeting, stipulating the terms of any resolution of the claims. If the Department Claims Committee determines after review of the claims that no resolution and no further payment is warranted, it shall notify the Contractor in writing of its decision. Within 15 State Business Days of the receipt of the Department Claims Committee decision, the Contractor shall either accept or reject it in writing, or upon failure to complete this, the claim will be considered withdrawn and the Contractual Claim Resolution Process shall be considered to be concluded for that particular claim. If the Contractor accepts the decision, such acceptance shall include execution of an unconditional release furnished by the Department effective upon payment. If the Contractor rejects the decision, there will be no further review of the claim unless the Contractor submits a written request for the utilization of Non-Binding Mediation.

d. **Step IV, Non-Binding Mediation.**

(1) **Conditions.** The Contractor may request at any time during the Project, but no later than 30 State Business Days after issuance of the Final Certificate, that any claim unresolved by the Department Claims Committee be elevated to Step IV. The request must be in writing to the Secretary, Department Claims Committee, P.O. Box 600, Trenton, New Jersey 08625-0600. No claim will be elevated to Step IV unless all of the following conditions are satisfied:

(a.) The claim has been reviewed by the Department Claims Committee.
(b.) The Contractor has escrowed its bid preparation documents as required under Subsection 103.06 and the documents are still being held in escrow.
(c.) The Contractor has entered into a Non-Evidential agreement to the effect that any statement or information provided during the Non-Binding Mediation proceedings shall not be evidential in any legal proceeding unless obtained by other discoverable means.
(d.) The Contractor has entered into a cost sharing agreement to equally share the cost of using Non-Binding Mediation in accord with Department issued forms.
(e.) The utilization of Non-Binding Mediation has been mutually agreed to by the Department and the Contractor; and
(f.) Prior to the commencement of the Non-Binding Mediation the parties shall confer with one another for the purpose of resolving the format of presenting the claim summary, supporting information, opening statements, and responses. Failure by the Contractor to request Non-Binding Mediation within the required time period shall constitute a waiver by the Contractor of any utilization of the Non-Binding Mediation Step.

(2) **Forms.** Where the Contractor requests that Non-Binding Mediation be conducted, the Department will forward to the Contractor the required Non–Evidential and cost sharing agreement forms.
which shall be executed by the Contractor and returned to the Department within ten State Business Days. The failure by the Contractor to return the fully executed Non-Evidential and cost sharing agreements to the Department within the ten-day period shall constitute a waiver by the Contractor of the availability of Step IV.

(3) **Mediator**. The Department will select the Mediator to be utilized for the Non-Binding Mediation from a list of candidates submitted by the Contractor. The Contractor shall submit the names of six proposed Mediators, along with a biographical background listing the experience and qualifications of each candidate. Candidates may be from the same employment category or disciplines, such as construction, mediation, partnering facilitation, consulting engineer, attorney, judiciary (retired), accountant, architect, etc.

A candidate may have been used for mediation purposes for this Project or another project but shall not have any other relationships with either the Department or the Contractor for a period of two years preceding the request for Step IV. If the Department determines that none of the candidates submitted are acceptable, the Department will request and the Contractor shall submit four additional Mediator candidates. The Contractor shall submit this additional list within five State Business Days of the receipt of the written request. Upon mutual agreement, the Mediator can be an individual proposed by the Department.

(4) **Escrow Documents**. Once the Contractor has fully executed the required Non-Evidential and cost sharing agreements, its escrowed bid documents will be released upon request of the Department Claims Committee Chairperson solely for the exclusive use of the Mediator, the Department’s selected Negotiator(s), the Department Regional Representative(s) and the Contractor Representative(s) participating in the Mediation session. These documents will be used by the Department as part of the Contractual Claims Resolution Process only to resolve the pending claims except it may seek such documents through the discovery process in the event mediation is not successful and litigation ensues.

(5) **Meeting**. The Secretary of the Department Claims Committee will schedule a meeting for the Non-Binding Mediation of the submitted claims to be held within 30 State Business Days of the return of the executed Non-Evidential and cost sharing agreements. The meeting time limit may be extended by mutual agreement of the parties. The Secretary of the Department Claims Committee will issue the recommendations of the Department’s Negotiator to the Commissioner for action within 15 State Business Days of the Non-Binding Mediation session. The Commissioner, or their designee, will accept, reject, or modify the recommendation of the Department Negotiator and notify the Contractor of the decision within 15 State Business Days.

(6) **Decision**. The Contractor shall accept or reject the decision within 15 State Business Days of notification of the Commissioner's decision. If the Contractor accepts the decision of the Commissioner, or their designee, such acceptance shall be in writing and include execution of an unconditional release furnished by the Department effective upon payment. If the Contractor fails to accept or reject the Commissioner’s decision within 15 State Business Days, the decision of the Commissioner will be withdrawn and the Contractual Claims Resolution Process shall be deemed concluded as to that particular claim under review.

After submission of the recommendation to the Commissioner, the bid documents released from escrow will be returned to the escrow agent for continued escrow in the designated repository.

### 107.05 Permits, Licenses, and Taxes
THE FOLLOWING IS ADDED:

The Contractor is responsible for ensuring that his supervising personnel have knowledge of the terms and conditions of the permit authorizations issued by the NJDEP, the Army Corps of Engineers, and the U.S. Coast Guard.

No change in plans or specifications that may affect compliance with the permits shall be made except with the prior written permission of the permitting agencies. Any change in plans or specifications shall be submitted for approval of the Engineer and the New Jersey Department of Transportation Bureau of Environmental Project Support prior to requesting authorization from the permitting agencies.

Any unanticipated work required which deviates from the approved Permit Plans and Permit Conditions, such as an emergency action, will require emergency authorization from the permitting agencies. Emergency authorizations shall be coordinated through the Engineer and the Bureau of Environmental Project Support.

**ROUTE 36 OVER THE SHREWSBURY RIVER**
**HIGHLANDS BRIDGE**
**MONMOUTH COUNTY**
107.13 Construction Over or Adjacent to Navigable Waters

THE FOLLOWING IS ADDED:

One copy of the Contractor’s plan and sequence of operations, approved by the Engineer shall be submitted to the First District U.S. Coast Guard office for approval, at least 45 days prior to any work over or in the waterway that may obstruct or pose a hazard to navigation. In addition, a sketch of the project area shall be submitted showing: 1) the waterway, 2) the bridge, 3) the location of any restriction that will be placed in the waterway such as barges, anchors, and anchor lines, and 4) the location, height above mean high water and detailed description of any scaffolding or netting to be used. The schedule should also include the daily hours of operation and indicate whether waterborne equipment will remain in the waterway at night. The Contractor will be required to comply with all provisions of the Navigation Rules International-Inland, copies of which are available from the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 371954, Pittsburgh, PA 15250. Refer to stock No. 050-012-00376-9. No deviation from the approved plan and schedule of operations may be made unless the modification has previously been submitted and approved.

The construction of false work, turbidity barriers, bubble curtains, cofferdams, or other obstructions, if required, shall be in accordance with plans submitted to and approved by the District Commander prior to construction of the bridges. All work shall be so conducted that the free navigation of the waterway is not unreasonably interfered with and the present navigable depths are not impaired. Timely notice (at least 45 days) of any and all events that may affect navigation shall be given to the District Commander during construction of the bridges. The channels through the structures shall be promptly cleared of all obstructions placed therein or caused by the construction of the bridges to the satisfaction of the District Commander, when in the judgment of the District Commander the construction work has reached a point where such action should be taken.

The First District U.S. Coast Guard office contact information is as follows:
Mr. Ernest Feemster
First Coast Guard District
Bridge Branch
One South Street
Battery Park Building
New York, NY 10004-5073
212-668-7994

At no time during the construction will the waterway be closed to navigation without prior written notification to and approval from the Coast Guard. All waterway closures or restrictions shall be requested in writing to be received at the First District U.S. Coast Guard Office at least 45 days in advance. At the same time, waterway closings shall be coordinated with the harbormasters of the local marinas so as to minimize the impact on commercial operations. Written confirmation of the coordination shall be received by the Engineer at least 14 days in advance of the closings. In addition, the Contractor shall coordinate with NJDOT maritime police for continued maintenance of the waterway.

Positive means shall be taken to prevent any hot work, debris or construction material from entering the waterway. This includes sandblasting material, paint and any concrete work by-products. If welding or burning is to take place, some type of flameproof material shall be the upper most protective containment material. All welding and burning shall cease upon approach of a vessel and shall not start again until the vessel is past the bridge. An observer or observers shall be stationed so as to have an unimpeded view of both upstream and downstream access to the waterway area thereby assuring that all workmen can be alerted of a vessel’s approach by appropriate, mechanical means, such as an air horn.

Floating equipment shall have a radiotelephone capable of operation from its main control station in accordance with Part 26 Title 33, Code of Federal Regulations and shall be monitored during all periods the floating equipment is on station.
All construction equipment (including false work, cofferdams, turbidity barriers, trestles, dolphins, buoys, barges, cranes, and any other obstruction in or above the waterway) placed in the waterway shall be lighted in accordance with the provisions outlined in the Navigation Rules International – Inland and the Code of Federal Regulations, 33.

Floating work equipment (barges, etc.) must be moved out of the navigable channel during darkness after work hours or upon approval of the First District Commander, may remain in the channel with appropriate lighting. The First District U.S. Coast Guard must be notified at least 45 days in advance of placement of the equipment in the channel. If barges are used and held in place by anchors it shall be oriented so as to minimize reduction of the horizontal clearance, all anchor lines must be marked by anchor buoys which shall be lighted.

If permanent navigational lighting cannot be maintained operable, identical, temporary battery or power-operated lights shall be installed at the same locations. These temporary lights shall be visible for a distance of 2,000 yards on 90% of the nights of the year. Generally, a lamp of 20 foot-candles will meet these requirements. The temporary lights shall be in place until the repairs have been completed or permanent navigational lighting has been installed and determined to be operating satisfactorily. Plans for temporary lighting (if used) during periods of construction shall be submitted to the United States Coast Guard for written approval. If temporary lights are not installed in the same locations as permanent lights, specific information regarding proposed locations compared to the permanent position shall be provided. Deviations from the approved temporary lighting shall be permitted only upon written authorization from the Engineer.

During the progress of work should any material, machinery or equipment be lost, dumped, thrown overboard, or sunk so as to obstruct, interfere with or hazard navigation, immediate notice shall be given to the Coast Guard and the object removed as soon as possible. Until removal can be effected, the obstruction shall be properly marked in order to protect navigation. Notice to the Coast Guard shall give a description and location of any such object and the action taken or being taken to protect navigation and of action to remove the obstruction.

Spillage of oil and hazardous substances is specifically prohibited by Section 311 of the Clean Water Control, as amended. Measures should be taken including: (1) proper maintenance of construction equipment, (2) arrangement of fuel/hazardous substances handling areas so as to ensure that any spills are contained before reaching navigable waterways or their adjoining shorelines, (3) instructions to personnel not to dispose of hazardous substances into drains or the navigable waterways directly or onto adjoining shorelines and (4) other procedures to prevent spillage. If in spite of such planning oil/hazardous substances are spilled into a navigable waterway or adjoining shoreline, The U.S. Coast Guard is to be notified immediately at 212-668-7994. A supply of an absorbent material shall be retained so that it may be rapidly deployed to soak up any spillage, pending Coast Guard arrival on the scene. The use of chemical dispersing agents and emulsifiers is not authorized without prior, specific, Federal approval.

Upon completion of the bridge work, an inspection of the waterway bottom shall be performed to insure that all bridge construction waste materials have been completely removed from the waterway. The U.S. Coast Guard will require certification in writing by a licensed Engineer, licensed Surveyor or responsible official of the Contractor that the waterway has not been impaired and all construction related debris has been cleared from the same. The Coast Guard recommends that a bar sweep (wire drag) or sidescan sonar be used as the method of determining that the waterway is cleared of debris. The Contractor’s certification shall include the actual method used to conduct the inspection. The Contractor shall remove any bridge related debris, resulting from the current or prior work or occurrences, discovered during this survey. Channel surveys shall be performed in accordance with the requirements of the U.S. Coast Guard. No payment will be made for additional surveys required based on the Contractor’s methods of operation.

It shall be the Contractor’s responsibility to ensure that the waterway depths are not affected by his work. Should it be suspected that waterway depths have been impaired or that an obstruction resulting from the work may exist, the Contractor, upon request of the Coast Guard or Corps of Engineers, shall provide the necessary equipment and personnel to undertake a survey to determine the presence of such impairment or obstruction. The cost of this work shall be the responsibility of the Contractor.

All instrumentation shall be removed from the waterway upon termination of its use.

107.22 Risks Assumed by the Contractor

THE FIRST PARAGRAPH UNDER SUBPART 1 IS CHANGED TO:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY

Page 42
1. **Risks of Loss or Damage to the Permanent Construction.** Until Acceptance, and within the limits of the Project’s work, the Contractor shall bear the risk of all loss or damage to all permanent construction and temporary construction performed under this Contract and to materials, whether or not it has received payment for such construction or materials under Subsection 109.05, 109.06, or 109.07, except payment will be made to the Contractor for the repair or replacement of any permanent element of the construction which has not been accepted by the Department, if the element of the work damaged is completed to the stage of serving its intended function and is subsequently damaged by accident by public traffic. In order to receive payment, the Contractor must supply satisfactory evidence that such damage was caused by a public traffic accident which was not caused by vandalism or by the equipment of the Contractor or any of its subcontractors or suppliers. Satisfactory evidence shall generally be limited to: accident reports filed with the Division of Motor Vehicles, police agencies or insurance companies; statements by reliable, unbiased eye witnesses; identification of the vehicle involved in the accident. Physical evidence that the damage was caused by a motor vehicle (such as tire marks or broken headlight glass) will not be sufficient unless it can be clearly shown that the damage was not caused by the Contractor’s vehicles or by vandalism. The Contractor shall take every precaution, as allowed by the Contract against injury or damage to any part of the construction or to materials by the action of the elements, the traveling public, vandalism, or from any other cause, whether arising from the execution or the non-execution of the work. The Contractor shall promptly repair, replace, and make good any such damage or loss without cost to the Department. The Contractor shall not bear such risk of loss or damage, which arises from acts of war or floods, tidal waves, earthquakes, cyclones, tornadoes, hurricanes, or other cataclysmic natural phenomenon unless such loss or damage is covered by insurance.

**SECTION 108 - PROSECUTION AND PROGRESS**

**108.02 Subcontracting.**

Specialty Items are as listed below:

- Above ground highway lighting items.
- Above ground sign lighting items.
- Above and below bridge deck lighting items.
- Electrical wire items.
- Metal Railing items
- Dynamic Pile Load Tests
- ITS items

THE FOLLOWING IS ADDED TO THE END OF THE FIFTH PARAGRAPH:

The Contractor shall also attach to that form (application for subcontracting form) proof of the Subcontractor’s valid, current registration with the New Jersey Department of Labor, Division of Wage and Hour Compliance as required by “Public Works Contractor Registration Act,” N.J.S.A. 34:11-56.48 et seq. (P.L. 2003, c. 91). Pursuant to P.L. 2003, c. 91, the Department will not consent to the proposed subcontracting, and the Subcontractor shall not perform any work under the Contract, unless the Contractor first provides the required proof of the Subcontractor’s valid, current registration with the New Jersey Department of Labor, Division of Wage and Hour Compliance as required by “Public Works Contractor Registration Act.” The Contractor shall ensure full compliance with the Public Works Contractor Registration requirements by their Subcontractors.

**108.03 Commencement of Work.**

THE THIRD SENTENCE OF THE FIRST PARAGRAPH IS CHANGED TO:

Construction operations shall not begin until the Contractor has supplied, and the Engineer has accepted, the preliminary schedule and other certifications, forms, schedules, and any other information required by the Contract Documents, and until the Contractor has established a field office as required by Subsection 105.15.
THE FOLLOWING IS ADDED:

Construction operations that require lane or shoulder closures shall not begin until the REAL TIME WORK ZONE TRAFFIC SYSTEM is operational as specified in Section 706.

THE FOLLOWING IS ADDED TO THE END OF THE FIRST PARAGRAPH:

The Contractor shall notify the Resident Engineer in writing at least twenty-one calendar days in advance of the date of the start of work at the Project Site. No work at the Project Site will be permitted prior to the date given in the notice. Notices submitted prior to the Pre-Construction meeting shall be addressed to the contacts specified in Subsection 101.04.

THE LAST PARAGRAPH IS CHANGED TO:

The Contractor shall give the Resident Engineer in writing a notice of 72 hours in advance of starting Construction Operations.

108.04 Progress Schedule and Prosecution of the Work.
THE ENTIRE SUBSECTION IS CHANGED TO:

In scheduling and executing the Work, the following shall be complied with:
1. Progress Schedules. The progress schedule shall conform to and incorporate the following requirements:
   a. General.
      (1) The work shall be monitored by a detailed CPM schedule. The CPM schedule shall be developed utilizing the most current NJDOT Capital Program Management Construction Scheduling Standard Coding and Procedures for Designers and Contractors Manual and the NJDOT Primavera template project containing the latest standard coding. The manual and template are available from the Bureau of Quality Management Services.
         The CPM schedule shall consist of diagrams and accompanying mathematical analyses. The scheduling of submittals, procurement, construction, and all else necessary to complete the Work as described in the Contract Documents, is the responsibility of the Contractor. The requirement for the CPM schedule is included to ensure adequate planning and execution of the Work and to assist the Department in appraising the reasonableness of the proposed schedule, as well as its compliance with Contract requirements.
         The CPM schedule is the Contractor’s committed plan to complete all work within the allotted time. The Contractor assumes full responsibility for the prosecution of the Work as shown. The CPM schedule shall be based on and derived from detailed schedules used to complete all Contract activities.
      (2) No claim for extension of time due to extra work or any other type of delay will be considered unless the baseline schedule has been approved and monthly updates are current and submitted within the time limits stated.
      (3) No claim for additional compensation as specified in Subsection 109.04 will be considered unless the baseline schedule has been approved and monthly updates are current and submitted within the time limits stated.
      (4) The CPM preliminary, baseline, and updated schedules shall be submitted in electronic format on a floppy diskette or compact disk, in addition to the required number of copies specified in b. (1) and b. (2) below.
      (5) Once the CPM baseline schedule has been approved, the Contractor shall not deviate from it without first notifying the Engineer in writing and the schedule is updated in accordance with 1.h. and 1.i. below.
   b. Submittals. The CPM schedule shall consist of the following two distinct initial submittals:
      (1) Preliminary Schedule. No later than 10 State Business Days after execution of the Contract, the Contractor shall submit to the Engineer for review and approval or rejection and return a preliminary schedule. The contractor shall submit six copies of:
(a) A CPM time-scaled diagram defining the Contractor’s planned activities during the first 90 Calendar Days. For projects with a construction cost over $40 million, a CPM time-scaled diagram defining the Contractor’s planned activities during the first 120 Calendar Days.

(b) A summary network for the remainder of the Contract time. The preliminary schedule shall indicate all milestone activities expected to be completed or partially completed before submission and approval of the CPM baseline schedule as specified in b. (2) below.

(c) All multiple shifts per day and anticipated production rates shall be detailed in the Contractor’s narrative accompanying the preliminary schedule.

(d) The Work shall not begin until the preliminary schedule has been approved. Five State Business Days will be required for review and approval or rejection and return of the preliminary schedule.

(2) **Baseline CPM Schedule.** In accordance with the time frames listed below, the Contractor shall submit six copies of the Baseline CPM Schedule documents depicting the Contractor’s work plan for the entire Contract.

<table>
<thead>
<tr>
<th>Project Construction Cost ($ million)</th>
<th>Time Frame After Approval of Preliminary Schedule for Submission of the Baseline CPM Schedule (State Business Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5</td>
<td>10</td>
</tr>
<tr>
<td>5 - 15</td>
<td>15</td>
</tr>
<tr>
<td>15 - 40</td>
<td>20</td>
</tr>
<tr>
<td>&gt; 40</td>
<td>30</td>
</tr>
</tbody>
</table>

The Contractor shall submit to the Engineer for review and approval or rejection and return:

(a) Computer generated tabular schedule and logic reports in accordance with l.e. below.

(b) Time-scaled computer generated Layout Output in conformance with l.f. below.

(c) A written narrative explaining the schedule and the Contractor’s general approach for achieving Substantial Completion and the date of Completion as specified in Subsection 108.10 of these Special Provisions. Multiple shifts per day and anticipated production rates shall be detailed in the Contractor’s narrative accompanying the Baseline CPM Schedule.

(d) Electronic version as specified in l.a. (4) above.

c. **CPM Schedule Requirements for the Baseline and Updates.**

(1) The CPM schedule and updates shall contain the following:

(a) The order in which the Contractor proposes to prosecute the Work; the starting dates of the various work stages, operations, and principal items of work including procurement of materials and plant, and the contemplated dates for completing the same.

(b) List dates for all required submissions.

(c) A clear outline of the intended maintenance of traffic.

(d) The locations and timeframes for the installation of temporary and permanent soil erosion and sediment control measures to be installed.

(e) All unusual requirements specific to the project included in the Contract Documents or as deemed appropriate for the project.

(f) Special consideration to sensitive areas such as wetlands, floodplains, waterways, and parklands to ensure that appropriate staging and seasonal constraints are considered in order to maximize the effectiveness of the soil erosion and sediment controls.

(g) The time frames when work is restricted in sensitive areas as reflected in present and future permits as anticipated or known.

(h) Updates to reflect permit conditions if changed.

(i) Include a detailed, step-by-step outline of any clean-up operations regarding contaminated material.

(j) The work of the Contractor, subcontractors, suppliers, the Department, permitting agencies, utility companies, and all others that affect progress shall be shown and identified on the schedule by responsibility codes.

(k) The Contractor should plan for and allow sufficient time for the checking, returning, and distribution of all submissions. No work shall proceed until the necessary drawings have been
approved and distributed. The Department will make every effort to expedite their reviews, but it will not be responsible for any delays which may result during the proper handling of any submission. Procurement activities shall be shown, including plans, permits, materials, individual working drawings, fabrication, and delivery of the material. 20 State Business Days will be required for review and certification or rejection and return of fabrication working drawings. 30 State Business Days will be required for review and approval or rejection and return of working drawings for items that were included as conceptual and the Contractor is required to complete final design plans. The time frames set forth in this paragraph are provided for scheduling purposes only. The Department reserves the right to enlarge such time periods for review by a reasonable amount of time where circumstances necessitate, within the sole discretion of the Engineer.

(i) Traffic staging, delivery of Department - furnished labor/equipment, project phasing, right-of-way availability dates, and any other requirements specified in Divisions 200 through 900 shall be shown.

(m) The CPM schedule shall contain sufficient activities to adequately depict the Work, and will be subject to the review and approval of the Engineer.

(n) The logic and activity time durations established by the Contractor shall be consistent with the Contract Documents and be reflective of proper coordination between trades.

(o) The CPM schedule shall contain sufficient activities for notification of the Department by the Contractor for changes to the traffic patterns and staging, including the following:

1. An activity with a duration of at least twenty-eight calendar days, but not more than sixty calendar days, shall be shown in advance of the date of establishing a new permanent traffic pattern.

2. An activity with a duration of at least fourteen (or seven) calendar days shall be shown in advance of the date of starting establishing a new permanent traffic pattern.

(2) The CPM schedule shall operate as follows:

(a) The CPM schedule shall be of the precedence type.

(b) One activity for each discrete component part of each Pay Item scheduled in the Proposal. The Engineer may allow grouping of similar Pay Items into one activity. No work activity shall have a duration greater than 30 Calendar Days, except as approved by the Engineer. The activities shall be consistent with the Work Breakdown Structure (WBS), and shall also include discrete component parts of the Contractor’s submittal preparation, Department approval, procurement, and construction work activities with sufficient detail such that all the relationships with all direct and non-direct parties to the Work are shown.

(c) The system shall be based upon network diagrams and accompanying mathematical tabulations as described hereinafter. Diagrams shall show the order and interdependence of activities and the sequence and quantities in which work is to be accomplished. The basic concept of network scheduling shall be followed to show how the start of a given activity is dependent on the completion of preceding activities and how its completion may affect the start of subsequent activities. The critical path shall be distinguished from other paths on the network.

(d) The completion date of the CPM schedule shall be the date of Completion specified in Subsection 108.10 of these Special Provisions, except as specified in Subsection 108.04 subpart 5, which shall be input as a Finish Milestone with a Late Finish Constraint. All Intermediate Milestones required in the Contract shall be shown in proper logical sequence and input as a “Start-no-Earlier-Than” constraint for entrance into an area or start activity or a “Finish-no-Later-Than” constraint date for completions.

(e) Activities shall be described such that the Work is readily identifiable for assessment of start and completion, as well as intermediate status. Descriptions shall utilize activity codes for physical locations at each stage such as distance-markers, structures, and elevations where possible to define the Work. Activity descriptions of “Start,” “Continue,” “Completion,” “X percent,” “Y percent,” “Z percent” or similar nonspecific descriptions will not be allowed.

(f) The CPM schedule shall be calculated in Working Days. The Working Day to calendar date correlation shall be based upon the Contractors proposed work week with adequate allowance for weekends, legal holidays and any special requirements of the Contract. Activities shall indicate the calendar being used. Durations for activities shall not be less than one workday. Multiple shifts
per day and anticipated production rates shall be detailed in the Contractor’s narrative accompanying the baseline schedule and subsequent updates.

(g) Constraint dates are permitted only on milestone activities, unless otherwise approved by the Engineer.

(h) All activities with the exception of the Project Start Milestone and Project Completion Milestone shall have predecessors and successors. The start of an activity shall have a Start-to-Start or Finish-to-Start relationship with preceding activities. The completion of an activity shall have a Finish-to-Start or Finish-to-Finish relationship with a succeeding activity. Start-to-Finish relationships are not acceptable.

(i) CPM schedules, which have been resource leveled, are permissible, provided the effects of leveling are incorporated in the schedule using “Start-no-Earlier-Than” date constraints.

d. Computer Program Requirements. The computer program requirements shall be the same as that specified in Subsection 105.15 subpart 1.e. of these Special Provisions.

e. Tabular Reports.

(1) CPM schedule reports shall be provided for the following sort orders:

(a) Total float, then early start for activities with float less than 20 days.
(b) Grouped by responsibility, then by early start.
(c) Grouped by WBS, area, then sorted by early start.

(2) The minimum activity information required for each of the above reports in (1), shall include the following:

(a) A unique activity ID for each activity.
(b) A description of the Work represented by the activity.
(c) Location code identification.
(d) Work responsibility code identification.
(e) Original activity duration and remaining activity duration in Working Days.
(f) Early and late, start and finish dates calculated according to CPM principles.
(g) Total float.
(h) Historical (actual) dates for activities completed or underway shall replace the appropriate calculated dates.
(i) Stages.
(j) Calendar used for each activity.

f. CPM Time-Scaled Layout Output.

(1) The network displayed on the schedule diagram shall depict the exact detail of the CPM schedule reports.

(2) The network diagram shall be of the precedence type and drawn by using early dates.

(3) The layout output shall be time-scaled. The length of the activity representation shall be proportional to the activity duration.

(4) The activity display shall include the:

(a) Activity description.
(b) Activity identification.
(c) Activity original duration and remaining duration.
(d) Activities coded by area, responsibility, and WBS.
(e) Activity total float.
(f) Activities early start dates.
(g) Activities finish dates.

(5) The activities, which are displayed on the network diagram, shall be grouped by WBS and sorted by area. The title of these components shall appear on the left-hand side of the plot.

(6) The critical path shall be identified on the plot.

(7) Vertical lines indicating the start and the end of each month shall be shown.

(8) The data date shall be indicated on the plot in the activity display and in the title at the top or bottom of the plot.

(9) Completed activities shall be indicated on the plot.

(10) The Contract title shall be displayed on the plot.

(11) A legend shall be provided which indicates the various symbols used and their meanings.

(12) Milestone Activity shall be indicated by a prominent symbol.
(13) Different line types shall indicate the critical path and completed Milestone and activities.

g. **Review and Approval.** The Engineer will review a submitted preliminary schedule for approval or rejection within five State Business Days of receipt and will thereafter return same to the party having submitted it. There will, in turn, be allotted ten State Business Days for review and approval or rejection by the Engineer of the submitted baseline schedule, which will thereafter be returned to the party having submitted it. The Engineer will review revised preliminary or revised baseline submittals within five State Business Days of receipt. The time periods set forth in this paragraph are provided for scheduling purposes only. The Department reserves the right to enlarge such time periods for review by a reasonable amount of time where circumstances necessitate, within the sole discretion of the Engineer.

h. **Updating and Revisions.**

   (1) Within ten State Business Days after review by the Engineer, all preliminary and baseline schedules that are not approved shall be revised and resubmitted by the Contractor until the Engineer’s approval is received.

   (2) The Contractor shall update the CPM schedule every two months whether or not the Engineer has accepted the schedule, to reflect actual activity progress. The update shall include the historical record of actual start and actual finish dates for activities in progress, or completed, and the remaining duration based on the amount of workdays required to complete the activity.

   (3) Monthly progress meetings shall be held. The updated CPM schedule shall be the basis for the monthly progress review meetings. Activity progress shall be prepared in advance of the meeting. At this meeting, attended by the Engineer, all progress during the calendar month shall be presented and reviewed for incorporation into the schedule by the Contractor. Within a period of ten State Business Days from the date of this progress meeting, the Contractor shall submit the schedule update to the Engineer with the agreed upon changes.

   (4) The monthly schedule update submission shall consist of three copies of electronic format on floppy diskettes or compact disks and three copies of the following:

      (a) Updated CPM schedule reports (see Item e. above).
      (b) Layout output. (See item f. above)
      (c) CPM progress narrative. The CPM progress narrative report submitted as part of the update analysis shall include, but not be limited to, the:

         1. Description of schedule status.
         2. Discussion of current and anticipated delaying problem areas and their estimated impact.
         3. Schedule slippage, pay revisions, and/or progress along the critical path in terms of days ahead or behind the allowable dates, and if the Work is behind schedule, progress along other paths with negative float. This shall be in addition to and not a substitute for requirements in Subsection 108.11.
         4. Logic changes and an explanation of the revisions. Revisions to activities not worked on during the period, including changes in duration, or revisions to activity relationships are to be considered logic revisions. Out-of-sequence activities are not acceptable and shall be corrected in logic revisions prior to submission to the Department.

      (5) When, in the Engineer’s opinion, the CPM schedule fails to reflect the Contractor’s actual plan and method of operation, or the Contractor’s completion date as indicated by the CPM is more than one month behind the Contract completion date, the Engineer may require the Contractor to submit for review within ten State Business Days, a recovery plan for completion of the remaining work within the Contract completion date. A recovery plan shall include, but not be limited to, a revised CPM schedule and additional manpower and equipment that shall be utilized to complete the project by the date of Completion.

      (6) When the Contractor adds activities that are not Extra Work Items to the CPM schedule, they shall be added in a method that completion dates of any succeeding baseline activities are not affected. All revisions shall be submitted to the Engineer for approval before incorporation into the CPM schedule.

      (7) The Engineer shall have the right, within its sole discretion, to prepare its own update(s) or revision(s) to the baseline schedule in the event of a dispute between the parties regarding the appropriateness of the submitted revision(s) or updates to the baseline schedule or by reason of a failure on the part of the contractor to prepare same, which update(s) or revision(s) may reflect...
what the Engineer has determined to be the actual status of the project progress, actual sequencing of the Work and appropriate scheduling logic required under this Subsection. The Engineer may thereupon rely on its own revision(s) or update(s) of the baseline schedule in the administration of the project, review of claims and/or the imposition of liquidated damages.

i. Changes and Delays. To ensure that the CPM schedule continues to accurately reflect the Contractor’s plan for the Work and that it incorporates the impact of all changes and delays as soon as the Work scope can be defined, the Contractor shall use the following procedure to incorporate changes and delays.

When Extra Work or a change is proposed or claimed, the Contractor shall submit a Time Impact Evaluation form. Each Time Impact Evaluation must identify in a CPM fragment sketch, additional work required as a result of the proposal and its interrelationship to the CPM schedule. Each change or delay shall be represented by adding a new activity or activities. These activities shall be clearly identified. This sketch shall show all activities, logic revisions, duration changes, and new activities with all the predecessors and successors. The Time Impact Evaluation form shall also include any associated cost changes for performing the Work in question. Upon the Engineer’s approval of the Time Impact Evaluation, the Contractor shall incorporate the fragment’s illustrating the influence of changes and delays into the baseline schedule and the working schedule in the next schedule update. An extension of time may only be considered when the Time Impacted scheduled completion date exceeds the date of Completion. For cases where the Contractor is behind schedule, an extension will be granted for only the amount of time that the Department is responsible as supported by a Time Impact Evaluation. In the event of a dispute, the Engineer may prepare an update, which is believed to be the true impact on the project. No additional compensation will be paid to the Contractor for preparing these revisions. Any request for extension of time shall be verified by CPM analysis and shall be in accordance with Subsection 108.11. Compensation for additional expense to the Contractor and allowance of additional time for completion of the Work shall be as set forth in a Construction Order in accordance with Subsections 108.11 and 109.03.

2. Staging. The Contractor shall schedule the Work using such procedures and staging as may be specified in the Contract Documents. Work designated as part of separate stages may be performed simultaneously where provided by the Contract Documents or where approved.

When the Contract Documents provide for staging or specific procedures, the Contractor may present, for written approval of the Engineer, a detailed, written alternate staging plan or procedure which incorporates the requirements of the Department. If the Contractor proposes an alternate-staging plan, two CPM schedules shall be submitted. One based on the original staging and one based on the Contractor’s alternate staging. As a condition of the Engineer’s reviewing of the alternate staging plan or procedure, the Contractor agrees that it is not entitled to additional Contract Time or compensation arising from possible delays to construction due to the time spent in reviewing the Contractor’s staging plan or procedure, regardless of whether the Department accepts or rejects it. The Engineer will review and approve or reject and or return, with comments, the staging plan within ten State Business Days. If such staging plan or alternate procedure is approved in writing, the Contractor shall then finalize the progress schedule consistent with the alternate approved staging.

3. Prosecution of the Work.
   a. At or prior to the preconstruction conference, the Contractor shall furnish the name and location of the solid waste facilities to be utilized as well as the fee structure of each of the facilities. Failure to provide such information shall make the Contractor ineligible for adjusted compensation as provided for in Subsection 104.07.
   b. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the Completion of the Project in accordance with the Contract Documents and within the time set forth under Subsection 108.10.
   c. The Contractor shall supply the Engineer with a weekly work schedule indicating the Contractor’s planned work, the subcontractor’s planned work, the dates when materials and submissions are to be delivered, and a forecast of lane closings.
   d. The Contractor shall notify the Engineer, in writing, prior to discontinuing work for any reason and at least 24 hours in advance of resuming operations.
   e. The Contractor shall arrange and prosecute the Work so that each successive construction operation at each location shall follow the preceding operation as closely as the requirements of the various types of construction permit.
f. Underground structures for traffic signals, except for pressure detector installations shall be constructed prior to completion of the intersecting road.

g. Work, which closes or alters the use of existing roadways, shall not be undertaken until adequate provisions, conforming to the requirements of Section 617, have been made by the Contractor and approved.

h. The Engineer may revise stage construction and maintenance of traffic, if deemed necessary, by the Engineer due to unforeseen circumstances that may arise during construction.

i. When possible, the construction of subsurface structures adjacent to traffic shall be performed while traffic is being diverted from such areas. If traffic must be maintained in such areas, the Work shall be done expeditiously in stages, as approved, and with minimum interference with traffic.

j. Subsurface structure excavation adjacent to traffic shall not remain open overnight unless adequately protected by approved safety devices.

k. The Contractor shall proceed with the Work of demolition of the various buildings that are identified with a demolition number as and when they become available for demolition. If any of the buildings to be demolished is not available for demolition at the time the Contractor begins work on the Project, the Contractor shall temporarily defer its work in the vicinity of the building and complete the Work when the building is made available for demolition.

l. Operations adjacent to traffic shall be confined to only one side of the traffic at any one time unless otherwise specified in the Contract Documents.

m. Concrete curbs constructed adjacent to flexible base and surface courses shall be completed, cured, and backfilled before the flexible base and surface courses are constructed.

n. Bituminous paving operations shall be staged to progress up to the bottom of the surface course. The top layer of the bituminous concrete surface course for the full width of the traveled way, shoulder, and auxiliary lanes shall be paved as a single stage of construction and as the final paving operation.

4. Acceleration and Default. If, in the opinion of the Engineer, the Contractor falls behind its baseline schedule, and cannot complete the Work within the time prescribed under Subsection 108.10, as modified pursuant to Subsection 108.11, the Contractor shall take such steps as may be necessary to improve its progress. The Engineer may require the Contractor to increase the number of shifts, begin overtime operations, work extra days including weekends and holidays, or supplement its construction plant and to submit for approval such supplementary schedule or schedules, as may be deemed necessary to demonstrate the manner in which the agreed rate of progress shall be regained, all at no cost to the State.

Failure of the Contractor to comply with the requirements of the Engineer under this Subheading is grounds for the determination that the Contractor is not prosecuting the Work with such diligence as to ensure Completion within the time specified. Upon such determination, the Engineer may terminate the Contractor’s right to proceed with the Work or any separate part thereof in accordance with Subsection 108.17.

5. Intent, Responsibility, and Time. Scheduling of construction shall be the responsibility of the Contractor. The Contractor’s shall determine the most feasible order of work commensurate with the Contractor’s abilities and the Contract Documents. The CPM schedule will be used for determining extensions or reductions of Contract Time pursuant to Subsection 108.11.

It is not intended that the Engineer, by approving the CPM schedule, agrees that it is reasonable in any or all respects or that following the CPM schedule can result in timely completion of the Project. The progress schedule is not a part of the Contract.

If, in the preparation of the CPM schedule, the Contractor reflects a completion date different than that specified under Subsection 108.10, this in no way voids the date set therein. The date as specified in that Subsection governs. Where the CPM schedule reflects a completion date earlier than that specified as the Contract Time, the Engineer may approve such schedule with the Contractor specifically understanding that no claim for additional Contract Time or compensation shall be brought against the State as the result of failure to complete the Work by the earlier date shown on the CPM schedule.

6. Payment. Payment for the accepted progress schedule will be made on a lump sum basis for the costs for schedule preparation, maintenance, updating, facilities, personnel, computer hardware and software requirements, schedule submittals and reproduction as specified. Twenty-five percent of the lump sum bid will be paid upon approval of the baseline submission, and the balance paid on approval of updates at a prorated sum based upon the number of anticipated updates to be submitted during the Contract Time.

Payment will be made under:
108.05 Mobilization.
THE ENTIRE SUBSECTION IS CHANGED TO:

Mobilization shall consist of the preparatory work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to the Project site, and other work performed or costs incurred prior to beginning Work.

Payment for mobilization will be made on a lump sum basis regardless of the fact that the Contractor may have, for any reason, shut down its work on the Project or moved equipment away from the Project and back again.

Payment will be made in accordance with the following schedule:

1. When five percent of the Work is completed and the Baseline Progress Schedule is approved by the Engineer, 25 percent of the lump sum bid for mobilization or 2.5 percent of the Total Contract Price, whichever is less, will be paid.
2. When ten percent of the Work is completed and all required CPM Progress Schedule Updates are approved by the Engineer, 50 percent of the lump sum bid for mobilization or five percent of the Total Contract Price, whichever is less, will be paid.
3. When 15 percent of the Work is completed and all required CPM Progress Schedule Updates are approved by the Engineer, 75 percent of the lump sum bid for mobilization or 7.5 percent of the Total Contract Price, whichever is less, will be paid.
4. When 20 percent of the Work is completed and all required CPM Progress Schedule Updates are approved by the Engineer, 100 percent of the lump sum bid for mobilization or ten percent of the Total Contract Price, whichever is less, will be paid.
5. When all Work on the Project is complete, payment for the lump sum bid for mobilization in excess of ten percent of the Total Contract Price will be made.
6. The percentage of Work completed shall be the total of payments earned compared to the Total Contract Price. The total of payments earned excludes the amount paid for this item and the amount paid for materials furnished but not incorporated into the Work in accordance with Subsection 109.06, as shown on the monthly estimates of the approximate quantities of Work performed, prepared in accordance with Subsection 109.05.
7. No payment will be made for mobilization until a Baseline Schedule is approved, except when all Work on the Project is complete, then 50 percent of the lump sum bid for mobilization will be paid and no further payment(s) will be made for the lump sum bid for mobilization.

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROGRESS SCHEDULE</td>
<td>LUMP SUM</td>
</tr>
</tbody>
</table>

When mobilization is not a Pay Item, all costs for the Work shall be included in the prices bid for various Pay Items scheduled in the Proposal.

108.06 Limitation of Operations.
THE FOLLOWING IS ADDED TO THIS SECTION:

This project is to be constructed in stages as shown on the Traffic Control and Staging Plans. Lane closure restrictions shall be in accordance with the Traffic Control and Staging Plans.

Allowable single lane closures shall be in accordance with the following schedule:

- **May 15 – September 15**
  - Monday – Thursday: 9PM – 6AM the following day
  - September 16 – May 14
    - Monday – Sunday: 9PM – 6AM the following day

In addition, single lane closure will not be permitted on the following holidays:

- **Easter Sunday**: Including 6AM Saturday until 12PM Monday
- **Memorial Day**: See note below
- **July 4th**: See note below
- **Labor Day**: See note below
Election Day  6AM until 8PM the day of  
Thanksgiving Day  See note below  
Christmas Day  See note below  
New Year’s Day  See note below  

Note: If holiday falls on    No Lane Closure Permitted  
Sunday or Monday    6AM Friday until 12PM Tuesday  
Tuesday    6AM Friday until 12PM Wednesday  
Wednesday    6AM Tuesday until 12PM Thursday  
Thursday    6AM Wednesday until 12PM Monday  
Friday or Saturday    6AM Thursday until 12PM Monday  

In addition, the Route 36 Highlands Bridge is a designated hurricane/emergency evacuation route. Two lanes, on Route 36 NB, will have to be available to move traffic from June 1st to November 30th in case of an emergency. 

The seasonal restrictions associated with this project shall be in accordance with the Environmental Plans and permit conditions. 

Certain construction activities will be restricted to minimize noise levels that may impact the nesting habitat of piping plover in accordance with the Environmental Plans and permit conditions. 

All work in the wetland areas shall be in accordance with the conditions and limits stated in the Environmental Plans and permit conditions. 

Work shown on the plans within NPS property will be restricted during certain dates and all work within NPS needs to be coordinated with Richard Wells (732) 872-5913– Superintendent of Gateway National Recreation Area (Sandy Hook) or his designated representative. 

The Contractor shall provide notification to the First District U.S. Coast Guard at least 45 days prior to initiating any work over or in the waterway that may present an obstruction or hazard to navigation. Notification shall meet the requirements specified in Subsection 107.13 Construction Over or Adjacent to Navigable Waterways of the Contract Specifications. 

The Resident Engineer is to be notified a minimum of seven (7) calendar days before the start and/or completion of any stage of this project. Traffic Operations South (856-486-6650) is to be notified a minimum of 72 hours before any lane closure takes place. Traffic interference report (TIR) has to be faxed to Traffic Operations South (856-486-6802) three (3) days in advance. All traffic restrictions, including lane width reductions, lane closures, and detours are subject to the approval of the Resident Engineer, Regional Traffic Engineer – Work Zone (T.S. & S.E.) and the Bureau of Traffic Operations South. 

The following scheduled events may increase the flow of traffic on the bridge and therefore the Contractor must coordinate his efforts with the appropriate boroughs. These dates are tentative dates and subject to change. The dates are shown for the first year of the contract and the Contractor must obtain the information from the boroughs and Gateway National Recreation Area for the following years of the contract.

The Highlands Recreation Department’s 2008 dates for events are as follows: 
Halloween Parade  10/31/08  
Memorial Day Parade  5/24/08  

The Highlands Business Partnership’s 2008 dates for events are as follows: 
St. Patrick’s Day Parade  3/22/08  
Pride in Highlands Earth Day  4/19/08  
Seaport Craft Show  5/25/08  
Farmer’s Market weekly event at Huddy Park  Sat 6/28 – 11/1/08  
Concert Series Veterans Park  7/3,10,17,24/08  
Clamfest (Huddy Park)  7/31-8/3/08  
Twinlights Bike Ride  9/27 or 9/28/08  
Oktoberfest Veterans Park  10/4 or 10/5/08  
Highlands Cares Breast Cancer Walk  10/19/08  
Tree Lighting (Huddy Park)  12/5 or 12/6/08  

ROUTE 36 OVER THE SHREWSBURY RIVER  
HIGHLANDS BRIDGE  
MONMOUTH COUNTY
The Gateway National Recreation Area’s yearly events are as follows. The dates listed below are only approximate. The Contractor is responsible for contacting the Gateway National Recreation Area and confirming dates of events.

- Bicycle Time Trial: Early April 08
- 5K Run: Early April 08
- Walk for Multiple Sclerosis: Mid April 08
- COA Beach Sweep: Mid April 08
- Charity Fun Run/Walk: End April 08
- 3K Benefit Walk: End April 08
- Student Summit: Early May 08
- MAST Rude Awakening: Early May 08
- 25 Mile in Park Benefit Bike Tour: Mid May 08
- Jersey Shore Benefit Dinner: End June 08
- Police Dept Outing: Mid June 08
- MAST Graduation: End June 08
- Annual Company Outing: End June 08
- NPS All Woman Lifeguard Tournament: End July 08
- Boy Scout Camporee: End Aug 08
- NPS Foundation Fundraiser: Early Sept 08
- Bayshore Clambake: Early Sept 08
- Bike NY Bicycle Tour: Early Sept 08
- Danskin Triathlon: Mid Sept 08
- 5K Memorial Run/Ride: End Sept 08
- Annual Shore Half Marathon: End July 08
- Bike New York: End Sept 08
- NJ Lighthouse Challenge: End Sept 08
- Fall Beach Sweep: End Oct 08
- Ft. Hancock Establishment Day: End Oct 08

The Sea Bright Borough yearly events are as follows. The dates listed below are only approximate. The Contractor is responsible for contacting Sea Bright Borough and confirming dates of events.

- Donovan’s St. Patrick Day Foot Race: Mid March 08
- Easter Egg Hunt – SB Public Beach: Mid April 08
- SB Beach Bash: Mid June 08
- Fourth of July Fireworks: Early July 08
- One Mile Ocean Swim: End July 08
- Beach Concert: End Aug 08
- Sea Bright Day: Mid Sept 08
- Skim Board Contest: Mid Sept 08
- Garden State Crewzers: End Sept 08
- Halloween Poster Painting: Early Oct 08
- Halloween Parade: End Oct 08
- Mr. and Mrs. Santa: Early Dec 08

108.09 Unusual Site Conditions.
THE FIRST SENTENCE OF THE SECOND PARAGRAPH IS CHANGED TO:

Upon written notification, the Engineer will investigate the conditions, and if the Engineer determines that the conditions materially differ and could not have been discovered by the Contractor pursuant to Subsection 102.03 and if they cause an increase or decrease in the cost or time required for the performance of any work under the Contract, an adjustment, excluding loss of anticipated profits, will be made and the Contract modified in writing accordingly.

108.10 Time of Completion.

A.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
1. All work required for Substantial Completion of the Project shall be completed on or before September 15, 2010.

B. 1. The entire Work of the Project shall be completed on or before December 30, 2010.

THE ENTIRE TEXT IS CHANGED TO:

A. Basis for Adjustment. Extensions or reductions to the Contract Time may be provided by Construction Order, however, such extensions or reductions will be allowed only to the extent that the increase or decrease in the Work or delays of the types indicated below affect the Critical Path of the current approved Progress Schedule update and the Completion of the Work and/or Substantial Completion Dates provided in Subsection 108.10. However, when the Finish Milestone(s) for the Substantial Completion Date or Completion of the Work Date identified on the current approved schedule is a date or dates prior in time to the dates specified in the Contract, the Department will consider the time between the dates projected in the schedule and that in the Contract as constituting float in the schedule which shall offset the amount of allowable delay contributable to the actions of the Department, third parties, or the Contractor, or caused by a combination of those factors, and other factors beyond the control of the Contractor as determined by the Department which ever first occurs.

An extension will also provide only for those Working Days adversely impacted where operations were on an approved schedule, including all shifts of Work. No extension can be requested unless all submittals and approvals have been completed as specified in Subsection 108.04.

The Contractor may be granted an extension of Contract Time and not be assessed liquidated damages for any portion of the delay beyond the Completion of the Work and/or Substantial Completion Dates as specified in Subsection 108.10 caused by reasons beyond the control and without the fault or negligence of the Contractor, and subject to all due diligence by the Contractor to avoid and mitigate the delay. Reasons may include, but are not restricted to, those provided for in the Specifications and the following:

1. acts of civil or military authorities, terrorism, war, or riot;
2. fire;
3. floods, tidal waves, earthquakes, cyclones, tornadoes, hurricanes, sustained severe winds exceeding 75 mph, or other cataclysmic natural phenomenon (except on working day contracts);
4. Extreme Weather Conditions (subject to Item 1 of subpart B) (except on working day contracts);
5. epidemics or quarantine restrictions;
6. strikes or labor disputes beyond the control of the Contractor that prevent work on the construction operations that are critical to the completion of the Project;
7. shortages of materials (subject to Item 2 of subpart B) or freight embargoes;
8. acts of the State in its sovereign capacity;
9. court orders or injunctions;
10. discovery of Regulated Hazardous Waste;
11. acts by others consistent with Subsections 105.10 and 107.09;
12. failure of the Engineer to furnish interpretations of the Contract Documents (subject to Item 3 of subpart B).

Unless specifically provided for in the Specifications or where the delay is caused by the negligence, bad faith, active interference, or other tortuous conduct of the Department or its employees, the Contractor shall not make any claim for damages or Additional Compensation for any delay, and agrees that any such delay shall be fully compensated for by an extension of Contract Time if granted. In such a case where the delay is shown by the Contractor to have been caused by such tortuous conduct of the Department or its employees, the Contractor's remedy for Additional Compensation shall be as specified in Subsection 109.04. Negligence of consultants, other contractors, Utility(s), other public entities or any other person or entity, shall not be imputed to the Department. The Contractor shall not be entitled to Additional Compensation or an extension of Contract Time for any delay contemplated or that which should have been contemplated by the Contractor at the time the Contract was awarded.

Extensions of Contract Time will not be granted due to delays caused by, or in any way related to, the financial condition of the Contractor, subcontractors, sub-subcontractors, material, personnel, fabricators, or
suppliers. The Contractor and its surety assume full responsibility for ensuring that the financial condition of any of the above does not delay completion of the Contract.

If the Work required is reduced or altered so that the time required for Completion is reduced, the Department may reduce the Contract Time as specified in Subsection 108.10. The Engineer will evaluate the facts and the extent of the reduction. The Department’s findings thereon will be final and conclusive.

The Contractor or surety is not relieved of liability for liquidated damages for any period of delay in completion in excess of that expressly provided for in this Subsection.

B. Requests for Extensions. Request for extension of Contract Time will not be evaluated or granted unless they meet the provisions of A. above and the Contractor has notified the Resident Engineer in writing of the causes of delay within 15 State Business Days from the beginning of any such delay on forms provided by the Department. The effect of the delay on the Progress Schedule shall be documented by the Contractor as specified in Subsection 108.04. The Department will evaluate the facts and the extent of the delay, and the Department’s findings will be final and conclusive. Request for extensions shall also be based on the following:

1. If the Contractor submits daily documentation of such conditions, Extensions of Contract Time for Extreme Weather Conditions may be granted according to the following:
   a. The specified completion dates anticipate that the number of total Working Days available for Construction Operations, subject to the requirements of the Contract Documents, during the period of April through November inclusive is at least 146 days for 2008, and 146 days for 2009 and 146 days for 2010 for road and bridge work.
   b. The specified completion dates anticipate that the number of total Working Days available for Construction Operations, subject to the requirements of the Contract Documents, during the four month winter period of December through March inclusive is 20 days for road work and 41 days for bridge work for 2008/2009 and 21 days for road work and 43 days for bridge work for 2009/2010.
   c. When the actual number of Working Days available for Construction Operations is less than the anticipated number provided for in the Special Provisions, an extension of one day for each day less may be allowed.

2. Extensions of Contract Time will not be granted for a delay caused by a shortage of materials unless the Contractor furnishes the following:
   a. Documentary proof that it has diligently made every effort to obtain such materials from all known sources within reasonable distance from the Work.
   b. Proof that the inability to obtain such materials when originally planned, could not be compensated for by revising the sequence of the Contractor's operations. The term "shortage of materials" applies only to raw and fabricated materials, articles, parts, or equipment which are standard items and does not apply to materials, parts, articles, or equipment which are processed, made, constructed, fabricated, or manufactured to meet the specific requirements of the Contract. Only the physical shortage of materials and not the cost of materials will be considered.

3. Extensions of Contract Time will not be granted for failure of the Engineer to furnish interpretations of the Contract Documents unless such request for an interpretation of the Contract Documents is reasonable and made in good faith, and the failure to respond was palpably unwarranted and was furnished more than 20 State Business Days after the written request was received by the Resident Engineer.

4. Extension of Contract Time for utility work delays will only be granted when the Utility does not complete their work within an additional 30% of the estimated durations for the Utility as specified in Subsection 105.09. A day for day extension will be allowed for each day extended beyond the 30% time that the Critical Path is affected.

108.12 Right-Of-Way Delays.
THE TITLE OF THIS SUBSECTION IS CHANGED TO:

108.12 Right-Of-Way Information and Delays.

THE FOLLOWING IS ADDED:
ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
The Contractor shall obtain from the Engineer all information regarding ROW Parcels and Easements acquired for the Project as well as the nature and type of title acquired. The Contractor shall make periodic requests for updates to this information during the course of the Contract.

The Contractor shall not enter an Easement until the Resident Engineer provides written notice to the property owner. The Contractor shall provide written notice to the Resident Engineer, 30 calendar days prior to entering a particular Easement or right, which is lesser than a fee interest. The Contractor shall make no claim for delays by reason that entry upon an Easement or right which is lesser than a fee interest is conditioned upon notice or is limited in duration; the Contractor is required to schedule accordingly and take such limitations into account when planning performance of the Work.

Temporary Easements and/or temporary construction rights will in most cases contain a limitation as to the length of time that they are extant. The Contractor shall schedule the Work pursuant to Subsection 108.04 so as to accommodate the particular time limitations of an Easement or right which is lesser than a fee interest as reflected on the R.O.W. plans. The Contractor shall provide a written request to the Engineer that the Department procure an extension from the owner of a particular temporary easement or right, which is lesser than a fee simple interest, so as to enable the Contractor to continue occupancy of or re-enter same in the future, beyond the initial time period set forth in the respective property description prior to the expiration thereof.

Where the Contractor fails to complete the work within an area of a temporary easement or right lesser than a fee interest during the time allowed under the property description, by reason of the Contractor’s own fault; the Contractor shall reimburse the State for the sum payable to the owner of the underlying fee interest for the extended period of occupancy use. The Resident Engineer may deduct an amount equal to such payments from the monthly estimate of the Work performed after providing 30 day written notice to the Contractor of such action, including a breakdown of the costs sought or to be sought by reason of the delay in timely vacating a temporary easement or right lesser than a fee interest.

The following is a list of all rights-of-way that have not been secured and their approximate anticipated dates of availability:

<table>
<thead>
<tr>
<th>Demolition and/or Parcel No.</th>
<th>Approximate Baseline Station</th>
<th>Offset/Direction</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 Block 38 Lot 8 Lee, Rafaella, Robert &amp; Christian R Temporary Site Mitigation Permanent Maintenance Easement</td>
<td>103+20</td>
<td>72 Ft/Left</td>
<td></td>
</tr>
<tr>
<td>121 Block 20 Lot 1 M&amp;D Property Management, LLC Temporary Site Mitigation Partial Take</td>
<td>103+50</td>
<td>40 Ft/Right</td>
<td></td>
</tr>
<tr>
<td>122 Block 39 Lot 17-17.01 Borough of Highlands Entire Take</td>
<td>Rt 36 108+50</td>
<td>60 Ft/Left</td>
<td></td>
</tr>
<tr>
<td>123 Block 8 Lot 2 Borough of Highlands Partial Take Temporary Construction Easement</td>
<td>Rt 36 110+50</td>
<td>0 Ft/Right (Under Bridge)</td>
<td></td>
</tr>
<tr>
<td>S124 Site Parcel National Park System – 18.636 Acres</td>
<td>122+40</td>
<td>30 Ft/Left</td>
<td></td>
</tr>
<tr>
<td>T125 Tidelands Parcel</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

108.13 Archeological Findings.

THE FOLLOWING IS ADDED AFTER THE END OF THE FIRST PARAGRAPH:

ROUTE 36 OVER THE SHREWSBURY RIVER HIGHLANDS BRIDGE MONMOUTH COUNTY
Any object found or removed of historical significance will be turned over to the State. The Contractor shall coordinate with NJDOT archaeological personnel to assure that the required archaeological mitigation outlined in the MOA is completed on the Sea Bright side of the project prior to any excavation.

108.16 Failure to Complete on Time.
THE SUBSECTION HEADING AND TEXT ARE CHANGED TO:

108.16 Liquidated Damages and Incentive Payments For Early Completion.
A. LIQUIDATED DAMAGES

The Contractor and the Department recognize that delay in Completion results in damages to the State in terms of the effect of the delay on the use of the Project, upon the public convenience and economic development of the State, and also results in additional costs to the State for engineering, inspection, and administration of the Contract. Because it is difficult or impossible to accurately estimate the damages incurred; therefore, the parties agree that if the Contractor fails to complete the Contract within the time stated in these Special Provisions, or within such further time as may have been granted in accordance with provisions of the Contract, the Contractor shall pay the State liquidated damages in accordance with the following paragraph. Such liquidated damages shall be paid for each and every day, as hereafter, defined that the Contractor is in default to complete the Contract.

LIQUIDATED DAMAGES SHALL BE AS FOLLOWS:

1. For each Calendar Day that the Contractor fails to meet the provisions as specified in Subpart A of Subsection 108.10 of the Special Provisions, for Substantial Completion, the Contractor shall pay liquidated damages consisting of Road User Costs and Construction Engineering Costs, as defined in Subsection 101.03, to the State in the amount of $14,000.

2. For each Calendar Day that the Contractor fails to complete the entire Work of the Project as specified in Subpart B of Subsection 108.10 of the Special Provisions, for Completion, the Contractor shall pay liquidated damages consisting of Construction Engineering Costs, as defined in Subsection 101.03, to the State in the amount of $5,250, provided that Construction Operations as specified for Substantial Completion are actually completed.

The days in default set forth above are the number of Calendar Days in default when the time for Completion is specified on the basis of Calendar Days or a specified completion date, and are the number of Working Days in default when the time for Completion is specified on the basis of Working Days.

Anytime after the Engineer notifies the Contractor in writing, that Substantial Completion of the Project has been actually achieved, the Commissioner may elect, to waive the imposition of liquidated damages under Subpart 2 above and, in lieu thereof, require the Contractor to pay the actual costs incurred by the State for engineering, inspection, and administration (including overhead) between the actual date of Substantial Completion of all Work, as established by the Certificate of Completion. The Contractor hereby waives the right to challenge this election by the Commissioner on the grounds that such costs exceed the amount of liquidated damages specified under Subpart 2 above.

The Commissioner will recover all liquidated damages specified above by deducting the amount thereof from any monies due or that may become due the Contractor, or from the Contractor or from its surety.

108.19 Lane Occupancy Charges.
THE SECOND PARAGRAPH IS CHANGED TO:

Except as specifically excluded in the Special Provisions, a Lane Occupancy Charge will be collected by deducting the appropriate charge, calculated according to this Subsection, from the monthly estimate, whenever a lane or lanes are not promptly made available to the traveling public during the lane closure limits for the following reasons: equipment breakdowns; non-extreme weather related causes; late start of work; shortage of labor, materials, fuel, machinery or equipment or by reason of the Contractor’s negligence or fault or that of its workers, employees, subcontractors or suppliers. This charge will be collected for that period of time each lane is unavailable to the traveling public beyond the lane closure limits. This charge will be calculated by multiplying the length of time of the delayed opening, in minutes, by the rate of $10 per minute per lane, unless otherwise set forth in the Special Provisions.

ROUTE 36 OVER THE SHERWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
THE THIRD PARAGRAPH IS CHANGED TO:

The total amount of the Lane Occupancy Charge collected from a Contractor shall not exceed $10,000.00 per day.

THE FOURTH PARAGRAPH IS CHANGED TO:

The Resident Engineer will keep record of each occurrence as well as the cumulative amount of time that a lane is kept closed beyond the lane closure limits. After each occurrence the Contractor will be notified. For every three such occurrences, one day will be deducted from the Substantial Completion date or days. For every 60 minutes of lane closures recorded beyond the lane closure limits, one additional day will be deducted from the Substantial Completion date or days. The Substantial Completion date or days will be re-established. The Contractor will be notified of such action, and the Contractor shall not make any claim against the Department as a result of such action. The Resident Engineer also reserves the right to suspend all Work until the next allowable lane closure time period, where the Contractor exceeds the lane closure limits. Before deduction of any charge from a monthly estimate for occupancy of a lane beyond the allowable lane closure hours, the Department will provide the Contractor with a statement of the charges to be collected and the supporting calculations.

THE FOLLOWING IS ADDED:

The rate or rates to be applied in the calculation of a Lane Occupancy Charge shall be in accordance with the following:

<table>
<thead>
<tr>
<th>Description</th>
<th>Rate per Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overrun of “Single Lane Closure” Time Limits</td>
<td>$10.00</td>
</tr>
</tbody>
</table>

SECTION 109 – MEASUREMENT AND PAYMENT

109.01 Measurement of Quantities.

THE 25TH TYPE 2 PAY ITEM IS CHANGED TO:

<table>
<thead>
<tr>
<th>Type 2 Pay Items</th>
<th>Charge per Unit of Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAWCUT GROOVED DECK SURFACE</td>
<td>$0.06 PER SQUARE FOOT</td>
</tr>
</tbody>
</table>

THE FOLLOWING IS ADDED TO THE LIST OF TYPE 2 PAY ITEMS:

- CONCRETE IN STRUCTURES, FOOTINGS
- CONCRETE IN STRUCTURES, PIER FOOTINGS, 5000 PSI (HPC)
- CONCRETE IN SUPERSTRUCTURE, 1'-9" CURB (HPC)
- CONCRETE IN SUPERSTRUCTURE, SIDEWALK (HPC)
- CONCRETE IN SUPERSTRUCTURE, PARAPETS, 2'-8" HIGH (HPC)
- CONCRETE IN SUPERSTRUCTURE, PARAPETS, 2'-10" HIGH (HPC)
- CONCRETE IN SUPERSTRUCTURE, 7000 PSI (HPC)
- CONCRETE IN STRUCTURES, PRECAST SUBSTRUCTURE 6000 PSI (HPC)
- CONCRETE IN STRUCTURES, PRECAST SUBSTRUCTURE 8000 PSI (HPC)
- POST-TENSIONING STEEL STRAND IN SUPERSTRUCTURE (LONGITUDINAL)
- POST-TENSIONING STEEL STRAND IN SUPERSTRUCTURE (TRANSVERSE)
- POST-TENSIONING STEEL BARS IN SUPERSTRUCTURE
- POST-TENSIONING STEEL STRAND IN SUBSTRUCTURE, EPOXY COATED
- POST-TENSIONING STEEL BAR IN SUBSTRUCTURE

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
109.02 Scope of Payment.
THE SECOND PARAGRAPH IS CHANGED TO:

The “Basis of Payment” clause in the Specifications relating to any Pay Item in the proposal encompasses all compensation for Work to complete that Pay Item and no other Pay Item. All elements of the Work related to that Pay Item will not be measured or paid for under any other Pay Item in the Contract Documents unless it is stated in the “Basis of Payment” clause for that Pay Item that a portion of the Work will be paid for under another Section or Subsection of the Specifications.

109.03 Force Account Payment.
THE FIRST, SECOND, THIRD, AND FOURTH PARAGRAPH ARE CHANGED TO:

When the Department has directed the Contractor to do Work on a Force Account basis it will be compensated as specified in this Subsection.

The total direct costs for labor, materials, equipment, bonds, insurance, and tax as provided below, together with applicable markups constitute full compensation for all direct and indirect costs (including overhead and profit), and are deemed to include all items of expense not specifically designated. Any adjustments to Performance Bond and Payment Bond will be made as specified in Subsection 103.05. Force Account payments will be adjusted for those costs incurred determined to be the fault of the Contractor. The Force Account payment will be further adjusted where the Contractor’s prices in its Proposal for any affected original items of work did not properly include all the costs to complete the affected work as originally provided in the Contract Documents.

When Work that is paid on a Force Account basis is performed by forces other than the Contractor’s organization, the Contractor shall reach an agreement with such other forces as to the distribution of payments made by the State for such Work, with a copy of all such completely executed agreements to the Resident Engineer. Additional payment will not be made for any reason due to the performance of the Work by a subcontractor or other forces, or for costs outside that covered by the agreement.

It is understood that a Contractor’s remedy for Additional Compensation for Extra Work or for any other reason as specified in these Specifications, when an action is brought before the Superior Court as specified in the Contractual Liability Act, NJSA 59:12-1 et seq., shall not exceed the amount that would be specified in these provisions had a Force Account been carried out. However, damages sought by the Contractor in a court proceeding shall be limited to actual additional costs incurred by the Contractor resulting directly from the Extra Work or by other reason specifically permitted under the terms of the Specifications as specified in the Contractual Liability Act. As a condition precedent to seeking Additional Compensation under the claims process or in the Superior Court, the Contractor shall have the burden of proof to demonstrate compliance with the requirements of this Subsection and other applicable Subsections, and shall have kept all records required under this Subsection even if the Department has not directed that the Contractor do such Work on a Force Account basis.

Force Account payment will be limited to the following:

1. Labor.
THE FIRST PARAGRAPh IS CHANGED TO:

For all necessary direct labor and foremen in direct charge of the specific operations, whether the employer is the Contractor, subcontractor, or another, the Contractor shall receive the rate of wage (or scale) actually paid as shown in its certified payrolls for each and every hour that said labor and foremen are actually engaged in such Work.

For specific extraordinary operations the Department may allow supervising or other special type employees to be considered direct labor, but only that time in direct labor or direct charge to complete the specific construction operations.
2. **Bond, Insurance, and Tax.**
   THE ENTIRE TEXT IS CHANGED TO:

   For bond premiums; property damage, liability, and workers compensation insurance premiums; unemployment insurance contributions; and social security taxes on the Force Account work, the Contractor shall receive the actual incremental cost thereof, necessarily and directly resulting from the Force Account work. For payment, the Contractor shall furnish satisfactory evidence of the rate or rates paid for such bond, insurance, and tax.

   Payment for Performance Bond and Payment Bond adjustments will be as specified in Subsection 103.05.

4. **Equipment and Plant.**
   a. **Contractor Owned Equipment and Plant.**
   THE SECOND AND THIRD PARAGRAPH ARE CHANGED TO:

   The Blue Book will be used in the following manner:
   
   (1) The estimated “rental” hourly rate will be determined by dividing the monthly rate by 176 and then applying a 20% reduction factor. The weekly, hourly, and daily rates will not be used.
   
   (2) The estimated operating costs per hour will be the Blue Book rates.
   
   (3) The number of hours to be paid for will be the number of hours that the equipment or plant is actually used on a specific Force Account activity each day, as presented in Daily Equipment Work Sheets, received from the Contractor and verified by the Department.
   
   (4) The current revisions will be used in establishing rates. The current revision applicable to specific Force Account work is as of the first day of work performed on that Force Account work and that rate applies throughout the next six months of the period the Force Account work is being performed. The rates will be adjusted for each six-month period thereafter.
   
   (5) Area adjustment will not be made. Equipment life adjustment will be made in accordance with the rate adjustment tables.
   
   (6) Overtime shall be charged at the same rate indicated in Item (1) and (2) above.
   
   (7) Idle time for equipment will not be paid for, except where the equipment has been held on the Project site on a standby basis at the request of the Engineer and, but for this request, would have left the Project site. Such payment will be made at one-half the rate established in Item (1) above and will be limited to the total hours worked for any Force Account activity on that particular day.
   
   (8) The rates established above include the cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs, overhaul and maintenance of any kind, depreciation, storage, overhead, profits, insurance, all costs (including labor and equipment) of moving equipment or plant to, on, and away from the site, and all incidentals.
   
   (9) Operator costs will be paid only as provided in Subheading 1 above.

   All equipment shall, in the opinion of the Department, be in good operating condition. The State will not provide payment of any type for equipment that is determined to be unsuitable by the Department for the Force Account Work or that is inoperable during periods of breakdown or repair. Equipment used by the Contractor shall be specifically described and be of suitable size and suitable capacity required for the work to be performed. In the event the Contractor elects to use equipment of a higher rental value than that suitable for the Work, payment will be made at the rate applicable to the suitable equipment. The equipment actually used and the suitable equipment paid for will be made a part of the record for Force Account work. If there is a differential in the rate of pay of the operator of oversize or higher rate equipment, the rate paid for the operator will be that for the suitable equipment.

   b. **Rented Equipment and Plant.**
   THE ENTIRE TEXT IS CHANGED TO:

   In the event that the Contractor does not own a specific type of equipment or plant and must obtain it by rental, the Contractor shall inform the Resident Engineer of the need to rent the
equipment and of the rental rate for that equipment prior to using it on the Work. The Contractor will be paid the actual rental for the equipment as specified in the rental agreements for the time that the equipment is actually used to accomplish the Work, provided that rate is reasonable, plus the cost of moving the equipment to, on, and away from the Project site. The Contractor shall provide the Resident Engineer a copy of the fully executed rental agreement, and a paid receipt or canceled check for the rental expense incurred.

If the rental agreement does not cover operating costs, the Contractor shall be entitled to the rate established in Subheading 4.a. above for each hour that piece of rental equipment is actually operational.

The State will not provide payment of any cost incurred due to equipment that is determined to be unsuitable by the Department for the Force Account Work or that is inoperable during periods of breakdown or repair.

5. Profit.
THE ENTIRE TEXT IS CHANGED TO:

Profit shall be computed at ten percent of the following:
   a. Total material cost excluding transportation, shipping & handling.
   b. Total direct labor cost (actual hours worked multiplied by the regular hourly rate).
   c. Total fringe benefits on total direct labor cost as computed above.

6. Overhead.
THE ENTIRE TEXT IS CHANGED TO:

Any and all overhead for the Contractor is defined to include the following:
   a. All salaries and expenses of executive officers, supervising officers, or supervising employees, except as provided for under Subheading 1 above;
   b. All clerical or stenographic employees;
   c. All charges for minor equipment, such as small tools, including shovels, picks, axes, saws, bars, sledges, lanterns, jacks, cables, pails, wrenches, and other miscellaneous supplies and services; and
   d. All drafting room accessories such as paper, tracing cloth, and blueprinting.

Any and all overhead costs of the Contractor for Force Account work shall be computed at 15 percent of the following:
   a. Total material cost excluding transportation, shipping & handling.
   b. Total direct labor cost (actual hours worked multiplied by the regular hourly rate), except for the direct labor cost of any supervisory or special employees allowed under Subheading 1 above.
   c. Specific extraordinary overhead expenses, required specifically for the Force Account, may be allowed if approved by the Department prior to incurring any cost. In such instances, the Contractor will be paid only the reasonable costs of such extraordinary overhead expenses.
   d. Total fringe benefits on total direct labor cost as computed above.

The Contractor will be allowed an additional five percent for overhead on the total amount of all work performed by the subcontractors.

THE FOLLOWING IS ADDED:

   Where work is performed under a Force Account, responsibility of such work shall remain that of the Contractor. The Department will determine if the Work is eligible for payment.

109.04 Payment for Contractor's Expenses During Delays.
THE FIRST PARAGRAPH IS CHANGED TO:

When the Department has approved an adjustment for Additional Compensation due to a delay, the Contractor will be paid its expenses during that period of delay by Change Order in the following manner:

THE ENTIRE TEXT IS CHANGED TO:
For bond premiums; property damage, liability, and, workers compensation insurance premiums; unemployment insurance contributions; and social security taxes during the period of delay, the Contractor is to receive the actual incremental cost thereof, necessarily and directly resulting from the delay. For payment, the Contractor shall furnish satisfactory evidence of the rate or rates paid for such bond, insurance, and tax.

Payment for Performance Bond and Payment Bond adjustments will be as provided in Subsection 103.05.

3. Equipment.
THE FIRST PARAGRAPH IS CHANGED TO:

For any idle machinery or special equipment other than small tools which must remain on the Project site, with approval of the Department, during delays of specific operations, the Contractor is to receive compensation at one-half the rate calculated pursuant to Subheading 4 of the fifth paragraph of Subsection 109.03. Should the Department determine that it is not necessary for machinery or equipment to remain on the Project during delays, the Contractor is to receive transportation costs to remove the machinery or equipment and return it to the Project at the end of the delay period.

4. Miscellaneous.
THE SUBPART HEADING IS CHANGED TO:

4. Overhead.

THE SECOND AND THIRD PARAGRAPH ARE CHANGED TO:

The Department's records will be compared with completed daily reports furnished by the Contractor and any necessary adjustments will be made. When these daily reports are agreed upon and signed by both parties, said reports become the basis of payment for the expenses incurred, but do not preclude subsequent adjustment based on a later audit by the Department.

The Contractor's cost records pertaining to expenses under this Subsection shall be open to inspection or audit by the Department during the life of the Contract and for a period of not less than three years after Acceptance thereof, and the Contractor shall retain such records for that period. Where payment for equipment or labor is based on the cost thereof to forces other than the Contractor, the Contractor shall make every reasonable effort to ensure that the cost records of such other forces are open to inspection and audit by the Department on the same terms and conditions as the cost records of the Contractor. Payment for such cost may be deleted if the records of such third parties are not made available to the Department. If an audit is to be commenced more than 60 days after Acceptance, the Contractor is to be provided with a reasonable notice of the time when such audit is to begin. In case all or a part of such records are not made so available, the Contractor understands and agrees that any items not supported by reason of such unavailability of the records will not be allowed, or if payment therefore has already been made, the Contractor shall refund to the Department the amount so disallowed.

109.05 Partial Payments.
SUBPART 1 OF THE SECOND PARAGRAPH IS CHANGED TO:

1. Each subcontractor or supplier has been paid any amount due from any previous progress payment and shall be paid any amount due from the current progress payment and no retainage is being withheld from any subcontractor on federally funded projects; or

THE SEVENTH PARAGRAPH IS CHANGED TO:

From the total amounts ascertained as payable, excluding subcontracted work on federally funded projects, an amount equivalent to two percent of the amount due on the total adjusted Contract price will be deducted and retained pending Substantial Completion. Any amounts paid to the Contractor in the form of incentive payments for early Completion and positive pay adjustments will not be included in the adjusted Contract price when calculating retainage.

109.06 Materials Payments.
THE SUBSECTION HEADING IS CHANGED TO:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
109.06 Materials Payments and Storage.

THE first PARAGRAPH IS CHANGED TO:

The monthly estimates and payments made on account thereof may also include, when authorized by the Department, an amount equal to the actual cost of materials furnished but not incorporated into the Work, provided, however, that such amount does not exceed 85 percent of the Contract price for the Pay Item into which the material is to be incorporated, and the quantity allowed does not exceed the corresponding quantity estimated in the Contract Documents. Advance payment will only be for that portion of the price in the Proposal related to the materials and any costs for storage at the facility of manufacture. Any taxes levied by any government against the materials shall be borne by the Contractor. Before including payments for such materials in an estimate, the Department must be satisfied that:

1. The materials have been properly stored and protected along or upon the Project site or have been stored and protected at locations owned or leased by the Contractor or the Department within the State, except that structural steel, prestressed concrete beams, and other large items not suitable for storage on or near the site, may be stored outside the State with the approval of the Department; and
2. The materials have been inspected and appear to be acceptable based upon available supplier’s certification and/or materials test reports; and
3. The Contractor has provided the Resident Engineer with an paid invoice or paid bill of sale for the materials and a fully executed Department form “Release of Liens for Materials Stored for Incorporation in Department of Transportation Project” including the transfer of ownership to the Department; and
4. The materials are clearly identified in large letters as being without encumbrances and for use solely on the Project, and if stored on property not belonging to the State or at the facility of manufacture, are fenced in with access limited to the State and the Contractor; and
5. When such materials are stored in a leased area, the lease is made out to the Contractor and provides that it shall be canceled only with the written permission of the Department.

THE FOURTH PARAGRAPH IS DELETED:

109.09 Payment Following Acceptance.
THE ENTIRE SUBSECTION IS CHANGED TO:

All Partial payments by monthly estimate will be processed prior to acceptance. Final payment will be made as specified in Subsection 109.11.

109.10 As-Built Quantities.
THE FIRST AND SECOND SENTENCE OF THE SECOND PARAGRAPH ARE CHANGED TO:

The Resident Engineer may from time to time, before Substantial Completion, prepare as-built quantities and incorporate these quantities into monthly estimate certificates through an appropriate Field Order or Change Order. Such interim as-built quantities are subject to recalculation in completion of the Final Certificate.

THE THIRD PARAGRAPH IS DELETED.

109.11 Final Payment and Claims.
THE ENTIRE SUBSECTION IS CHANGED TO:

1. Final Certificate. All prior estimates and payments made by the Department are subject to correction in the Final Certificate, which will be completed as follows:
   a. After Acceptance is completed as specified in Subsection 105.23 and the As-Built quantities finalized, the Department will make an estimate of the total amount of Work done under the Contract, and prepare and issue the Final Certificate to the Contractor.
   b. Within 30 State Business Days after said Final Certificate has been issued to the Contractor, the Contractor shall submit to the Department either a written acceptance of the Final Certificate without exception together with an executed release in the form provided with the Final Certificate or a written acceptance of the Final Certificate with a reservation of specific claims, but otherwise
releasing all claims not specifically reserved, by executing a conditional release in the form provided with the Final Certificate. The Contractor's failure to submit any written acceptance or acceptance with reservation within said 30 days will be construed by the Department as an acceptance by the Contractor of the Final Certificate without exception or reservation of Claims.

c. Upon receipt of the Contractor’s written acceptance of the Final Certificate with unconditional or conditional release, or when the Contractor fails to provide any written acceptance of the Final Certificate within 30 State Business Days of issuance, the Department will pay the entire sum due thereunder as provided by the New Jersey Prompt Payment Act NJSA 52:32-32 et seq., provided the Final Certificate indicates a payment is due the Contractor. However, where the Final Certificate indicates a Credit (payment) is due the Department, the Contractor shall remit said Credit (payment) to the Department in the amount set forth in the Final Certificate.

d. If the Contractor fails to remit the Credit (payment) due the Department, as indicated on the Final Certificate, within 30 State Business Days of issuance of the Final Certificate, the Department may pursue all legal means available to recover the amount due the State, including but not limited to, deducting the amount from payment due the Contractor on this or other Department Contracts or from retainage and/or the sale of bonds held in lieu of retainage for the Contract or for other Contracts, even where the credit is being contested by the Contractor.

Neither the failure of the Contractor to accept the tendered Final Payment nor the failure of the Contractor to remit the credit (payment) due the Department shall affect when the “Completion of the Contract” shall be deemed to have occurred for any reason. Where there is a remaining monetary balance due to the Contractor by the Department, Final Payment will be made after the “Completion of the Contract”. Retainage shall be released to the Contractor upon completion of the contract unless a credit (payment) is due to the Department, which shall be deducted or adjusted in accord with the Specifications.

2. Conditions for Claims. Conditional acceptance of the Final Certificate will be permitted only where all of the following are met:

a. When the Contractor submits a Release conditioned with exception or reservation, the release shall state the specific monetary amounts and category of the claims being reserved. The Contractor acknowledges, by the act of executing the contract, that failure to state specific monetary amounts and specific categories shall result in a waiver of such claims lacking as to amounts or specific categories thereof. The Contractor may reserve only those claims properly filed with the Department pursuant to Subsection 107.02 and not previously resolved. The Contractor waives all claims for which the required notice has not been filed with the Department.

b. The Contractor further understands and agrees, by the act of executing the Contract that neither the procedures established under this Subsection nor the review of claims by the Department pursuant hereto shall in any way modify the requirements applicable to the filing of a Contractual Notice Form or the filing of a suit pursuant to the provisions of N.J.S.A. 59:13-1 et seq. .

c. If the Contractor conditions its acceptance of the Final Certificate by reserving particular claims, the Contractor shall at the same time state in writing whether it would like to submit its reserved claims for review by the Department Claims Committee. Only those claims properly reserved, as provided for in Subsection 107.02, and which are unresolved after completing Steps I and II of the Contractual Claim Resolution Process for the resolution of contract claims, are eligible for review by the Department Claims Committee to the extent provided in that Subsection. If the Contractor states that it does not want Department Claims Committee review of the reserved claims or if it fails to request Department Claims Committee review of reserved claims when it conditions its acceptance of the Final Certificate or if it files suit in a court of law regarding those claims, the Contractor shall be deemed to have waived any ability to have its reserved claims reviewed by the Department Claims Committee.

d. If the Contractor requests review of its reserved claims when it conditions its acceptance of the Final Certificate, it shall send at the same time a copy of its request for review to the Secretary of the Department Claims Committee, PO Box 600, Trenton, NJ 08625-0600. Department Claims Committee review will then take place according to Subsection 107.02.

e. At the election of the Contractor upon completion of the Contract, claims that are unresolved after review by the Department Claims Committee may be submitted to Non-Binding Mediation according to Subsection 107.02.
f. Interest shall neither be paid nor shall it accrue upon the amount of any additional compensation paid in resolution or settlement of a claim resolved through the various steps of the Contractual Claims Resolution Process.

109.13 Contractor’s Compliance with NJSA 34:11-56.25 et seq.
THE ENTIRE SUBSECTION TEXT IS CHANGED TO:

The Contractor shall furnish the Engineer with written statements on a form provided by the Department certifying that all employees employed by the Contractor or by any subcontractor have been paid wages not less than those required by the Contract provisions.

109.15 Affidavit Concerning Gifts to Department of Transportation Employees, etc.
THE ENTIRE SUBSECTION TEXT IS CHANGED TO:

The Contractor shall not give any gifts of any nature, nor any gratuity in any form whatsoever, nor loan any money or anything of value to any Department employee, or relative or agent of any Department employee. The Contractor shall not rent or purchase any equipment or supplies of any nature whatsoever from any Department employee, or relative or agent of any Department employee. Similarly, such gifts, gratuities, loans, rentals, or purchases shall not be given to or made from any agent of the Department during the period of time that such agent is performing any function related in any way to the Project. The Contractor shall execute, under oath, an affidavit, on forms provided by the Department, swearing that the Contractor has given no such prohibited gift, gratuities, or loans nor made any such prohibited rentals or purchases, and acknowledges that the Contractor has a continuing obligation to abide by the restrictions set forth in this Subsection.
DIVISION 200 - EARTHWORK

SECTION 201 - CLEARING SITE

201.04 Removal of Bridges, Culverts, and Other Structures.
THE FOLLOWING IS ADDED:

The bridge work to be performed under this Contract includes removal and disposal of reinforced concrete bridge decks, sidewalks, curbs, parapets, deck joints, railings, and conduit as shown on the Plans and as directed by the Engineer.

The equipment listed below is permitted subject to the following applicable restrictions:

1. **Pneumatic or Electric Equivalent Hand Operated Hammers.**
   a. Up to 90-pound hammers exclusive of the bit may be used for deck removal not closer than 6 inches to structural members. This hammer may also be used for removal of barriers, sidewalks, curbs, and parapets not closer than 6 inches from structural members. Only chisel point bits will be permitted. Structural members are defined as girders, floorbeams, stringers, diaphragms, or cross frames.
   b. Up to 30-pound hammers exclusive of bit may be used for removal of concrete within 6 inches of structural members.

2. **Saw Cutters.**
   a. Vermeer concrete cutters or cutting saws may be used to cut within 6 inches adjacent to structural members.
   b. If water is used in conjunction with cutting operations, shielding beneath the operation shall prevent water leakage. Water shall be disposed by an approved method. The disposal method shall be submitted by the Contractor for approval by the Engineer.

3. **Hydraulic Breakers.** Hydraulic breakers, such as, but not limited to, Tramac or other ram-hoe type breakers, are permitted for removal of substructure concrete. For deck concrete removal, such equipment is permitted subject to the following restrictions:
   a. The girders shall be analyzed to determine if induced stresses may be harmful.
   b. The centerline and limits of the top flange of girders shall be delineated before starting the equipment operation.
   c. The equipment shall not be used directly over the top of girders nor in overhang areas. Concrete removal in these areas shall be performed by jackhammers.
   d. Pulling and twisting of the reinforcement steel is prohibited.
   e. Any damage to existing reinforcement, shear studs, structural steel, or any other structural components that are to remain shall be repaired at no cost to the State.

4. **Hydraulic Splitters.** Hydraulic splitters such as Darda hydraulic splitters are permitted subject to approval.

5. **Other Equipment.** Equipment not specifically approved in this Section may be used only with written approval.

The sequence of removal shall be coordinated with the operations of the utility company to protect and maintain its facilities.

During removal operations, the Contractor shall take all necessary precautions so as not to damage the structural members scheduled to remain. All damage done to the existing structural members scheduled to remain shall be repaired. The repair procedure shall be as follows:

1. **Prestressed Concrete Stringers and Concrete Diaphragms.** Damage done to existing prestressed concrete stringers and concrete diaphragms scheduled to remain shall be repaired with nonshrink grout conforming to Subsection 914.03 before deck placement. The repair procedure shall be approved.

2. **Steel Stringers, Floorbeams, Cross Frames, and Diaphragms.**
   a. Repair procedures to tensile components shall conform to ASTM A 6/A 6M and the following:
      (1) Gouges up to 120 mils shall be removed by grinding flush in the direction of principal stress.
      (2) Gouges deeper than 120 mils shall be removed first by grinding; then, weld metal shall be deposited and ground flush with the surface of the metal in the direction of principal stress. Welding shall be done using low hydrogen electrodes conforming to current AWS Specifications A5.1 and A5.5. The electrodes shall be protected from moisture during storage.
(3) Kinks and deformations shall be repaired by flame straightening or a combination of flame straightening and jacking. Flame straightening shall be done by personnel approved by the Department with a minimum of three years of prior documented experience.

b. Repair procedures to compression components shall conform to the following:

1. Where more than five percent of the cross-sectional area of the member is damaged due to removal operations, the Contractor shall submit a repair procedure for approval.

2. Kinks and deformations shall be repaired as outlined in 2.a (3) above.

Existing top flanges of beams exposed by removal operations shall be cleaned and painted with a prime coat of paint according to Subsection 514.07, Subpart B.

THE FOLLOWING IS ADDED:

Demolition of Bridge No. 1315-150 and 1315-164—The bridge demolition work to be performed under this Contract includes all labor, equipment, and materials required for the removal and disposal of bridge No. 1315-150 and 1315-164. These structures include Operators, Control Houses and associated storage sheds. The existing Route 36 Highlands Bridge over the Shrewsbury River is to be demolished in stages as described in the Traffic Control and Staging Plans. The limits of the pier and abutment foundation demolition shall follow the Demolition Plans. Land piers and abutment foundations shall be demolished to a minimum of 2 feet below the natural bottom/ground line or 2 feet below the lowest final grade elevation (either existing or proposed). River piers, steel sheeting, and rip rap shall be demolished to El -22.0 as required for the construction of new piers and abutments and for compliance with permit regulations. The work shall include the design and construction of all temporary shielding necessary to contain/collect all demolished materials.

In addition, the bridge demolition work includes the removal, preservation, relocation and replacement after completion of the new bridge of the war memorial statue located on the south east corner of Portland Road and Rt 36. Prior to moving the war memorial statue, the Highlands Veterans Society shall be contacted to arrange for services to be performed during the moving and relocating phases. The Contractor shall notify the Borough of Highlands 30 days prior to any operations involving the memorial statue and shall coordinate all operations with the Highlands Veterans Society. The memorial shall be preserved and protected during the relocation of the statue from its current location to a point in Memorial Park which will be designated by the Borough of Highlands. The foundation of the statue shall be placed with the same cover as the existing base. Once the bridge has been completed the memorial statue is to be relocated to the south east corner of the intersection as shown on the plans and facing in the same direction which it currently faces. All movements of the statue shall be coordinated with the Highlands Veterans Society. Any damage which occurs during the removal and relocation of the statue shall be repaired to the satisfaction of the Highlands Veterans Society and restoration shall be made with materials which are historically compatible to the statue.

In addition, the bridge demolition work includes the development of a detailed bridge demolition plan and schedule and a debris control plan (material containment/collection scheme) to be submitted to the Engineer for review and approval prior to the start of any demolition work. Debris capturing device must be substantial enough to collect the fines, as well as larger pieces and prevent loss into waterbody. The submittal shall include the following:

1. Detailed plans showing the intended methods of demolition for each stage of demolition, which shall include but not be limited to the following:
   a. The type of equipment for demolition.
   b. Debris control plan being used for each stage of demolition including shielding systems.
   c. Calculations showing that the existing bridge structure members and foundations are not overstressed and stability is maintained during each and every stage of demolition.
   d. Schedule for bridge demolition work which takes into account environmental timing restrictions for construction/demolition work in the waterways and the Contractors construction access scheme for all ongoing construction work.

The Contractor shall reference the Traffic Control and Staging Plans for any schedule constraints affecting the sequence of demolition.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
In addition, the bridge demolition work shall include a detailed survey of the Channel bottom upon completion of the existing bridge demolition. A video of this inspection shall be supplied to the Engineer for his review and approval. Any debris found on the channel bottom shall be promptly removed at no additional cost to the State.

THE PAINT OF THE EXISTING BRIDGE CONTAINS LEAD. THE TWO STORAGE BINS NEXT TO BARRIER GATES HAVE ACM IN THE ROOFING TAR. There will be no separate payment for these items and the removal is included under the item “CLEARING SITE, BRIDGE STRUCTURE NO. 1315-150”

The existing bridge shall not be used for demolition and/or construction activities. The bascule bridge will be taken out of service after the last phase in which traffic is maintained across the roadway. Immediately upon removal of traffic the bascule span will be left in the open position until such time as the span can be removed from the waterway.

All debris generated by the Contractor’s demolition operation shall become the property of the Contractor. Proper and legal disposal of this debris must be demonstrated to the Engineer through proper documentation. The Contractor’s proposed shielding system(s) shall be designed to catch debris which is generated or may potentially occur during the demolition operation. These systems shall be designed in such a manner so as to prevent all falling debris from reaching the ground and/or water below the spans as appropriate. All debris arising from the removal of the existing bridge shall be removed from the shoreline and prevented from entering the waterway. Any debris that inadvertently falls on the ground or into the water shall be removed promptly. Demolition of foundations in open water shall minimize channel bottom disturbances through the use of turbidity barriers, cofferdams, silt curtains, or other approved methods. If the Contractor’s method of demolition will cause any disturbances to the channel bottom, then such demolition activities shall be restricted from April 1 to June 30 unless performed in a method allowable by the approved environmental permit conditions.

The Contractors proposed bridge demolition scheme and debris control plan (material containment/collection scheme) shall be in accordance with the approved Permit Plans and Permit Conditions, as indicated on the Contract Environmental Plans. If the Contractor’s demolition and debris control plan are not in conformance with the approved Permit Plans and Conditions, then he shall submit his revised schemes to the Engineer and permitting agencies for approval at no cost to the State and no impact to the construction schedule. The Contractor shall allow 30 days for the Engineer’s review of his proposed schemes for completeness before submitting the applications for permit modifications to the permitting agencies.

Blasting shall not be used for the demolition of the existing bridge.

The existing bridge and adjacent buildings shall be monitored for vibration and settlement during the construction of the new bridge in accordance with Section 525.

Demolition shall be coordinated with the Video Recordation to be performed by the State.

The Contractor is encouraged to consider reuse of materials from the bridge demolition in the New Jersey Division of Fish and Wildlife Artificial Reef Program. The Contractor may contact the New Jersey Division of Fish and Wildlife for the detailed information and requirements using the following contact information:

Artificial Reef Program
Bureau Of Marine Fisheries
New Jersey Department of Environmental Protection
Division of Fish and Wildlife
P.O. Box418
Port Republic, NJ 08241
609-292-2083

If any material from the demolished bridge is proposed to be used in artificial reef construction, the Contractor shall notify the Engineer and the New Jersey Division of Fish and Wildlife Artificial Reef Program, with a copy sent to the U.S. Army Corp of Engineers, which is subject of separate Department of the Army permits (CENAP-OP-R-199802530-1, CENAP-OP-R-200401135-1).

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
No stockpiling or disposal of demolished bridge material shall be placed within the waters of the U.S., including wetlands, without specific written authorization from the U.S. Army Corp of Engineers.

The Contractor shall provide notification to the First District U.S. Coast Guard at least 45 days prior to initiating any work over or in the waterway that may present an obstruction or hazard to navigation. Notification shall meet the requirements specified in Subsection 107.13 Construction Over or Adjacent to Navigable Waterways of the Contract Specifications.

Salvage:

The following items on the bridge have been identified to be salvaged:

1) Four concrete pylons- one on each corner of the east and west abutment. These pylons are to be removed by sawcutting at the base of the pylon and two pylons delivered to a location within Sea Bright and Highlands each for preservation. Should the condition of the pylon be such that the base becomes unstable during cutting operations, the existing tiles on the pylons should be salvaged and turned over to the Borough’s for preservation.

2) Modular Blocks used to create existing planting wall along the North Ramp- The blocks shall be palletized and delivered to a storage facility in Highlands, NJ to a location to be determined during construction. The Highlands Business Partnership, will provide a storage area for the contractor to deliver the modular blocks once removed during demolition of the abutment and walls adjacent to the North Ramp. The blocks shall be removed in such a manner and with such care that they can be reused. The blocks shall be stacked and stored using standard industry practice for preserving and transporting the blocks.

3) Machinery/Electrical Components- Immediately after the Bascule Span is taken out of service the NJDOT Movable Bridge Maintenance Division shall be contacted to inspect the condition of existing machinery and electrical components for salvage. NJDOT will tag those items to be removed by NJDOT personnel prior to the bridge demolition. The contractor shall coordinate with NJDOT for scheduling removal of the components of the electrical and mechanical equipment in coordination with the contractors schedule for bridge demolition. Upon completion of this work the contractor shall notify the respective Boroughs Historical Societies to determine if any other components of the bridge are of value to the local museums and they shall also make arrangements to remove any elements approved by NJDOT for salvage. The contractor shall provide each of the Historical Societies with a schedule for removal so as to not impact the construction schedule. Each of the Historical Societies will be responsible for the removal of the components requested. The contractor will be required to notify NJDOT immediately if the item sought by the Historical Society will adversely impact the stability of the structure or future removal operations for the bridge. No safety devices such as navigation lights or railings shall be removed while the bridge remains in place. Should elements such as this be requested by the Historical Societies, the contractor will need to determine if the component can be turned over to the Society after removal and coordinate this transfer otherwise it will be noted that the salvage is not feasible.

4) Existing Historic Tile: Prior to removal of existing concrete pylons:
   a. Photograph historic tile at each pylon. Photographs shall be in color and of size to clearly see all visible portions of the tile.
   b. Document location of tile and pylon of origin, and reference these locations in photograph.
   c. Carefully salvage all existing ceramic tile containing artwork plus sufficient quantities of monochromatic tile necessary to provide samples for matching. Box and label tile from each pylon separately. Deliver boxes with tile to location identified by the Engineer and NJDOT.

THE FOLLOWING IS ADDED:

Special protective systems for the removal of bridges, culverts, and other structures shall be as follows:

1. **Temporary Shielding.** Temporary shielding for demolition and new construction shall include furnishing, installing, and removing a structural framing and barrier system for as many times as the contractor needs during the course of construction. The system shall be supported from girders to provide an adequate and substantial temporary shielding system to protect vehicular, pedestrian, and navigation traffic from falling
construction materials or other objects. The barrier system shall remain in place during the time that construction work is performed and until the work is completed and accepted.

All necessary efforts must be taken to prevent debris from falling into the waterway or onto South Bay Avenue, Ocean Avenue or any adjacent local roadways. Any debris falling in the waterway or on adjacent roadways or private properties shall be immediately removed at the Contractor’s expense. The cost of all temporary shielding shall be included in the pay items “Clearing Site, Bridge Structure Number 1315-150” and “Clearing Site, Bridge Structure Number 1315-164”.

For deck replacement or new deck work, the temporary shielding shall seal the underside of deck and extend outside of the fascia stringers to enclose the soffits and parapets. Stay-in-place forms cannot be used for temporary shielding.

For parapet removal and replacement or new parapet construction, an outrigging type of temporary shielding, which encloses the soffit and parapet, shall be used.

The Contractor shall submit for approval detailed working drawings showing all elements of the temporary shielding system, including bonding and grounding over electrified rail lines, design calculations, and the sequence of operations thereof, signed and sealed by a Professional Engineer licensed in the State. Should the Contractor’s operation or construction staging require it to install and remove the shielding more than once, no additional payment will be made.

The traffic lanes and pedestrian areas below the areas where temporary shielding is being installed shall be closed, in accordance with the requirements of Section 617.

The temporary shielding shall be designed to withstand a load of at least 0.8 psi or greater if heavier loads are anticipated and shall prevent small particles and dust from falling through.

Bolted connections or welding between temporary shielding and bottom flanges of the beams shall not be permitted. Any materials dropped on the temporary shielding shall not be allowed to accumulate and shall be removed promptly.

The selection of sizes, materials, their arrangements, and details shall be the Contractor’s option and responsibility, but subject to approval by the Engineer.

In no case shall the temporary shielding reduce the existing underclearances of the bridges to less than 14 feet – 9 inches over roadways and 22 feet over railroads. If any existing underclearance is less than these values, it shall be maintained without any further reduction.

The Contractor shall obtain the Engineer’s approval of the method, design, and details of the temporary shielding system that the Contractor intends to use for the protection of traffic. No construction work shall be performed above traffic before such approval.

201.09 Demolition of Buildings.

5. Backfilling.

THE FIRST ITEM OF THE FIRST PARAGRAPH IS DELETED.

201.11 Method of Measurement.

THE FOLLOWING IS ADDED:

Excavation or the use of any type of sheeting that is required for the removal of the structure, or when such sheeting is to remain for planned new construction that is at the same location of the removal, will not be measured. Payment shall be included in the bid price for “Clearing Site, Bridge Structure Number 1315-150” and “Clearing Site, Bridge Structure Number 1315-164”.

201.12 Basis of Payment.

THE SECOND PARAGRAPH IS CHANGED TO:

Payment for the Pay Item “Clearing Site” shall be paid at 50% at the completion of stage 2 and 50% at the completion of stage 3.

THE FOLLOWING IS ADDED AFTER THE THIRD PARAGRAPH:

Payment for the Pay Item “Clearing Site, Bridge Structure Number 1315-150” shall be paid at 50% at the completion of stage 2 and 50% at the completion of stage 3.
Payment for the Pay Item “Clearing Site, Bridge Structure Number 1315-164” shall be paid at 100% at the completion of stage 2.

SECTION 202 - ROADWAY EXCAVATION

202.09 Milling of HMA.

2. Construction Requirements.

THE FOLLOWING IS ADDED AFTER THE NINTH PARAGRAPH:

Milled areas shall not be left unpaved for longer than 72 hours, unless approved by the Engineer.

202.15 Basis of Payment.

THE FOLLOWING IS ADDED AFTER THE FOURTH PARAGRAPH.

Separate payment will not be made for Sawcutting when used with the Pay Items "Joint Removal" or "Removal of Concrete Base Course and Concrete Surface Courses".

SECTION 203 - EMBANKMENT

203.08 Control Fill Method.

A. Control Strips.

4. Procedure.

THE LAST SENTENCE OF THE FOURTH PARAGRAPH IS CHANGED TO:

Density of the control strip will be determined according to AASHTO T 191 or AASHTO T 310 (Direct Transmission Method) except that only one method will be used throughout the Project.

B. Embankment Compaction.

THE THIRD PARAGRAPH IS CHANGED TO:

The density of such inaccessible areas will be determined from the average of five randomly located measurements according to AASHTO T 191 or AASHTO T 310 (Direct Transmission Method) except that only one method will be used throughout the Project.

203.10 Density Control Method.

THE LAST SENTENCE OF THE FIRST PARAGRAPH IS CHANGED TO:

The compacted density of embankments will be determined by taking the average of a minimum of five randomly located measurements for each 1,000 cubic yards placed according to AASHTO T 191 or AASHTO T 310 (Direct Transmission Method) except that only one method will be used throughout the Project.

203.13 Vertical Drain Method.

3. Construction of Zone 3 Embankment.

SUBPART C. IS CHANGED TO:

c. Zone 3 material shall be placed as follows:

SECTION 204 – BORROW EXCAVATION

204.03 Construction Requirements.

THE THIRD SENTENCE OF THE SECOND PARAGRAPH IS CHANGED TO:

A minimum of two field density tests will be taken according to AASHTO T 191 or AASHTO T 310 (Direct Transmission Method) on each compacted layer at each substructure unit, except that only one of the referenced methods will be used on the Project.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
SECTION 206 – FOUNDATION AND BRIDGE EXCAVATION

206.08 Cofferdams
THE FOLLOWING IS ADDED TO THIS SECTION:

The type of cofferdam used for foundation construction is to be determined by the Contractor’s means and methods with design calculations and working drawings submitted according to Subsection 105.04. The Contract Plans show a precast concrete tub cofferdam at the water pier footings for illustration only as a possible method of construction. The cofferdams that are supplied must provide an acceptable dry condition in which to construct the pier footings. All costs associated with a Contractor’s proposed scheme, including costs associated with developing and getting the scheme approved, shall be included in the appropriate Cofferdam pay item. Review time for Contractor proposed scheme or rejection of a Contractor proposed scheme shall not be a basis for a claim for extra compensation or for a request for a contract extension.

The Contractor is responsible for designing the top of cofferdam elevations or providing additional shielding above the maximum expected flood water levels, tidal fluctuations or wave action. No additional payment will be made to the Contractor if a cofferdam is flooded during construction and results in additional material, labor or equipment costs.

The Contractor’s selected foundation construction scheme shall satisfy the following conditions of the construction permits:

1. Cofferdams constructed using sheeting shall be removed after footing construction is complete.
2. Construction of pile foundations below the mean high water line in open water and wetland areas is subject to the anadromous fish timing restrictions. In order to protect anadromous fish, construction activities occurring below the mean high water line that may introduce sediment into the waterway are restricted as specified in the Environmental Plans. The Contractor shall refer to the approved environmental permit conditions and the Contract Environmental Plans for permit condition language and a summary of allowable activities. The Contractor shall refer to the Environmental Plans and Specifications for requirements for sediment control such as turbidity barriers. Payment for these items will be separate from the cofferdams.
3. All material to be used as fill within the water or wetland areas shall be free of oil and grease, debris, wood, general refuse, plaster and other pollutants, and shall contain no broken asphalt.
4. In wetland and shallow water areas, dikes and well points may be used for dewatering the areas of foundation excavation if the resulting environmental impacts are in accordance with the approved permit plans and permit conditions.
5. Per NJDOT soil erosion and sediment control standards, any dewatering that will result in discharge to wetlands or waterways shall either be held for 24 hours in properly sized sediment basins/holding tanks or shall be filtered. The Contractor shall employ appropriate measures to ensure that return water discharged from the cofferdams does not cause an increase in turbidity to the receiving waterway.
6. If the Contractor chooses to develop a foundation construction scheme that is not in conformance with the construction permits, he shall submit the revised scheme to the permitting agency and the Engineer for approval and shall not commence work until the approvals are secured.
7. The Contractor shall provide notification to the U.S. Coast Guard as required by the permits prior to initiating any work over or in the waterway that may present an obstruction or hazard to navigation. Notification shall meet the requirements specified in Subsection 107.13 Construction Over or Adjacent to Navigable Waterways of the Contract Specifications.
8. No pumped water from grout / concrete operations may be discharged directly to the waterway.

206.13 Basis of Payment
THE FOLLOWING PAY ITEMS ARE ADDED:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>COFFERDAM – PIER_</td>
<td>LUMP SUM</td>
</tr>
</tbody>
</table>

All costs associated with providing cofferdams at the locations required on the plans, including development, submittal and obtaining approval of design calculations and working drawings for the Contractor’s method, all materials, forms,
supplies, equipment, labor, temporary supports, dewatering, sealing, or other item necessary for complete installation of a sealed cofferdam for the purposes of construction of the substructure units shown on the plans in the dry, shall be included in the appropriate cofferdam pay item.

Separate payment shall not be made for the cost of all dewatering required in cofferdams or open excavations for foundation construction. The cost of dewatering shall be included in the respective cofferdam or foundation excavation pay items. Additional excavation required for the placement of seal concrete shall be included in the cost of the cofferdam.

Precast concrete cofferdams, if used and left in place shall be constructed using HPC as per the General Notes and Specifications. Vertical surfaces for water piers as per the limits and details shown on the Contract Drawings shall included a granite faced finish.

Payment for each of the Pay Items “Cofferdam – Pier_” in excess of $150,000 will not be made until Substantial Completion.

SECTION 207 – SUBSURFACE STRUCTURE EXCAVATION

207.03 Bedding Materials.
SUBSECTION HEADING IS CHANGED TO:

207.03 Bedding and Backfill Materials.

207.03 Bedding and Backfill Materials.
THE FOLLOWING IS ADDED:

Controlled Low Strength Material (CLSM) shall conform to Subsection 919.22

207.04 Construction Requirements.
THE FIRST PARAGRAPH IS CHANGED TO:

Before excavating, existing subsurface structures which may be affected by or interfere with the proposed construction shall be located. If directed, test pits shall be excavated to obtain the required information. Test pits or portions of a test pit shall be dug by hand when in close proximity to utilities or when directed. Excavation beyond that which is necessary to obtain the required information will not be measured for payment. Test pits shall be backfilled according to Subsection 203.06.

1. Pipes and Culverts.
THE FIRST PARAGRAPH IS CHANGED TO:

The width of trench shall be at least 1 foot – 6 inches greater than the outside diameter of the pipe or culvert. When the material at the bottom of the excavation is rock or other hard material, it shall be removed within 6 inches for reinforced concrete culvert pipe and high density polyethylene (HDPE) pipe, and 1 foot for corrugated metal, steel, or aluminum alloy culvert pipe outside the bottom of the pipe or culvert and the space backfilled with suitable material.

207.05 Bedding for Pipes and Culverts.
THE FIFTH PARAGRAPH IS CHANGED TO:

Bedding for corrugated aluminum alloy culvert pipe and HDPE pipe shall be placed as specified for Class B bedding.

207.06 Backfilling.
A. Pipes and Culverts.
THE ENTIRE SUBPART A. IS CHANGED TO:
Backfill to a height of 2 feet above the top of pipes and culverts, except underdrains, corrugated aluminum alloy culvert pipe and HDPE pipe, shall be made with excavated material free from stones or rock fragments larger than 2 inches in any dimension. Below this level, the backfill shall be placed in layers not more than 6 inches thick, and each layer shall be compacted with flat-face mechanical tampers. Backfill shall be worked into the haunch area and compacted for all pipe.

For HDPE pipe, backfill to a height of 2 feet above the top of the pipe shall be made with excavated material free from class IV or class V materials according to ASTM D2321, with stones or rock fragments no larger than 1½ inch in any direction. Below this level, the backfill shall be placed symmetrically on each side of the pipe in layers not more than 6 inches thick with each layer compacted with flat-faced mechanical tampers for all pipe.

Backfill to a height of 2 feet above the top of corrugated aluminum alloy culvert pipe shall be made with a granular soil with the gradation as specified in Subsection 207.03. Below this level, the backfill shall be placed symmetrically on each side of the pipe in layers not more than 6 inches thick, and each layer shall be compacted with flat-faced mechanical tampers.

All backfill more than 2 feet above the top of pipes and culverts, except underdrains, shall be made with excavated material and compacted in 6 inches layers as follows:

1. By vibratory soil compactors, if the backfill material is predominately sand or sand and gravel.
2. By flat-faced mechanical tampers, if the backfill material is not predominantly sand or sand and gravel.
3. Flat-faced mechanical tampers may be substituted for the vibratory soil compactors where the shoring and bracing of trenches or other special conditions make the use of vibratory compactors impractical.
4. Care shall be taken to avoid contact between the pipe and compaction equipment at all times. All damaged pipes shall be removed and replaced at no additional cost to the State.

The Engineer may direct compaction to be according to Subsection 203.10 except that the frequency of measurements may increase. If a hydrohammer or hoe-pak is used for compacting the backfill over the pipe, a minimum of 4 feet of cover over the pipe shall be provided.

CLSM may be used as alternate backfill material when backfilling trenches for drainage pipe and utility conduit. Combining other backfill materials in the same trench as CLSM shall not be permitted. Mixing and placement of CLSM shall begin only when the ambient temperature is at least 30 °F. During placement, the CLSM mixture shall have a temperature of at least 41 °F and shall not be placed on frozen ground. The CLSM mixture shall be discharged directly from the truck into the trench to be filled with care taken to prevent the pipe from becoming displaced. After placement, the CLSM mixture shall be cured and protected to prevent damage from cold weather according to Subsection 405.14. CLSM shall not be used to replace pavement, base courses or drainage layers that form the structure of the roadway.

The special backfill in trenches for the underdrains shall be compacted by vibratory compactors. Earth backfill above the special backfill material shall be compacted as specified in Subsection 203.07.

Shoring, bracing, and sheathing shall be withdrawn as the backfilling proceeds. Compaction requirements shall not be compromised due to the removal of sheathing, shoring, trench boxes or other type of excavation support systems.

In rock cuts, the backfill shall be either broken stone or washed gravel.

SECTION 212 - SOIL EROSION AND SEDIMENT CONTROL

212.06 Soil Erosion and Sediment Control Measures.
THE FOLLOWING IS ADDED:

K. Concrete Washout Facility. Design concrete washout facility to fully contain all concrete washout needs of the Work. Concrete washout facility may be portable or a bermed basin that is lined with a single sheet of a minimum of 10-mil polyethylene sheeting that extends over the entire basin and berm to prevent escape of discharge. Place a secure, non-collapsing, non-water collecting cover over the concrete washout facility prior to inclement weather to prevent accumulation and overflow of precipitation. Submit a plan for concrete washout facility for approval to the Resident Engineer 10 days before first concrete pour. Provide concrete washout facility to prevent discharge from concrete trucks or equipment cleaning to inlets, surface or groundwater. Designate an area for the concrete washout facility that is no closer than 50 feet from...
environmentally sensitive areas such as waterbodies, wetlands, or other areas indicated on the plans. Use signs to designate concrete washout facilities. Ensure that the concrete washout facility complies with all Federal, State, and local laws, rules, and regulations. Ensure that the concrete washout facility is in place before delivery of concrete to the site.

Ensure that concrete washout is limited to the designated areas. Contents of the concrete washout facility shall not exceed 50% capacity of the facility. At or before the 50% capacity is reached, discontinue pouring concrete until the facility is cleaned out. Remove hardened concrete and properly dispose or reuse it as specified in Subsection 202.12. Allow slurry to evaporate or remove from site and dispose of it as specified in Subsection 201.10.

If a lined basin is used, immediately replace the liner if it gets damaged. Remove concrete washout facility when it is no longer needed. Restore the disturbed area to its original condition.

L. **Oil-Only Emergency Spill Kit.** Before start of construction operations of the Work, place on site at least 2 oil-only emergency spill kits with each kit capable of cleaning up at least 50 gallons of spill. Ensure that each kit contains the items as provided in the Special Provisions:

1. 10 oil-only absorbent booms (5-inch by 10-foot)
2. 10 oil-only absorbent booms (3-inch by 10-foot)
3. 60 absorbent mat-type pads (20-inch by 16-inch)
4. 20 temporary disposal bags and ties
5. 1 emergency response guide book
6. 1 instruction manual
7. 1 wheeled container for the above
8. One 40 lb bag loose absorbent pellets

If a spill occurs, immediately contain and clean up the spill. Notify the Resident Engineer as soon as circumstances permit. Stockpile the excavated contaminated soil separately. Dispose of cleaned up material and used kit material as specified in Subsection 201.10. Replenish kits as necessary to keep at least 2 complete kits on site at all times during construction operations.

212.09 **Method of Measurement.**
THE FOLLOWING IS ADDED:

Concrete washout Facility will not be measured, and payment will be made on a lump sum basis.
Oil only emergency spill kit will be measured by the unit.

212.10 **Basis of Payment.**
THE FOLLOWING PAY ITEMS ARE ADDED:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONCRETE WASHOUT FACILITY</td>
<td>LUMP SUM</td>
</tr>
<tr>
<td>OIL ONLY EMERGENCY SPILL KIT</td>
<td>UNIT</td>
</tr>
</tbody>
</table>

Payment for silt sacks shall be made according to the following: 1 unit = 2 silt sacks.

THE FOLLOWING IS ADDED TO THE END OF THIS SECTION:

DUNE MITIGATION

**Description**

1. Dune mitigation work shall be as follows: All asphalt and non-native material must be removed from the mitigation area.
2. Native sand should be accessed within a foot of the existing surface. If not, additional sand may be added to the area by stockpiling sand from the dune area being paved and sifting it of extraneous materials.
3. Vegetation shall be planted in accordance with the contract plans and as specified in this specification.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
4. The area shall be fenced off to prevent trampling and wind erosion until the plants are established. A permanent fence along the leeward side shall be installed to prevent sand from being blown onto the roadway.

Materials

Vegetation shall be planted by hand as follows:

1. Plant restoration area with American beachgrass 18” on center over 75% of the mitigation area. Plant two American beachgrass culms per hole, approximately 7-9” deep. Cut tops back to 16-18” high.
2. Plant coastal panic grass 18” on center over the remaining 25% of the mitigation area. Plant two coastal panic grass culms per hole, approximately 7-9” deep. Cut tops back to 16-18” high.
3. Intersperse clusters of coastal panic grass within the American beachgrass planting area.
4. Plant between October 1st and April 1st.
5. Fertilize grass plantings directly in each hole with 30-10-0 or 20-10-5 slow release fertilizer.
6. Plant beach plum (minimum of 20 plants) throughout the dune restoration in a naturalistic fashion.
7. After three months apply broadcast fertilizer at a rate of 50lbs/acre to the entire restoration area. Repeat at three month intervals for the first year.

Method of Measurement

Dune mitigation will not be measured but will be paid for on a lump sum basis.

Basis of Payment.

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>DUNE MITIGATION</td>
<td>LUMP SUM</td>
</tr>
</tbody>
</table>

ABSORBENT BOOM

Description

The work covered by this section consists of providing all labor, materials, and equipment required for the installation, use and removal of absorbent booms as required. Absorbent Booms are required for cleaning up oil-based spills on land or in water.

Materials

Absorbent Booms shall have the following characteristics:

1. Absorbent Booms shall be 10’ long with an 8” exterior diameter.
2. Strong mesh outer skin
3. UV-treated spunbond skin
4. Meets NFPA 99 standards for static decay
5. Polypropylene skin
6. Polyester mesh netting
7. Polypropylene pulp filler

Absorbent Booms shall be manufactured by New Pig, One Pork Avenue, P.O. Box 304, Tipton, PA 16684-0304, 1-800-468-4647, or an approved equal.

Reference Documents

All Absorbent Booms shall conform to the requirements of the EPA’s Spill Prevention, Control, and Countermeasure (SPCC) Guidance for Regional Inspectors rule at 40 CFR part 112.

Method of Measurement

Absorbent Boom will not be measured but will be paid for on a lump sum basis.

Basis of Payment.

Payment will be made under:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
HEAVY DUTY TURBIDITY BARRIER

Description
A. Provide all facilities, labor, materials, tools equipment, appliances, transportation, supervision, and related work necessary to complete the work specified in this Section, and as shown on the Contract Plans.
B. Furnish all labor, materials, equipment and incidentals necessary to perform all installation, maintenance, removal, cleanup and disposal related to controlling siltation and turbidity in surface water during construction as shown on the Contract Plans and as specified herein. The work shall include, but not necessarily be limited to, the following: installation, maintenance, and removal of all temporary construction-phase silt/turbidity control systems and features, collection and appropriate disposal of silt recovered from within the control systems and spent control system materials, and final cleanup.

Regulatory Requirements
The Contractor shall comply with all rules, regulations, laws, ordinances, and permit conditions of the NJDEP, NJDOT, US Coast Guard (USCG), Army Corps of Engineers (USACOE), United States Department of Commerce National Marine Fisheries Service (NMFS), United States Department of the Interior Fish and Wildlife Service (FWS), and all other authorities having jurisdiction. All labor, materials, equipment, and services necessary to make work comply with such requirements shall be provided without additional cost to the Owner.

Performance Criteria
Silt/turbidity control system shall control silt and turbidity such that the requirements of the NJDEP, USCG, USACOE, NMFS and FWS are met.

Submittals
A. Within 10 days after Notice of Award, the Contractor shall submit to the Engineer, for approval, a construction-phase water quality control plan describing the measures the Contractor intends to employ to meet applicable permit and regulatory requirements during execution of the work, including drawings of proposed control systems and technical product literature for all commercial products to be used.
B. Within 10 days after Notice of Award, submit to Engineer, for approval, a Shop Drawing of the silt/turbidity control system.
C. Submit weekly reports of turbidity measurements, including tabulated turbidity measurements.

Quality Assurance
A. The silt/turbidity control system shall be installed and maintained in a manner that will contain silt and turbidity between the shoreline and the control system, and prevent turbidity, or impacts to water quality in the Shrewsbury River that violate New Jersey DEP Water Quality Regulations; Federal Clean Water Act Regulations; requirements of the US Army Corps of Engineers, US Coast Guard, and NJDEP project specific permits; or results in degradation of water quality beyond conditions existing in the Shrewsbury River prior to construction.
B. The Engineer may conduct surface water quality monitoring in the Shrewsbury River before and/or during construction to monitor turbidity. All turbidity measurements shall be measured in NTU.
C. If visible impacts to surface water quality (suspended sediments) occur during construction, the Contractor shall immediately inform the Engineer of such conditions and undertake measures to contain and remove or remediate the impacts. The Contractor’s surface water quality control plan shall contain contingency measures for containing and removal/remediation of surface water quality impacts. Measures, in addition to those shown on the Contract Plans, necessary to maintain water quality in the Shrewsbury River at pre-construction levels shall be installed, maintained, removed, and cleaned up as required by the Engineer at no additional cost to the Owner.
Special Site Conditions
Water levels in the Shrewsbury River normally fluctuate in response to tides, precipitation, run-off, and other weather conditions. Silt/turbidity control system installed by the Contractor shall accommodate these tidal level fluctuations while maintaining a seal with the river bottom during the entire period of construction.

Silt/Turbidity Control System
A. Silt/turbidity barrier shall consist of heavy duty non-woven skirt, flotation elements, PVC coated reinforced vinyl debris boom, top tension cable and bottom chain ballast or other anchorage system which will not obstruct navigation.

B. Barrier shall be full-height, extending from the water surface to the river bottom. The height will depend on the alignment of turbidity barrier and the bathymetric contours along that alignment.

C. Non-woven skirt shall be comprised of 100% polypropylene filaments, needle punched and heat set. Non-woven skirt shall have the following properties:

<table>
<thead>
<tr>
<th>Properties</th>
<th>Test Method</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>ASTM D-3776</td>
<td>10.0 oz/yd²</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D-4632</td>
<td>250 lbs</td>
</tr>
<tr>
<td>Elongation @ Break</td>
<td>ASTM D-4632</td>
<td>50%</td>
</tr>
<tr>
<td>Mullen Burst</td>
<td>ASTM D-3786</td>
<td>460 psi</td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>ASTM D-4833</td>
<td>150 lbs</td>
</tr>
<tr>
<td>Trapezoidal Tear</td>
<td>ASTM D-4751</td>
<td>100 lbs</td>
</tr>
<tr>
<td>AOS – US Std. Sieve</td>
<td>ASTM D-4751</td>
<td>100</td>
</tr>
<tr>
<td>Permittivity</td>
<td>ASTM D-4491</td>
<td>1.2 sec⁻¹</td>
</tr>
<tr>
<td>U.V. Resistance</td>
<td>ASTM D-4355</td>
<td>70% (500 hrs)</td>
</tr>
</tbody>
</table>

Pre-Installation Survey
The Contractor shall conduct field measurements in advance of silt/turbidity control system installation to determine the required dimensions of the silt/turbidity barrier.

Installation
A. Install silt/turbidity control barrier along the general alignment shown on the Contract Plans

B. The Contractor shall install the barrier such that:
   1. The barrier shall have sufficient buoyancy to remain floating at all times while deployed. Buoys may be used as necessary to ensure buoyancy of the barrier.
   2. The barrier shall extend from the water surface to the river bottom at all times.
   3. The barrier shall be weighted at the bottom to form a seal with the river bottom during the entire period of construction.
   4. The barrier shall be securely anchored to remain in position at all times. Each end of the barrier shall be anchored to a fixed object (pile). Intermediate anchors shall be installed along the river bottom if necessary but the location of all anchors and chains shall be approved by the USCG and USACOE for possible impact on the navigable waterway.

C. The system and installation plan shall be designed and stamped by a Registered Professional Engineer with a minimum of 10 years demonstrated experience with the design, manufacture, and installation of full water depth, floating, filtering barrier curtains. The Engineer shall provide boom structural calculations and the design information for review and approval by the Engineer.

Inspections and Maintenance
A. The Contractor shall perform the following inspections:
   1. Make a visual inspection of surface water and the silt/turbidity control system a minimum of three times per day and maintain a log documenting the observations. If such inspection reveals that additional measures are needed to prevent movement of silt, promptly notify the Engineer and install additional devices as needed. Sediment controls in need of maintenance shall be repaired promptly.
B. The Contractor shall perform the following maintenance of the silt/turbidity control system and also perform all other work necessary to keep the barrier operating efficiently during all construction activities:

1. Provide additional pile anchors or other suitable means to secure the barrier against wind, waves, ice, boat activity, dredging and other forces acting on the barrier as required to maintain the intended function.
2. Keep all anchor lines secure and properly positioned to maintain efficient operation and positioning of the barrier. Collect sediments as necessary to avoid potential water quality impacts or potential failure of the silt/turbidity control system. Collected sediments shall be disposed in the consolidation area.
3. Collect sediments as necessary to avoid potential water quality impacts or potential failure of the silt/turbidity control system. Collected sediments shall be disposed in the consolidation area.
4. Immediately contain, collect or otherwise mitigate the migration of sediments that are released from within the area protected by the silt/turbidity control system.
5. Immediately replace any portions of the barrier that are damaged while the barrier is deployed. Damaged sections must be replaced by new sections of containment booms or silt curtains. Use of patched sections is prohibited.
6. Relocate barrier, as necessary, to conduct work based on flow conditions in the Shrewsbury River or as required by the Engineer.

Removal and Disposal

A. Removal: The Contractor shall remove the silt/turbidity control system as follows:

1. Allow sufficient time from completion of construction activities to allow suspended sediments within the area contained by the silt/turbidity control system to settle to the river bottom before removing the system. The Contractor shall maintain all turbidity control equipment surrounding work areas until all suspended sediment within the works areas has settled and water quality is similar to pre-construction conditions.
2. Collect sediments contained by or adhered to the barrier. Manually remove residual sediments attached to the barrier. Collected sediments shall be disposed in the consolidation area.
3. Prevent release of sediments to the river during removal of the system.
4. Remove all piles and other support/anchor systems installed for the system to a minimum of El -22 in accordance with the USCG permit.

B. Disposal: The Contractor shall dispose of the silt/turbidity control system off-site. If temporary storage is necessary, temporarily store the silt curtain by encapsulating with polyethylene or containerizing.

Materials

Heavy Duty Turbidity Barriers shall be manufactured by Gunderboom, Inc., 2 White Sands Lane, Scarborough, ME 04074, (207) 883-1777, www.gunderboom.com, or an approved equal.

Method of Measurement

Heavy Duty Turbidity Barriers will not be measured but will be paid for on a lump sum basis.

Basis of Payment

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEAVY DUTY TURBIDITY BARRIER</td>
<td>LINEAR FEET</td>
</tr>
</tbody>
</table>
DIVISION 300 - BASE COURSES

SECTION 301 - SOIL AGGREGATE BASE COURSE AND DENSE-GRADED AGGREGATE BASE COURSE

301.05 Compaction.
THE LAST SENTENCE OF THE FIRST PARAGRAPH IS CHANGED TO:

The in-place dry density of each compacted layer will be determined according to AASHTO T 191 or T 310 (Direct Transmission Method) except that only one method will be used throughout the Project.

THE THIRD SENTENCE OF THE LAST PARAGRAPH IS CHANGED TO:

One density determination will be made at each of the selected locations using AASHTO T 191 or T 310 (Direct Transmission Method) except that only one method will be used throughout the Project.

301.08 Maintenance Under Traffic.
THIS SUBSECTION IS CHANGED TO:

When it is provided on the Plans that traffic is permitted to ride on the completed base course, the base course shall be maintained smooth and uniform until covered by the following stage of construction.

SECTION 302 – ROAD-MIXED STABILIZATION

302.09 Compaction, Shaping, and Finishing.
A. Compaction.
THE LAST SENTENCE OF THE SECOND PARAGRAPH IS CHANGED TO:

The in-place dry density of each compacted course will be determined according to AASHTO T 191 or T 310 (Direct Transmission Method) except that only one method will be used throughout the Project.

302.15 Basis of Payment.

THE FOLLOWING PAY ITEM IS ADDED:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILTER BED SAND</td>
<td>CUBIC YARD</td>
</tr>
</tbody>
</table>

SECTION 305 – CONCRETE BASE COURSE

305.05 Opening to Traffic.
THIS SUBSECTION IS CHANGED TO:

The opening to traffic shall be as specified in Subsection 405.20.
DIVISION 400 - SURFACE COURSES

SECTION 402 – BITUMINOUS SURFACE TREATMENT

SECTION 404 – HOT MIX ASPHALT (HMA)

404.02 Materials.
THE FOLLOWING IS ADDED TO LIST OF MATERIALS IN THE SECOND PARAGRAPH:

Polymerized Joint Adhesive..................................................................................................................908.08

404.05 Plant Laboratory.
ITEM 23 OF THE FIFTH PARAGRAPH IS CHANGED TO:

23. Microcomputer and workstation requirements shall be according to Subsection 106.06.

404.06 Vehicles for Transporting HMA Mixtures.
THE ENTIRE SUBSECTION IS CHANGED TO:

The mixture shall be transported from the mixing plant to the Project in trucks equipped with tight, clean bodies, which may be lightly coated with soap or lime solution, or other such non-petroleum-based release agent. Under no circumstance shall a petroleum-based product be used as a release agent.

The trucks shall be permanently equipped with an airfoil that is capable at any speed or under any weather conditions to deflect air over the tarp and to prevent air from going under the tarp. The airfoil will be affixed no more than 2 feet in front of the tarp roll and be at least as high as the top of the tarp roll.

Each truckload shall be covered immediately after loading at the plant with a waterproof tarpaulin of such size to protect the mixture from the weather. The tarpaulin shall be able to withstand normal handling and placement temperatures of up to 400 °F without endangering the structural integrity and serviceability of the fabric. The tarpaulin shall also comply with one of the following:

1. A heavyweight tarpaulin to completely drape the load. The heavyweight tarpaulin shall have a minimum weight of 18 oz./yd² and shall be a minimum of 2 feet wider and 4 feet longer than the truck body. The heavyweight tarpaulin shall securely meet or overlap the top of the tailgate and be securely held in place so as to prevent air from lifting the tarp during transport.

2. A tarpaulin equipped with side and back flaps sufficient to lap down outside along the sides and rear of the truck bed a minimum of 12 inches. The tarpaulin shall be secured by tie downs at a maximum of 5 feet spacing along the sides and rear of the truck.

The truck bodies shall be insulated or heated as necessary, to ensure delivery of the mixture at the specified temperature. Any truck that: causes excessive segregation of the mixture by its suspension or other contributing factors; leaks; causes delays; does not have an airfoil; or does not have an approved tarpaulin shall be removed from the work until such conditions are corrected and the truck is presented for inspection to the Engineer. The Engineer may require that all vehicles for transporting HMA mixture to be used by the contractor be made available for inspection at the plant laboratory prior to any shipments of materials.

404.08 HMA Paver.
THE FIFTH AND SIXTH PARAGRAPHS ARE CHANGED TO:

When wedge joint construction is required, HMA pavers shall be equipped with a sloped plate to produce a wedge edge at longitudinal joints. The sloped plate shall meet the requirements of Subsection 404.17.1.B and shall be attached to the paver screed extension.

THE SEVENTH PARAGRAPH IS DELETED.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
1. Longitudinal Joints. All longitudinal joints shall be cleaned free from dust and coated before placing the HMA with a uniform application of a polymerized joint adhesive selected from the Department’s approved products list. The polymerized joint adhesive material shall be applied at a slow rate to ensure an even coating thickness of an \( \frac{1}{8} \) of an inch over the entire joint face. For echelon paving the longitudinal joints need not be treated with the polymerized joint adhesive.

The paving shall be done with the spring loaded end plates of the paver in the “down” position. When constructing the first lane, care shall be exercised in rolling so as not to displace the line and grade of the edges of the HMA. The longitudinal joint in one layer shall offset that in the layer immediately below by approximately 6 inches. The joint in the surface course shall be offset from the lane lines by 6 inches except for the centerline of a roadway in which the joint shall fall between the double yellow traffic stripe.

Paving, compaction and the supply of material shall proceed at a uniform rate with minimal or no stopping.

If a single paver does not spread the HMA material the entire width of the roadway, two pavers shall be used provided that the rate of production of HMA material can be maintained. The second unit shall follow within 300 feet of the first unit in echelon, so as not to permit cooling of the longitudinal joint between the two lanes. If echelon paving is to be utilized, the distance that the screed and end gate of the trailing paver shall extend over the uncompacted HMA layer behind the first paver shall be 1 inch or less. The inside end gate of the second paver must be set at the same level as the bottom of the screed plate of the first paver. Raking of the joint is not needed.

A wedge joint shall be constructed when traffic is to be maintained and lift thickness is greater than 2\( \frac{1}{4} \) inches. A vertical edge joint will be permitted for lift thickness 2\( \frac{1}{4} \) inches or less when traffic has to be maintained. For lift thickness greater than 2\( \frac{1}{4} \) inches and traffic is not required to be maintained, a vertical edge shall be utilized.

Longitudinal joints shall be constructed utilizing one of the following methods:

A. Vertical Edge Joint. The paver shall be positioned so that in spreading, the HMA material uniformly overlaps the edge of the lane previously placed by 1 to 2 inches and shall be left sufficiently high to allow for compaction. In general, the height of the uncompacted HMA above the compacted HMA shall be \( \frac{1}{4} \) inch for each 1 inch of compacted mix. The overlapped HMA material being placed in the abutting lane shall be tightly crowded (bumped) over the joint. Any material in excess of the 1 to 2 inch overlap shall be pulled away from the joint and removed instead of broadcasting onto the new mat. When compacted, the new mat at the joint shall be even or slightly higher (Maximum \( \frac{3}{8} \) of an inch) than the previously placed adjoining mat. If the newly compacted mat results in a depression at the joint of \( \frac{1}{8} \) of an inch or more lower than the previously placed adjacent HMA layer, all paving operations shall cease until corrective action is taken by the Contractor to prevent reoccurrence. For all longitudinal joints that do not meet this requirement, the Contractor shall saw joints according to dimension guidelines of Subsection 404.19 and seal with an approved sealer.

B. Wedge Joint. The sloped plate of the paver shall produce a wedge edge having a face slope of 3H:1V. The plate shall be so constructed as to accommodate compacted layer thickness of 2 to 4 inches. The bottom of the sloped plate shall be mounted 1 inch above the existing surface. The plate shall be interchangeable on either side of the screed. The Contractor shall maintain the wedge configuration under traffic conditions.

All loose material shall be removed from the traveled way before opening to traffic. The rolling operation of the adjoining lane shall proceed as indicated in subpart A above, except that care shall be taken to keep coarse aggregate away from the point where the wedge meets the surface of the previously placed lane.

To assure a true line, the paver shall closely follow lines or markings placed along the joint for alignment purposes. All longitudinal joints shall be constructed parallel to the centerlines within a tolerance of plus or minus 3 inches for every 100 linear feet. If this tolerance is not met, the mat shall be cut back to conform. The width and depth of overlapped material shall be kept uniform at all times. Overlapped material
shall be luted back, pushing the material off of the cold HMA and onto the hot HMA mat directly over the joint. In no case shall excess material be broadcast across the new layer. All excess material shall be removed.

404.18 Compaction.
THE FOURTH PARAGRAPH IS CHANGED TO:

When compacting the longitudinal edge of the first lanes placed using the wedge joint, the breakdown roller shall not extend more than 2 inches over the top of the sloped face of the wedge joint. The Contractor shall submit a plan, to ensure material at the wedge edge is properly seated and loose material is removed, for the Resident Engineer’s approval prior to the commencement of paving operations.

THE FOLLOWING IS ADDED AFTER THE FOURTH PARAGRAPH:

Care shall be taken to prevent lateral displacement of the unconfined edge during the compaction operation. The edge of the drums of vibratory or static wheel rollers shall extend over the free edge of the mat by at least 6 inches. When compacting the joint, while paving the adjacent lane, the roller shall be placed on the newly placed HMA and overlap the joint by a distance of approximately 6 inches.

THE FIFTH PARAGRAPH IS CHANGED TO:

Alternate trips of the roller shall be terminated in stops approximately 2 feet from the preceding stop. When paving in echelon, rollers compacting the mat behind the lead paver shall maintain approximately 6 inches of uncompacted material adjacent to the second paver. After mix from the second paver is placed against the uncompacted edge of the mat from the first paver, the rollers shall compact the HMA on both sides of the joint.

THE FOLLOWING IS ADDED AFTER THE ELEVENTH PARAGRAPH:

After compaction has been completed, the pavement shall be free of all visible defects such as segregation, bleeding, ruts, ridges, roller marks, cracking, tearing, raveling, open or segregated transverse or longitudinal joints, depressed or raised areas around manholes or raised areas around inlets in the Traveled Way or any other defects, as determined by the Resident Engineer. All visible defects shall be repaired to the satisfaction of the Resident Engineer at no additional cost to the State.

At the discretion of the Resident Engineer where it is deemed to be impractical to repair such visible defects, a payment reduction due to nonconformance will be applied according to Subsection 404.26.

404.21 Surface Course Rideability Requirements.
For this Project, the no payment reduction provisions shall govern.

404.25 Method of Measurement.
THE FOLLOWING IS ADDED AFTER THE SEVENTH PARAGRAPH:

Polymerized joint adhesive will be measured by the linear foot.

THE EIGHTH AND NINTH PARAGRAPHS ARE CHANGED TO:

Sealing of Cracks in HMA surface course will be measured by the linear foot.
Sawing and sealing joints in HMA overlays will be measured by the linear foot. Sawing joints in base or intermediate course will be measured by the linear foot.

THE THIRTEENTH PARAGRAPH IS CHANGED TO:

The monthly asphalt price index will be the average of quotations from suppliers serving the area in which the Project is located. The asphalt price index for North and South of Route I-195 will be posted every month on the Department’s web site: www.state.nj.us/transportation/eng/CCEPM/PriceIndex.shtm.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
THE FOURTEENTH PARAGRAPH IS CHANGED TO:

The basic asphalt price index will be the previous month’s asphalt price index before receipt of bids.

THE LAST PARAGRAPH IS DELETED:

404.26 Basis of Payment.
THE NINTH AND THIRTEENTH PAY ITEMS IN THE FIRST PARAGRAPH ARE CHANGED TO:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAWING JOINTS IN INTERMEDIATE OR BASE COURSE</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>CORE SAMPLES, HOT MIX ASPHALT</td>
<td>UNIT</td>
</tr>
</tbody>
</table>

THE FOLLOWING NEW PAY ITEM IS ADDED:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>POLYMERIZED JOINT ADHESIVE</td>
<td>LINEAR FOOT</td>
</tr>
</tbody>
</table>

THE FOLLOWING PAY ITEM IS DELETED:

SEALING OF CRACKS AND JOINTS IN HOT MIX ASPHALT SURFACE COURSE LINEAR FOOT

THE LAST PARAGRAPH IS CHANGED TO:

Separate payment will not be made for MTV, test strips, and quality control for compaction, including comparison cores, and nuclear density testing. All costs thereof shall be included in the prices bid for Hot Mix Asphalt Surface Course ___, Hot Mix Asphalt Intermediate Course ___, and Hot Mix Asphalt Base Course ___.

SECTION 405 – CONCRETE SURFACE COURSE

405.02 Materials.
THE FOURTH AND FIFTH PARAGRAPHS ARE CHANGED TO:

Epoxy grout shall meet the requirements of ASTM C 881, Type I, Grade 3, Class B or C. Certifications of compliance shall be furnished according to Subsection 106.04.

405.08 Mixing Concrete.
1. Mixing on the Project in Truck Mixers.
   THIS FIRST SENTENCE IN THE FIFTEENTH PARAGRAPH IS CHANGED TO:

   Each batch shall be mixed not less than 50 revolutions at the rate of rotation designated as mixing speed.

   3. Transit Mixing.
   THE NINTH PARAGRAPH IS CHANGED TO:

   Mixing shall begin immediately following the complete charging of the drum and continue for not less than 50 revolutions of the drum at the mixing speed recommended by the manufacturer of the truck mixer. Upon completion of at least the minimum number of mixing revolutions at the plant, the speed of the drum shall be reduced to the agitation speed recommended by the manufacturer.

   THE LAST PARAGRAPH IS CHANGED TO:

   Transit mix concrete will be rejected for any of the following reasons:
   a. If the concrete is not discharged within the specified time limit after loading all ingredients into the drum;
   b. If the indicator on the counter shows that the instrument has been turned off or tampered with;
c. If the non-resettable total revolution counter shows more than 300 revolutions;
d. If water has been added while the truck mixer is en route to the Project. Two-way telephone or radio communication between the site of the placement of concrete and the batching plant shall be provided.

405.22 Bridge Approach and Transition Slabs.
THE ENTIRE SUBSECTION TEXT IS DELETED

405.24 Method of Measurement.
THE FIRST PARAGRAPH IS CHANGED TO:

Concrete surface courses, with or without reinforcement, of the various thicknesses, will not be measured and payment will be made for the quantity in the Proposal adjusted for Change Orders except as provided for in Subsection 109.01.

THE SEVENTH PARAGRAPH IS DELETED

405.25 Basis of Payment.
THE THIRD, FOURTH AND ELEVENTH PAY ITEMS ARE DELETED

SECTION 406 – SUPERPAVE HOT MIX ASPHALT COURSES

406.12 Air Voids Acceptance Plan.
THE FIRST SENTENCE OF THE FOURTH PARAGRAPH IS CHANGED TO:

Each mixture in a given lot shall be compacted so that the combined percentage of material below 2.0 percent air voids or above 8.0 percent air voids shall be no more than ten percent.

THE SUBPART (2) IN THE FIFTH PARAGRAPH IS CHANGED TO:

(2) Compute Quality Index.

\[ QL = \frac{(\bar{X} - 2.0)}{S} \text{ and } QU = \frac{(8.0 - \bar{X})}{S}, \]
where “Q” is the quality index.

406.13 Surface Course Rideability Requirements.
For this Project, the no payment reduction provisions shall govern.

406.14 Thickness Requirements.
THE FIRST SENTENCE OF THE SECOND PARAGRAPH IS CHANGED TO:

Conformance to thickness requirements will be judged from the full depth cores taken for surface course air voids determinations evaluated according to Section 990, NJDOT B-4.

THE THIRD PARAGRAPH IS CHANGED TO:

Acceptance will be based on total thickness and thickness of the surface course.

THE FOLLOWING IS ADDED TO THE END OF THIS SUBSECTION:

Evaluation of the surface course will be performed solely to determine whether a remove-and-replace or an overlay condition exists, not for pay adjustment. To be judged acceptable, no more than 10.0 percent of the surface course shall be of deficient thickness as calculated by the procedure below.

Acceptance for surface course thickness will be based on the percentage of the lot estimated to fall below the specified thickness as follows:

(1) Compute the sample mean (\(\bar{X}\)) and the standard deviation (S) of the N Test Results (X1, X2,..., XN):
\[ \bar{X} = \frac{X_1 + X_2 + \ldots + X_N}{N} \]

\[ S = \sqrt{\frac{(X_1 - \bar{X})^2 + (X_2 - \bar{X})^2 + \ldots + (X_N - \bar{X})^2}{N-1}} \]

If for any reason the number of available test results is different from \( N = 5 \) for initial testing or \( N = 10 \) for retesting, tables for the appropriate sample size are to be used for Step (3).

(2) Compute Quality Index.

\[ QL = \frac{(\bar{X} - T_{all})}{S}, \]

where “Q” is the quality index and \( T_{all} \) is the minimum allowable thickness from the following table:

<table>
<thead>
<tr>
<th>HMA Designation</th>
<th>Nominal Maximum Aggregate Size of Mix</th>
<th>Minimum Allowable Compacted Lift Thickness (( T_{all} ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.5 MM</td>
<td>1.0 Inch</td>
<td></td>
</tr>
<tr>
<td>12.5 MM</td>
<td>1.25 Inches</td>
<td></td>
</tr>
<tr>
<td>19 MM</td>
<td>2.0 Inches</td>
<td></td>
</tr>
</tbody>
</table>

(3) Compute Percent Defective.

Using Table 914-5 for the appropriate sample size, determine the percentage of defective material (PD) falling below the allowable thickness associated with \( QL \) (lower limit).

(4) Retest.

If the initial series of \( N = 5 \) tests produces a percent defective value of \( PD \geq 10 \), the Contractor may elect to take an additional set of \( N = 5 \) drilled cores at new random locations, as designated by the Engineer. The additional cores must be taken within 10 Working Days of the receipt of the initial core results. If the additional cores are not taken within the 10 Working Days, the initial core results (\( N = 5 \)) will be used to determine acceptance. When additional cores are taken, Steps 1, 2, and 3 will be repeated using the combined data set of \( N = 10 \) test values to obtain the total PD estimate using Table 914-5.

(5) Removal and Replacement.

If the surface course fails to meet the acceptance requirement the Department will require removal and replacement of the lot, or milling and overlaying, at the Contractor’s expense. When either replacement or milling and overlaying are done, the new courses are subject to the same requirements as the initial construction.

406.15 Combined Pay Adjustment.

THE ENTIRE SUBSECTION IS DELETED AND IS INTENTIONALLY LEFT BLANK:

406.19 Basis of Payment.

THE SECOND PARAGRAPH IS CHANGED TO:

Pay Adjustments for air voids, rideablity, and thickness will be made according to Subsections 406.12, 406.13, and 406.14, respectively.

THE LAST PARAGRAPH IS CHANGED TO:

Separate payment will not be made for MTV, test strips, and quality control for compaction, including comparison cores, and nuclear density testing. All costs thereof shall be included in the prices bid for Superpave Hot Mix Asphalt __ __ __ Surface Course, Superpave Hot Mix Asphalt __ __ __ Intermediate Course, and Superpave Hot Mix Asphalt __ __ __ Base Course.
DIVISION 500 - BRIDGES AND STRUCTURES

SECTION 501 - CONCRETE STRUCTURES

501.01 Description.
THE FOLLOWING IS ADDED AFTER THE FIRST PARAGRAPH:

This work shall also consist of the construction of portland cement concrete parapets, curbs and sidewalks with the use of High Performance Concrete (HPC). Additionally, HPC shall be used for the protection of substructures (pier footings and sand filter structures) that may be subjected to waterway abrasion.

THE SECOND THROUGH SIX PARAGRAPHS ARE DELETED.

501.02 Materials.
THE FOLLOWING IS ADDED TO THE FIRST PARAGRAPHS MATERIAL LIST
High Performance Concrete .......................................................................................................................... 914.02

THE SECOND THROUGH SIX PARAGRAPHS ARE CHANGED TO:

The pressure injected epoxy shall meet the requirements of ASTM C 881, Type I or IV, Grade 1, Class B or C. The epoxy crack sealant shall be recommended by the pressure injected epoxy manufacturer. Certifications of compliance shall be furnished according to Subsection 106.04.

The pressure injected epoxy shall be capable of penetrating the cracks to their full depth and capable of bonding to the surfaces of cracked concrete.

In the production of HPC, in order to achieve the desired resistance to chloride penetration, an appropriate pozzalonic or other cementitious material; such as, silica fume, fly ash or ground granulated blast furnace slag shall be provided in the mix design.

Silica fume shall not be used as a sole material to achieve the desired resistance to chlorides. When used, silica fume’s content shall be limited to a maximum of 5 percent of the total cement content and a proportion of fly ash or ground granulated blast furnace slag shall be included to obtain the resistance specified in 914.02 to chloride penetration. The fly ash and ground granulated blast furnace slag limitations specified in 914.02 may be increased in the fabrication of HPC.

The maximum water cement ratio shall be maintained at 0.40. In the fabrication of HPC, the cement content should not be increased for the purpose of achieving high early strength.

501.05 Working Drawings.
THE SECOND, THIRD AND FOURTH PARAGRAPHS ARE DELETED.

501.07 Forms.
7. Permanent Steel Bridge Deck Forms.
THE FIRST SENTENCE OF THE SECOND PARAGRAPH IS CHANGED TO:

The use of permanent steel bridge deck forms shall conform to the following:

a. Design.
THE SEVENTH PARAGRAPH IS CHANGED TO:

The spacing (pitch) of the ribs (flutes) shall match the spacing of the bottom main reinforcement steel, except on curved girder structures and in the areas of bridge decks with a flared rebar pattern. In these locations, the pitch of the flutes may be independent of the bottom main reinforcement spacing, and the forms may be dropped as necessary to achieve the minimum 1 inch concrete cover between the main reinforcement steel and the form. When the forms are dropped, additional dead load shall be accounted for in the design. Approval from the Engineer to drop the forms shall be obtained before construction of the deck begins.
b. **Construction.**

THE FOLLOWING IS ADDED AT THE END OF THE SECOND PARAGRAPH:

Joints between the forms should be lapped in the direction of concrete placement.

501.11 **Limitations of Placing.**

THE SECOND SENTENCE OF THE FIRST PARAGRAPH IS CHANGED TO:

In no case, during mixing and placement, shall the temperature of the concrete be less than 60 or more than 90 degrees F.

501.12 **Placing Concrete.**

5. **Deck Slabs.**

THE FOLLOWING IS ADDED AFTER THE FIRST PARAGRAPH:

a. **General Provisions.** The following provisions shall be adhered to in all concrete deck slab construction.

THE 21st PARAGRAPH IS CHANGED TO:

When the concrete placing within any complete unit (i.e., for trusses, arches, continuous or cantilevered unit) is to be divided, the placing shall be made and finished in the numbered sequence shown, beginning with the lowest number. All sections having the same number shall be placed before sections of higher number. The sequence of placing for sections having the same number shall be optional. No deck section shall be placed until all previously placed concrete within the complete unit has cured for 72 hours. This requirement may be waived if the succeeding section(s) can be completed within four hours after the start of the initial placement of section(s) of any given unit for that day. A written request to waive this requirement shall be submitted to the Engineer for approval. This requirement may not be waived for deck slabs on prestressed concrete beams that are continuous for live load. The numbered sequence shown on the Plans shall be adhered to.

THE FOLLOWING IS ADDED:

b. **High Performance Concrete (HPC) for Parapets, Curbs, Sidewalks, and Substructure (pier footings and sand filter structures) Protection.** HPC is defined as concrete that meets special performance and uniformity requirements that cannot always be obtained by using conventional ingredients, normal mixing procedures and typical curing practices. The furnishing of HPC shall conform to the requirements of 914.02.

(1) The Contractor is advised that curing of the HPC deck slab shall be performed in accordance with the provisions of Subsection 501.17. Upon completion of the 7 day wet curing period, the HPC deck slab shall be further cured according to the provisions of Subsection 405.14, Subpart 1.

(2) The finishing machine equipment shall be set up so that the HPC is placed only 6 to 8 feet ahead of the machine.

15. **Pumped Concrete.**

THE FOLLOWING IS ADDED:

As per the provisions of 914.04, fresh mixed concrete shall be sampled according to the requirements of AASHTO T 141. Samples shall be taken at the discharge of the concrete pump. If the Engineer believes that this is not a feasible, the pump shall be calibrated to calculate slump and air entrainment losses. These losses shall be deducted from the values as sampled from the concrete truck.

17. **Reinforced Concrete Box Culvert, Precast.**

THIS SUBPART IS DELETED

18. **Slip-form Method of Parapet Construction.**

THIS SUBPART NUMBER IS CHANGED TO:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
17. **Slip-form Method of Parapet Construction.**
19. **Corrosion Inhibitor Admixture.**

THIS SUBPART NUMBER IS CHANGED TO:

18. **Corrosion Inhibitor Admixture.**

PARAGRAPH C IS DELETED

20. **Pressure Injection.**

THIS SUBPART NUMBER IS CHANGED TO:

19. **Pressure Injection.**

THE FOLLOWING SUBPART IS ADDED:

20. **Mass Concrete.** Mass concrete is the placement of any large volume of cast in place concrete or precast concrete with dimensions large enough to require that measures be taken to cope with the generation of heat and attendant volume change, so as to minimize cracking.

A Mass Concrete member is defined as any concrete placement where each measured dimension of a concrete component exceeds 3 feet and the ratio of its volume to surface area is greater than 1 foot. The surface area will include all of the cumulative area of all surfaces of the concrete component being considered including the full underside (bottom) surface of footings, caps, etc. Volume and surface area calculations shall be in units of feet. Therefore, the volume shall be measured in units of cubic feet and the area in units of square feet.

Mass concrete members will be as designated on the plans. Deck slab placements will not be considered as mass concrete.

a. **Thermal Curing Plan.** At least 20 days prior to the Mass Concrete pour; the Contractor shall submit to the Engineer a Thermal Curing Plan Report. The Report shall address the following issues:

1. An analysis of the anticipated thermal developments within the mass pour placements using proposed materials and casting methods.

2. A plan outlining specific measures to be taken to control the temperature differential within the limits stated below.

3. The proposed monitoring system.

4. Outline of corrective actions to maintain the temperature differential.

5. Proposed methods of repairs or corrective actions if the mass concrete member is not accepted.

b. **Curing and Monitoring.** The Contractor shall thermally cure the concrete so as to maintain a temperature differential between the internal (hottest – located as close as possible to the center of the pour but not less than 12 inches from the surface and external (coolest) temperature of the concrete to a 35 degrees F. maximum. In addition, the internal temperature of the concrete (measured at the hottest point located at the center of the pour) shall at no time exceed 160 degrees F.

The Contractor shall provide temperature-monitoring devices to record temperature development between the interior and exterior of the element at points approved by the Engineer and shall monitor the mass pours to measure temperature differentials. Temperature monitoring shall continue until the interior temperature is within 35 degrees F. of the lowest ambient temperature or a maximum of two weeks. The Resident Engineer shall be provided with a copy of
each set of readings as they are taken and a temperature chart for each mass pour element showing
temperature readings vs. time.

If monitoring indicates that the proposed measures are not controlling the concrete
temperature differential within the 35 degrees F. specified, the Contractor shall implement
corrective actions as presented in the Thermal Curing Plan to maintain the temperature differential.

c. Concrete Mix Requirement. In order to better control the heat of hydration of the mass concrete,
the concrete mix design shall contain a pozzolanic material; such as, fly ash, silica fume or ground granulated blast furnace slag.

d. Approval and Acceptance. Should any mass concrete placed under this specification prove
unsatisfactory, the Contractor will be required to make the necessary repairs or remove and replace
the material at the Contractor’s expense.

The Engineer will be the sole judge in determining acceptance of the Mass Concrete member.
Corrective actions, as approved in the Thermal Curing Plan Report, shall be made to those areas
directed by the Engineer before the Mass Concrete member will be considered for acceptance.

THE FOLLOWING SUBPART IS ADDED:

21. Concrete Bridge Approach Slabs.

Provide and install Subbase material as specified in Section 208. At least 1 day before placing concrete,
set forms as specified in 501.07 and place reinforcement steel as specified in 501.08 for the area that is to be
paved. Forms shall be set at grade and in full contact with the under laying surface. Install dowel bars, as
detailed on the Plans, through the forms and secure in place. Ensure that concrete does not seep through the
dowel bar locations.

Check the alignment and grade elevations of the forms and make corrections before placing the concrete.
Ensure that the forms do not deviate from the required alignment by more than ¼ inch. Reset, or remove and
replace, forms that settle or deflect under the spreading and finishing equipment. Clean the top and face of
forms and oil the face before placing the concrete.

Comply with the requirements of placing deck slab concrete that are specified in 501.12. Subpart 5.
Apply the surface texturing as specified in 501.15. Cure the concrete as specified in 501.17. Saw cut groove
the surface as specified in 501.15.

Adhere to the loading and vehicular traffic restrictions as specified in 501.24.

501.15 Deck Slab Surface Texture Finish.
THE FIRST PARAGRAPH AND SUBPART 1 ARE CHANGED TO:

The surface of the deck slab shall be finished according to Subsection 405.13 except that Subpart G shall not apply. The time between strike-off and application of deck slab surface texture finish in any location shall not exceed one hour. All concrete bridge deck slabs shall be textured with a stiff, coarse broom and shall be saw cut groove finished as follows:

1. Broom Finish. Immediately after finishing has been completed, the surface shall be given a texture with an
approved stiff, coarse broom.

The broom shall be operated in a longitudinal or transverse direction. Once begun, the direction of
texturing shall not be changed. Transverse texturing shall be done from a work bridge.

The broom finish shall be applied so as to prevent ridges or gouges from forming in the concrete surface.
The broom shall be weighted and the contact area changed as required to produce a uniform texture. The broom shall be cleaned periodically to remove all hardened concrete particles. Texture resulting from the
broom shall stop within 1 foot of curbs.


ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
THE SECOND PARAGRAPH IS DELETED.

501.16 Concrete Deck Surface Requirements.

B. Control Testing.

THIS SUBPART IS CHANGED TO:

Deck slab surfaces shall be checked during placement to correct surface irregularities while the concrete is in workable condition.

Such control testing shall be performed as follows:

1. After strike-off, the deck surface shall be checked with an aluminum straightedge having a minimum length of 10 feet, as provided by the contractor. The Resident Engineer shall determine the specific conduct of the control testing, including the number and location of Straightedge checks. Surface variations shall be corrected before the concrete sets. Major deviations shall be corrected by the finishing machine or other strike-off, while minor deviations may be corrected by a straightedge or float. The addition of water to the surface of the concrete to assist in finishing operations will not be permitted.

THE FIRST PARAGRAPH IN SUBPART C IS CHANGED TO:

C. Acceptance Testing. Conformance to the surface tolerance for concrete deck slabs will be determined in lots, each being equal to the length of deck in one span or continuous span. The longitudinal limits of the lot will be bounded by the expansion joints or fixed structural deck joints. The full length of the lot will be tested through any construction joints within the deck, whether these joints are required for the placement sequence or caused by the Contractor’s operations. Such lot quantity will be calculated using the specified nominal deck thickness and excludes the quantity of concrete placed in haunches, end dams, and diaphragms. For the second course of the two-course deck slab construction, such lot quantity will be calculated using the specified nominal thickness of the concrete overlay protective system.

501.17 Curing and Protecting Concrete

A. Curing Concrete Under Normal Conditions.

THIS SUBPART IS CHANGED TO:

Concrete decks, curbs, and tops of sidewalks for one-course deck slab construction shall be cured according to Subheading 4 of Subsection 405.14 with the exception that the minimum wet cure period shall not be less than seven calendar days. The burlap shall be kept continuously wet throughout this curing period. According to the provisions of Subheading 3 of Subsection 405.14, the wet burlap shall be covered with white polyethylene sheeting for the seven-day duration. The polyethylene sheeting shall be lapped at the joints and secured to the deck as tightly as possible. In two-course deck slab construction, the Contractor shall prepare the entire deck surface area according to Subheading 6 of Subpart C of Subsection 518.06 before placing the second course. The second course shall be cured according to Subsection 518.06 C.12.

The time between final finishing and application of the wet burlap shall not exceed 20 minutes in any location within the placement area.

Other concrete structures and concrete surfaces to receive an epoxy coating, rubbed finish or to be covered with another material shall be cured according to Subheadings 2, 3, 4, and 5 of the sixth paragraph of Subsection 405.14.

501.25 Method of Measurement.

THE 8TH PARAGRAPH IS DELETED.

THE FOLLOWING IS ADDED:

High performance concrete of the various strengths will not be measured and payment will be made for the quantity in the proposal adjusted for Change Orders except as provided for in Subsection 109.01.

501.26 Basis of Payment.

THE 18TH PAY ITEM IS CHANGED TO:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
THE FOLLOWING PAY ITEMS ARE ADDED:

- CONCRETE IN SUPERSTRUCTURE, SIDEWALK (HPC) CUBIC YARD
- CONCRETE IN SUPERSTRUCTURE 1'-9" CURB, (HPC) LINEAR FOOT
- CONCRETE IN SUPERSTRUCTURE, PARAPETS, 2'-8" HIGH, (HPC) LINEAR FOOT
- CONCRETE IN SUPERSTRUCTURE, PARAPETS, 2'-10" HIGH, (HPC) LINEAR FOOT
- CONCRETE IN STRUCTURES, PIER FOOTINGS, 5000 PSI, (HPC) CUBIC YARD
- CONCRETE IN SUPERSTRUCTURES, STAIRS CUBIC YARD
- CONCRETE IN SUPERSTRUCTURES, DIAPHRAGMS CUBIC YARD
- CONCRETE IN STRUCTURES, SAND FILTERS (HPC) CUBIC YARD
- CONCRETE BRIDGE APPROACH SLAB CUBIC YARDS
- SAW CUT GROOVED SURFACE, APPROACH SLAB SQUARE FOOT

THE 1ST, 10TH, 11TH, 14TH, 15TH, 16TH, 18TH, 19TH, 20TH, 21ST, 22ND, AND 24TH PAY ITEMS ARE DELETED.

THE FOLLOWING IS ADDED:

No separate payment will be made for work described under 501.12, Subpart 20 Mass Concrete. Such cost shall be included in the bid price for the applicable Pay Item.

In the construction of deck joint systems, no separate payment will be made for supplying and installation of steel armoring that is to be placed on the roadway side of the header. Such cost shall be included in the bid price for the Pay Item “Concrete in Substructures, Abutment Walls”.

The Pay Items “Concrete in Superstructure, 1'-9" Curb., (HPC)”, “Concrete in Superstructure, Sidewalk (HPC)”, “Concrete in Superstructure, Parapets 2'-8" High (HPC)” and “Concrete in Superstructure, Parapets 2'-10" High (HPC)” will include payment for use of HPC for each item respectively.

The pay items “Concrete in Structures, Pier Footings, 5000 psi (HPC)” and “Concrete in Structures, Sand Filters (HPC)” will include payment for use of HPC for substructure member protection concrete.

No separate payment will be made for the pedestrian bridge scupper units. The cost for the fiberglass lining shall be included in the price bid for “CONCRETE IN SUPERSTRUCTURE, DECK SLABS”.

As detailed on the plans, the cost for providing the subbase outlet drain shall be included in the price bid for the Approach Slab item. Cost for providing the subbase material shall be according to Section 208. The Contractor may construct the approach slabs with the use of High Performance Concrete (HPC). No additional payment will be made for the use of HPC.

SECTION 502 – PRESTRESSED CONCRETE STRUCTURES
THE TITLE OF THIS SECTION IS CHANGED TO:

SECTION 502 – PRECAST/PRESTRESSSED CONCRETE STRUCTURES

502.01 Description.
THE FOLLOWING IS ADDED:

This work shall also consist of manufacturing, furnishing, and erecting of precast reinforced concrete box culverts and precast concrete arch structures in accordance with these Specifications and in conformity with the lines, grades and dimensions shown on the Plans.

The use of precast concrete end sections, including headwalls and wingwalls, is permitted. However, precast end sections for precast concrete culverts shall not be used when the skew angle requires that the smallest side of the precast concrete culvert segment is less than 3 feet. In such cases, cast-in-place end sections shall be provided. Adequate provisions shall be made for cast-in-place appurtenances, such as end sections, headwalls, wingwalls, aprons, and cut-off walls. Such provisions shall include proper transition of the precast culvert unit section into the cast-in-place appurtenance section. If the sections do not align, both the cast in place appurtenance and precast culvert unit section shall be redesigned and properly detailed.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Unless otherwise stated, all provisions of Sections 501, 502, and 914 shall apply in the furnishing of precast concrete culverts and precast concrete arch structures.

Materials and methods of construction that are used in the furnishing of precast concrete culverts and precast concrete arch structures and that are not specifically covered on the Plans and in these Specifications shall conform to the AASHTO LRFD Bridge Design Specifications or to the AASHTO Standard Specifications for Highway Bridges, whichever is applicable. In lieu of the applicable AASHTO Specifications, the current ACI Manual of Concrete Practice and the current PCI Precast Prestressed Bridge Design Manual shall be adhered to.

502.02 Materials.
THE FOLLOWING IS ADDED:

Concrete for precast concrete culverts and precast concrete arch structures, according to Section 914, shall be, as a minimum, Class P concrete. However, coarse aggregate for such concrete shall be washed gravel or broken stone of argillite, granite, gneiss, quartzite, or trap rock conforming to the requirements of Section 901, and shall also be graded as specified for size No. 57 or 67.

Reinforcement steel for precast concrete culverts and precast concrete arch structures shall be deformed billet steel bars or welded wire fabric. The deformed billet bars shall conform to AASHTO M 31, Grade 60. The welded wire fabric shall conform to ASTM A-497 or ASTM A-185. Longitudinal distribution reinforcement may consist of welded wire fabric or deformed billet steel bars. Welded wire fabric shall not be shipped in rolls but shall be shipped in mats.

Longitudinal ties used to tie the precast concrete culvert units together shall be ¾-inch diameter high-tensile strength steel bars conforming to AASHTO M 275 or ½-inch, Grade 270 polystrands conforming to AASHTO M 203. No splices will be allowed in the ½-inch diameter polystrands, if used. Bars shall be galvanized according to AASHTO M 111. End anchorages (nuts, washers, and anchor plates), to be used with high-tensile strength steel bars, shall be approved by the Engineer. End anchorages shall be compatible with the tie rod system and shall be galvanized according to AASHTO M 111. When corrosion protection of the longitudinal ties is specified, the ¾-inch diameter high-tensile strength steel bar shall be used. Anchorages and end fittings for the ½-inch diameter polystrands and the corrosion protection method for the end fittings shall be as indicated on the Plans.

502.04 Working Drawings.
THE FOLLOWING IS ADDED:

Before fabrication of precast concrete culverts and precast concrete arch structures, the Contractor shall submit complete working drawings and erection plans according to Subsection 105.04.

Working drawings for precast concrete culverts and precast concrete arch structures shall show plan, elevation, and sections as well as details for all appurtenances such as headwalls, cutoff walls, wingwalls, and aprons. In addition, working drawings shall show details of the neoprene gasket between the precast concrete culvert units as well as all threaded inserts, bar extensions, waterproofing, and end anchorage details for the longitudinal ties.

Erection details shall be complete in every detail including handling points, neoprene gasket details, the method for pulling the culvert boxes together, details of the joint seal between the precast concrete culvert units as well as all sectional lengths and the method of installing the units. Additionally, the working drawings shall indicate the profiles and dimensions of all precast arch units, lifting loads of all components and steel reinforcement layout.

502.15 Storage, Transportation and Erection.
THE FOLLOWING IS ADDED TO THE NINTH PARAGRAPH:

Additionally, the requirements stated in Subsection 503.07 B. shall be followed for the erection process.

THE NEW SUBSECTION IS ADDED:

502.16 Precast Concrete Structures.

The fabricator of precast concrete structures shall be certified by the PCI or the NPCA to the category of applicable work. The certification will be maintained during production of items for the Project. A copy of the current field audit report shall be submitted to the Department’s Bureau of Materials before the start of production. The fabricator shall provide an Engineer’s office according to Subsection 502.03, Subpart E.

1. Precast Concrete Box Culverts.
a. **Design and Detail Requirements.**

Precast concrete units shall be designed with a minimum design compressive strength of $f'_c = 5,000$ pounds per square inch.

The cover of concrete over the circumferential reinforcement shall be 1½ inches except on the top slab where it shall be 2 inches.

Reinforcement bars shall be tied at all intersections, except where the spacing is less than 12 inches in each direction, in which case alternate intersections shall be tied.

The wall thickness for the precast culvert shall be a minimum of 8 inches. The top and bottom slab thickness shall be a minimum of 10 inches.

A flexible, watertight neoprene gasket, conforming to ASTM D-1056 requirements, shall be provided at the joint between the precast units. The gasket shall be continuous around the circumference of the joint and shall contain only one splice.

A positive means shall be provided to prevent water from entering the vertical joint between the last precast culvert section and any cast-in-place appurtenances such as wingwalls, cutoff walls, aprons, and cast-in-place culvert end sections.

Two rows of threaded inserts or bar extensions shall be provided in the last precast culvert section for the cast-in-place end section and the wingwall attachment. The same information shall be provided for the headwall attachment, if necessary.

When the earth fill over the precast culvert is less than 2 feet, the top mat of reinforcement in the roof slab shall be corrosion protected.

Lifting devices will be permitted in each precast unit for the purpose of handling and erection. If lifting hooks or lugs are used, they shall be galvanized according to AASHTO M 111. The precast units shall be tied together with a minimum of four longitudinal rods or strands to ensure an adequate seal and to provide continuity and concrete shear transfer between the precast units. For the purpose of tying units together, a 1½-inch diameter hole shall be preformed in each corner of each unit. If hand holes are used for the installation of the longitudinal ties, they shall be spaced appropriately.

Design calculations shall be submitted according to Subsection 105.04.

b. **Fabrication Requirements**

Each precast concrete culvert unit shall be identified with a permanent marking. The precast concrete culvert units shall be manufactured in steel forms. Curing of the precast units shall be by any one of the methods specified in Subsections 4.19 and 4.20 of the PCI Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products.

If steam curing is used, the PCI Manual is amended as follows. The application of steam within the enclosure shall be delayed for a period of five to six hours when the air temperature is less than 50 ºF and shall be delayed for a period of three hours when the air temperature is 50 ºF or higher. If retarders are used, the waiting period shall be from four to six hours regardless of the air temperature. The temperature in the enclosure shall be maintained between 90 and 150 ºF for a period of 12 hours.

Two representative concrete test cylinders per precast culvert unit, similarly cured, shall be tested after the curing period specified above. Should tests indicate that the precast units have not achieved a compressive strength of 4,000 pounds per square inch or greater, the precast units shall be cured further until the required strength is achieved.

To determine the acceptance or failure of the concrete, one compressive strength test from the two concrete cylinders that are taken from each concrete truck or from each batch of concrete that is produced shall be performed. The two test results shall be averaged together to obtain a single value representing the units. Concrete will be accepted if this averaged single value is equal to or greater than the class design strength as identified in Section 914.05, Table 914-3. Concrete will be accepted with a pay adjustment if the averaged single value is no less than 500 psi below the class design strength of the specified concrete class, (i.e. for Class P concrete, this range will be between 5,000 to 5,500 pounds per square inch). The pay adjustment will be according to Section 914. Concrete will be rejected if the averaged single value is greater than an amount that is 500 pounds per square inch less than the class design strength for the specified concrete class. The Engineer may use testing results obtained from concrete cores or nondestructive testing before requiring any corrective action or removal and replacement of the concrete. All costs for coring and testing shall be paid for by the Contractor.
Precast concrete culvert units shall remain in their steel forms for the duration of the steam or natural curing operation. Upon removal of the forms, the entire precast concrete culvert unit including exterior, interior, and all lap surfaces shall be given a Class 1 finish according to Subheading 1 of the fourth paragraph of Subsection 501.14.

Upon approval of the Class 1 finish, precast concrete culvert units shall be given one coat of an epoxy waterproofing seal coat on the exterior of the roof slab. This coating shall be applied in the precaster’s plant not earlier than 72 hours after fabrication, and after the concrete compressive strength has reached 5,000 pounds per square inch. The concrete surfaces of the precast units shall be dry before application of the epoxy waterproofing seal coat. The application of the epoxy seal coat shall be in conformance with the product manufacturer’s recommendation.

Precast concrete culvert units shall not be shipped until 72 hours after fabrication and after the concrete compressive strength has reached 5,000 pounds per square inch.

The precaster is ultimately responsible for providing a finished product which is acceptable to the Engineer.

c. Construction and Erection.

A coarse aggregate layer shall be provided under the precast concrete box culvert. The minimum depth of the coarse aggregate layer shall be 2 feet. It shall extend 12 inches on each side of the precast box culvert. The coarse aggregate layer shall be compacted according to Subsection 203.09.

Before backfilling, a 2-foot wide strip of filter fabric shall be placed over the top and side transverse joints. The filter fabric shall be according to Subsection 919.06.

If precast concrete culvert units are used in parallel for multicell installations, the parallel units shall be placed a maximum of 6 inches apart, and the 6-inch space between the units shall be filled with non-shrink grout. As an alternate, the 6-inch space may be filled and compacted with Zone 2 or crushed stone conforming to coarse aggregate size No. 57. If crushed stone is used, a 2 foot-8 inch wide strip of filter fabric shall be placed over the longitudinal joint.

One longitudinal tie rod or strand shall be placed in position through a 1½-inch diameter preformed hole located in each corner of the box units (a minimum total of four longitudinal ties) and stressed to a tension of 30,000 pounds each. After tensioning, the exposed end of the ties shall be removed so that no part of the ties or no part of the end fittings extend beyond a point 1 inch inside the anchorage pocket. All hardware associated with the end anchorage system shall be galvanized. The exposed parts of the end fittings shall be coated with two coats of bituminous paint. If hand holes are used for the installation of longitudinal ties, they shall be spaced appropriately. A tensile force versus elongation chart for the strand shall be furnished by the fabricator.

The tie rod bars shall be tensioned by torquing. Precautions shall be taken during the tensioning process to prevent any damage to the concrete under the outside bearing plates. The tensioning process shall be conducted so that the tension being applied may be measured at all times.

Hand hole pockets, longitudinal tie rod sleeves, and lifting lugs shall be grouted after the joints are sealed and the longitudinal ties are tensioned. The grout shall be non-shrink and nonmetallic and conform to Subsection 914.03. Any top slab hand hole pockets or lifting holes which are grouted in the field shall receive one coat of an epoxy waterproofing seal coat after the grout has properly cured.

502.16 Method of Measurement.
THE SUBSECTION NUMBER IS CHANGED:
502.17 Method of Measurement.
The following is added:

Precast concrete box culverts and precast concrete arch structures will be measured by the linear foot along their centerline.

502.17 Basis of Payment.
THE SUBSECTION NUMBER IS CHANGED:
502.18 Basis of Payment.
THE FOLLOWING IS ADDED TO THE LAST PARAGRAPH:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Payment for the use of plain elastomeric bearing pads shall be included in the price that is bid for the prestressed concrete beam type that is to be used in the project. Payment for the use of other type bearing assemblies shall be according to the provisions of 503.18.

THE FOLLOWING SECTION IS ADDED
HIGH PERFORMANCE CONCRETE (HPC) – PRECAST/PRESTRESSED AND CAST-IN-PLACE/PRESTRESSED CONCRETE ELEMENTS

Description
This work shall consist of the construction of precast/prestressed and cast-in-place/prestressed concrete elements with the use of High Performance Concrete (HPC). Structural concrete components which shall conform to this specification include: precast superstructure box segments, closure joints between superstructure segments, cast-in-place pours and transverse ribs, and precast pier columns and caps. HPC is defined as concrete that meets special performance and uniformity requirements that cannot always be obtained using conventional ingredients, normal mixing procedures and typical curing practices.

Materials
Materials, admixtures and methods of construction not specifically covered in the Plans and these Specifications shall conform to the AASHTO LRFD Bridge Construction Specifications and the Prestressed Concrete Institute (PCI) “Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products”. For segmental concrete, conformance with the National Precast Concrete Association (NPCA) “Quality Control Manual for Precast Concrete Plants” may be substituted in lieu of the PCI conformance requirements.

In the production of HPC, in order to achieve the desired resistance to chloride penetration, an appropriate pozzalonic or other cementitious material, such as silica fume, fly ash, or ground granulated blast furnace slag, shall be provided in the mix design.

Silica fume shall not be used as a sole material to achieve the desired resistance to chlorides. When used, silica fume’s content shall be limited to a maximum of 5 percent of the total cement content and a proportion of fly ash or ground granulated blast furnace slag shall be included to obtain the resistance to chloride penetration specified in the table below. The fly ash and ground granulated blast furnace slag limitations specified in 914.02 may be increased in the fabrication of HPC.

The maximum water cement ratio shall be maintained at 0.40. In the fabrication of HPC, the cement content should not be increased for the purpose of achieving high early strength.

Mix Designs and Fabrication of the HPC
1. Fabrication Requirements. For the construction of the HPC items of work, the HPC shall be produced according to the requirements of these Specifications or as amended herein or according to the Special Provisions.

2. Mix Design Verification. In the development of the HPC mix designs, the performance requirements stated in the following table, that are in accordance with the indicated test method, shall be achieved. A report to document these results shall be provided to the NJDOT Bureau of Materials. The Contractor shall obtain the results of these standard tests from an AASHTO Accredited testing agency that is approved for Portland cement concrete testing, at no cost to the Department.

<table>
<thead>
<tr>
<th>Performance Characteristic</th>
<th>Standard Test Method</th>
<th>Performance Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creep @ 180 days</td>
<td>ASTM C 512</td>
<td>(X=0.31/) psi maximum</td>
</tr>
<tr>
<td>Modulus of Elasticity @ 28 days of age</td>
<td>ASTM C 469</td>
<td>(X=6x10^6) psi - minimum</td>
</tr>
<tr>
<td>Chloride Permeability 56 days</td>
<td>AASHTO T 277</td>
<td>1000 coulombs maximum</td>
</tr>
<tr>
<td>Shrinkage</td>
<td>ASTM C 157</td>
<td>(X=600) (maximum) @ end of testing</td>
</tr>
<tr>
<td>Abrasion Resistance (x=average depth of wear)</td>
<td>ASTM C 944</td>
<td>(X=0.04) inches minimum</td>
</tr>
<tr>
<td>56 Day Compressive Strength (Verification Strength)</td>
<td>AASHTO T 22</td>
<td>Class P-2 7000psi minimum, Class P-4 8000psi minimum</td>
</tr>
</tbody>
</table>
3. **Table Notes.**
   a) As designed in the table, a compressive strength of 7000 psi, 8000 psi, or 9000 psi should be considered for Class P-2, P-4 and P-5 respectively, when HPC is to be used for the respective precast/prestressed and cast-in-place/prestressed concrete items (as designed on the Contract Plans).

   b) Chloride permeability testing will be required when precast or prestressed concrete members are located, as defined in Section 24 of the NJDOT Design Manual – Bridges and Structures, Salt Splash Zones or Salt Intrusion Zones.

   c) When testing for determination of Shrinkage is required, in accordance with the Standard Test Method, specimen shall be wet cured for a 28 Day duration. The specimens, as described in the Standard Test, shall then be air cured for a duration of 32 weeks. Comparative readings of each specimen shall be taken after periods of air storage at intervals of 4, 7, 14, and 28 days and at the end of the 8th, 16th, and 32nd week.

   d) When testing for determination of Creep is required, specimens shall be moist cured, as prescribed in the Standard Test Method for 7 days. They shall then be air cured, as prescribed in the Standard Test Method for a duration of 49 days. The specimens shall then be prepared for initial loading at ages of 2, 7, 28, 90, and 180 days.

       Stain readings shall be taken immediately before and after loading, 2 to 6 hours after, than daily for 1 week, weekly until the end of one month and monthly until the end of the 180 day duration.

   e) If the 56 day compressive strength requirement is achieved in 28 days, no further strength testing is required. If the required compressive strength is not achieved in 28 days, the HPC sample shall be tested at 56 days.

   f) If the chloride permeability requirement has been achieved in 28 days, the chloride permeability shall be considered acceptable. If the required chloride permeability is not achieved in 28 days, the HPC sample shall be tested at 56 days.

   g) At least 90 calendar days prior to the planned start of the concrete placement, the mix design shall be submitted for approval and verification in accordance with Subsection 914.02. The submission shall include the results of the required Performance testing specified above, with the exception of the creep and shrinkage performance testing results which shall be delivered to the Department as they are completed. The creep and shrinkage testing results specified above shall not be subject to the Engineer’s review and approval as part of the HPC mix design performance criteria, but shall be provided for the Department’s records.

   h) In accordance with the above referenced AASHTO T 277 test, at 28 and 56 day intervals, the Department will perform chloride permeability testing to document the quality of the HPC mix design and to verify the results submitted in the above referenced report.

       The Contractor shall deliver, at no cost to the State, four (4) additional cylindrical samples, for performance of this testing, to the Department Laboratory. These samples shall be 100 millimeters (4 inches) in diameter and at least 200 millimeters (8 inches) in length. The test value shall be the result of the average value of tests on two (2) specimens for each mix design.

**Production HPC.**

   During production, the components of the HPC mix design shall not be changed in any way from the approved mix design. If, for some reason, the components must be changed, the mix design shall be re-verified according to the requirements stated herein.

**HPC Acceptance Requirements.**

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
1. With the exception that compression testing may be required at 56 days, the applicable requirements specified in Subsection 914.02 for control and acceptance testing of Precast/Prestressed concrete items shall be adhered to in the fabrication of the HPC elements.

2. Acceptance testing performance measures shall consist of the following parameters:

<table>
<thead>
<tr>
<th>Performance Characteristics</th>
<th>Standard Test Method</th>
<th>Performance Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Air Entrainment *</td>
<td>AASHTO T152</td>
<td>Prestressed Items:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.0±1.5(#57 Aggregate)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.0±1.5(#67 Aggregate)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.0±1.5(#8 Aggregate)</td>
</tr>
<tr>
<td>Slump (inches) *</td>
<td>AASHTO T 119</td>
<td>2 ± 1</td>
</tr>
<tr>
<td>56 Day Compressive Strength **</td>
<td>AASHTO T 22</td>
<td>Class P-2 6400 psi minimum</td>
</tr>
<tr>
<td>(Retest Limit)</td>
<td>ASTM C 39</td>
<td>Class P-4 7400 psi minimum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class P-5 8400 psi minimum</td>
</tr>
<tr>
<td>Chloride Permeability ***</td>
<td>AASHTO T 277</td>
<td>2000 maximum</td>
</tr>
<tr>
<td>56 days (coulombs)</td>
<td>ASTM C1202</td>
<td></td>
</tr>
</tbody>
</table>

*As per the guidance stated in Subsection 501.03, a Type F water-reducing, high range admixture will be permitted in accordance with Subsection 905.02 and Subsection 914.02, Subparts B and C. When a Type F admixture is used, the Slump and Air Content values for the HPC shall be as follows:

*Slump: 6 inches ± 2 inches
Air content: increase both the target value and tolerance percentages by 0.5.

**For compressive strength testing the Initial Sampling Rate for the precast prestressed HPC shall be 6/Lot.

***For chloride permeability testing, 4 additional cylinders per lot shall be delivered to the Department Laboratory at no additional cost to the State. Two cylinders each from two randomly selected delivery trucks shall be taken for testing at 28 day and 56 day intervals.

3. The HPC shall be a Non-Pay-Adjustment Item. Whenever one or more individual test results fall below the Retest Limit, the lot shall be considered as failing. If the Lot is so determined to have failed, the Engineer may:
   a) Require the Contractor to remove and replace the defective lot at no cost to the State,
   b) Allow the Contractor to leave the lot in place and receive a percent pay adjustment of minus 50 percent, or
   c) Allow the Contractor to submit a plan, for approval, for corrective action to be performed at no cost to the State. If the plan for corrective action is not approved, either option a) or b) above may be applied.

4. A test for chloride permeability shall consist of two test specimens. The results of the two specimens shall be averaged to determine the test result. There will be two tests performed on each lot from samples taken from two randomly selected delivery trucks.

The lot is eligible for 100 percent payment provided that all test results are equal to or below 2000 coulombs. Whenever one or more individual test results exceed 2000 coulombs at 28 days, the lot shall be re-evaluated at the same testing rate at 56 days. If, upon testing at 56 days, one or more individual test results exceed 2000 coulombs, the Engineer may:
   a) Require the Contractor to remove and replace the defective lot at no cost to the State,
   b) Allow the Contractor to submit a plan, for approval, for corrective action to be performed at no cost to the State.

Method of Measurement.
See Section 528 title “Precast Concrete Segmental Construction” for method of measurement for precast segmental concrete under the pay items, CONCRETE IN STRUCTURES, PRECAST SUPERSTRUCTURE, HPC and CONCRETE IN STRUCTURES, PRECAST SUBSTRUCTURE, HPC.
Basis of Payment.
Payment for HPC will be included in the cost of concrete for the precast elements described in Section 528.07, Basis of Payment.

SECTION 503 - STEEL STRUCTURES

503.01 Description.
THE FIRST PARAGRAPH IS CHANGED TO:

This work shall consist of the furnishing, fabrication, erection and painting of bridges, structures, furnishing of Structural Bearings and Reinforced Elastomeric Bearings and associated elements that include use of structural steel and miscellaneous metals.

503.02 Materials.
C. 1. Steel
THE FIRST SENTENCE IS CHANGED TO:

Steel that is to be used in the bearing assemblies shall conform to AASHTO M 270, Grades 36 or 50, except for steel that is used for guide bars and shear restriction pins and sleeves.

D. 1. b. (7)
THE 2ND SENTENCE IS DELETED.

D. 1.
THE FOLLOWING IS ADDED TO THIS SECTION:

Energy dissipation shall not be achieved via the material degradation of a structural element in the bearing system. The structural element shall be designed to provide adequate resistance to service loads (wind, braking forces, etc.) independent of the rate of load application.

Isolation bearings shall display restoring force characteristics over the full range of seismic displacement. Isolation bearings shall be maintenance free for seismic, post-seismic and non-seismic conditions.

E. 1. Elastomer Material.
THE LAST SENTENCE IN THE FIRST PARAGRAPH IS DELETED.

E. 3. Bond Strength.
THIS SUBPART IS CHANGE TO:

The vulcanized bond between fabric and reinforcement shall have a minimum peel strength of 30 lbs/inch. Steel laminated bearings shall develop a minimum peel strength of 40 lbs/inch. Peel strength tests shall be performed by ASTM D 429 Method B.

503.03 Inspection and Testing.
THE SUBPART 1 IS CHANGED TO:

1. Steel bridge bearings and HLMR bearing assemblies are considered to be main load carrying members.

THE SUBPART 2A IS CHANGED TO:

2. a. Simple Steel Bridge Structures (SBr): Includes highway sign support structures, parts for bridges (such as cross frames), unspliced rolled steel bridges, steel bridge bearings and HLMR bearing assemblies.

THE SUBPART 4C IS CHANGED TO:

4. c. Fracture Control Plan. Steel bridge members or member components designated as Fracture Critical Members (FCM’s) shall conform to the provisions of the most current edition of the AASHTO/AWS
D1.5 Bridge Welding Code, Section 12 “AASHTO/AWS Fracture Control Plan (FCP) for Non-Redundant Members”.

THE FOLLOWING IS ADDED TO THE FIRST PARAGRAPH OF SUBPART 5:

5. Two complete bearings, of different sizes, shall be subjected to the “Low Temperature Test” as per AASHTO Guide Specifications for Seismic Isolation Design, Section 13.1.1

503.04 Working Drawings.

B.

THE FOLLOWING IS ADDED TO THIS SECTION:

The Contractor shall submit shop drawings to the Engineer for approval, and shall have received said approval prior to the construction of the beam seats and fabrication of isolators.

503.07 Shipping, Handling and Erection.

B. Erection.

THE FOLLOWING IS ADDED TO THE FIRST LISTED ITEM 2:

The written plan shall be signed by a Professional Engineer licensed in the State of New Jersey. The Contractor’s Professional Engineer and the State’s Design Engineer shall attend the meeting.

THE FOLLOWING IS ADDED TO THE FIRST LIST:

4. The Contractor’s Professional Engineer shall inspect each phase of girder installation prior to permitting vehicular or pedestrian traffic on or below the bridge.

503.08 Setting Shoes and Bearings.

D. Structural Bearings.

THE FIRST SENTENCE IS CHANGED TO:

This work shall consist of furnishing and installing structural bearing assemblies that are one or more of the following types: High Load Multi-Rotational (HLMR) bearings as defined in 503.02 or Seismic Isolation Bearings. As per the requirements of 105.04, Working Drawings, for the complete design of such structural bearing assemblies, shall be submitted. The designs shall conform to the provisions of the AASHTO LRFD Bridge Design Specifications and/or the AASHTO LRFD Bridge Construction Specifications and these Specifications.

503.15 Cleaning and Painting of Structural Steel.

A. 4. f

THE FOLLOWING IS ADDED AFTER THE FIRST SENTENCE:

Surfaces of steel that will be embedded in concrete shall be given a prime coat of paint only.

F. 3. b

SUBPART B IS CHANGE TO:

With the exception of steel designated to be galvanized, all structural steel for a distance away from the ends of the girders of 1.5 times the depth of the girder or a maximum of 6 feet shall be cleaned and painted.

503.17 Method of Measurement.

THE FOLLOWING IS ADDED:

Reinforced Elastomeric Bearing assemblies shall be measured on a Unit basis.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
503.18 Basis of Payment.
THE FOLLOWING PAY ITEM IS DELETED:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEEL BEARINGS FOR PRESTRESSED CONCRETE BEAMS</td>
<td>LUMP SUM</td>
</tr>
</tbody>
</table>

THE FOLLOWING PAY ITEMS ARE ADDED:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISOLATION BEARINGS</td>
<td>UNIT</td>
</tr>
</tbody>
</table>

THE SECOND PARAGRAPH IS CHANGED TO:

Structural bearing assemblies shall include payment for furnishing all labor, materials, tools, equipment and incidentals, and all work involving furnishing, testing, and installing said bearing assemblies, complete and in place, as shown on the Working Drawings.

SECTION 505 - LOAD BEARING PILES

505.02 Materials.
THE FOLLOWING IS ADDED:

Prestressed concrete piles shall be manufactured using Class P concrete containing calcium nitrite corrosion inhibitor as specified in Section 905.02 of the Standard Specifications.

The prestressing strands shall be high-tensile strength seven-wire strands and shall conform to AASHTO M203 (ASTM A416), Grade 270, with Supplement I requirements for low relaxation strands. Strands shall be Grit Impregnated Epoxy coated as specified in Section 915.02 of the Standard Specifications.

505.03 Equipment.

B. Impact Pile Drivers.
THE FOLLOWING IS ADDED TO SUBPART 2:

For prestressed piles, tensile driving stresses shall not exceed the effective prestress $f_{pe}$. Compressive driving stresses for prestressed concrete piles shall not exceed 85% of the compressive strength $f_c$ minus the effective prestress $f_{pe}$.

SUBPART 3. IS CHANGED TO:

3. For steam or air hammers, the weight of the ram shall be no less than 1/3 the weight of the pile. For diesel hammers, the weight of the ram shall be no less than ¼ the weight of the pile.

C. Vibratory Pile Drivers.

THE FOLLOWING IS ADDED:

No vibratory hammer is allowed.

E. Leads and Followers.
THE FOLLOWING IS ADDED AFTER THE SECOND SENTENCE:

Leads may be either of the fixed or swinging type. Fixed leads, when used, shall be held in position by guys or braces to ensure support to the pile during driving. Swinging leads, when used, shall be fitted with a pile gate at the bottom of the leads and, in the case of battered piles, a horizontal brace may be required.
Swinging leads shall be adequately embedded in the ground or the pile constrained in a structural frame such as a template to maintain alignment.

F. Water Jets.
THE FOLLOWING IS ADDED:

No jetting is allowed. No airlifting will be allowed.

G. Hammer Cushion (Cap Block) and Pile Cushion.
1. Hammer Cushion.
THE SECOND AND THIRD SENTENCES ARE CHANGE TO:

Hammer cushions (cap block) shall be made of manufactured materials according to the hammer manufacturers guidelines. Wood, rope, wire rope, hose, tires and asbestos cushions are specifically disallowed and shall not be used.

505.04 Preparation for Driving.
THE FOLLOWING IS ADDED:

2. Prebored Holes.

THIS SECTION IS CHANGED TO READ AS FOLLOWS:

Preboring shall only be used for the purpose of vibration control and only with the approval of the Engineer. The locations and depths of Preboring shall also be subject to the approval of the Engineer.
Preboring shall only be used to penetrate obstructions or hard soil layers, and shall be to the minimum depth required for this purpose. In no case shall Preboring extend below the minimum pile tip elevation shown on the Plans, or determined by the Engineer.
Preboring shall be conducted in a manner such that the load carrying capacity of the piles already in place will not be impaired nor will damage to adjacent structures and utilities occur.
The diameter of the auger used for Preboring shall be as follows:
1. For round piles, not less than 2 inches or more than the average nominal diameter of the piles.
2. For square piles, 2 to 3 inches less than the nominal diagonal dimension of the pile, unless otherwise authorized.

3. Furnishing Equipment for Driving Piles.

THE FOLLOWING IS ADDED:

The Contractor shall furnish a wave equation analysis for each proposed pile type and hammer combination to the Engineer for approval in accordance with this subpart of the Standard Specifications before delivery of any equipment to the work site.

THE FOLLOWING SUBPART 4 IS ADDED:


Before the start of pile driving, the Contractor shall submit for the Engineer’s review a schedule of the procedures and operations he intends to adopt. The schedule shall show the sequence and timing of all pile driving operations and the equipment to be used.

Pile Handling Procedures.
Before the start of work, the Contractor shall submit working drawings to the Engineer for review and approval showing the procedures for picking up, transporting, and handling the piles.

Pile Driving Equipment.

Before delivery of the equipment to the Project site, information regarding the type makes and model number, striking energy per blow, rated speed, source of energy, and serial number of the hammer(s) proposed for use shall be submitted to the Engineer for approval. Twenty working days before delivery of the equipment to the Project site, the Contractor shall submit to the Engineer a completed Pile and Driving Equipment Data Form and a complete Wave Equation Analysis signed and sealed by a Professional Engineer licensed in the State of New Jersey. This submission shall be for each pile type and hammer combination with summary and recommendations showing that the proposed hammer will perform adequately. Included in the submittal of the results of the Wave Equation Analysis shall be computer input and output sheets, and suitable data plots to display the Contractor’s Wave Equation Analysis for pile driving throughout the various subsurface conditions of the site. The plots shall show ultimate resistance versus blow count as well as maximum tension and compression stress versus blow count and hammer stroke. The ultimate required compression capacity is shown on the Plans. Drivability analysis shall be performed to determine the percentage and distribution of the skin friction for use in the Wave Equation Analysis. In addition, the necessary dynamic soil resistance parameters, such as quake and damping, and other related data required to perform the Wave Equation Analyses shall be determined. The drivability analysis must be submitted to the Engineer for review and approval along with the wave equation input data and assumptions before performing the Wave equation Analysis. A Pile and Driving Equipment Data Form can be obtained by contacting the Manager of Geotechnical Engineering Unit at 609-530-3730. The following information shall be submitted on the Pile and Driving Equipment Data Form:

1. Pile Driving Hammer: Make and model number, manufacturer’s rated energy, ram weight and stroke, and rated speed.
2. Driving Helmet: Make and model number, weight, and drawing showing all dimensions.
3. Hammer Cushion: Material type, thickness, cross-section dimensions, and manufacturer’s data on stiffness and coefficient of restitution.
4. Accessory Equipment: Make and model number, operating pressure, rated capacity of boiler or compressor, and diameter and length of hose connecting this equipment to hammer.
5. Pre-boring Equipment: Type, dimensions, and detailed procedure for their use.

Before pile driving is started, the Contractor shall submit to the Engineer written certification from the hammer manufacturer or an authorized representative of the hammer manufacturer that the manufacturer has performed a detailed inspection of the hammer and that the pile hammer, compressors and valves, and other components have been inspected and found to be in satisfactory working condition. The date of certification shall not be more than two months before using the equipment for the Project. All parts of the hammer shall be properly lubricated at all times. Any indication of collapse of hoses, stripping of hose line or any erratic action of the hammer shall be cause for immediate shutdown until the problem has been corrected.

Pile Driving Records.

The Engineer will maintain a complete set of pile driving records for each pile driven. In addition, the Contractor shall maintain and submit to the Engineer a complete and accurate record of all driven piles, including:

1. The date and time of driving.
2. The pile number, location, size, length, elevation of tip and top of pile, the depth of auguring (if used), and the number of blows required for each foot of penetration throughout the entire length of the pile, or the number of blows per distance penetrated when refusal is met. In addition, for the test piles and production piles selected for dynamic pile testing, the number of blows per inch for at least the last 3 feet of penetration.
3. For variable stroke steam, air, or hydraulic hammers, the hammer stroke used, and the depth at which the hammer stroke is changed. For diesel hammers, the blow rate, stroke, bounce chamber pressure, and fuel setting throughout the entire length of driving. For all types of hammers, the blow rate shall be determined by the Engineer using a Saximeter furnished by the Contractor. One Saximeter shall be provided for each pile-driving rig. For open-ended diesel hammers, hammer stroke shall be determined using a Saximeter.
4. The type and size of hammer, the type and dimensions of hammer and hammer cushion.
5. Any unusual occurrence during driving of the pile.
6. The time and duration of interruptions in driving, if any.

No materials or pile driving equipment shall be delivered to the Project site without prior review and approval of the proposed driving equipment by the Engineer. Approval of the proposed driving equipment shall not relieve the Contractor of the responsibility for the safety of the method or equipment used or the responsibility of carrying out the work in full accordance with the requirements of the Contract Documents.

The Contractor shall submit a manufacturer’s certification for all materials specified herein and of compliance with the stated requirements.

The Contractor shall furnish reproducible as-built record drawings showing the exact location, dimensions, batter, cut-off elevations, and tip elevations of piles driven and identifying abandoned piles.

The Contractor shall submit the concrete mix design in accordance with NJDOT Standard Specifications Section 914.

5. Installation Sequence. The order of placing individual piles in pile groups shall be either starting from the center of the group and proceeding outwards in both directions or, starting at an outside row and proceeding progressively across the group.

505.05 Order List of Piles.

The Engineer will not provide the production pile furnished length list for a specific substructure unit until all test piles have been driven and static load test, if any, completed and the resulting data tabulated and interpreted by the Engineer, the wave equation analysis for the specific substructure unit are completed, all required test piles at the specific substructure unit have been satisfactorily driven, and all dynamic pile testing and CAPWAP analysis specified for the specific substructure unit have been performed. The Engineer will determine the minimum tip elevation and minimum driving resistance criteria for production piles based on the available geotechnical data and results of the test pile driving, dynamic pile testing, wave equation analysis and static load testing, and will notify the Contractor of these findings within 10 working days after all driving records and load test report for the specific substructure unit have been furnished by the Contractor.

Production pile shall not be ordered or driven until the list of production pile lengths to be furnished and the respective driving criteria are provided by the Engineer, in writing, to the Contractor.

Pile order lengths will include only the lengths anticipated for use in the completed structure. The Contractor shall increase the lengths provided in the production pile furnished length list to provide for fresh heading and any additional length needed to suit his means and methods, without added compensation.

The piles shall be driven to the minimum tip elevation and the required ultimate driving resistance determined by the Engineer to obtain the required ultimate load capacity. The Engineer may revise the pile driving criteria during the project based on the results of wave equation analysis, driving of test pile, dynamic pile testing, production pile driving and changes to the pile driving equipment or performance.

The Contractor shall provide all facilities so that the required records may be kept of pile lengths, hammer speeds, hammer blows versus pile penetration, tip elevations and other pertinent data.

505.06 Methods of Driving.

THE FOLLOWING IS ADDED:

   It is the Contractor’s responsibility to construct the piles at the proper location and to the minimum tip elevation and the required ultimate pile driving resistance as specified on the detailed footing design plans using whatever means and methods determined acceptable during the test pile process and as approved by the Engineer.
All excavation of the foundations in which the piles are to be driven shall be completed before driving begins. Piles located in embankment shall not be driven until the embankment has been placed, compacted, any preload surcharge removed, and excavation completed.

All piles shall be located on the line and spacing shown on the Plans and as specified herein. Installation of all piles shall be performed in the presence of the Engineer and sufficient notice shall be given in advance of any pile installation to permit the Engineer to witness the installation.

Before driving, the Contractor shall clearly mark all piles with lines 1-foot apart starting at the bottom with numerals every five feet. At the direction of the Engineer, driving of test piles and selected production piles shall pause long enough to mark shorter lines at 1-inch intervals to measure the driving resistance per inch for at least the last foot of driving. For piles on which dynamic testing is performed, the driving resistance shall be recorded at 1-inch intervals for at least the last 3 feet of driving.

Piles shall be driven continuously until the required minimum penetration and required ultimate driving resistance have been obtained. Deviation from this procedure will be permitted only by approval of the Engineer. If the pile reaches refusal before reaching the required minimum tip elevation, the Contractor shall notify the Engineer.

The pile driving sequence shall begin at the pile located at the center of the group and proceed outwards in both directions, or shall begin at a side of the group and proceed progressively to the opposite side. Pile driving shall progress in a direction away from previously installed piles and existing structures.

Any unusual occurrences observed during driving shall be reported immediately to the Engineer and recorded in the driving log.

1. Accuracy of Driving.

Foundation and fender piles shall be driven with a variation of not more than ¼ inch per foot from the vertical or from the batter. Foundation piles shall not be out of the required position by more than 6 inches after driving, or ¼ of their diameter, whichever is greater.

The Contractor shall survey the top of the piles by taking elevation measurements immediately after driving and during the driving of the remaining piles in the group to check piles for heave from driving of adjacent piles or by any other cause. Piles found to have heaved more than ¼-inch shall be redriven to the minimum driving resistance and to the original tip elevation, or deeper, as determined by the Engineer. The Contractor shall be responsible for furnishing the Department with the results of the pile top survey for heave and an as-built survey of piles for both horizontal location and cutoff elevation. The Contractor shall provide the pile as-built survey data at least 5 days prior to pouring of the footing/pile bent cap concrete.

Any remedial work required, in cases where the pile head is driven below the required elevation or beyond the tolerances specified in the Standard Specifications, or where the pile is damaged below cutoff level or is otherwise damaged or does not meet all of the provisions of these specifications, shall be corrected as directed by the Engineer at no cost to the State.

Should a pile be driven outside the specified pile location tolerance and if required by the Engineer, the Contractor shall enlarge the pile cap to a size determined by the Engineer, or furnish and install additional piles, at no additional cost to the State.

SUBPART 2 IS CHANGED TO:

2. Penetration. The Contractor shall be prepared to use pre-extraction, auguring, drilling, spudding and/or other work necessary to obtain the penetration required in areas where obstructions are encountered. For the purposes of this specification, an obstruction is defined as any timber, concrete or steel remnants of previously existing structures, or boulders larger than 2 cubic feet. The Engineer shall approve such procedures in writing before they are implemented.

SUBPART 4. IS CHANGED TO:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
4. **Test Piles.** Test piles of the specified materials, dimensions, and at the designated locations shall be furnished and driven with an impact hammer unless specifically stated otherwise in the Special Provisions or on the Plans. The minimum length of test piles shall be as specified on the Plans or as ordered by the Engineer. The driving equipment and procedure used for driving test piles shall be identical to that which the Contractor proposes for all the production piles at the same footing location. The Contractor shall excavate the ground at each footing location to the elevation of the bottom of the footing before the test pile is driven.

505.07 **Determination of Bearing Values.**

THE FIRST PARAGRAPH IS CHANGED TO:

Test piles of the materials and dimensions specified and lengths directed shall be furnished. Test piles shall be driven with the same type of equipment that is proposed for the corresponding production piles at the same footing location. Test piles shall be driven with the Pile Driving Analyzer (PDA) monitoring at the locations designated on the Plans to the bearing capacity and tip elevation that is shown on the Plans or as directed by the Engineer. The Engineer shall be the sole judge in determining bearing capacity and the length of pile to be driven.

The Contractor shall submit test pile driving logs and PDA data within 2 working days after completion of driving each test pile. The Engineer will provide production pile order lengths for each substructure unit location within 10 calendar days after receipt of all test pile driving logs and PDA data for the respective location, provided the test pile has been driven in accordance with the following:

The test piles shall be driven to attain both the minimum pile tip elevation, when one is so designated on the Plans, and to the required ultimate pile driving resistance specified on the Plans as determined by the Pile Driving Analyzer (PDA).

In the event that a test pile that is to be driven to a required driving resistance has been driven to the estimated tip elevation shown on the Plans and the observed driving resistance, as measured by the PDA, is less than 90% of that required, driving shall stop and a waiting period of not less than 48 hours, or as directed by the Engineer, shall be observed before restriking the pile in accordance with Subsection 505.07 Subpart 4 of these Specifications.

If the required driving resistance is not observed during initial restrike, the test pile shall continue to be driven until the required driving resistance is observed, or until the full remaining length of the test pile is driven, whichever occurs first.

If the required driving resistance has not been observed before the full length of the test pile is driven, the Contractor shall notify the Engineer and submit 4 copies of the complete PDA data report with CAPWAP analysis to the Engineer within 2 working days. The Engineer will then provide directions for proceeding within 2 working days after receiving the PDA data and report.

SUBPART 2. IS CHANGED TO:

1. **Empirical Pile Formula.** If no other methods of determining pile capacity are stated in the Special Provisions or Plans, then the ENR formula shall be used.

4. **Dynamic Pile Load Tests.**

THE THIRD SENTENCE OF THE FIFTH PARAGRAPH IS CHANGED TO:

The restrike should be terminated when the ultimate capacity of the pile is reached or the penetration reaches 6 inches or the total number of hammer blows reaches 50, whichever occurs first.

THE FOLLOWING IS ADDED:

All piles designated as test piles on the Plans shall have dynamic measurements taken with the Pile Driving Analyzer (PDA) during driving in accordance with the Standard Specifications. In addition, other piles shall be monitored by using the PDA if, when, and where directed by the Engineer.

THE FOLLOWING SUBPART IS ADDED:

5. **Restrikes with PDA Analysis.**
The Contractor shall be prepared to restrike any previously driven pile within the current pile group when so directed by the Engineer in order to verify the pile capacity. In general, such restrikes shall be conducted no sooner than 48 hours after completion of the initial driving or as directed by the Engineer. The restrike should be terminated when the amount of penetration reaches 6 inches or the total number of hammer blows reaches 50, whichever occurs first. All restrikes shall have dynamic measurements taken with the Pile Driving Analyzer (PDA) and shall have a CAPWAP analysis performed on a representative blow from the initial portion of the restrike. The pile hammer shall be warmed up by applying not less than 50 blows to an adjacent pile prior to restriking the designated pile.

505.11 Manufacture of Precast Concrete Piles and Precast Concrete Pile Caps.
The third paragraph is changed to:

Concrete piles for use in seawater and/or sulfate soils shall be cured for not less than 30 days before being used.

505.12 Extensions and Splices.
B. Precast and Prestressed Concrete Piles.
The first sentence of the second paragraph is changed to:

After the driving is completed, the concrete at the end of the pile shall be cut away leaving the reinforcing steel exposed for a length of 40 diameters.

505.13 Cut-Offs and Cappings.
The second paragraph is deleted.
The third paragraph is changed to:

As shown on the Plans, all piles shall be anchored to the structure.

505.16 Basis of Payment.
Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST PILES, FURNISHED, PRESTRESSED CONCRETE, 14”X14”</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>TEST PILES, DRIVEN, PRESTRESSED CONCRETE, 14”X14”</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>TEST PILES, FURNISHED, PRESTRESSED CONCRETE, 24”X24”</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>TEST PILES, DRIVEN, PRESTRESSED CONCRETE, 24”X24”</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>PRESTRESSED CONCRETE PILES, FURNISHED 14”X14”</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>PRESTRESSED CONCRETE PILES, DRIVEN 14”X14”</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>PRESTRESSED CONCRETE PILES, FURNISHED 24”X24”</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>PRESTRESSED CONCRETE PILES, DRIVEN 24”X24”</td>
<td>LINEAR FOOT</td>
</tr>
</tbody>
</table>

The section heading and text are changed to:

SECTION 506 – BULKHEADS, FENDER SYSTEMS, DECK PIERS, DRAINAGE PIPE SUPPORTS AND DOLPHINS

506.01 Description.
The following is added:

This work shall also consist of designing, furnishing and installation of Fiberglass-Concrete Composite Piles (F CCP) and Fiberglass Reinforced Plastic Piles (FRPP) that may be used for the construction of fender systems, dolphins, and fishing pier. All equipment, materials and labor that are required to install these type piles, as shown on the plans, shall be included.

This work shall also consist of designing, furnishing and installing Fiberglass Reinforced Plastic Lumber (FRPL) wales for fender systems and smaller dimensional FRPL for fender system platforms, fishing pier, and walkway as shown on the plans and as specified herein.

506.02 Materials.
The following is added to the list of material references:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
THE FOLLOWING IS ADDED:

The material conformance criteria of Section 921 shall be followed for supplying FRPL, of Section 922 for supplying FRPP and of Section 923 for supplying FCCP.

THE NEW SUBSECTION IS ADDED:
506.06 Fiberglass-Concrete Composite Piles / Fiberglass Reinforced Plastic Piles / Fiberglass Reinforced Plastic Lumber.

A. Fiberglass-Concrete Composite Piles (FCCP). The following criteria shall be followed in furnishing (FCCP).

1. Working Drawings. According to the requirements of 105.04, Working Drawings for FCCP shall be submitted. The submission shall include test results and calculations to establish the flexural strength requirements stated herein and shall also include the following criteria:
   a. The outside diameter of the FCCP and wall thickness of the composite reinforcement tube.
   b. The location of any embedded or attached lifting devices and use of pick up or support points.
   c. The location of the roughened surface where skin friction is needed between the pile and the soil.
   d. The location of detailing of any splices, shoes and top of pile connections that may be required.

2. Additional Submittals. The following documentation and details shall be submitted to the Engineer for approval at least thirty (30) days prior to the scheduled FCCP installation.
   a. Documentation that indicates the fiberglass tubing physical properties and the diameter and wall thickness of the tubes.
   b. The method of placing concrete in the fiberglass tubes.
   c. Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, brochures or lab reports that illustrate the size, physical appearance and other characteristics of FCCP that indicate conformity to the requirements of the Plans and the requirements specified in Section 923.
   d. Lab reports from an independent testing facility shall include calculations that confirm that the FCCP meets the ultimate strength requirements specified in Section 923. A minimum of three (3) flexural tests shall be required. The average of the three tests shall exceed the specified ultimate flexural strength.
   e. Placement method of the concrete for the fiberglass tubes. The concrete shall be placed in one continuous bottom to top operation in a manner that prevents voids from forming.

3. Storage and Handling. FCCP shall not be installed until 30 days after concrete has been placed in the tubes. FCCP shall be stored and handled to avoid damage to all components including fiberglass tubes, protective coatings and concrete. During storage, the piles shall be placed on minimum 6 inch wide timber cribbing arranged to give even support and to maintain straightness within the tolerance specified herein.

4. Lifting Piles. Only fabric slings may be used to lift the piles. Chain or cable in direct contact with the piles may not be used.

5. Splices. Full length piles where practicable shall be used. Where splices are unavoidable their number and locations will be subject to written approval by the Engineer. Splicing details shall be submitted to the Engineer for approval.

6. Shoes. Steel shoes for FCCP, when required, shall be provided. Install shoes in conformance with details submitted to and approved by the Engineer.

7. Equipment for Driving FCCP.
   a. Equipment for driving FCCP shall conform to the requirements of 505.03.
b. As per the requirements of 505.03 G., an approved hammer cushion block to transfer pile hammer energy to the FCCP shall be used. Each hammer shall be equipped with a helmet/drive head to fit the diameter of the FCCP to be driven.

c. As per the requirements of 505.03 G., an approved pile cushion block to prevent damage to the FCCP shall be used. At a minimum frequency, the pile cushion block shall be inspected after each FCCP is driven and replaced as needed.

8. **Allowable.** Variation in Pile Alignment. FCCP shall be installed truly vertical or accurately battered as indicated on the Plans. The top of any FCCP driven its full length into the ground shall not vary from the plan location by more than 2 inches.

9. **Defective Composite Piles.** The provisions of 505.08, in addition to the following, shall apply for determining FCCP defective characteristics. The following will be causes for rejection of a FCCP:
   a. Incorrect pile location or batter.
   b. Pile damage from any cause prior to driving.
   c. Insufficient concrete strength, based on testing of cylinders.
   d. FCCP broken by reason of internal defects (even if placed in the leads), or improper driving.

10. **Cutting Off Piles.** Tops of FCCP shall be cut off at the elevation indicated on the Plans, or as established by the Engineer. The FCCP shall be cut to a true plane, in accordance with the detail shown on the Plans. All cut off lengths will become the property of the Contractor.

B. **Fiberglass Reinforced Plastic Lumber (FRPL).** The following criteria shall be adhered to in furnishing FRPL for the project:

1. **Submission Requirements.** The Contractor shall submit the following information to the Resident for approval at least thirty (30) days before installation of FRPL.
   a. Copies of the FRPL manufacturer’s standards and most recent brochure for the product covered by these Specifications.
   b. According to the requirements of Subsection 106.04, the Contractor shall submit a written certification from the FRPL manufacturer that their product satisfies the requirements of Section 921 and has been in service for a minimum of three (3) years on other bridge protection applications in the United States. This written certification shall include project owner information, project names, locations, contacts and phone numbers.
   c. Copies of independent lab test reports and performance test data that confirm that the FRPL meets the Plastic material properties and the structural property requirements specified in Section 921.

2. **Shipping, Storage, Handling.** During storage FRPL materials shall be protected at all times against exposure to extreme heat or impact. FRPL shall be shipped in a manner that will minimize scratching or damage to the outer surfaces. FRPL shall be stacked on dunnage above ground so that it may be easily inspected and stored in a manner that will avoid damage. FRPL shall be handled with nylon slings. Sharp instruments shall not be used in handling the product. FRPL damaged in shipping or handling will be rejected.

3. **Installation.** FRPL shall be cut, beveled, drilled, countersunk, and otherwise fabricated in accordance with the manufacturer’s recommendations. Set all material accurately to required levels and lines, with members plumb and true and accurately cut and fitted. Securely attach all FRPL to substrate by anchoring and fastening as shown on plans.

C. **Fiberglass Reinforced Plastic Piles (FRPP).** The following criteria shall be adhered to in furnishing FRPP piles:

1. **Working Drawings.** According to the requirements of Subsection 105.04, FRPP submissions shall consist of working drawings. The submission shall include calculations to establish the FRPP structural properties found in Tables 3-A and 3-B.

2. **Additional Submittals.** Submit the following documentation and details to the Engineer for approval at least thirty (30) days prior to driving the piles.
   a. Copies of FRPP manufacturer’s standards and most recent product brochure for the product covered by these specifications.
   b. Written certification from the FRPP manufacturer that their product meets the requirements of Section 922 and that the product has been in service for a minimum of three (3) years on at
least 5 bridge protection applications in the United States. The certification shall include project owner information, project names, locations, contacts and phone numbers.

c. Independent test lab report confirming that FRPP meets the Plastic Material Properties and structural properties specified in Section 922.

d. Manufacturer’s field guide with recommendations on handling, storage, cutting, drilling and driving. Driving recommendations shall include recommended driving energies.

3. **Splices.** Splices shall not be permitted except where overhead restrictions in the driving area require splices to be used. Splicing details shall be submitted to the Engineer for approval.

4. **Pile Points.** Steel pile points shall be provided by the manufacturer and attached prior to shipment.

5. **Allowable Variation in Pile Alignment.** Install FRPP truly vertical or accurately battered as indicated on the Contract Plans. The top of any pile driven its full length into the ground shall not vary from the plan location by more than 2 inches.

6. **Defective FRPP.** The provisions of Subsection 505.08, in addition to the following, shall apply for determining FRPP defective characteristics:

   a. Incorrect pile location or batter.
   
   b. Pile damage from any cause prior to driving.

   c. Pile broken by reason of internal defects (even if placed in the leads0, or improper driving.

7. **Cutting Off Piles.** Cut off the tops of FRPP at the elevation indicated on the Contract Plans, or as established by the Engineer. Cut the piles to a true plane, in accordance with the detail shown on the Contract Plans. All cut off lengths become the property of the Contractor.

8. **Wrapping.** Wrapping for the FRPP that are to be placed in clusters shall be ¼” diameter cable (5/8” OD covering) polypropylene impregnated wire rope.

9. **Test Pile.** A test pile shall be installed and load tested as noted on the contract plans for the Fishing Pier.

To verify suppliers of Composite Piles/Fiber Reinforced Plastic Piles/Composite Lumber that may be used, the Contractor is advised to study the “Bureau of Material’s Approved List” on the following NJDOT website:

http://www.state.nj.us/transportation/eng/technology/materials

**506.06 Method of Measurement.**

THE SUBSECTION NUMBER IS CHANGED:

**506.07 Method of Measurement.**

THE FOLLOWING IS ADDED:

FRPP and FCCP will be measured in linear feet of pile that is placed in accordance with the plans.

FRPL will be measured in cubic feet computed on the basis of actual volumes and the shortest commercially available lengths which may be used and that is placed in accordance with the Plans.

**506.07 Basis of Payment.**

THE SUBSECTION NUMBER IS CHANGED:

**506.08 Basis of Payment.**

THE FOLLOWING IS ADDED:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIBERGLASS REINFORCED PLASTIC PILE (FRPP), 16 INCH DIAMETER</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>FIBERGLASS REINFORCED PLASTIC PILE (FRPP), 10 INCH DIAMETER</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>FIBERGLASS REINFORCED PLASTIC LUMBER (FRPL)</td>
<td>CUBIC FOOT</td>
</tr>
<tr>
<td>FIBERGLASS REINFORCED PLASTIC DECK PLANK (FRPL), 3” X 24”</td>
<td>SQUARE FOOT</td>
</tr>
<tr>
<td>FIBERGLASS REINFORCED PLASTIC SPANDREL BEAM (FRPL), 8” X 12”</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>FIBERGLASS REINFORCED PLASTIC BRACING (FRPL), 4” X 8”</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>CLEARANCE GAUGE</td>
<td>LUMP SUM</td>
</tr>
<tr>
<td>TEST PILE FURNISHED &amp; DRIVEN</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>DYNAMIC LOAD TEST (PDA)</td>
<td>EACH</td>
</tr>
</tbody>
</table>

Wrapping is to be paid for under the item FIBERGLASS-CONCRETE COMPOSITE PILE (FCCP), ___ INCH DIAMETER or FIBERGLASS REINFORCED PLASTIC PILE (FRPP), 16 INCH AND 10 INCH DIAMETER.

**ROUTE 36 OVER THE SHREWSBURY RIVER**

**HIGHLANDS BRIDGE**

**MONMOUTH COUNTY**
No additional payment will be made for re-driving of FCCP or FRPP that are forced up by any cause. Included in the Payment will be all costs for all material, labor, equipment, and other necessary items required for completing the work including storage costs, disposal of unused piles, repair to damaged piles, and transportation costs. Parts of pile cut off will not be included for payment.

Payment for FRPL shall include all material, labor, equipment, fasteners, and other necessary items required for completing the work including storage costs, disposal of unused materials, and transportation costs.

Also, no separate payment will be made for grout, plates, bolts, screws or other hardware that is needed for attaching the wales to the dolphins or for assembly and or installation of a platform, and fishing pier. All costs hereof are to be included in the item FIBERGLASS REINFORCED PLASTIC LUMBER.

SECTION 508 – METAL BRIDGE RAILING AND FENCE

508.01 Description.
THE FOLLOWING IS ADDED:

This work shall also consist of the fabrication and construction of a 5-Bar Open Steel Bridge Railing System on a bridge.

508.02 Materials.
THE FIRST SENTENCE SHALL BE CHANGED TO:

In the furnishing of a 4-Bar Open Steel Bridge Railing and a 5-Bar Open Steel Bridge Railing, anchor studs, washers, and exposed nuts shall conform to ASTM F 568, Class 8.8, and all other bolts and nuts shall conform to ASTM F 568, Class 4.6.

508.03 Working Drawings.
THE FOLLOWING IS ADDED:

The Contractor shall provide documentation that the 5-Bar Open Steel Railing has been approved by FHWA as passing the TL-4 crash test level.

508.05 Steel Railing.
A. Fabrication and Erection
THE FOLLOWING IS ADDED:

The fabricator shall be AISC certified.

B. Painting
THE FOLLOWING IS ADDED:

The “5-Bar Open Steel Railing” railing, posts and hardware shall be galvanized as per AASHTO M 111 (ASTM 123) and ASTM A 153. Then the railing, posts and hardware shall be prepared for painting as per ASTM D 2092, Method A. Once all prepared surfaces have been accepted, they shall be painted in accordance with Standard Specification 503.15, with the epoxy intermediate coat followed by the urethane finish coat. The finish coat for all rails, posts, base plates, and exposed bolt threads shall be the lightest practical gray color which has the absolute minimum variation in color. The target uniform color to be produced is Federal Color Number 36622. A mock up of the rail shall be submitted to the Engineer for approval of the color. Rails, posts, and base plates shall be painted in the shop. Exposed bolt threads shall be painted in the field.

508.09 Basis of Payment.
THE FOLLOWING IS ADDED:

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-BAR OPEN STEEL BRIDGE RAILING</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>5-BAR OPEN STEEL RAILING (PEDESTRIAN BRIDGES)</td>
<td>LINEAR FOOT</td>
</tr>
</tbody>
</table>
For the 5-Bar Open Steel Railing, no separate payment shall be made for the Engineering and working drawings development required to detail the locations of the railing anchor bolts. In addition, no separate payment shall be made for the embedded rail post anchorage assemblies (anchor bolts, anchor plate, misc. nuts), and the labor and equipment required for the anchor bolt assembly installation. Payment for Engineering and working drawing development, the embedded rail post anchorage assemblies, and the labor and equipment required for the anchor bolt assembly installation shall be included in the respective concrete parapet and concrete curb pay items.

No separate payment shall be made for the cost of galvanizing and painting the 5-Bar Open Steel Railing. All costs for galvanizing and painting these railings shall be included in the pay items 5-Bar Open Steel Railing and 5-Bar Open Steel Railing (Pedestrian Bridges).

No separate payment shall be made for the cost of the anti climb mesh. The anti climb mesh shall be included in the pay items 5-Bar Open Steel Railing and 5-Bar Open Steel Railing (Pedestrian Bridges).

**SECTION 509 – SIGN SUPPORT STRUCTURES**

**509.01 Description.**

THE FOLLOWING IS ADDED:
The “Lumi-Trak lighting Maintenance System” shall be used in place of the maintenance walkway and handrail on all overhead sign support structures. No substitutions will be permitted. The Contractor may contact Mr. Ron Lesser of Metro – Tech Sales Representing Lumi – Trak at (201) 529-0909 or Lumi – Trak at the following address:

Lumi – Trak Inc.
P.O. Box 158
Shrewsbury, PA 17362
Telephone: (732) 235-2863

**509.02 Materials.**

THE SEVENTH PARAGRAPH IS CHANGED TO:

Caps for the ends of chords and tops of posts shall be steel conforming to AASHTO M 270 Grade 36 and shall be hot dip galvanized according to ASTM A 123.

**SECTION 513 – SHEETING, TEMPORARY AND LEFT IN PLACE**

**513.05 Method of Measurement.**

THE first paragraph is removed and the following is added:

Temporary sheeting and sheeting left in place will be measured by the square foot basis. The area measured will be the product of the average height and the length of sheeting that is driven. The average height will be determined by extending a line from the bottom of excavation to a vertical plane of the top of sheeting.

**SECTION 520 - MECHANICALLY STABILIZED EARTH (MSE) WALLS**

**520.01 Description.**

THE SECOND SENTENCE OF THE SEVENTH PARAGRAPH IS CHANGED TO:

To verify approved listing of MSE Wall systems that may be used, the Contractor is advised to study the “Bureau of Material’s Approved List” on the following NJDOT website:

http://www.state.nj.us/transportation/eng/technology/materials

**520.02 Materials.**

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY

THE FOURTH ITEM UNDER SIEVE SIZE IS CHANGED TO:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 50</td>
<td></td>
</tr>
</tbody>
</table>

THE THIRD PARAGRAPH IS CHANGED TO:

Select granular backfill shall meet the following recommended electrochemical limit requirements:

THE FIRST ITEM IN FOURTH PARAGRAPH IS CHANGED TO:

<table>
<thead>
<tr>
<th>Property</th>
<th>Standard</th>
<th>Test Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistivity, ohm-cm</td>
<td>Greater than 3,000</td>
<td>ASTM G57</td>
</tr>
</tbody>
</table>

THE SIXTH PARAGRAPH IS CHANGED TO:

The frequency of sampling of select granular backfill necessary to ensure electrochemical limits shall be performed at least once for every 6000 cubic yards of material that is placed. A minimum of one sample per structure shall be taken. Whenever the appearance or behavior of the material changes and as directed, additional samples shall be taken.

THE SEVENTH PARAGRAPH IS CHANGED TO:

The materials shall be substantially free of shale or other soft, poor durability particles. The material shall have a sodium sulfate soundless loss of less than 15 percent after five cycles determined according to AASHTO T 104.

THE LAST PARAGRAPH IS CHANGED TO:

The Contractor shall determine, by means of proper sampling and laboratory tests that the Select Granular Material from proposed sources conform to the requirements of the Specifications. A copy of all test results performed by the Contractor shall be furnished to the Engineer prior to delivery of the material.

520.03 Methods of Construction.
   O. Compaction of Backfill Material.

THE SECOND SENTENCE IS CHANGED TO:

AASHTO T 310 (Direct Transmission Method) shall be used to determine the achieved density.

THE FOLLOWING SECTION IS ADDED:

SECTION 524 – PRESTRESSED CONCRETE CYLINDER PILES

524.01 Description

This work shall include the furnishing and installation of 54 inch outside diameter open-end precast prestressed concrete hollow cylinder piles for the bridge piers. The cylinder piles shall be manufactured with a wall thickness of 6 inch and in standard segment lengths of 16 feet. The required overall length of pile will be achieved by assembling the segments into a pile unit and post-tensioning at the precast plant. The work includes furnishing equipment and supporting structure for driving prestressed concrete piles including all material, labor, equipment, and all else necessary to construct any temporary supporting structure necessary for driving prestressed concrete piles. The work shall also include pile load tests (static) and pile load tests (dynamic).

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
The Engineer shall be notified when casting and/or fabrication of the piles will begin in order that the Engineer may inspect the operation.

Project’s Contractor or Subcontractor shall provide proof of prequalification for NJDOT work type classification, class code 9M, large diameter cylinder pile 3 feet or more in diameter prior to the commence of the pile installations. Shop drawings and working drawings submitted by the pile Contractor shall include pile driving equipment, pile hammer size, type and energy, proposed driving criteria, and other details pre-described herein.

Prior to the preconstruction meeting, the Contractor shall submit for the Department’s review, a pile installation plan which shall include at least the aforementioned data and the following:

1. Resumes of key personnel showing experience with large diameter prestressed concrete cylindrical piles on previous projects. It will be required from the Contractor that at least one sufficiently experienced person be present on site during all pile operations. The name(s) of such person(s) shall be given by the Contractor in his pile installation plan.

2. Proposed mode of transportation from the supplier of piles to the site, together with a list of incidental permits which may be required for the transportation and the propose schedule of delivery to the site. The pile installation plan shall also indicate the intended location for storage of the piles at the site.

3. The proposed methods and equipment to move, lift and install the piles. This description shall include barges, access roads, temporary trestles, crane locations and type, and all relevant details essential to demonstrate the feasibility of the proposed scheme and support the proposed schedule of installation. Placement of fill or embankment in the water will not be permitted.

4. A schedule of installation of all the piles, indicating the time allocated for manufacturing, transporting and installing the piles. The schedule shall indicate the proposed order of installation of the piles and the estimated time required to install each pile.

Work plan for the pile installation shall be submitted no later than 60 days prior to the commence of the pile installation for review and approval.

These submittals shall be in conformance with Section 105.04.

The pile manufacturer’s structural details for the piling, section and assembly descriptions, in the form of shop drawings and working drawings, shall be adhered to in every respect for the work to be performed under this contract.

524.02 Materials

A. Concrete for the prestressed concrete cylinder piles shall be Class P-3 with calcium nitrite corrosion inhibitor as specified in Section 905.02 of the Standard Specifications. Pile sections which do not attain a 28 day compressive strength (f'c) of 7000 psi will be rejected.

The maximum size aggregate shall not exceed one-third the thickness of the pile and cement shall be Portland Cement Type II conforming to ASTM 6150. The concrete mixture shall be such as to give the most uniform possible distribution of the aggregates across the wall section. The fine and coarse aggregates shall be as nearly as possible of the same specific gravity.

B. Grout for Longitudinal Holes. Grout for longitudinal holes shall be a non-shrink, non-metallic cementitious-based grout. Aluminum based expansion agents shall not be used.

The grout shall be a mixture of Portland Cement and water prepared to a consistency of cream. The grout shall have a minimum 28-day compressive strength of 4000 psi as determined by the testing of 2” x 2” x 2” cubes.
C. Grout for Pile Joints. The grout for pile joints shall be a non-shrink, non-metallic, cementitious-based grout. Aluminum based expansion agents shall not be used.

D. Material for Pile Joints. The material for pile joints shall be a polyester resin conforming to the following minimum requirements:

Minimum Properties of Uncured Sealing Material

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity @ 77 Degrees F. Cps</td>
<td>600 to 700</td>
</tr>
<tr>
<td>Specific Gravity @ 77 Degrees F</td>
<td>1.13</td>
</tr>
<tr>
<td>Weight in Pounds, per gallon</td>
<td>9.4</td>
</tr>
<tr>
<td>Percent Polymerizable</td>
<td>100</td>
</tr>
<tr>
<td>Color, Apha, max.</td>
<td>150</td>
</tr>
<tr>
<td>Minimum Stability, Catalyzed with 1% Benzoyl Peroxide in Dark, @ 70 Degrees F, Days</td>
<td>5</td>
</tr>
</tbody>
</table>

Minimum Properties of ⅛ inch Unfilled Castings

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barcol Hardness</td>
<td>50</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.22</td>
</tr>
<tr>
<td>Ultimate Tensile Strength, psi</td>
<td>10600</td>
</tr>
<tr>
<td>Elongation in Tension, %</td>
<td>1.7</td>
</tr>
<tr>
<td>Ultimate Compressive Strength, psi</td>
<td>22500</td>
</tr>
<tr>
<td>Ultimate Flexural Strength, psi</td>
<td>16700</td>
</tr>
<tr>
<td>Modulus of Elasticity in Flexure, psi</td>
<td>650000</td>
</tr>
<tr>
<td>Deflection Temp. Under Load, 264 psi, degrees F</td>
<td>198</td>
</tr>
<tr>
<td>Water Absorption, 24 Hours %</td>
<td>0.21</td>
</tr>
<tr>
<td>Flammability, inches per minute</td>
<td>0.87</td>
</tr>
<tr>
<td>Dielectric constant @ 60 cycles</td>
<td>3.43</td>
</tr>
<tr>
<td>@ 1 million cycles</td>
<td>3.00</td>
</tr>
</tbody>
</table>

When the pile sections are brought together under compression as specified, the abutting joint surface shall be covered by a grout of sufficient thickness to fill all the voids between the end surfaces, except at the longitudinal holes for the prestressing strands. This grout must attain a minimum 28-day compressive strength (f’ c) of 7000 psi.

Concrete for build-ups and plugs shall be Class A conforming to the requirements of Section 914. Concrete for tremie shall be Class S (tremie) conforming to the requirements of Section 914.

Prestressing steel cables shall each consist of two ½ inch diameter high tensile strength seven-wire strands conforming to AASHTO M203 (ASTM A416), Grade 270, with Supplement I requirements for low relaxation strands. Strands shall be Grit Impregnated Epoxy Coated as specified in Section 915.02 of the Standard Specifications.

Spiral reinforcement shall be cold drawn steel wire conforming to AASHTO M32 (ASTM A82) and epoxy coated conforming to Subsection 915.01 (c).

The Contractor shall mark each pile prior to driving with horizontal lines at 1 foot intervals, and the number of feet from pile tip at 5 foot intervals.

Final inspection of the fabricated piles will be made at the site, both before and after the pile has been placed in final position. Any pile found to be defective in any manner at any time shall be rejected and replaced by an approved pile, or repaired in an acceptable manner at no additional cost to the State.

524.03 Equipment

Driving Equipment for Prestressed Concrete Cylinder Piles

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
River piles shall be driven from a jack-up barge, platform, or floating derrick barge of sufficient size, capacity and stability to handle and install piles of the specified lengths, sizes, and dimensions shown on the Plans. The equipment shall be operated in accordance with the Manufacturer’s recommendations. The Contractor shall verify the stability of the pile driving system, for example, consider the weight ratio of the hammer and pile to the barge carrying it when lifting and transferring the hammer weight to the pile.

The Contractor’s pile driving equipment shall be capable of driving the piles to the required tip elevation without damaging or overstressing the pile. All pile driving equipment shall be of an approved type and shall not be transported to the site without approval by the Engineer.

A. Hammers: The pile driving hammer shall be of the size and type able to consistently deliver an effective dynamic energy sufficient to drive the piles to the estimated tip elevations (see Contract Plans). The minimum ram weight and the maximum stroke shall be as specified in Subsection 505.03 (B), or as otherwise approved by the Engineer on the basis of wave equation analysis or PDA data. The minimum hammer energy shall be 400,000 foot-pounds per blow.

Hammers shall be provided with proper driving helmets suited for the piles. The hammers shall be maintained in good operational condition and shall be operated according to the manufacturer’s recommendations. The driving equipment shall conform to the approved driving system. Approval shall be in accordance with Subsection 524. The efficiency of the hammer shall be ascertained by the Manufacturer’s representative, who shall be present at the site during the driving of the test piles and when requested by the Engineer.

All necessary gages required to monitor performance of the hammer, as suggested by the manufacturer, shall be installed prior to any pile driving.

It is the sole responsibility of the Contractor to provide a driving system that will deliver sufficient dynamic energy to develop the required ultimate driving resistance for the 54 inch o.d.- prestressed concrete cylinder piles at the specified toe elevations shown on the Plans.

All piles must penetrate to the minimum tip elevations and as deep as necessary to develop required ultimate driving resistance as indicated on the drawings. The Engineer shall be the sole judge as to what constitutes a satisfactory penetration into original ground.

The hammer shall be capable of low energy driving or tapping (short stroke) through soft soil strata to assure that the tensile stress in the concrete pile does not exceed the maximum allowable tensile stress shown on the drawing. The Contractor shall adjust the fuel setting on diesel hammers and have multiple stroke settings on air/steam hammers when directed by the Engineer to provide low energy driving.

When necessary, reduce hammer energy and/or use additional pile cushions to prevent pile cracking during pile driving. Protection against cracking of the piles shall be the Contractor’s responsibility. Repair or replacement of damaged piles shall be at the Contractor’s expense. When the point of the pile is being driven into firm ground, the full capacity of the hammer shall be used to develop the final driving resistance.

The cost of manipulating, proof-load testing, repairing, or removing and replacing any defective pile shall be borne by the Contractor, and no separate payment will be made therefore.

The Contractor shall provide a suitable measuring system so that hammer stroke is easily observed by the Engineer. For single acting diesel hammers, the Contractor shall provide the Engineer with two electronic gages for remote monitoring of the pile hammer stroke. Stroke rate monitoring gages to be furnished shall be “Saximeter” model, or other similar measuring device.

If air/steam hammer is used, provide calibrated pressure gage (complete with calibration certificates) positioned on the hammer side of all valves and coated so as to be conveniently monitored by the Engineer.
B. Hammer Cap Block: Cap block material shall be made of a stable and predictable material such as aluminum, Force 10, as manufactured by Metex Corporation, aluminum and Conbest as manufactured by Penn State Metal Fabricators, or other suitable material as approved by the Engineer.

C. Helmet: The helmet shall be seated onto the pile and bear evenly and concentrically with minimum play upon the pile. The pile head shall be free to rotate about the piles long axis, unrestrained by the helmet.

D. Pile Cushion: For driving of concrete piles, the helmet shall contain a suitable cushion pad placed in the pile driving helmet. The cushion shall conform to the cross sectional shape of the pile. The minimum thickness of the cushion to be used shall be 12 inch. A cushion shall be placed in the helmet at the start of driving of each pile and it shall be replaced at the start of driving each pile. The pile cushion shall be inspected periodically during driving and no driving shall be done with cushions that have been unduly worn or compressed more than 40% of its original thickness. The cushion shall be replaced in the helmet as soon as it has reached 50% of its original thickness or it is evident that it has begun to smoke, burn, or otherwise deteriorate. If necessary, the cushion thickness shall be increased to reduce tension or compressive stresses as determined by the pile driving analyzer (see Subsection 524.06). Under no circumstances will the use of small wood blocks, wood chips, rope or other material permitting excessive loss of hammer energy be permitted.

524.04 Preparation for Driving

Furnishing Equipment for Driving Piles

Twenty working days prior to delivery of the equipment to the worksite, a pile and driving equipment data form shall be submitted for approval. The forms can be obtained by contacting Mr. Jack Mansfield, Geotechnical Engineering Unit, Telephone No. 609-530-3755. At this time, for each pile supported substructure unit and hammer combination, a wave equation analysis prepared, signed and sealed by a licensed Professional Engineer registered in the State of New Jersey shall be submitted showing that the proposed hammer will perform adequately. Drivability analysis shall be performed to determine the percentage distribution of the skin friction for use in the wave equation analysis. The drivability analysis must be submitted to the Engineer for review and approval along with the wave equation input data and assumption before performing the wave equation analysis.

Approval of the proposed driving system by the Engineer shall be based upon the wave equation analyses indicating that the proposed driving system can develop the pile capacities shown on the Plans within allowable driving stress limits.

A new pile driving system, modifications to existing system, or new pile installation procedures shall be proposed by the Contractor if the pile installation stresses predicted by wave equation analysis or calculated by the pile driving analyzer exceed the following maximum values:

- Compression stresses………………………………………………………4.6 ksi
- Tension stresses……………………………………………………….……1.4 ksi

Shop drawings and working drawings submitted by the pile Contractor shall include pile driving equipment, pile hammer size, type and energy, proposed driving criteria, and other details described herein.

At least 30 days prior to the proposed start of the pile installation, the Contractor shall submit a written work plan for the installation of the piles to the Resident for approval. The work plan, which shall include the aforementioned data and the following, shall adhere to, as applicable, all provisions of Section 524.

1. The proposed Method of Operation. A narrative step by step description of the complete pile installation process from the beginning to end by numbered paragraph. Included, by way of example and not limited to, transportation, storage, setting of the pile, and driving and any other method or variation of advancing the pile removal of the driving frame. The number and type of personnel, including the foreman and supervision, as well as job task shall be set forth.
2. Equipment Description. The equipment to be used should be consistent with the provisions of Subsection 524.03.

3. Pile driving record and installation sequence shall be performed in accordance with the provisions of subsection 505.04.4 and 505.04.5.

4. Knowledge Level. History of past experience of the knowledge level of the Contractor’s or Subcontractor’s work force with similar type operations. Key personnel, who will be in charge of the pile installation, shall be identified. Resumes of key personnel showing experience with large diameter prestressed concrete cylindrical piles on previous projects shall be submitted. It will be required from the Contractor that at least one sufficiently experienced person be present on site during all pile operations. The name(s) of such person(s) shall be given by the Contractor in his pile installation plan.

5. Proposed mode of transportation from the supplier of piles to the site, together with a list of incidental permits which may be required for the transportation and the proposed schedule of delivery to the site.

6. The proposed methods and equipment to move, lift and install the piles. This description shall include barges, access roads, temporary trestles, crane locations and type, and all relevant details essential to demonstrate the feasibility of the proposed scheme and support the proposed schedule of installation. Placement of fill or embankment in the water will not be permitted.

7. A schedule of installation of all the piles, indicating the time allocated for manufacturing, transporting and installing the piles. The schedule shall indicate the proposed order of installation of the piles and the estimated time required to install each pile.

8. Contingency Plan. A plan for any interruption to the advancement of the pile resulting from equipment breakdowns or failures, accidents, resistance, need to change or improve method of advancing the pile, encountering rocks, boulders, or other buried objects and other unanticipated events.

9. Discontinuance Plan. A plan for discontinuing the pile driving due to damage to the pile or inability to reach acceptance criteria.

These submittals shall be in conformance with Subsection 105.04.

The pile manufacturer’s structural details for the piling, section and assembly descriptions, in the form of shop drawings, shall be adhered to in every respect for the work to be performed under this contract.

524.05 Order List of Piles

Production piles shall be furnished in accordance with the provisions of Section 505.05.

524.06 Methods of Driving

Piles shall be driven by hammers and equipment conforming to Subsection 524.03. In addition, when followers are permitted for use in driving, one pile from each group of ten shall be a long pile driven without a follower, and shall be used as a test pile to determine the average bearing capacity of the group.

Pile driving shall conform to the following:

1. Accuracy of Driving

The prestressed concrete cylinder piles shall be installed such that they will not be out of their required position at the top of the pile by more than 6 inch after driving. Piles shall be installed with a variation of not more than 1/8 inch per foot from the vertical.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Piles and hammers shall be held in fixed leads, which form a track in which the hammer is engaged for the full length of the travel. The pile driving leads shall be of such type and height that hold the pile firmly in position and alignment and in axial alignment with the hammer. The leads shall not be suspended from a line (swinging or hanging). The requirement for fixed leads will only be waived when the physical conditions of the construction site make the use of such equipment impractical. In such cases, the piles shall be rigidly braced and held in alignment by suitable guide frames. The intent of these Special Provisions is that the leads supporting the hammer control the path of the pile throughout the entire length of driving.

The Contractor shall provide an adequate fixed template to maintain the pile in proper position and alignment during driving with swinging leads or with semi-fixed leads. For piles on land, the template shall be located within 5 foot of cutoff or within 5 foot of ground line, whichever is lower. For piles in water, the template shall be located within 5 foot of cutoff or within 5 foot of the waterline, whichever is lower. Floating templates (attached to a barge) will not be allowed. Where practical, the template shall be placed so that the pile can be driven to cut-off elevation before the template is removed. When the Contractor proposed to use a free hammer, he shall provide a rigid double template, which will independently support the pile. Free hammers shall be provided with approved guide extensions which hold the hammer in alignment with the pile to assure that the hammer blow is applied axially to the pile at all times. When driving piles with a follower using floating equipment, a double template or other approved equipment shall be provided to maintain alignment of the hammer, follower and pile. A double template shall consist of a pile template within 5 foot of cut-off elevation and a second upper support above the water surface for the leads. Where practical, the template shall be placed so that the pile positions of the second upper template shall be adjustable in size to serve as a guide for both the pile and follower. Templates shall not restrict the vertical movement of the pile.

The Contractor shall survey the top of the piles by taking elevation measurements immediately after driving and during the driving of the remaining piles in the group to check piles for heave from driving of adjacent piles or by any other cause. Piles found to have heaved more than ¼ inch shall be re-driven to the minimum driving resistance and to the original tip elevation, or deeper, as determined by the Engineer. The Contractor shall be responsible for furnishing the Department with the results of the pile top survey for heave and as-as-built survey of piles for both horizontal location and cutoff elevation. The Contractor shall provide the pile as-built survey data at least 5 days prior to pouring of the footing/pile bent cap concrete.

Any remedial work required, in cases where the pile head is driven below the required elevation or beyond the tolerances specified in the Standard Specifications, or where the pile is damaged below cutoff level or is otherwise damaged or does not meet all of the provisions of these specifications, shall be corrected as directed by the Engineer at not cost to the State.

Should a pile be driven outside the specified pile location tolerance and if required by the Engineer, the Contractor shall enlarge the pile cap to a size determined by the Engineer, or furnish and install additional piles, at no additional cost to the State.

2. Penetration

The Contractor shall be prepared to use pre-excavation, auguring, drilling, spudding and/or other work necessary to obtain the penetration required in areas where obstructions are encountered. For the purposes of this specification, an obstruction is defined as any timber, concrete or steel remnants of previously existing structures, or boulders larger than 2 cubic feet. The Engineer shall approve such procedures in writing before they are implemented.

3. Prestressed Concrete Cylinder Pile Installation

The procedure incident to the driving of piles shall not subject them to abuse producing crushing and spalling of concrete. Manipulation of piles to force them into proper position considered by the Engineer to be excessive will not be permitted. Any pile damaged by reason of internal defects, or by improper handling or driving, or driven out of its proper location or the butt is driven below the elevation fixed by the Plans or by the Engineer, shall be withdrawn and replaced by a new and if necessary, a longer pile at the Contractor’s expense. Splicing shall not be allowed unless absolutely necessary as per Section 524.10.
When concrete is being placed and/or cured in the vicinity of pile driving operations, a minimum distance of 100 foot in any direction between the two processes shall be observed to avoid aggregate settlement and/or separation from reinforcement resulting from the vibrations. The minimum distance between operations shall be approved by the Engineer and is subject to changed based on field conditions.

Production piles shall be installed by the same method as piles designated as test piles. Pile Load Tests (Dynamic) shall be conducted on all test piles as indicated in Section 505.07 (4). PDA with CAPWAP analysis may be required for the production piles as directed by the Engineer. PDA with CAPWAP will always be used when driving and re-striking test piles and production piles where directed.

Re-striking of test piles shall be performed once for each test pile after at least 48 hours from driving the piles. Production piles may be re-struck at locations selected by the Engineer. The time between end of initial driving and re-striking shall be a minimum of two days or as directed by the Engineer after reaching the minimum tip elevation. Re-Striking shall be performed with a “warm hammer” which was warmed by striking a minimum of 20 blows at another pile or on any other suitable object.

Re-striking is defined as positioning the driving system and driving a previously installed pile after some waiting period after initial installation as determined by the Engineer. Dynamic monitoring is defined as monitoring performed with Case-Goble Pile Driving Analyzer (PDA) equipment. Gauges are attached to the pile approximately 5 foot below the pile head and connected with a cable to a monitoring station on the ground away from the piles. The gauges consist of two (2) accelerometers, two (2) strain transducers and a junction box.

During driving and re-striking, the Contractor shall maintain and operate the driving equipment in accordance with the manufacturer’s recommendations and maintain the hammer concentric with the driving train in axial alignment on the pile. The hammer shall not be used to limit deviation of the pile during driving by exerting lateral forces or striking at an angle. If damage to the pile head (as determined by the Engineer) occurs during driving and the hammer can no longer strike the pile uniformly and axially, then driving shall cease and the top of the pile shall be “fresh headed” and checked for proper fit and alignment within the helmet cap.

Jetting. Jetting shall only be permitted with the written approval of the Engineer and shall comply with all environmental and permitting requirements at no additional cost.

Outside Augering. Outside augering shall only be permitted with the written approval of the Engineer and shall comply with all environmental and permitting requirements at no additional cost.

Internal augering may be required to clean the plug formed during pile driving and reduce the driving resistance in the event a particular pile proves difficult to advance at no additional cost.

Airlifting. Airlifting shall not be used to advance the pile.

Piles shall be driven beyond the tip elevations shown on the contract drawings or as determined during test pile installation according to the provisions of the following paragraph. The required penetration resistance (blows per inch) will be determined by the Engineer based on the results of the PDA for each pier. The Engineer shall be the sole judge as to when the tip of the piles has reached the desired elevation and the required penetration resistance (blows per inch).

The driving criteria and tip elevation as well as pile bearing capacity will be verified by using Pile Driving Analyzer (PDA) measurements of the prestressed concrete test piles. A comparison with or modification of the wave equation analysis submitted under Section 524.04 may be ordered by the Engineer. A “CAPWAP” analysis (Case Pile Wave Analysis Program) shall be performed for all dynamically monitored piles. Monitoring shall be performed during full length of driving and re-striking.

The Contractor shall engage the services of a specialty subcontractor experienced in dynamic monitoring of all the piles. The stresses in the pile shall be monitored during driving to ensure that the pile is not damaged by excessive compressive or tensile stresses. The energy effectively delivered to the pile head shall be monitored during driving. The
pile capacity obtained by the pile driving analyzer shall be monitored during driving and compared to the requirements of Subsection 505.07 (4) regarding minimum ultimate soil resistance.

Test Pile Monitoring: Tentative approval of the Contractor’s driving procedure and pile tip elevation of test pile installation, and authorization to proceed with the installation of the production piles, will be issued on the basis of the Engineer’s field inspection and PDA monitoring.

However, final approval will only be issued after review of the data submitted by the specialty subcontractor. The specialty subcontractor shall submit the test data including CAPWAP analysis to the Engineer who will use this data to evaluate the Contractor’s proposed driving procedure and pile tip elevation. The Contractor shall submit this data within 48 hours of end of driving the pile.

The following specialty contractor is known to be experienced in dynamic monitoring of piles:

Goble Rausche Likins and Associates, Inc.
223 Wilmington West Chester Pike
Chadds Ford, PA 19317
Telephone: (610) 459 – 0278

The specialty subcontractor shall be selected by the Contractor. The Contractor may select a specialty subcontractor other than that indicated above subject to submission of qualifications and approval by the Engineer. Approval will be based on previous experience on similar projects involving large diameter prestressed concrete piles.

Concrete fill for prestressed concrete piles, 54 inch diameter: After the piles are driven to the required capacity, the piles shall have sand backfill (or removal) to the limits shown on the pile detail plan sheet. Tremie concrete will then be poured below the bottom of the pier cap. An 8 foot Class A concrete connection to the pile cap will then be made.

Concrete cast inside cylinder piles for the pile cap connection or for any other reason must be protected from excess heat generated from hydration. Type III cement should not be used. Low heat of hydration concrete mix designs should be used, including concrete mixes containing granulated blast furnace slag cement or fly ash, should be used to help minimize heat from hydration.

524.07 Determination of Bearing Values

This section shall conform to Section 505.07 except otherwise changed in these provisions and the following:

A. Pile Load Tests (Dynamic).

All test piles and selected production piles shall be dynamically monitored as per Subsection 524.06.

B. Pile Load Test (Static).

A load testing program consisting of one load test on a test pile as shown on the plans, or as directed by the Engineer, will be required. The test pile designated for static load testing shall be the first pile to be driven with PDA and load tested prior to the start of the construction of the rest of the piles. The testing shall be done in accordance with the procedure set forth in ASTM D1143 using quick load compression test method. The static load test shall be performed before any other test pile installation begins.

524.08 Defective Piles

This section shall conform to Section 505 and the following:

The Contractor is cautioned to ensure that piles are well seated before applying the full driving energy and to avoid using excessive energy when driving soft layers.
At all times, while driving the prestressed concrete cylinder piles, tensile driving stresses shall be maintained below allowable stress levels, particularly under conditions of low penetration resistance. When the pile point is passing through soft soil so that there is little or no resistance to penetration at the bottom of the pile, there is the possibility that that longitudinal tensile stresses will be set up in the pile shaft by the elastic shock waves traveling up and down the pile. For such driving conditions, the hammer energy must be modified. The piles shall not be subjected to excessive and undue abuse producing crushing and spalling of the concrete. Manipulation of piles to force them into proper position, considered by the Engineer to be excessive, will not be permitted. Any pile damaged by improper driving or driven out of its proper location shall be repaired, as approved by the Engineer, or removed all at the Contractor’s expense.

Furthermore, the Contractor must take all precautions to avoid pile bursting failure during driving.

A wave equation analysis shall be submitted to the Engineer for his approval prior to mobilization for pile driving. Wave equation analysis shall fully investigate appropriate pile hammer operating criteria for safely driving piles through soft and through firm soil conditions.

Very soft soils and/or water sometimes rise inside the pile to levels above original mudline/water elevation, potentially resulting in high internal pressures building up inside the pile. The Contractor shall make observations after pile setting, and during pile driving to determine whether soil and/or water is rising inside the pile. The pile shall be bailed after pile setting, before pile driving, and also any time the soil or water rises inside the pile to levels above the original mudline/water elevation. The soil and/or water shall be removed from the inside of the pile down to the level of the surrounding ground or mudline. Piles damaged by such pressures shall be replaced by the Contractor at no additional cost to the State. To reduce the effect of excess internal water pressure, the piles shall be provided with weep holes as outlined in Section 524.11. The Contractor can substitute the weep holes with a driving head which provide full venting.

Interior inspection for pile damage: For all test piles and production piles when pile damage due to high internal pressures is suspected, when directed by the Engineer, the Contractor shall bail out soil and water from inside the pile to the original mudline or lower, but not closer than 15 feet from the pile tip, as directed by the Engineer, and inspect the inside of the pile for damage. The Contractor shall provide all required equipment to allow the Engineer to assist in the inspection including: hoisting equipment, power, flashing, work platforms, push board, motorized skiff, lights, boatswain’s chair, lift, oxygen, etc. The Contractor is hereby reminded that he must comply with all applicable OSHA, Federal and local safety and environmental requirements while performing this work.

During the inspections, all cracking shall be noted as to length, width and depth, and recorded. If any of the crack criteria listed below are not met, the Contractor must modify his approach and continue the process until an accepted driving procedure and equipment are established.

Allowable cracks shall be limited to longitudinal cracks not exceeding five per section; such concrete shall be tight, allowing virtually no penetration of a penknife point; and shall show no indication of seepage. No piles shall be used that show any cracks prior to installation.

Rejection of piles. Any pile which has been subjected to tensile forces under conditions of low penetration resistance or to abuse resulting in spalling or crushing of the concrete sufficient in the opinion of the Engineer to damage the value of the pile; or which has been damaged, or driven sufficiently far out of location to impair its value to the structure, shall be repaired or removed and replaced with a suitable pile at the Contractor’s own expense. No manipulation of any pile to bring it into position or repair will be permitted unless, after an inspection of the pile by the Contractor and the Engineer, the Engineer approves in writing such manipulation or repair. Detail sketches of the proposed repair plus a complete description of the proposed repair materials shall be included. All repair work shall be at the Contractor’s own expense, with no additional cost to the State. If, while being moved into position or repaired after approval of such a proposal, a pile is subjected to forces great enough to impair its value as described above, or the completed repair is found to be unsatisfactory by the Engineer, the pile shall be removed and replace at the Contractor’s own expense. If the bearing capacity of any pile remains in question under any conditions herein described, the Contractor may proof-load test the pile in accordance with ASTM Specification D1143 for Axially Loaded Piles, Quick Test.
The manufacture of 54 inch diameter prestressed concrete cylinder piles shall conform to Division II Section 8 of the AASHTO Standard Specifications for Highway Bridges 2002, including interim revisions except herein as amended. The manufacture of precast concrete cylinder piles shall conform to Section 502 and Subsection 505.11. Prestressed concrete cylinder piles shall be manufactured by a fabricator with at least 5 years experience in the manufacturing of large diameter cylinder piles.

Pile sections shall be manufactured by the centrifugal casting process with vibration and compaction.

Forms. The forms shall be metal and must be well braced and stiffened against deformation under pressure of the wet concrete during spinning. The portions of the forms which form the end surface of the sections must be a true plane perpendicular to the axis of the sections with the following tolerances:

Maximum allowable deviation for abutting end surface 1/8 inch, for Head end surface ½ inch, and for the point end surface 3 inches.

Spiral Reinforcing. Spiral reinforcing sections have a spiral reinforcement cage, arranged and dimensioned as shown on the contract drawings. This reinforcing cage shall be securely held in position during the casting and spinning of the concrete.

Longitudinal Holes. Longitudinal holes for the prestressing strand shall be formed during casting of the walls of the pile sections. The holes shall be 1 3/8 inch (nominal diameter) and positioned as shown on the contract drawings. The spiral steel reinforcing shall be outside the tendon holes and shall have a minimum concrete cover as shown on the contract drawings.

Arrangement of Strand. The arrangement of the prestressing strand shall be in accordance with the details shown on the contract drawings.

Weep Holes. One tapered weep hole per 16 feet section shall be provided at the locations shown on the plans. The holes shall be included during the forming of the pile. The tapered diameter shall be 1 inch to 1 ½” inch. Drilling of weep holes shall not be allowed.

Steam Curing. As soon as possible after casting, the pile sections and forms shall be steam cured. The steam curing shall be in accordance with Section 502.

Handling. The method of handling the pile sections shall be such that no permanent damage to the concrete wall occurs. Care must be taken in handling to insure a minimum of spalling on the section end surface. Any section which has a greater than 10% of the end surfaces spalled to a depth greater than 0.12 inches (3 mm) will be rejected. Any section, which has any spalling or other defects on the exterior or interior surfaces, will be rejected. Any section which has honeycombing visible in a tendon hole or spiral reinforcement visible in a tendon hole will be rejected. The Engineer retains the right to reject any section that appears unsatisfactory.

Making of Test Cylinders. The fabricator of the cylinder piles shall have the equipment necessary to make two test cylinders simultaneously. That equipment shall include two operable combination vibratory table/compaction devices. The fabricator shall provide two technicians during production to make two test cylinders simultaneously. The technicians shall be present until the required number of cylinders has been made for that day’s production. Production shall be halted if two test cylinders cannot be made simultaneously. The fabricator shall insure that there is a constant and uninterrupted minimum air pressure of 80 psi (0.55 MPa) to operate the vibratory table/compaction devices. Production shall be halted if air pressure drops below 80 psi (0.55 MPa). The fabricator shall not begin production until he has demonstrated the ability to perform the above.

Pile Assembly

Concrete strength. The pile sections shall not be assembled together into a pile until the compressive strength of the concrete is at least 4000 psi.
Grout for pile joints. Pile sections shall be positioned in accurate alignment so that the axis of the pile does not deviate from a straight line more than 1/8 inch per 12 inch of length. Adjacent sections shall be positioned so that the maximum deviation of the outside surfaces at the joint will not exceed ¼ inch, and so that the maximum deviation circumferentially in the alignment of the prestressing cable holes at the joint will not exceed 1/4 inch. The abutting joint surfaces shall be covered with grout in conformance with Section 524.02 except at the core holes for the stressing. The pile sections shall be brought into contact and held together by a force producing a pressure of not less than 100 psi on the gross concrete area, while the grout sets up.

Post-tensioning. The Contractor shall calculate the required jacking force which will result in the permanent effective prestress, after losses, indicated on the contract drawings. He shall submit his calculations for the Engineer’s approval. The approved tension shall be measured by the elongation of the steel and verified by a pressure gauge on the stressing jack. When the difference between the results of the measurement and the gauge reading is more than 5%, the operation shall be stopped and the cause of the discrepancy shall be determined and corrected. The tension in the cables shall be maintained until final stress transfer, by mechanical end-locks or anchors. The Contractor's proposed method of releasing the strands shall be submitted for approval.

Grouting of Longitudinal Holes. After completion of the prestressing, each cable hole shall be completely filled with grout. The pressure of the grout shall be slowly raised to a minimum of 100 psi and a maximum of 150 psi, and held for a minimum of one minute. While grout is curing, the pile shall not be moved or handled in any manner that would result in permanent damage to the pile.

Removal of Anchorage. The transfer of the prestressing force from temporary end-locks to grouted cables shall not be done until the grout has reached a compressive strength of not less than 4000 psi. The prestressing cables shall be considered to be without slippage with the removal of the end-locks when, upon cutting the wires between the end of the pile and the anchor, with a burning torch, the wires do not part under stress with a “cup and cone” fracture but are burned through with the torch.

524.10 Extension and Splices

Splices of prestressed concrete cylinder piles will not be permitted unless absolutely necessary. A separate request for each splice shall be submitted in writing stating the reason and location of the splice. The Contractor shall submit working drawings and design calculations detailing the proposed splice to the Engineer for approval. The Engineer reserves the right to deny any splice requested by the Contractor.

Disposal of Excess Pile Material. Rejected and withdrawn piles and excess pile material resulting from cut-offs or other reasons, shall be removed from the project site by the Contractor.

524.11 Cut-Offs and Cappings

Tops of foundation piles shall be embedded in the concrete footing at least 1 foot. At locations of tremie concrete, the piles shall project at least 1 foot above the top of the seal concrete. Piles shall be cut off at the designated elevation as shown on the contract plans. The length of pile cut-off shall be sufficient to permit the removal of all injured material. When the cut-off elevation is below the elevation of the bottom of the footing concrete or cap, the pile shall be built up from the butt of the pile to the elevation needed to achieve the required embedment into the footing as described in the previous paragraph by means of reinforced concrete extensions as per section 524.10.

Cut-offs shall be made at right angles to the axis of the pile. The cuts shall be made in clean, straight lines. Cut-off portions of cylinder piles shall not be reused as production piles, or as a splice section for any portion of any production pile.

524.12 Method of Measurement

A. Test Piles, Furnished. Test Piles, Furnished will be measured by the linear foot. The length of Test Piles, Furnished, will be based on the criteria that is stated in Subsection 505.06, Subpart 4. If the required penetration for any
one Test Pile is greater than the length that has been directed, the extension length ordered by the Engineer will be included for payment in the linear feet of Test Piles, Furnished. Slices for such Test Piles will be measured for payment in accordance with the provisions of this Subsection.

B. Test Piles, Driven. Test Piles, Driven will be measured by the linear foot. The total length shall be the total linear foot that has been installed and accepted and that is measured below the cut-off elevation for all of the driven Test Piles. Lengths of piles that are used to replace Test Piles that have been previously accepted by the Engineer, but are somehow damaged before completion of the Project, will not be paid for.

C. Production Piles, Furnished. Production Piles, Furnished including buildups or extensions, as ordered by the Engineer, will be measured by the linear foot. Furnished length for test piles and production piles is measured from the cut-off to the estimated tip elevation. The Contractor shall consider any necessary length that is required to facilitate the pile driving based on their means and methods. This extra length will not be considered for payment. If the required penetration for any one Production Pile is greater than the length that has been directed, the extension length ordered by the Engineer will be included for payment in the linear foot of Production Piles, Furnished. Splices for such Production Piles will be measured for payment in accordance with the provisions of this Subsection.

D. Production Piles, Driven. Production Piles, Driven will be measured by the linear foot. The total length shall be the total linear foot length that has been installed and accepted and that is measured below the cut-off elevation for all of the Driven Production Piles. Lengths of Piles that are used to replace Production Piles that have been previously accepted by the Engineer, but are somehow damaged before completion of the Project, will not be paid for.

No separate measurement will be made for sand, tremie concrete, Class A concrete, reinforcing steel, excavation, drilling, cleaning holes, drilling fields, sealing materials, concrete, required caging and all other items necessary for and incidental to the cost of completing the work as required under this section, including storage costs of pile elements at the Manufacturer’s plans, disposal of unused piles, repair to damaged piles, and transportation costs.

The number of splices measured for payment shall be only those splices actually made and as required to drive the piles in excess of the order length furnished by the Engineer.

No separate payment shall be made, for spudding or any other method used to facilitate pile driving procedures. The cost shall be included in the price of driven piles.

The quantity of load tests to be paid for will be the number of load tests completed and accepted, except that load test made at the option of the Contractor will not be included in the quantity measured for payment.

No separate payment shall be made for anchors and test piles for load tests incorporated into the permanent structure. Pile Load Tests (Dynamic or PDA Monitoring) will be measured per unit when specified by contract documents. Restriking and a CAPWAP analysis of a dynamic load test will not be measured and will be included in the Pile Load Tests (Dynamic), Item. When Pile load tests (Dynamic or PDA Monitoring) are used, no payment for installation of test piles will be made until recorded data is submitted to the Engineer.

Furnishing Equipment for Driving Piles. Furnishing equipment for driving piles will not be measured, and payment will be made on a lump sum basis.

524.13 Basis of Payment

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST PILES, FURNISHED, PRESTRESSED CONCRETE, 54” DIA PILE</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>TEST PILES, DRIVEN, PRESTRESSED CONCRETE, 54” DIA PILE</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>PRESTRESSED CONCRETE PILES, FURNISHED 54” DIA</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>PRESTRESSED CONCRETE PILES, DRIVEN 54” DIA</td>
<td>LINEAR FOOT</td>
</tr>
</tbody>
</table>
Payment of 75 percent of the lump sum price bid for furnishing equipment for driving piles will be made when the equipment necessary for driving piles is furnished and driving of test piles has commenced. Payment for the remaining 25 percent will be made when the work of driving piles is entirely completed on an individual bridge basis. If piles are deleted from the design, or if the number of pile units is decreased, payment for the remaining 25 percent will be made without any reduction. If the number of pile units is increased, no increase in payment will be made in the total remaining 25 percent.

Payment for test piles furnished and production piles furnished will include full compensation for all costs that are involved in the furnishing and delivery of all piles to the project site.

Payment for test pile driven and production piles driven will include full compensation for all costs involved in the actual driving and cutting off of piles.

Payment adjustments for strength will be made in accordance with Subsection 914.02, Subpart E and will be applied to the lot foot for prestressed concrete piles.

THE FOLLOWING SECTION IS ADDED:

SECTION 525 - VIBRATION AND SETTLEMENT MONITORING AND CONTROL

525.01 Description

Vibration and settlement monitoring and control shall consist of the monitoring of vibration levels at any adjacent buildings/structures within 100 feet from the pile locations during foundation construction and pile installation.

This work shall consist of the following:

Pre-construction and post-construction inspections of the existing structures, as directed by the Engineer.

Developing a program to monitor the ambient and construction vibrations and settlements at the existing buildings/bridges/structures.

1. Quality Assurance: All work shall be performed under the direct supervision of a professional engineer registered in the state of New Jersey. The Engineer must have at least ten (10) years responsible experience in similar work and have available professional level capability in related geotechnical and structural evaluations and engineering.

2. Pre-Construction Inspection: At least 20 working days prior to commencing pile driving operations within 200 feet of the existing Route 36 Highlands Bridge and adjacent structures the Contractor shall make a detailed pre-construction inspection of the adjacent existing buildings/structures and report the findings to the Engineer. The pre-construction inspection report shall be 8 1/2 x 11 inch format including an index, names and responsibilities of the inspection party, notes and four by six inch color prints of photographs with date and location captions documenting the existing condition of the structures. The scope and detail of the survey shall be sufficient to serve as a reference for comparison should evidence of damage be observed during construction. The pre-construction inspection report shall also include a comprehensive plan for the vibration control and monitoring of the existing structures. The plan shall include, but not be limited to, all of the provisions described in these specifications. Among others, the plan shall include materials, installation procedures, schedule of installation, and drawings indicating the location of the monitoring points.

Prior to commencing pile driving operations within 100 feet of the existing Route 36 Highlands Bridge and adjacent structures, the Contractor shall establish survey targets along the side of the structure nearest the work location at convenient points on the substructure units nearest the proposed pier locations. The locations of the Contractor’s proposed survey targets shall be provided on working drawings submitted to the Engineer for approval.

These survey targets shall be monitored vertically and horizontally on a daily basis for a period of 5 days prior to commencing pile installation operations to establish ambient baseline data. The Contractor shall also hire the services of an experienced vibration specialist who is capable of installing baseline data. The Contractor shall also hire the services of an experienced vibration specialist who is capable of installing, operating, reading and interpreting accelerometers on the existing structure for the purpose of monitoring vibrations. The qualifications of the vibration specialist shall include at least 3 previous projects on which similar services were provided.
Prior to commencing pile driving operations within 100 feet of the existing Route 36 Highlands Bridge and adjacent structures, the Contractor shall take accelerometer readings at one or more representative substructure locations on the existing structure for 48 continuous hours to establish ambient baseline data. The Contractor’s vibration specialist shall interpret the readings and submit a vibration report to the NJDOT prior to pile driving operations adjacent to the existing structures. The report shall show the accelerometer locations and results of the ambient vibration readings at the bridges. A distinction shall be made in the report between vibrations caused with and without vehicular traffic.

Two copies of all preconstruction survey documentation, baseline survey point monitoring data, and baseline vibration data and reports shall be delivered to the Engineer prior to commencing pile installation operations.

A preliminary baseline ambient vibration study has been completed and is available to the Contractor upon request.

3. If any adjacent structure is located within 100 feet from the pile locations, and the building is supported on a spread footing, the Contractor shall use prebored holes or alternate methods to control vibrations as approved by the Engineer.

4. Vibration Monitoring and Control Program: The Contractor shall prepare a vibration monitoring program such that the adjacent buildings/existing bridges/structures are to be monitored by a minimum of three (3) monitoring points located a minimum of 10 feet apart.

Whenever pile installation operations are being first conducted at a proposed substructure unit within 100 feet of the existing Route 36 Highlands Bridge and adjacent structures, a designated representative of the Contractor shall visually inspect the portion of the existing structures immediately adjacent to the work area with the Engineer in order to document baseline conditions. One or more accelerometers shall be placed on the said existing structures at points on the existing substructure unit closest to the ongoing construction operations and vibrations shall be recorded continuously during work hours and evaluated full-time by the on-site vibration specialist during the first day of operations, and reviewed once daily thereafter. In addition, the pre-established survey targets shall be surveyed vertically and horizontally on a twice-daily basis. A copy of all data and evaluations shall be provided daily to the Engineer.

The Contractor shall commence pile installation operations for each substructure unit at the point closest to the existing bridge structures. If the vibration levels monitored by the accelerometers during pile installation operations exceed a peak particle velocity of 1.0 in/sec above that caused by vehicular traffic passing in the ambient condition, and/or any survey target is observed to move more than 1/8” vertically or 1/8” horizontally, the Contractor shall cease operations and inform the Engineer. The Engineer will then perform an initial inspection of the portion of the structure adjacent to the Contractor’s operations. If no indication of significant damage is found, i.e. noticeable deformation, that may impact the operation of the movable span and/or the integrity of the structure, or observed cracking of structural members, the Contractor may resume operations and maintain vehicular traffic on the existing structure while the Engineer simultaneously monitors and observes the structure to evaluate if it is sustaining damage or excessive deformation. If no significant damage or excessive deformation is observed during the initial operations, the Contractor may proceed with traffic maintained on the existing structure, however, the Engineer will perform daily inspections of the portions of the structures adjacent to the Contractor’s work areas.

If it is determined within 48 hours of conducting any pile installation operations that there is imminent or actual observed damage to the existing Route 36 Highlands bridge and adjacent structures, operations in the vicinity of the structure shall cease. The Contractor shall evaluate proposed modifications to his operations and/or the existing structures to mitigate damage to the adjacent structures and submit the proposed changes to the Engineer for review and acceptance prior to resuming operations.

Vibration and movement monitoring shall be performed daily for the full duration of the driving operation or as otherwise directed by the Engineer. The results of the monitoring shall be reported to the Engineer daily or as otherwise directed by the Engineer.

In the event that the Contractor does not follow the vibration monitoring and control provisions described above, then he shall be responsible for the cost of any necessary repairs to the existing buildings/bridges/structures in addition to liquidated damages caused by the loss of use for the public.

5. Post-Construction Inspection: The Contractor shall make a detailed post-construction inspection of the existing buildings and report the findings to the Engineer. The post-construction inspection report shall be 8 1/2 x 11 inch format including an index, names and responsibilities of the inspection party, notes and four by six inch color prints of
photographs with date and location captions. The report shall include all the results of the monitoring program. Seven color copies of the report shall be submitted to the Engineer a maximum of ten days after completion of pile driving. The Contractor shall be responsible for any damage caused by his activities.

6. **Predrilling:** Predrilling shall only be used for the purpose of vibration control and only with the approval of the Engineer. The locations and depths of Predrilling shall also be subject to the approval of the Engineer.

Predrilling shall only be used to penetrate obstructions or hard soil layers, and shall be to the minimum depth required for this purpose. In no case shall Predrilling extend below the minimum pile tip elevation shown on the Plans, or determined by the Engineer.

Predrilling shall be conducted in a manner such that the load carrying capacity of the piles already in place will not be impaired nor will damage to adjacent structures and utilities occur.

The diameter of the auger used for Predrilling shall be as follows:

1. For round piles, not less than 1 inch or more than the average nominal diameter of the piles.
2. For square piles, 2 to 3 inches less than the nominal diagonal dimension of the pile, unless otherwise authorized.

7. **Noise Monitoring:** NJDOT will provide a noise monitor whenever required during construction. The Contractor is made aware of the following requirements:

A. Noise monitoring during test piles operations will determine which piers will require monitoring for piping plover. If during the test pile driving the noise levels exceed or approach 6dBA, monitoring will be required for the pile driving of those piers.

B. If test piles are to be driven during the restricted time period, monitoring of plovers will have to be done during the test. If there is a noticeable, negative reaction to the pile driving by the plovers, the NJDOT monitor has full authority to stop the test pile operation.

C. Monitoring of plovers will be required during the pile driving for the piers that are identified during test driving as a potential risk. Monitoring may only be required for the first few piles for each pier if there is no noticeable negative reaction by the plovers. If there is a negative reaction, the NJDOT monitor has full authority to stop work. If work is stopped, the Contractor is required to provide additional means to muffle the noise. The pile driving can then proceed, but with continued monitoring of plovers. If the additional muffling devices are not successful at mitigating the disturbance, work will stop until such means are developed to reduce noise or the driving is discontinued until after the restricted nesting period.

D. If plover monitoring during the first few piles of each pier shows no effect to plovers, plover monitoring for the remaining piles for that pier will not be required. However, USFWS requires daily noise monitoring of the remaining piles to insure that there is no significant deviation in the noise levels for the remaining piles.

---

**525.03 Basis of Payment**

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIBRATION MONITORING AND CONTROL</td>
<td>LUMP SUM</td>
</tr>
<tr>
<td>PREBORED HOLES</td>
<td>LINEAR FOOT</td>
</tr>
</tbody>
</table>

Payment for monitoring existing structures and noise monitoring will include full compensation for all costs involved in performing baseline inspections of the existing structures, establishing survey targets on the existing structures, providing survey readings of said targets, providing services of a vibration specialist and vibration monitoring of the existing structures with seismographs, analysis of damages to existing structures, development of proposed repair procedures, all in accordance with these special provisions and preparing mitigation measure for adverse noise levels on the project. Twenty- five percent payment will be made after all baseline surveys have been completed, submitted and accepted by the Engineer. Twenty- five percent payment will be made after the successful completion of Stage 2. Twenty – five percent payment will be made after the successful completion of Stage 3 and the remaining twenty-five percent will be made at substantial completion of the
THE FOLLOWING SECTION IS ADDED:

SECTION 526 – PREFABRICATED ALUMINUM BUILDING SPECIFICATIONS

526.01 Description.
This work shall consist of furnishing and installing one (1) Entrance Station and three (3) Toll Booth structures, all with weatherproof roof conforming to the following specifications. All buildings are to ship completely assembled. Masonry is to be completed after installing of the buildings. Design calculations and working drawings shall be submitted according to Subsection 105.04.

See Contract Plans for required dimensions of Entrance Station and Toll Booths.

Electrical service supply and connection is not included in this section.

Foundation work shall be included in this item. See Contract Plans for foundation notes.

Masonry work shall be included in this item. See Contract Plans for details.

526.02. Materials.
Entrance Station (1) and Toll Booth (3)

1. Structural Framework
Structural members to be extruded aluminum angles, channels, and tee sections of structural alloy 6063T6, anodized 204R1, with ribbed pattern exterior surfaces.

2. Wall Panel
Wall panels to be 5/8” high-impact resistant and expansion resistant insulating Redex board. Wall panels to carry a five (5) year warranty from swelling due to moisture absorption.

3. Finish
Anodized aluminum, diamond embossed sheet permanently laminated to exterior side. Interior to have vinyl walnut wood grain surface.

4. Floor Structure
Floor structure to be integral part of the building with solid waterproofing insulating core fit tight against wall panels and fastened to bottom structural base frame. Buildings commercial grade ceramic tile, standard in a beige color.

5. Ceiling
Ceiling panel to be 1” thick, high impact resistant, and expansion resistant insulating Redex board with white vinyl permanently laminated to interior side, and plastic protective sheet laminated to upside. Ceiling panel to carry a five (5) year warranty from swelling due to moisture absorption.

6. Doors
Doors to be of anodized aluminum, 1” tubular construction and half-glazed. Bottom portion to include panel finish to match interior and exterior building walls.

6.1 Sliding door to be ceiling suspended in overhead track assembly and shall be fully weather-stripped. Sliding doors shall incorporate a maximum security laminated hook bolt deadlock with removable cylinders.

7. Windows
Windows shall be tinted with blinds, and have anodized aluminum frames and inserts and to be industrial quality with active window panel to slide horizontally on stainless steel, ball-bearing rollers (plastic rollers are not
acceptable). Windows to include inside positive locking device. Exterior window sill height to be 38” (inside sill height 34” from finished floor.)

8. Glass-Glazing
Glass in sliding windows and doors to be 1/8” clear tempered glass. Fixed windows to be glazed with clear tempered glass.

9. Shelf
Furnish 22” deep, full-width shelf, per plans, 32” a.f.f. and with walnut wood grain plastic laminate to match interior walls.

10. Electric Service
Electrical service to include single phase, 150 amp capacity load center, pre-wired in conduit, with one 230V circuit and four 115V circuit capacity (2 spare circuits). Furnish one duplex 115V outlet and one 230V outlet. Electric work to be in conformation with the National Electric Code. All electrical components to bear the UL label. See Contract Plans for outlet and lighting locations.

10.1 Lights to be fluorescent type fixture with acrylic lens (tubes to be furnished by others).

11. Exterior Roof
Exterior waterproof roofs include ribbed anodized fascia trim, matching structuralss with integral, self-contained gutters.

12. Air Conditioning

13. VMS Capability (See Contract Plans for locations)

13.1 Capability above south window to indicate lane open or closed. Minimum 20 characters long and 12 inches high, multicolored. Red and Green.

**Entrance Station – One (1) Unit**

1. Heating

2. Wired for Telecommunications
   i. Phone service – wired for multiple lines
   ii. Internet Service
   iii. Radio base station with external antenna
   iv. Closed circuit monitors with cameras at the fee plaza, Gatehouse, and throughout the park
   v. Control for all four (4) automated lanes including operation of gates and lights
   vi. VMS controls for four (4) lanes
   vii. Traffic counters with “real time” stats in four (4) lanes monitored in Entrance Station

3. ADA accessible

4. Kitchenette with small sink fridge, microwave and storage

5. One (1) secure entry door on north side with peep hole. (See above for Door specifications.)

6. One (1) visitor contact window on west side ADA compliant (See above for Window Specifications.)

7. One (1) visitor contact window/door on east side (1/2 door able to shut and window remain open.) (See above for Window Specifications.)

8. Sliding windows on all sides. (See above for Window Specifications.)
9. VMS (36”x48”) capabilities on south side with parking lot status. Green for lot open, red for lot full.

10. Outside spotlights controlled from inside station.


12. Entrance station sign with arrowhead on south side of building.

13. Stop sign that can swing out to be used if necessary.


15. Single Pedestal Desk (48” Wide x 30” Deep x 29 ½” High)

16. Swivel Chair (Heavy Duty)

17. 3-Vinyl Chairs (Heavy Duty)

18. Rectangular Waste Basket


**Toll Booth – Three (3)**

1. Phone service

2. VMS (36”x48”) capability attached to south side of booth, controlled in Entrance Station and Gatehouse

3. Windows on all four (4) sides able to slide open. (See above for Window Specifications.)

4. Window/door on west side. (1/2 door with sliding window.)

5. Collision absorbers south of booths with Fee schedule attached to front.

**526.03 Construction.**

1. **Product Construction**

   Entrance Station and Toll Booth Buildings to be of aluminum construction, with natural satin anodized aluminum exterior surfaces. All anodized aluminum surfaces to carry a five (5) year warranty from surface deterioration caused by oxidation. Building heights to be 86 9/16”, or 88 1/8” including rimfit exterior roof.

   1.1 Fasteners used to manufacture and assemble buildings to be corrosion-proof type and to permit on-site replacement of damaged components. Welded fabrication is not acceptable.

**526.04 Method of Measurement.**

1. **Entrance Station**

   The Entrance Station will be furnished and installed on a Unit basis. (Total of 1 Unit)

2. **Toll Booth**

   The Toll Booths will be furnished and installed on a Lump Sum basis. (Total of 3 Units)

**526.05 Basis of Payment.**

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTRANCE STATION</td>
<td>LUMP SUM</td>
</tr>
<tr>
<td>TOLL BOOTHS</td>
<td>LUMP SUM</td>
</tr>
</tbody>
</table>

**ROUTE 36 OVER THE SHREWSBURY RIVER**

**HIGHLANDS BRIDGE**

**MONMOUTH COUNTY**
All costs associated with providing the Entrance Station and Toll Booths including fabrication, delivery, installation, foundation construction, excavation, masonry work, etc. shall be included in the unit cost of the respective pay items.

THE FOLLOWING SECTION IS ADDED:

SECTION 527 – TILES

527.01 Description.

This work shall consist of furnishing, fabrication and installation of mosaic tiles as shown on the drawings. In addition to the number of tiles required to be placed on structures, two spare tiles of each size and type shall be furnished. Unused spares will be the property of the Department and will be delivered to the Engineer at the completion of the project.

527.02 Materials.

Glazed ceramic porcelain mosaic tiles shall be fabricated in the size shown on the plans. The bisque shall be made from earthen bisque or feldspar of a thickness of 3/8”. The glaze shall be hand painted on the bisque. The bisque shall be fired at 1800 degrees F. and the glaze shall be fired at 235 degrees F. in a reduction atmosphere.

Tiles shall meet the following specifications:

<table>
<thead>
<tr>
<th>Test Name</th>
<th>Procedure</th>
<th>ANSI Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Absorption</td>
<td>ASTM C373</td>
<td>0.5% (impervious)</td>
</tr>
<tr>
<td>Frost Resistance</td>
<td>ASTM C1026</td>
<td></td>
</tr>
<tr>
<td>Crazing Resist.</td>
<td>ASTM C424</td>
<td>1 Cycle – 150 psi</td>
</tr>
<tr>
<td>Thermal Shock</td>
<td>ASTM C484</td>
<td>No Disintegration</td>
</tr>
<tr>
<td>Bond Strength</td>
<td>ASTM C482</td>
<td>50 psi or greater</td>
</tr>
<tr>
<td>Scratch Hardness</td>
<td>7 to 9</td>
<td></td>
</tr>
<tr>
<td>Breaking Strength</td>
<td>ASTM C648</td>
<td>250 pounds</td>
</tr>
<tr>
<td>Resistance</td>
<td>ASTM C1027</td>
<td></td>
</tr>
</tbody>
</table>

Ceramic tile shall be back-mounted onto fiber mesh or other suitable material. The mesh shall become an integral part of the tile installation. Back-mounted tile assemblies shall have sufficient exposure of each tile to comply with the bond strength requirements.

The manufacturer of the tile and tile setting products shall be a company specializing in the manufacturing of products specified on the plans and in this section, with at least ten (10) years of experience. Shop workers shall be thoroughly trained, have a minimum of five (5) years of experience and be capable in the necessary craft to provide quality work and shall demonstrate the following:

1. Production capability to meet the project schedules;
2. Artistic capability to faithfully produce the tiles in quality, dimension, color, texture and finish.

The Contractor shall submit samples of the type of tiles to be provided, to the Engineer, prior to ordering the production tiles. Do not order production tiles prior to approval of these samples.

Setting materials shall comply with pertinent recommendations in the Tile Council of America “Handbook for Ceramic Tile Installation”.

Bond coat shall be dry-set mortar, commercially prepared mixture or Portland cement, with sand and additives imparting water retentivity and used as a bond coat for setting clay tiles. Only potable water need be added to the dry-set mortar.
Grout shall be dry-set grout, commercially prepared mixture of Portland cement, with sand and additives imparting water retentivity and suitable for clay tile installation. Only potable water need be added to the grout. Grout color shall be approved by the Engineer.

Final colors of tile shall be as shown on the Plans, and shall match the appropriate Federal Standard 595B Colors.

527.03 Methods of Construction.

The Contractor shall examine the areas and conditions under which this work is to be performed, correct conditions detrimental to the timely and proper completion of the work, not proceed until unsatisfactory conditions are corrected, comply with ANSI A108.1 for the installed in Portland cement mortars and the “Handbook for Ceramic Tile Installation” of the Tile Council of America except as directed by the Engineer.

Specific instructions are as follows:

1. Dampen wall surfaces before mortar application;
2. Tiles do not require water soaking for installation;
3. After tiles have been set, apply grout and remove excess from faces of the tiles;
5. Maintain minimum temperature limits and installation practices recommended by the materials manufacturers.

Mosaic ceramic tile shall be cleaned after installation using only soap and water. A continuous covering of laminated, reinforced, non-staining kraft paper shall be installed for protection until acceptance. Such protection shall be maintained until removal is ordered by the Engineer. Upon removal, mosaic tile shall be cleaned again as directed by the Engineer.

527.04 Installation.

Prior to the preparation of shop drawings, the panel installer shall visit the site and examine the job conditions and verify field measurements as necessary to ensure a perfect fit of the tiles to the concrete pilasters, bollards, and abutment monuments. Any conditions that could adversely affect the installation shall be reported to the Engineer. The installation shall not proceed until such adverse conditions have been resolved to the satisfaction of the Engineer.

527.05 Method of Measurement.

The quantity of tiles will not be measured.

527.06 Basis of Payment.

No separate payment will be made for supplying or installing tiles, or for any work associated with preparing surfaces to receive the tiles, the cost thereof shall be included in the appropriate concrete pay item.

THE FOLLOWING SECTION IS ADDED:

SECTION 528 - PRECAST CONCRETE SEGMENTAL CONSTRUCTION

528.01 General

1.1 Description

The work specified in this Section consists of manufacturing structural precast concrete segments and the storage, transport and erection of those segments into the completed structure. The final structure shall conform to lines, grades and design dimensions shown on the plans and with the provisions of these Specifications. This work also includes reinforcing steel embedded in the segments along with cast-in-place closure joints.
Except as modified herein, all construction and materials shall conform to the New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction (2001), other Specifications, Technical or Special Provisions designated for the Project (hereinafter referred to as the "Project Specifications").

The Contractor must provide key personnel on the project with past experience on precast segmental bridges. Each of these key personnel shall have worked in a similar capacity on the construction of at least one precast segmental balanced cantilever bridge in the past 10 years. The key personnel are as follows:

- Project Manager or Assistant Project Manager
- Erection Superintendent or Assistant Erection Superintendent
- Casting Superintendent

Resumes of these three key personnel shall be submitted by the Contractor prior to precasting or erection of the segmental bridge. The Contractor shall not perform any of the work involved in precasting or erection of the segmental bridge, until the Department has approved, in writing, the three key personnel identified above. Additionally, the Contractor is required to maintain throughout the duration of the project, in their respective positions, the three approved key personnel. If there is a need to replace any of the three key personnel during the course of the project, the proposed replacement(s) must have equivalent experience as stated above and must first be approved, in writing by the Department.

1.2 Definition of Terms

The following terms apply to segmental bridge construction:

1. Segment: Refers to a modular section of the superstructure and/or substructure consisting of a certain cross-section shape and length as detailed on the plans.

2. Match-Cast: Refers to a precast concrete fabrication process whereby a segment is cast against the preceding segment producing a matching interface that will permit the reestablishment of the cast geometry at the time of erection. Match-casting may be accomplished by either the short-line or long-line casting method.

3. Short-Line Casting: A method of casting segments one at a time in a casting cell between a bulkhead at one end and a previously cast segment at the other. The first segment is cast between the bulkhead and another temporary bulkhead.

4. Wet Joint System: A method whereby segments are made in a casting cell between two bulkheads and are not match-cast. Subsequently the segments are erected in the superstructure with a narrow cast-in-place joint between each segment. (During erection, all segments of a span or multiple spans are supported by falsework, truss or other techniques until the joints have gained strength and the longitudinal post-tensioning installed to make the segments self supporting.)

5. Casting Cell: Refers to a special formwork arrangement usually consisting of a fixed vertical bulkhead of the cross-section shape at one end and adjustable soffit, side and core forms all designed and assembled into a machine for making a single superstructure segment. A casting cell for a substructure pier shaft segment would consist of exterior and interior side forms and a soffit form of the cross-section shape.

6. Balanced Cantilever (Erection): A method whereby the segments are sequentially erected, in cantilever, alternately on either side of the pier to a point where a closure is cast-in-place with an adjacent span or cantilever.

7. Casting Curve or Casting Curve Geometry: The curve of casting geometry that has to be followed in the casting cell or bed in order to achieve the theoretical bridge profile and alignment after all the final structural and time dependent (creep and shrinkage) deformations have taken place. The casting curve is a combination of the theoretical bridge geometrical profile grade, alignment and the camber.

8. Camber: The amount by which the concrete profile at the time of casting must differ from the theoretical geometric profile grade in order to compensate for all structural dead load, post-tensioning, all long-term time dependent deformations (creep and shrinkage) including all the intermediate erection stages and effects (the opposite of deflections).

9. Erection Elevation: The elevation to which a segment is to be set in the structure at the time it is erected (this is not necessarily the profile grade but rather the profile grade corrected by the amount of deflection calculated to occur from that stage onwards).
10. Precaster: The firm or organization responsible for manufacturing the precast concrete segments (this may be the Contractor or his Sub-Contractor).
11. Erector: The firm or organization responsible for the erection of the precast concrete segments in the final structure (this may be the Contractor or his Sub-Contractor).
12. Engineer: The firm or organization responsible for the structural design of the structure.
13. Supplier: The firm or organization responsible for supplying certain proprietary hardware or equipment for incorporation in the structure.

1.3 Contractor Proposed Options

The Contractor may propose, for consideration by the Engineer, certain variations from the construction and erection schemes shown in the contract documents. Any approved options shall be performed at the Contractor's expense without an increased payment to or allotted construction time. Any proposed options must meet the design, material, and construction specifications and submittal requirements.

Options for construction details covered by this section are limited to the following:

1.3.1 Prestressing

Optional post-tensioning systems or layouts such that the proposed optional systems meet the requirements specified hereinafter and the Special Provision for Post-Tensioning System.

1.3.2 Segment Lengths

For all types of superstructure construction, segment lengths shall not be altered without the review and approval of the Engineer. The Contractor shall provide all related changes necessary to change segment lengths and shall submit changes to the Engineer for review as part of the submittal. Any resulting change in the post-tensioning layouts shall meet the requirements specified hereinafter and the Special Provisions for Post-Tensioning System. There shall be no adjustment in the contract price or time due to such change of segment lengths.

1.4 Overall Restrictions to Contractor Proposed Options

Any modification with regard to method of superstructure construction or prestressing system differing in any respect from the structure as designed and detailed on the plans shall comply with the following:

- The span lengths, exterior shape, dimensions and appearance shall not be changed from those on the contract plans - with the above exception (Art. 1.3.2).
- The Contractor demonstrates that any proposed option or modification meets the "Design Criteria" noted on the plans and the Specifications. Any alternate that causes deviation of stresses, temporary or permanent, shall be proposed with measures to satisfy all design criteria and intent. Additional costs shall be borne by the Contractor.
- Stressing blocks for any optional or modified permanent prestressing system's anchorages shall only be located within the slab, within the webs of box girders, within reinforced stressing blocks or within partial depth diaphragms of the box girder. Stressing blocks for any temporary prestressing system anchorages may be located within the slabs, in partial depth diaphragms within the box girder, in external systems temporarily anchored to the girders and removed after use or a combination of any of the above methods. All construction added outside the box girder for temporary prestressing shall be subsequently removed to restore the girder to the designed cross section and visual appearance shown on the plans and as approved by the Engineer.
- Any precast, match-cast proposal shall utilize the multiple shear key concept - single shear keys will not be permitted.

1.5 Acceptance of Contractor Proposed Options

Options will be evaluated by the Engineer for factors such as utility, cost, schedule, appearance, maintenance, durability, and other factors, which shall be equal to or better than the design on which the Contract Documents are based.
1.6 Shop Drawing Requirements

Shop drawing submission shall be in accordance with the requirements of Subsection 105.04. Shop drawings shall be 22 by 36 inches in size, smaller sizes will not be accepted.

The contractor shall submit detailed shop drawings, which include, but are not necessarily limited to, the following:

1.6.1 Precast Segment Fabrication System

Complete details of the proposed precast segment fabrication system, including casting forms, their foundations, operational details, casting yard layout and precast geometry control observation and measuring system. The casting form details may be provided by presenting a generalized drawing with a table of specific dimensions for the various segment forms.

1.6.2 Precast Segments

Complete, detailed integrated shop drawings of the precast superstructure and substructure segments. These submittals shall include, but not necessarily limited to, the following:

1. Fully and accurately dimensioned views showing the geometry of each segment including projections, recesses, notches, openings, blockouts, and the like.
2. Details of mild reinforcing steel to scale clearly shown as to size, spacing, location, splices and rebar bends, cover, rebar clearances in conformance with AASHTO as well as special reinforcing steel required for the performance of the anchors but not shown on the contract drawings.
3. Details of inserts or lifting holes including any necessary localized strengthening and the materials and methods to fill and finish such holes.
4. The size, type, and components of the post-tensioning system to be used. Indicate duct type, size and support spacing. Locate all relevant details and grout inlets/outlets. Post-tensioning alignments shall be in accordance with the plans unless Contractor proposed variations require changes in which case horizontal and vertical profiles shall be fully detailed.
5. Fully integrated drawings to scale and in sufficient detail to show the relative positions of all the items that are to be embedded in the concrete, and their embedment depth. Such embedded items include the prestressing ducts, vents, grout tubes, anchorage reinforcement and anchorage hardware, reinforcing steel, anchor bolts, drainage assemblies, utility conduits, inserts, and other such items. Such drawings shall be adequate to ensure that there will be no conflicts between the planned positions of any embedded items, and that the concrete cover and all rebar clearances are adequate and allow for proper placement and consolidation of concrete. Prior to submittal, the Contractor shall review these drawings to determine the absence of reinforcement and tendon or embedment conflicts. If during the preparation of such drawings conflicts or inadequacies are discovered, the Contractor shall revise the working drawings for one or more of the embedded items as necessary to eliminate the conflicts and provide proper cover and clearance. In the event of conflicts between post-tensioning hardware and reinforcement, the location and details of post-tensioning hardware generally takes precedent over the location of mild reinforcing steel. Unresolved conflicts shall be called to the attention of the Engineer at the time of the submittal. The Contractor shall be solely responsible for any and all effects of conflicts found during fabrication.

Where variations are made to segment geometry and dimensions, appropriate details of changes to reinforcing clearly showing the size, spacing and location, including any special reinforcing steel required but not shown on the Contract plans, with clear and concise cross-reference to the appropriate Contract plans to which the variations apply.

1.6.3 Post-Tensioning System
Complete details for the post-tensioning ducts, anchorage hardware, any additional anchorage reinforcing, inserts and lifting devices to be embedded in the segments. For any Contractor proposed options, a complete geometric layout for each post-tensioning tendon shall also be submitted.

1.6.4 Casting Manual

A manual for the casting and geometry control of the segments prepared by the Contractor or his Engineer in accordance with the information provided in the Contract Plans and Documents or as required by this specification. (This is referred to as the "Casting Manual")

Casting curves prepared by and in accordance with the casting and erection methods, schedule, loads, and material properties proposed by the Contractor. The casting curves shall be of sufficient accuracy to allow the determination of control point settings for accurately casting the segments.

Preparation of the casting curve shall recognize all deviations from straight line and deformations due to the final required alignment, self-weight, future superimposed dead loads, erection loads, post-tensioning stresses including secondary moments, creep and shrinkage. Each casting curve submittal shall be accompanied by all information (loads, casting and erection schedules, material properties, etc.) considered in its development. In developing casting curves, deformations due to creep and shrinkage and the concrete modulus of elasticity shall be computed using the recommendations of CEB-FIP Model Code for Concrete Structures or ACI 209. CEB-FIB stands for Comite Euro-International De Beton-Federation Internationale De La Precontrainte.

Preparation of casting curves is dependent upon the erection sequence and the Contractor's schedule. Thus, if the Contractor proposes a change to an erection procedure that was previously approved, he shall develop a new casting curve in the same manner as required for the original casting curve. The Engineer may waive submittal of a revised casting curve if he considers the change to erection procedures as insignificant. With submittal of a revised casting curve, the Contractor shall include a proposed method(s) and location(s) for transitioning between the current curve(s) in use and the submitted curve(s). Preparation of casting curves shall be done at no additional cost and considered incidental to the contract.

The Contractor shall provide the casting geometry control procedures that he intends to use for precast substructure segments to the Engineer for review and approval.

1.6.5 Handling, Storage and Transport of Segments

Complete details of handling, storing and transporting segments. These details shall include, for each type of segment, the method of lifting (location of any inserts, configuration of lifting devices, etc.) and the method of supporting segments during storage and transportation, the planned route for transporting the segments and the axle loads for the segment transporter. The details shall be accompanied by calculations indicating that the forces imposed on a segment during lifting, storage and transportation will not adversely affect the structural adequacy of the segment.

If the segments are to be stacked, calculations showing the stresses induced by stacking shall be prepared and submitted for approval.

1.6.6 Erection Manual

A manual for the detailed step-by-step erection of the segments including all intermediate procedures relating to any erection equipment, falsework, movement of equipment, counterweights, support jacking, stressing of temporary post-tensioning bars, closure operations including any partial stressing across the closure during concrete curing, location and size of shim blocks, main post-tensioning tendon sequences, stressing loads and tendon elongations, erection elevations, the field survey and
alignment control methods to be employed for setting the initial and subsequent segments and any other relevant operations. (This is referred to as the "Erection Manual")

Three (3) copies of the Erection Manual shall be submitted to the Engineer 40 days prior to the proposed start of erection operations. One (1) copy of the final, accepted, Erection Manual shall be provided to the Engineer.

The detailed step-by-step procedure for erection of segments shall include the sequence in which these items are to be erected along with a table of theoretical elevations and alignment of the geometry control points as established during casting of each segment and computed at each stage of erection. Stages for which theoretical positions of control points are to be computed shall include the segment in place prior to applying post-tensioning and the segment with post-tensioning applied.

The theoretical position shall be computed taking into consideration:
1. Effect of as-cast geometry established from surveys during casting of segments.
2. Effects of construction dead and live load, as applicable.
3. Effects of post-tensioning.
4. Effects of creep and shrinkage.
5. The required final profile of the roadway as shown in the plans.

The procedure shall also include a method for measuring and recording the elevations and alignment of all control points at each stage of erection.

The Contractor shall submit a new erection procedure at any time that he proposes to deviate from the sequence and schedule of erection contained in an approved erection procedure under which he is operating. If the Contractor proposes an erection procedure that is different from the assumed procedure in the contract plans that requires a structural analysis, the Contractor will pay for the Engineer to perform the analysis at a rate of $150/hour.

For substructure segments, the Contractor shall provide an erection survey procedure for review and approval by the Engineer.

The Contractor shall provide notification to the First District U.S. Coast Guard at least 45 days prior to initiating any work over or in the waterway that may present an obstruction or hazard to navigation.

1.6.7 Field Survey and Erection Control

Field survey and alignment control methods to be employed for setting the initial and subsequent segments are the sole responsibility of the Contractor. One (1) copy of the field survey records shall be provided to the Engineer in a timely manner to allow review prior to the Contractor’s use of the information.

1.6.8 Construction Equipment and Load Testing

Complete details covering equipment to be used to handle segments and incorporate them into the structure, details related to access of post-tensioning stressing equipment, erection methods to be used, the sequence of erection, all loads to be imposed on any portion of the permanent structure by the erection equipment and details covering the time, location and all procedures for load testing of erection equipment.

1.6.9 Calculations

All calculations shall be prepared under the direction of, and signed and sealed by, a Professional Engineer registered in the State of New Jersey, to show that the loads imposed on the permanent structure by the erection, equipment, and in the handling, stacking or storage of precast segments, will
not adversely affect the structural adequacy of the permanent structure, nor exceed allowed stresses during the construction process.

1.6.10. Contractor’s Quality Control

The Contractor (and Precaster) are responsible for all quality control for the production of precast segments for any part of the structure (superstructure and, where required, substructure). Furthermore, the Contractor (and Erector) is (are) responsible for all quality control for installation and erection of the segments and for the construction of all cast-in-place joints and closures.

The Contractor shall submit his detailed Quality Control Plan (QC Plan) for segment casting for the review and approval of the Engineer at least 30 days prior to the commencement of any segment production. The Contractor’s Quality Control Plan shall not be approved if it does not follow the test methods, procedures and frequencies as required in the 2001 New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction. Likewise, the Contractor shall submit his QC Plan for erection to the Engineer for review and approval at least 30 days prior to the start of segment erection operations. Each plan shall clearly define the QC procedures, QC personnel, frequency of QC activities, remedial actions if required and other items that are needed in a detailed QC Plan.

The Contractor (and Precaster) shall provide the Engineer’s precast inspector with copies, on a daily basis, of all quality control reports, documents and material certifications related to the fabrication of all precast concrete segmental units. This information shall include but is not limited to, pre and post pour casting reports, concrete batching and delivery tickets and any other information requested by the Engineer. The Contractor (and Precaster) shall also provide the Engineer’s precast inspector with copies of all reports related to the production of concrete supplied for the fabrication of precast concrete segmental units. This information shall include, but is not limited to, cement certifications, coarse and fine aggregate delivery tickets, admixture delivery tickets and certifications, equipment calibration and certification reports and any other Quality Control testing activities as required by the approved Quality Control Plan.

All Quality Control activities related to the production of the precast concrete segmental units shall be performed at a frequency greater than or equal to that specified in the Standard Specification or the Special Provisions. The Contractor and/or Fabricator shall be responsible for the sampling and testing of fresh concrete to be used for the precast concrete segmental units. Further, the Contractor and/or Fabricator shall be responsible for the molding, curing and testing of concrete compression test cylinders. All activities, equipment and facilities related to the molding, curing and testing of concrete compression test cylinders shall be provided and maintained by the Contractor and/or Fabricator at no additional cost to the Engineer. All molding, curing and testing of concrete compression test cylinders shall take place at the precast fabrication yard or plant, convenient to the fabrication activities.

Partial payments for mobilization of segmental production and casting, under the Special Provision for Precast Segmental Casting Forms and Erection Equipment, shall not be made until the Contractor’s Quality Control Plans for the segment production and erection, respectively, have been approved by the Engineer.

528.02 Materials

2.1 General
All materials shall be new and shall conform to the requirements contained herein.

2.2 Concrete
All concrete shall conform to the added subsection titled “HIGH PERFORMANCE CONCRETE (HPC) – PRECAST/PRESTRESSED AND CAST-IN-PLACE/PRESTRESSED CONCRETE ELEMENTS” in Section 502 of the Project Specifications except as modified herein. Gradation for coarse aggregate utilized in the
Concrete for segments shall be such that 100 percent passes a one-inch sieve. Screenings will not be permitted as a substitute for silica sand in concrete for precast segments.

The class of concrete for use in each element of construction shall be as shown in the plans. Concrete used to cast closure joints between superstructure segments, cast-in-place pours and transverse ribs shall be the same mix design as that used to cast the segments.

2.3 Reinforcing Steel

All reinforcing steel shall conform to the Project Specifications and shall be ASTM A-615, Grade 60, Epoxy Coated Reinforcement where shown on the Plans. When permitted by the Engineer, welded reinforcing grillages shall be shop prepared and shall conform to the requirements of the American Welding Society's Structural Welding Code D1.4. Field welding of reinforcing steel shall not be permitted.

2.4 Ducts for Post-Tensioning Tendons

Ducts to be embedded in or external to superstructure and substructure segments shall conform to the requirements of the Special Provision for Post-Tensioning System.

2.5 High Performance Grout for Bearing Plinths

High performance grout for bearing plinths as shown in the Plans shall be High Performance Grout that is ready-to-use, non-shrink, non-corrosive, non-metallic and achieves a high early strength (5000 psi in one day). High Performance Grout shall be Dayton Superior Sure-Grip High Performance Grout or an equal approved by the Engineer that meets the requirements of ASTM C-1107 Specification for Non-Shrink Grout, Grades A, B, & C and requirements of ASTM C-827.

2.6 Utility Supports

Ducts to be embedded in or external to superstructure to accommodate utility conduits shall be PVC ducts and shall conform to the requirements of the Special Provision for Post-Tensioning System.

Utility supports embedded in the superstructure to accommodate utility conduits shall conform to the Contract Plans. Catalog cuts detailing the utility support to be used shall be submitted to the Engineer for approval.

528.03 Equipment

3.1 General

Design calculations prepared under the direction of, and signed and sealed by, a Professional Engineer registered in the State of New Jersey shall be submitted for any erection equipment, falsework, and other temporary construction which may be required to accomplish the work. These calculations shall only be checked to ensure that they have been properly signed and sealed by a Professional Engineer registered in the State of New Jersey. The Engineer will not review the calculations for any erection equipment, falsework, and other temporary construction which may be required to accomplish the work.

Prior to the use of special erection equipment, the equipment shall be personally inspected by the Contractor's Engineer who shall certify to the Engineer in writing that it has been fabricated in accordance with the submitted drawings and calculations. In addition, after assembly, the Contractor's Engineer shall observe the equipment in use and shall certify to the Engineer in writing that it is being utilized as intended and in accordance with the submitted drawings and calculations. In each case, the Contractor's Engineer shall also sign and seal the letter of certification.

After the erection or installation of falsework and shoring, that requires the submittal of design calculations or shop drawings, but prior to the application of any superimposed load, the falsework shall be personally
inspected by the Contractor's Engineer who shall certify to the Engineer in writing that the falsework has been constructed in accordance with the materials and details shown on the submitted drawings and calculations.

For construction that affects public safety and prior to placement of any concrete, the Contractor's Engineer shall certify to the Engineer in writing that formwork has been constructed to safely withstand the superimposed loads to which it will be subjected during construction.

Prior to the use of any equipment that is fabricated for the specific purpose of erecting any portion of the work included in this Project, the Contractor shall demonstrate by a full scale load test that this equipment is adequate for its intended use on this project.

Observation of load testing of erection equipment, review of drawings and calculations covering erection equipment by the Engineer shall not be construed as any assumption by the Engineer of responsibility for means, methods, techniques, sequences or procedures of construction, nor on safety precautions or to a safety program thereto.

All costs associated with load testing of any equipment necessary for the construction of this project shall be at no additional cost to the project.

3.2 Balanced Cantilever Erection Equipment and Load Testing

Prior to using a launching gantry, a beam and winch, or other equipment specifically fabricated for the purpose of lifting precast segments, the Contractor shall demonstrate by a full scale load test that the equipment is capable of supporting a load equal to 125 percent of the weight of the heaviest segments to be lifted. The full scale load test shall be conducted with the equipment supported in the most extreme loading condition to be encountered during its use on this project. The Contractor shall submit the program for testing for review by the Engineer.

The Contractor shall give the Engineer written notice at least 72 hours in advance of the time at which test load will be applied.

528.04 Requirements for Precast Concrete Segments

4.1 General

The precast segments shall be fabricated in accordance with the applicable Project Specifications except as modified herein.

All materials, details, and procedures shall be as specified herein or noted on the plans. Casting of segments shall not begin until review of the shop drawings, required computations, the post-tensioning system and concrete mix design, including a hot weather mix design, has been completed and approved by the Engineer. The segments shall be match-cast.

4.2 Design of Forms

The design and engineering of the forms and falsework, as well as their construction, shall be the responsibility of the Precaster. Forms shall be inspected and approved by the Engineer prior to authorizing casting operations. Forms that are worn, damaged or otherwise unacceptable to the Engineer shall be repaired to the Engineer's satisfaction before the casting of any segment will be authorized. Any segment cast in forms unacceptable to the Engineer may be subject to rejection. Forms that will not produce segments complying with the specified casting tolerances shall not be used until corrections are made.

Forms shall be mortar-tight and sufficiently rigid to prevent distortion due to the pressure of the concrete and other loads incidental to the concrete operations, including vibration. Forms shall be capable of casting the segments as shown in the plans.
All exposed surfaces of each element of the structure shall be formed with materials that will produce a similar surface texture, color and appearance for all concrete surfaces. The form surfaces of casting machines for superstructure shall be made of steel. The metal used for forms shall be of such thickness that the forms will remain true to shape. All bolt and rivet heads shall be countersunk. Clamps, pins or other connecting devices shall be designed to hold the forms rigidly together and to allow form removal without injury to the concrete.

The inside surfaces of forms shall be cleaned of all dirt, mortar and foreign material. Forms shall be properly coated with form oil prior to each use. The form oil shall be commercial quality form oil or other equivalent coating that will permit the ready release of the forms and will not discolor the concrete. Form oil shall be applied such that the finished surface of each segment is uniform in color as compared to the previously and subsequently cast segments. Form oil shall be applied such that none is deposited on the reinforcement in the forms.

Where sections of forms are to be joined, a maximum offset of 1/8 inch for flat surfaces and ¼ inch for corners and bends will be permitted. The Precaster shall accurately survey forms on a monthly basis for the purpose of monitoring settlements and distortion in shape. If any settlements or distortions are of great enough magnitude to interfere with achieving the required segment tolerances, casting with these forms shall be discontinued until the problem is corrected.

4.3 Preparation for Casting

Care shall be exercised in setting up forms for casting segments. All materials to be encased within the concrete of the segment shall be properly positioned and supported. Provisions for all projections, recesses, notches, openings, block-outs and the like shall be made in accordance with the plans or approved shop drawings. Extreme care shall be taken in positioning the match-cast segment in relation to the segment to be poured. The match-cast segment shall not be twisted. The abutting surface of the bulkhead segment shall be covered with a thin film of a bond breaker consisting of flax soap and talc, or other material approved by the Engineer. The soap and talc mixture will be approximately five parts flax soap and one part talc. The mixture may be varied based on job experience and results. The acceptability of a material other than soap and talc shall be determined by demonstration on a large specimen which has a facial area of at least four square feet, prior to its use in casting of the segments.

It is the intent of this specification that the precast segments and the cast-in-place closures have a uniform appearance of concrete without stains and blemishes. After casting the first five (5) precast bridge members, the Contractor and the Engineer will jointly inspect the appearance of the members. If they are not uniform in appearance then the Contractor will propose methods to correct this situation. Only bridge members that have a uniform appearance will be accepted for incorporation into the structure. The uniformity of appearance will be at the judgment and discretion of the Engineer. This joint inspection of precast bridge members is to be conducted thereafter on a mutually agreed upon schedule but at least twice a month during the casting operations.

A meeting shall be held at least two weeks prior to the start of the casting operations where the Contractor presents his plan for producing members of uniform appearance. At this meeting the Contractor will present his plan including materials to be used, Quality Control checks, Corrective Action Plans and other pertinent information to demonstrate that a plan is in place to provide bridge members of uniform appearance. Previous Contractors have produced bridge members of uniform appearance by paying close attention to the form cleanliness; using clear form oils; using clear curing compounds; paying special attention to the application of the curing compounds; using patching materials that closely matched the original concrete; and other methods.

4.4 Geometry Control

4.4.1 Casting Manual
Before commencing casting operations, the Contractor shall submit to the Engineer, for approval, his proposed method of geometry controls for both the casting and erection operation. This submittal shall be in the form of a "Casting Manual" and shall include, but not be limited to, the following information: a detailed narrative of the geometry control theory, a detailed narrative of the step-by-step geometry control procedure, detailed calculation forms, and a set of sample calculations. This submittal shall include all measuring equipment, procedures, location of control points to be established on each segment and qualifications of personnel who will carry out geometry control.

The casting manual shall cover all geometry control operations necessary for casting and shall be in agreement with the Contractor's chosen methods of casting and erection, including erection survey, elevation and alignment control. Casting shall not commence without the Engineer's approval of the geometry control method.

For precast substructure segments, the Contractor shall submit his casting and erection geometry control procedures (30 days in advance of casting) to the Engineer for review and approval.

4.4.2 Personnel

The Precaster shall provide personnel experienced in casting control to carry out the daily tasks of geometry control.

Geometry control at the casting yard and at the bridge site shall be under the direct responsible charge of a Professional Engineer or Land Surveyor registered in the State of New Jersey. Personnel who directly supervise layout and geometry control measurements shall have at least five (5) years of experience in geometry control techniques for precast concrete segmental bridges.

4.4.3 Instruments and Control

Instruments used in the casting yard for horizontal geometry control shall be mounted on a permanent platform independent of any other structure. Instruments used in the casting yard for vertical geometry control of superstructure segments shall be firmly supported on a tripod, set on top of the segments being surveyed, or mounted on a rigid permanent platform. Provision shall be made to protect instruments from construction activities and to minimize the effects of wind and temperature variations on the accuracy of readings.

A minimum of two permanent horizontal control points shall be established on line with the instrument mounting point. Permanent bench-marks shall be established at locations where they will not be disturbed by construction activities. The horizontal control points and bench-marks shall be located so as to be continuously visible from the instrument's location.

Prior to beginning casting operations using the short line method, horizontal and elevation control points shall be established on the fixed bulkhead. The alignment, elevations and shape of the fixed bulkhead shall be checked by each time the geometry of adjoining segments is checked.

4.4.4 Segment Hardware and Measurements

Immediately after casting of a segment is complete, the length of the segment along the line of each web shall be measured and recorded and references for horizontal and vertical control shall be established as follows:

1. Horizontal Control - A wire stirrup on the horizontal control line at both ends of the segment. A line not more than 0.001 feet in width shall be scribed in a permanent manner into each stirrup. Wire stirrups shall be stainless steel.

2. Vertical Control – A flat head bolt, with a pin point center-punched in the head shall be set approximately flush with the surface of the concrete over each web at both ends of the segment. The bolts shall be stainless steel.
After a segment is cast, and before breaking the bond, the positions of the two adjoining segments shall be checked from established control points. If the positions are not as required, corrections to the geometry shall be made in the next segment cast by utilizing the established control points.

4.4.5 Requirements for Short-Line Casting of Superstructure Segments

1. Instruments used to measure elevations shall be precision levels equipped with parallel plate micrometers capable of obtaining first order control and one-piece, invar rods with center point bases.

2. Instruments used to make horizontal measurements shall be a centerline sighting theodolite and centerline offset measuring tool directly graduated in intervals of 0.002 feet.

3. Elevation and centerline-offset measurements shall be observed to an accuracy of ±0.001 feet.

4. The set-up position of two adjacent segments before casting shall be independently determined by two observers. Casting shall not begin until these surveys agree within the following tolerances:
   - Elevation: ±0.002 feet on any control point.
   - Horizontal: ±0.002 feet on a segment centerline offset.

5. After cast observations shall be independently determined by two observers. They shall be checked until the independent observations agree within the following tolerances:
   - Elevation: ±0.001 feet on any control point.
   - Horizontal: ±0.001 feet on a segment centerline offset.
   - Twist error on elevation control points: ±0.001 feet
   - (with ±0.002 feet maximum on a random error)

4.5 Embedded Items

Reinforcing steel shall be fabricated and placed in accordance with the plans and as required herein. No reinforcing steel shall be cut or removed to permit proper alignment of tendon ducts or other embedded items. Any bar that cannot be fabricated to clear a post-tensioning tendon shall be replaced by additional bars, with adequate lap lengths, according to methods approved by the Engineer.

In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/2 inch, or 1/12 of the spacing between bars, whichever is less. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch. The top and bottom clear cover of reinforcing steel shall be within 1/4 inch of the clear cover limits dimensioned on the plans. The end and edge clear cover of the reinforcing steel shall be within one inch of the clear cover limits dimensioned on the plans.

In the event of a conflict between post-tensioning ducts and reinforcing bars, the post-tensioning shall generally have priority and the position of the bars shall be adjusted in a manner approved by the Engineer. Any such conflicts shall be brought to the attention of the Engineer for resolution and approval.

Embedded ducts for tendons shall be positioned accurately (within 1/4 inch) in respect to their vertical, linear and transverse position within each segment. Positive methods shall be utilized to assure that ducts will not be displaced during casting. Ducts that act to change the alignment of tendons shall be marked so that proper positioning is assured prior to casting and can be verified after casting.

Ducts internal to the concrete section shall be properly aligned when passing from segment to segment and from the segment to a cast-in-place closure.

Where an external tendon enters or exits the face of the concrete at deviation blocks and diaphragms except at anchor locations, a small blockout shall be provided. The blockout shall be approximately 2 inches larger in diameter or overall dimensions than the tendon duct and have a depth equal to at least the minimum prescribed concrete cover dimension shown in the plans.
Adequate spacing shall be provided for the duct supports. After installation in the forms, the end of the ducts shall be sealed to prevent entry of water and debris. Following each pour of concrete, the Precaster shall ensure that all empty ducts are unobstructed and undamaged.

Lifting devices incorporated in segments shall be adequate to distribute the handling and erection stresses without damage to the segment.

Drain/vent pipes shall be located in the bottom slab of segments at the low points of each span and at the high side of each bottom post-tensioning anchor block.

The anchoring devices for transverse top slab post-tensioning shall be recessed so that the ends of the prestressing steel and all parts of anchoring devices will be at least two inches inside the end surface of the segment. Following post-tensioning, the recesses shall be filled in accordance with the details noted on the plans.

Transverse post-tensioning anchors shall be placed into the form before the concrete is cast. Temporary blockouts to allow for later installation of anchors shall not be allowed. Local anchorage bursting, spiral, grid or multiple U-bar reinforcement shall be accurately located and securely fixed in position.

Ducts and connection devices for future conduits shall be placed into the segments at the locations shown on the Contract Plans.

Steel angles for the longitudinal joint shall be placed into the segments at the locations shown on the Contract Plans.

4.6 Placing Concrete

Concrete shall not be deposited into forms until the entire set up of the forms, reinforcements, ducts, and anchorage has been thoroughly inspected and checked. The placing of concrete shall not proceed until the rate of producing and placing concrete is sufficient to complete the proposed pour and finishing operations within the scheduled time. Furthermore, experienced concrete finishers shall be available where required for finish work and all necessary finishing tools and equipment are on hand at the site of the work and are in satisfactory condition for use.

During conveying, placement, and initial set, the concrete shall be protected against undue drying or rise in temperature and inclement weather. The placing of concrete shall not proceed until adequate measures, and protection, are available to prevent weather damage during conveying and placement. This includes shelter from rain intrusion during conveying, placement and curing.

Special care shall be taken to plan the sequence of placing concrete so as to assure that voids do not occur within the concrete in areas where air is likely to be entrapped within the forms or in areas where flow of the plastic concrete is constrained by embedded items.

Concrete shall not be dropped more than four feet, unless confined by closed chutes or popes. Formwork shall not be considered as chutes. Care shall be taken to prevent segregation when discharging concrete into the forms. Care shall be taken to fill each part of the form by depositing the concrete as near to the final position as possible. After the discharge of individual concrete loads into the forms, concrete shall not be bodily moved from place to place within the forms by mechanical vibrators or other similar equipment.

Concrete shall be placed in horizontal layers not more than 18 inches thick except as hereinafter provided. Each layer shall be placed and consolidated before the preceding layer has taken initial set. Each layer shall be so consolidated as to avoid the formation of a construction (cold) joint with a preceding layer before it has taken an initial set.
For superstructure segments, first, concrete shall be placed in the bottom of the webs to fill the corners, to approximately 6 inches up each web and extending 6 to 12 inches beyond the bottom slab and web interface for inspection and consolidation with successive loads when placed in the bottom slab. Concrete shall then be placed in the bottom slab to connect and be consolidated with that already placed down through the webs. When the bottom slab is full, the remainder of the webs shall then be filled with concrete in lifts up to but not into the top slab. Care shall be exercised when consolidating the webs to ensure that voids are not created by forcing concrete to flow down to the bottom slab. After the webs are full, concrete shall be placed in the top slab: first from one wing tip to the top of the adjacent web, then from the other wing tip to the adjacent web, finally in the middle of the top slab between webs. However, placement of bridge deck slab concrete on superelevation and/or grade that exceeds 2 percent in the casting cell shall progress from the low point upward. All top deck-slab concrete shall be thoroughly consolidated and blended with previous lifts while passing over the tip of the webs.

For substructure pier shaft segments, the segments shall be cast vertically. The concrete shall be placed in uniform lifts of approximately 24 to 36 inches and shall be well consolidated.

Immediately after all the concrete has been placed and consolidated, all accumulations of mortar splashed upon the remaining exposed reinforcement and surfaces of forms shall be removed before the concrete takes its initial set. Care shall be taken when cleaning reinforcing steel to prevent damage to or breakage of the concrete-steel bond.

Placing equipment shall be of a size and design to permit placing of concrete within a workable time period to avoid cold joints or blemishes between successive lifts. Placing equipment shall be cleaned as necessary at the end of each operation or workday and, just prior to reuse, shall again be checked and cleaned of hardened concrete and foreign materials.

Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An approved device shall be used at the discharge end of a belt conveyor to prevent aggregate segregation. Mortar shall not be allowed to adhere to the return length of the belt. Concrete shall be discharged into a hopper or through a baffle.

No construction joints will be permitted within a segment except as detailed on the plans.

**4.7 Casting Tolerances**

The following tolerances apply to the fabrication of Superstructure Segments:

- **Width of Web**: ± 0.25 inches
- **Depth of Bottom Slab**: ± 0.1875 inches
- **Depth of Top Slab**: ± 0.1875 inches
- **Overall Depth of Segment**: ± 0.1875 inches
- **Overall Width of Segment**: ± 0.25 inches
- **Length of Segment**: ± 0.375 inches
- **Diaphragm Dimensions**: ± 0.375 inches

The following tolerances apply to the fabrication of Substructure Segments:

- **Height (individual element)**: ± 0.25 inches
- **Width and Breadth**: ± 0.25 inches
- **Wall Thickness**: ± 0.25 inches

The following tolerances apply to the fabrication of all Precast Segments:

- **Ends (deviation from a plane per 20 feet width or depth)**: ± 0.25 inches per 20 feet
- **Flat Surface (deviation from a plane at any location)**: ± 0.025 inches per foot

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY

Page 146
Dimensions from segment to segment shall be adjusted so as to compensate for any deviations within a single segment so that the overall dimensions of each completed span will conform to the dimensions shown on the plans. If a check of two segments of any span (selected at random by the Engineer) shows that these tolerances are exceeded, the Precaster shall implement appropriate corrective action for casting.

4.8 Consolidation by Vibration

All concrete shall be consolidated by means of approved vibrators together with any other equipment necessary to perform the work as specified. Vibration of concrete shall conform to Project Specifications with the following exceptions.

Internal vibrators shall have a minimum frequency of 8,000 vibrations per minute and sufficient amplitude to consolidate the concrete effectively. At least two standby vibrators in working condition shall be provided for emergency use in case of malfunction. The use of external vibrators for consolidating concrete will be permitted and may be required when the concrete is inaccessible for adequate consolidation. When external vibration is used, the forms shall be constructed sufficiently rigid to resist displacement or damage. Care shall be exercised when placing and consolidating concrete so that reinforcing, post-tensioning ducts, anchorages and any other embedded items are maintained in their proper positions and are not damaged.

4.9 Finishing Top Surface of Superstructure Box Girder Segments

When the concrete has been placed and vibrated in a section of sufficient width to permit working, the surface shall be struck off level and with a screed such that a slight excess of concrete is carried ahead of the screed to insure filling of all low spots. The screed shall be designed rigid enough to hold true to shape. A hydraulically driven, bare steel tube rotating in the opposite direction of travel may be used if heavy enough to prevent undue distortion.

Longitudinally, the screed shall be moved back and forth across the concrete while one end rests on the upper surface of the form (bulkhead) and the other end on the match-cast segment.

The screed shall be used a sufficient number of times, and at such intervals to produce a uniform surface, true to grade and free of voids. Then, the surface shall be worked to a smooth finish with a long handled wood or metal float of the proper size, or hand floated from bridges over the top slab. A float finish shall be applied to the top slab to produce a uniform dense surface where the screed cannot be used because of projecting rebar.

Surfaces directly under barriers or rail plinths shall be finished dense but rough to an amplitude of approximately 1/8”.

After the water sheen has disappeared from the surface of the top slab, but while the concrete is still plastic, the final finish shall be applied to the top slab.

A float finish shall be applied to the top slab in preparation for subsequent transverse saw groove cutting in accordance with the Project Specifications. The finished bridge deck top surface shall meet the requirements of Section 4.15 of this Specification (below).

Only minimum hand finishing shall be permitted and there shall be no overworking of the top slab. Only minimal amounts of water will be allowed to aid in the finishing process when evaporation rates affect the quality of the finish. A fog spray shall be used to help retard surface evaporation, but shall not change the water-cement ratio at the deck surface. During periods of excessive drying, a cover of wet burlap or plastic sheeting will be maintained on the slab at all times until final cure cover is placed. Monomolecular film coatings applied as a uniform blanket over the entire surface of the slab to retain moisture may be used, provided they effectively retard surface evaporation and are adequately maintained throughout the finishing operation.
4.10 Removal of Forms

Weight supporting forms shall remain in-place until the concrete has reached the compressive strength specified for form removal. For precast segments, constructed as shown in the plans without design modifications, this strength shall be at least 2,500 psi unless otherwise designated in the plans.

Prior to removal of the wing forms, top transverse prestressing tendons shall be partially or fully stressed as indicated in the Plans or approved Shop Drawings. Otherwise, transverse tendons shall not be stressed until after the segment has been used for the match-cast.

Care shall be exercised in removing the forms to prevent spalling and chipping of the concrete.

Prior to moving a segment from its as-cast position, erection marks identifying its location in the structure and order in the erection sequence shall be affixed to the inside of the segment.

4.11 Test Samples

Test samples and testing for compressive strength of concrete on each precast segment, field closure joint, and cast-in-place rib shall be made by the Precaster and Contractor respectfully, to ensure adequate strength of these components at various stages of their manufacture and assembly. Test cylinders shall be made from concrete representative of that used to cast the structural component, in accordance with the applicable portion of AASHTO T 22 and T 23.

All activities, equipment and facilities related to the molding, curing and testing of concrete compression test cylinders will be provided and maintained by the Precaster at no additional cost to the Department. All molding, curing and testing of concrete compression test cylinders will take place at the precast fabrication yard or plant, convenient to the fabrication activities.

Test Cylinders shall be cured in the same manner as the structural components. Test cylinders shall be made for the following conditions:
1. Prior to partial prestressing of the transverse tendons in the casting cell. Prior to form release and/or moving the components to storage.
2. Prior to final post-tensioning of the remaining transverse tendons if the component is less than 28 days old.
3. Prior to placing a component into position in the structure and/or stressing of post-tensioning tendons if the component is less than 28 days old.

The test specimens for precast segments shall be stored in or on the segment, in a condition representative of the curing conditions to which the segment is exposed. The Precaster shall provide sufficient specimens to allow for additional tests as necessary and shall maintain complete records of all testing.

4.12 Curing Precast Concrete Segments

It is the responsibility of the Precaster to determine the measures to be taken to protect and properly cure the concrete except as specified herein. The Engineer shall review for adequacy, the curing method proposed by the Precaster. If the method proposed by the Precaster fails to produce satisfactory results in the judgment of the Engineer, the Precaster shall use other methods or shall alter the method used, so as to provide acceptable segments.

The minimum curing period, comprising the initial and final curing, shall be five days or until the concrete has achieved the required 28 day compressive strength as determined by the above test cylinders cured under the same conditions as the segment. When the ambient temperature is below 35°F, concrete surface temperatures shall be maintained above 50°F during the initial curing period. The initial curing period is defined as the period of time until the concrete has achieved the required compressive strength specified for removing or
lowering forms, partial stressing of transverse tendons, or segment handling as determined by test cylinders
cured under the same conditions as the precast segment.

Immediately after placing the fresh concrete it shall be cured through the initial curing period by one of the
following methods. However, membrane curing-compound will not be considered an acceptable alternative for
the initial curing period.

4.12.1 Forms-in-Place Method

For formed surfaces, leave the forms in place without loosening. Cover the wet concrete deck surface
with a waterproof sheet material that prevents moisture loss from the concrete. Secure all moisture
barriers so that wind will not displace them. Immediately repair broken or damaged waterproof
sheeting.

4.12.2 Water Method

All surfaces other than slabs shall be protected from the sun and the whole structure shall be kept wet
for the initial curing period. The concrete surface shall be kept moist at all times by fogging with an
atomizing nozzle until the covering is placed.

4.12.3 Blanket Method

Electrically heated curing blankets or insulation blankets may be used in cold weather to maintain
specified curing temperature and to retain moisture in concrete. Blankets shall be lapped (8 inches
minimum) and shall be free of holes. Blankets shall be secured at laps and edges to prevent moisture
from escaping.

4.12.4 Steam Method

After placement of the concrete, members shall be held for a minimum four-hour pre-steaming period.
If the ambient air temperature is below 50°F, steam shall be applied during the pre-steaming period to
hold the air surrounding the member at a temperature between 50°F and 90°F. When the ambient air
temperature is above 50°F, the member shall remain undisturbed in the ambient air for a four-hour pre-
steaming period.

To prevent moisture loss on exposed surfaces during the pre-steaming period, members shall be
covered with a moisture-tight covering as soon as surface finishing is complete or the exposed surfaces
shall be kept wet by an approved fog spray. The moisture-tight covering shall be removed just prior to
initiating the steam curing. Alternatively, the segment enclosure shall be fully closed and the relative
humidity shall be maintained at 95% or higher.

Enclosures for steam curing shall allow free circulation of steam around all surfaces of the segment
either formed or exposed and shall be constructed to contain the live steam with a minimum moisture
loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good
repair and secured in such a manner as to prevent the loss of steam and moisture. These enclosures
may also provide the required weather protection during conveying, placement and curing of the
concrete if they are substantial enough to prevent wind and rain damage during the casting operations.

Steam at the jets shall be low pressure and in a saturated condition. Live steam shall not be directed on
the concrete, test cylinders, or forms such as to cause localized high temperature. During application of
the steam the temperature rise within the enclosure shall not exceed 40°F per hour. The curing
temperature shall at no point within the enclosure exceed 150°F and shall be maintained at a constant
level for a minimum period of 12 hours in order to develop the required strength for handling at the
time of form removal. The steam curing cycle shall include a gradual cooling period during which the
rate of decrease in temperature shall not exceed 40°F per hour. The steam curing cycle shall include
the gradual cooling period until the temperature inside the enclosure is within ±20°F of the outside ambient temperature.

The Precaster shall provide temperature recording devices to make an accurate, continuous and permanent record of the curing temperature. At least two continuous temperature records per casting machine are required. A copy of the continuous temperature recordings from the casting machines shall be provided to the Engineer.

Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.

The match-cast segment shall be contained within the same curing environment (temperature and humidity) as the segment being steam-cured, throughout the initial curing process.

4.12.5 Radiant Heat Method

Enclosures for radiant heat curing shall allow free circulation of heat around all surfaces of the segment either formed or exposed. Measures shall be taken as soon as possible after casting to prevent moisture loss on all exposed surfaces.

During application of heat, the temperature rise within the enclosure shall not exceed 40°F per hour. The curing temperature shall at no point within the enclosure exceed 150°F and shall be maintained at a constant level for a minimum period of 12 hours in order to develop the required strength for removal of forms. A gradual cooling period, during which the rate of decrease in temperature in the enclosure shall not exceed 40°F per hour, shall be included in the curing cycle. This cycle shall include the gradual cooling period until the temperature inside the enclosure is within ±20°F of the outside ambient temperature.

The Precaster shall provide temperature recording devices to make an accurate, continuous and permanent record of the curing temperature. At least two continuous temperature records per casting machine are required. A copy of the continuous temperature recordings from the casting machines shall be provided to the Engineer.

Control cylinders shall be covered to prevent moisture loss and placed in a location where temperature is representative of the average temperature in the enclosure.

The match segment shall be contained within the same curing environment (temperature and humidity) as the segment being radiant-heat cured, throughout the initial curing process.

4.13 Final Curing of Concrete Segments

Except for segments cured by the Steam or Radiant Heat Methods, minimum curing of a precast segment period shall continue after the initial curing period, by the application of a membrane curing compound (conforming to the requirements of AASHTO M 148) to all exposed surfaces – except the segment face against the bulkhead to be used as the next match-cast face.

An approved, white-pigmented compound shall be used on the top deck surface and an approved, clear compound shall be used on all other exterior surfaces. Curing materials shall be on the New Jersey Department of Transportation approved materials list. The membrane curing compound shall be of a consistency suitable for spraying at temperatures prevalent at the time of construction operations, and which forms a continuous, uniform film. It shall be free from precipitated matter caused by conditions of storage or temperature. The compound shall be relatively nontoxic. After separating a segment from the bulkhead, this face shall have an approved de-bonding compound applied to serve both as a bond breaker for the next match-casting operation and as a curing compound.
The membrane curing compound shall remain intact through the minimum curing period of five days or until the required 28 day strength is achieved for the segment. Under no circumstances shall the concrete surfaces be allowed to dry prior to curing compound application. Upon completion of the curing period (attaining 28 day strength) the segments may be shipped for erection.

Curing compound delivered to the job in drums shall be in the manufacturer’s original container, labeled with the manufacturer’s name, plant location, grade designation of compound, lot number and quantity. Curing compound delivered in bulk shall be supplied from and delivered to storage tanks designed to provide thorough agitation by means of compressed air. Thorough agitation shall be performed prior to shipment from manufacturer’s plant and prior to use at job site.

Membrane curing compound shall be mixed with a mechanically operated mixer immediately before each use to provide uniform consistency. Application shall be in accordance with the manufacturer’s recommendations, subject to the rate of application specified herein. The rate of application for membrane curing compound shall be at least one gallon per 150 square feet. If a surface is dry after stripping forms, the concrete shall immediately be thoroughly wet with water and the curing compound applied just as the surface film of water disappears. If curing compound is to be applied by spraying, the sprayer shall be compressor driven and of sufficient size to provide uniform mist. Standby equipment will be required in case of mechanical failure. Hand held, pump-up sprayers will be permitted for standby equipment. However, the hand held pump-up sprayers shall not be used except in case of mechanical failure. The membrane curing compound covering shall be continuous, flexible and without defects. Failure to comply with these requirements will result in suspension of further concrete placements until proper control is re-established.

Curing compound shall be applied to create a uniform appearance from one segment to the next. If it is determined by the Engineer that the curing compound creates a visual difference in the color of the segments, the exterior surfaces shall be lightly sandblasted to remove the color variation. All surface treatment resulting from an inconsistency in concrete color shall be performed by the Contractor / Precaster with no additional compensation.

4.14 Finished Surfaces of Concrete Segments

All surfaces of precast segments shall receive a Class 1, Ordinary Surface Finish as described in Section 501.14 of the Standard Specification. In addition to the Class 1 Finish, all exterior surfaces of the precast segments that are exposed to view in the finished structure, except for roadway surfaces of superstructure segments, will be finished by rubbing with burlap and grout composed of equal parts of cement and clean, sharp sand to produce a smooth surface of uniform color and appearance. The roadway surface shall receive a sawcut grooved finish in accordance with Section 4.15 (below).

4.15 Bridge Deck Riding Surface Profile Requirements

Upon completion of the superstructure erection, the Contractor shall evaluate the bridge deck riding surface in accordance with the Standard Specifications. The Contractor shall take measures, to the approval of the Engineer, and in accordance with the added subsection of Section 524 “DIAMOND GRINDING OF BRIDGE DECK SURFACE”, to ensure that it conforms to this requirement. After the profile of the top deck riding surface has been accepted by the Engineer, the Contractor shall groove the deck in accordance with the Standard Specifications to a nominal groove depth of ¼ inch. Installation of expansion joint devices shall not proceed until the deck surface profile requirements have been met and accepted by the Engineer. Proposals for any temporary filling of expansion joint blockouts, to facilitate planning or grinding of the deck, shall be submitted to the Engineer for review and approval.

4.16 Precast Segment Handling, Storage, and Shipment

4.16.1 General
It is the intent of this project that precast segments be cast and placed into the structure with zero defects.

Care shall be exercised in the handling of segments to prevent damage to them. Handling shall only be by devices approved for the purpose. Lifting devices incorporated into any segment shall be adequate to distribute the handling and erection stresses so as not to damage the segment.

The Precaster / Contractor shall inspect each segment visually for evidence of damage or defect before, during and after critical operations and as often as necessary to ensure adequate quality control. The Precaster / Contractor shall immediately bring all such evidence of damage or defect to the attention of the Engineer. The extent and frequency of inspection by the Engineer for quality assurance is the Engineer’s prerogative. Segments may be inspected at any time during construction as deemed necessary by the Engineer to monitor compliance with this specification.

4.16.2 Storage and Shipping

Superstructure segments shall be stored level in the deck upright position and shall be firmly supported on a symmetrical three point bearing system under the webs at approved locations unless otherwise noted on the plans. The storage area of the segments shall be sufficiently stable to prevent differential settlement of the segment supports.

Superstructure segments have not been specifically designed to be stacked vertically in a system where forces are induced in the lower segment. The Contractor may request to vertically stack segments in the deck upright position provided he submits complete details of his stacking procedure and calculations substantiating that the segments will not be damaged or distressed by such stacking. The submittal shall be signed and sealed by the Contractor’s Engineer. In no case will stacking be permitted more than two high in a system that induces forces in the lower segments. Any evidence of damage or distress, as determined by the Engineer, resulting from stacking of segments shall be cause for immediate discontinuance of this practice.

Prior to shipment from the precasting yard, each segment shall be inspected for any damage. The faces of all match-cast joints shall be thoroughly cleaned of laitance, bond breaking compound and any other foreign material by wire brushing, light sandblasting or light water blasting. During transport, firm support at the bearing locations noted above for support during storage shall be provided and the segments shall be fully secured against shifting. Upon arrival at the erection site, each segment shall again be inspected. If any damage has occurred during shipment, the Contractor shall immediately notify the Engineer. Erection of such damaged segments into the structure shall not proceed without authorization from the Engineer.

4.17 Damaged or Defective Segments

4.17.1 General

Isolated defects are imperfections or damage that may occur randomly and infrequently. Recurring defects are imperfections or damages of the same general type and nature, which continue to be found in the same general location of the segments at an unacceptable frequency, as determined by the Engineer.

As a minimum, the first five segments cast will be jointly inspected by the Engineer, the Precaster, the Contractor and Contractor’s Engineer after casting, after moving to storage from the casting machine, before and after erection. All segment defects shall be identified and categorized during this inspection. The Precaster, Contractor and Contractor’s Engineer shall examine the defects and propose to the Engineer, in writing:

a. The measures to be taken to prevent recurring defects in future segments.
b. The method of repair of all defects discovered as a result of the inspection as required herein.

If recurring defects continue following implementation of preventive measures, or as detected at any time during the construction, the Engineer will instruct the Contractor, in writing, to cease operations producing such defective segments.

The Precaster / Contractor and Contractor’s Engineer shall examine the defects and propose to the Engineer, in writing: (1) measures he shall take to prevent recurring defects in future segments, and (2) the method of repairing all defects discovered as a result of the inspection as required herein.

4.17.2 Classification of Damage or Defects

The Engineer will determine what constitutes damage or defect, whether the damage or defect is isolated or recurring, and will categorize it according to the following:

(a). Cosmetic: Cosmetic defects or damages are those which do not affect the ability of the segment to resist construction or service-loads or reduce the life expectancy of the structure. This category includes superficial discontinuities such as non-structural cracks generally at or less than 0.012 inches wide (0.007 inches for the deck), small spalls or honeycombed areas, entrapped air pockets (bug holes) or any defect that does not extend beyond the centerline of any reinforcing steel, or to any elements of the post-tensioning system. However, cosmetic defects of other types and causes may also be designated by the Engineer.

Repair of cosmetic or superficial defects shall be made in such a manner that the aesthetics and the structural integrity of the segments are restored in accordance with this specification.

(b). Structural: This includes any defect which will impair the ability of the segment to adequately resist construction or service loads or reduce the life expectancy of the structure. Any defect or damage that extends beyond the centerline of any reinforcing steel or into any element of the post-tensioning system or occurs in the deck portion of the segment is considered a structural defect. Examples of such defects include cracks wider than 0.012 inches (0.007 inches for the deck), large spalls and honeycombed areas, major segregation or breakage of concrete. However, structural defects of other types and causes may also be designated by the Engineer.

The Contractor’s Engineer shall be licensed in the State of New Jersey, and shall be responsible for construction load analysis, service load analyses and life expectancy determinations.

Repair of structural defects shall be such that the aesthetics and structural integrity of the segment shall be completely restored to a condition to be expected had the defect or damage had not occurred.

(c). Rejectable: These are any defects or damage, as determined by the Engineer, that will impair the ability of the segment to adequately resist service loads or construction loads, or will reduce the life expectancy of the structure and which cannot be successfully repaired such that the structural integrity is completely restored.

Any segment with a rejectable defect shall be removed from the work and replaced at no additional cost.

Damaged or defective segments may be rejected by the Engineer for the following reasons:

- Failure of the Contractor’s Engineer to approve proposed repair procedures.
- Failure of the Contractor to execute the repair according to the approved procedure.
- Rejection by the Engineer of the proposed repair procedure or repair.
- Failure of the Contractor to provide the required certification or demonstration that the repair was successful and that the defect no longer exists, as required below.
- Failure of the Contractor to eliminate recurring defects.
- Determination by the Engineer that the work or materials used in the work does not meet other requirements of the Contract Documents and is not acceptable.
- Any other reason as designated by the Engineer.

4.17.3 Repairs

Cosmetic repairs shall be according to this specification. Cosmetic repairs may be made prior to or after transverse post-tensioning.

Structural repairs shall be made in accordance with 4.17.5.2 and 4.17.5.4 below or by following procedures prepared by the Precaster / Contractor. The repair procedure shall be signed and sealed by the Precaster’s / Contractor’s Engineer licensed in the State of New Jersey, and shall be submitted to the Engineer. The proposal shall include the following minimum information:

(a) A detailed description and sketch of the defect.
(b) The magnitude and type of the most critical construction loading condition to which the defective area will be subjected.
(c) Detailed reinforcement requirements, material types, surface treatments, curing methods and general repair procedures proposed. The procedure shall clearly indicate those areas required to be repaired before erection, and those areas to be repaired after erection.
(d) The nondestructive testing method and procedure by which the Contractor shall demonstrate that the defect no longer exists and the segment has been restored to a condition to be expected had the defect or damage not occurred. In lieu of such a demonstration, on a case-by-case basis, the Contractor shall provide a written certification by the Contractor’s Engineer that the repair has been performed satisfactorily and that the defect no longer exists.

4.17.4 Repairs to Shear Keys

Repairs to the shear keys along the webs shall be made only after the segments have been erected, providing that no more than 20 percent of the keys in a web are damaged. In this case, the shear keys shall be repaired after the segments have been erected and initially stressed together with no more than 10 percent of the final prestressing force applied across the joint. After the repair has been completed and has obtained a minimum compressive strength of 2500 psi, the final prestressing force may be applied across the joint.

If more than 20 percent of the shear keys in a web have been damaged, the Precaster / Erector / Contractor shall advise the Engineer. The Engineer shall make a structural assessment and shall advise on an appropriate course of action.

4.17.5 Procedures for Repair and Patching of Segments

4.17.5.1 Deep Voids in Webs, Slabs or Walls of the Segment

Void depths greater than 2 inches (but less than one-half of the local section thickness) and with a surface area greater than 6 square inches shall be categorized as “Structural Repairs” and the repair procedure shall be as follows:

Saw cut the perimeter of the affected area to a depth of at least ½ inch. Chip away all partially consolidated material until sound concrete is encountered. If reinforcing bars pass through the void, expose the full diameter plus ½ inch. The exposed portions of rebar shall be cleaned until they are free of concrete. If dirt, oil or paint
is present, it shall be removed by 3,000 psi water blasting or sand blasting. Remove all other debris with compressed air. Parent concrete shall be in a saturated surface dry condition without any standing water prior to placement of patching concrete. Attach wood or steel forms as necessary to contain the patching concrete.

Coat all surfaces of the void with Sika Armatec 110 EpoCem bonding agent (or other suitable material as approved by the Engineer). Fill the void with concrete of the same mix design as the segment, cover and allow to cure properly using curing procedures discussed in this specification.

Finish the patched area to match the surrounding concrete.

4.17.5.2  Shallow Voids (less than the cover)

Voids shallower than the cover depth and smaller than 6 square inches in surface area are categorized as “Cosmetic” Repairs. The repair procedure shall be as follows:

Saw cut the perimeter of the void to a depth of ½ inch. Chip away all partially consolidated material until sound concrete is encountered. If dirt, oil or paint is present, it shall be removed by 3,000 psi water blasting or sand blasting. Remove all other debris with compressed air. Parent concrete shall be in a saturated surface dry condition without any standing water, or prepared as per the recommendations of the manufacturer of the patching material. Fill the void with SikaTop 123 Plus no sag mortar, (or other suitable material as approved by the Engineer) as per the recommendations of the manufacturer and allow to cure properly using curing procedures discussed in this specification.

Finish the patched area to match the existing concrete.

4.17.5.3  Voids on a Match-Cast Face (or in Shear Keys)

Depending upon the size of the void, either 4.17.5.1 or 4.17.5.2 above shall be used. However, the patch shall be held back by ½ inch from the match-cast face. After erection, the resulting void shall be patched in the field.

4.17.5.4  Cracks

Cracks are classified as Structural or Non-Structural. Structural cracks are those induced by external forces which produce internal stresses exceeding the tensile strength of the concrete. Nonstructural cracks are those that appear as a result of component material characteristics, atmospheric effects and local constraints or shrinkage. The Precaster / Contractor shall notify the Engineer of any cracks and the Engineer shall determine the classification. No sealing or repair of structural cracks shall be made without approval in advance by the Engineer.

Non-structural cracks shall be treated as follows;

Cracks in the deck less than 0.006 inches wide shall be sealed with a penetrant sealer. Cracks from 0.006 inches to 0.012 inches wide shall be injected with epoxy according to the procedure below. Cracks wider than 0.012 inches shall be investigated further.

At all other locations, cracks less than 0.012” wide shall be sealed with a penetrant sealer. Cracks from 0.012” to 0.024” wide shall be injected with epoxy according to the procedure below. Cracks wider than 0.024” shall be investigated further.
Procedure for Epoxy Injection;

1. Drill holes and install plastic injection ports at approximately 8 inch on center.
2. Seal crack between ports with Sikadur-32 epoxy or approved equal.
3. Inject crack with a hand pump using Dayton Superior, Sure Inject J-56 epoxy or approved equal. Begin injection from the lowest port and continue until the epoxy runs out of the next highest port. Then move to the next port and repeat the process until the entire crack is filled.

4.17.5.5 Entrapped Air Pockets (Bug Holes)

These are considered “Cosmetic”. The exterior surface of the segment, except the top deck shall have all entrapped air pockets filled and the surface sacked with burlap. Entrapped air pockets (bug holes) shall be filled with a no shrink, no sag mortar as approved by the Engineer, and as per the recommendations of the manufacturer. Cure properly using curing procedures discussed in this specification. No entrapped air pockets on the match-cast faces or the inside (void) surfaces shall be filled or sacked.

4.17.5.6 Other Situations

Situations other than those mentioned above shall be analyzed on a case-by-case basis and repaired only after approval by the Engineer of the repair procedures proposed by the Contractor.

4.18 Payment for Segments with Cosmetic Defects or Repairs;

Segments with cosmetic defects will be paid for according to the contract unit price per cubic yard. However, such payment is subject to review by the Engineer, and failure of the Contractor to prosecute the required repairs properly and in a timely manner shall be cause for withholding of payments sufficient to protect the Owner’s interests.

Segments with structural defects will not be paid for until the repair procedure is complete and the segment is demonstrated by the Contractor to be free of structural defect as required by the Engineer.

Payment for segments with defects that have been satisfactorily repaired in accordance with the requirements herein, shall be made in accordance with Sections 6 and 7 as if the segments had been free of defects. No additional payment shall be made for any repairs carried out under these requirements.

528.05 Erection of Precast Segments

5.1 General

An erection scheme for handling and erecting segments is shown in the plans. The erection scheme is a concept only, consistent with the overall bridge design. It is presented to aid the contractor in developing his method of construction that is also to be consistent with the overall bridge design. The Contractor shall be solely responsible for design, fabrication, assembly and operation of all equipment to be used for handling and erecting segments.

Erection of segments shall not begin until the required shop drawings calculations have been reviewed and approved by the Engineer. No extra payment will be made to the Contractor for any cost incurred in modifying the permanent structure due to temporary loadings induced by the Contractor’s handling and erection equipment or his erection scheme.
Elevations and alignment of segments shall be carefully measured at each stage of erection with instruments capable of providing the degree of accuracy necessary to assure satisfying erection tolerances. Any deviation from the table of elevations and alignment prepared by the Contractor shall be corrected so as to prevent accumulation of deviations using a method submitted by the Contractor and approved by the Engineer.

5.2 Age of Precast Segments at Time of Erection

Precast segments shall not be erected until they have reached the age of 28 days and have obtained the minimum strength specified on the Plans.

5.3 Temperature of Precast Segments with Epoxy Joints

Erection of segments will be permitted only when the substrate temperatures of the mating surfaces are between 40°F and 115°F. Upon approval of the Engineer, an artificial environment may be provided to maintain the substrate temperature within the permissible limits by creating an enclosure heated by circulating warm air or by radiant heaters. Localized heating shall be avoided and the heat shall be provided in a manner that prevents surface temperatures greater than 95°F during the epoxy hardening-period. Direct flame heating of concrete will not be permitted. The requirements of the Special Provision for “Epoxy Joining of Precast Concrete Segments” shall apply.

5.4 Erection Tolerances

5.4.1 Superstructure Segments:

The following tolerances shall apply to erection of superstructure segments:

1. The maximum differential between the outside face of adjacent segments in the erected position shall not exceed 3/16 inch.
2. Transversely, the angular deviation from the theoretical slope difference between two successive segment joints shall not exceed 0.001 radians.
3. Longitudinally, the angular deviation from the theoretical slope change between two successive segments shall not exceed 0.003 radians.
4. The difference in roadway elevation at the connection of two adjacent segments (measured perpendicular to the deck surface) and across closure joints shall be no greater than 1/8 inch. If the Contractor fails to meet the tolerance, he may be required by the Engineer to grind the deck surface to meet the tolerance. All corrective work shall be at the Contractor’s expense. The Contractor is responsible for restoring the roadway surface finish to conform to the specified requirements. No additional payment shall be made for any work carried out under these requirements.
5. The horizontal and vertical position of a pier segment (superstructure segment which rests on a pier) shall be within ¼ inch of the longitudinal alignment, grade and cross-slope required by the approved erection plans. The longitudinal slope shall not vary by more than 0.005 feet in 10 feet from that required by the approved erection plans. These tolerances are for relative location of control points, not absolute location.
6. Dimensions from segment to segment shall be adjusted to compensate for any deviations within a single segment so that the overall dimensions of each completed span conform to the dimensions shown on the plans. The accumulated maximum error should not exceed 1/1000 of the span length for either vertical profile or horizontal alignment.
7. Deviations exceeding erection tolerances listed above, discovered during the match-casting operation by after-cast surveys before the matched-cast segments are separated, shall be corrected in subsequent castings. The method of correcting for such deviations shall be addressed in the casting manual or shall be submitted to the Engineer prior to casting the next match-cast segment.

5.4.2 Substructure Segments:
Cumulative Erection Tolerances for Precast Piers: Vertically, the angular deviation from the theoretical slope change between successive segments shall not exceed 0.002 Radians. The maximum overall deviation from the vertical, measured in any direction, shall not exceed 0.01 inch per foot of height. The maximum variation from the plan location shall not exceed 1 inch at the bottom and 2 inches at the top.

5.4.3 Segment Joint Shims

The shimming of segment joints shall only be proposed after all other corrective measures have been eliminated. The methods and procedures developed by the Contractor’s Engineer shall be submitted for approval by the Engineer. The anticipated bridge geometry both with and without shims be placed shall be included. Shims shall be made of ASTM A-240 Type 304 wire cloth (roving) with a maximum of 1/8 inch thickness. Use small patch wire cloth shims having a maximum thickness of 1/8 inch and minimum area of 1 square foot at the intersection points of webs and slabs to attain the required geometric change. The shims shall be fully impregnated with epoxy prior to placement. Shims shall be placed at a single joint to modify the geometry in a single direction, either vertical or horizontal. The shimmed joint shall be fully epoxied and water tight.

5.5 Special Requirements – Erection of Precast Segments by Cantilever Method

During erection by the cantilever method, the unbalanced load shall not exceed that shown on the erection scheme in the plans or in the approved Erection Manual. Erection shall not begin until the pier table (that is the pier segment(s) and the typical segment on each side of it is properly tied down to the pier by the means provided. Likewise, erection shall not proceed beyond a given number of segments, identified in the Erection Manual, until any associated tie-down bars or temporary supports have been introduced, stresses or secured as necessary.

Accurate positioning of the first typical segments adjacent to the pier table is most important as it establishes the line and grade for cantilevers in each direction. These segments must be positioned according to the final longitudinal alignment, grade and cross-slope. The horizontal and vertical location of the geometry control points on these segments shall be within 1/8 inch of the position required by the approved erection plans or Erection Manual. Likewise, the slopes across these segments shall not exceed 0.003 radians of angular deviation from the theoretical values for horizontal and vertical grades.

During erection, alignments and elevations shall be checked by the Erector. If measured elevations and alignments deviate by more than the allowed tolerances, from those given on the approved erection plans or in the Erection Manual, the Erector shall notify the Engineer. Reasons for any discrepancies shall be investigated and appropriate corrective action shall be taken by the Erector at no additional payment or time.

Note that a temperature differential between the top slab and remainder of the box sections will cause the superstructure to deflect, resulting in false elevation readings and leading to erroneous elevation adjustments. Even on overcast days it is possible for a temperature differential to develop within the superstructure. To guard against false readings due to temperature differentials, readings should only be taken when all portions of the box section are stabilized at the same temperature. The Contractor is expected to use precautions in devising methods to guard against these possible false readings and corresponding adjustments due to temperature differentials. To prevent false measurements, an ideal time for taking readings is within one hour of sunrise.

If measured elevations deviate from the table of elevations, the Engineer has the right to suspend further erection of superstructure segments until the cause of the deviation is discovered and a corrective action plan, submitted by the Contractor, is approved by the Engineer. No additional payment or time will be made to the Contractor as a result of this suspension for unacceptable erection deviation.

5.6 Cast-in-Place Closure Joints and Filling of Blockouts
5.6.1 Concrete

Concrete for closure joints, closure segments and filling of blockouts shall comply with the same specifications, compressive strength and criteria as the concrete in the precast segments, or as approved by the Engineer. It shall be carefully placed, consolidated and cured to provide dense, uniform concrete, free from blemish. Casting, curing and finishing shall be in accordance with the Project Specifications and procedures prepared by the Erector and approved by the Engineer.

5.6.2 Strength at Transfer (Application of Prestress)

The closure concrete shall reach the minimum required strength shown on the Plans and Project Specifications prior to stressing any longitudinal post-tensioning.

5.6.3 Formwork for Closures

Formwork for closures shall be adequately supported to take all loads applied and shall not be removed until the concrete in the joints has reached its required strength and the longitudinal tendons have been stressed. The formwork and release agent shall be of a type to provide the required surface finish to match that of the precast segments.

5.6.4 Closure Beams and Placement

Closure beams at closure placement shall be supported from the box girders on each side of the closure joint and locked together vertically, longitudinally, and transversely so that the applied concrete closure loads will yield equal deflections to both sides of the closure and maintain the segments relative positions during construction of the closure joint. Closure beams shall not be removed until the closure concrete has reached its specified strength and longitudinal continuity tendons are stressed. The concrete shall be placed in the closure joint at a time when the temperature differential between the top and bottom slab is minimum. The Contractor shall submit a plan for determining the appropriate time for casting of the closure to the Engineer for approval at least 60 days in advance of the casting. This plan shall define how the Contractor intends to monitor the bridge deflections, temperatures and gradients so that the concrete can be placed and the finishing completed near the time of minimal thermal gradient in the cantilevers. To prevent temperature differentials the ideal time to cast the closures is between midnight through 1 hour before sunrise.

5.7 Final Clean Up

Before final acceptance, the Contractor shall clean the interior of the concrete box of all rubbish, excess materials, loose concrete, dirt and debris. The interior of the box girders shall then be swept out. The final clean up shall be performed after all work on the interior of the box girders, including grouting of all tendons and utility work included in the contract, has been completed.

528.06 Method of Measurement

Precast superstructure and substructure segment concrete, including cast-in-place concrete for closure joints, closure segments, and cast-in-place ribs/wings shall be measured by volume according to the quantities represented by the dimensions of the segments and cast-in-place joints on the contract plans or approved shop drawing: whichever is the lesser.

All reinforcement in precast superstructure and substructure segments, including cast-in-place joints and cast-in-place ribs/wings shall be measured by weight according to quantities represented by reinforcement details on the contract plans or approved shop drawings: whichever is the lesser.

All permanent post-tensioning in the superstructure and substructure shall be measured by weight according to the quantities represented by the details on the contract plans or approved shop drawings: whichever is the lesser.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
### 528.07 Basis of Payment

The accepted quantities will be paid for at the contract unit price per cubic yard of concrete, and pounds of reinforcing steel. Payment for prestressing embedded in precast segments shall be in accordance with Sections 4 and 5 of the added “Post-Tensioning System” subsection of Section 502. Payment shall be full compensation for manufacturing and assembling the precast segments complete in-place in the bridge, including filling all concrete blockouts, for supply and application of epoxy bonding agent as required, for embedded prestressing ducts and anchorage hardware, for segment access details, cast-in-place joints, cast-in-place closure segments, cast-in-place ribs/wings or sealing the match-cast joints, and all other materials, testing, and all the equipment, tools, forms, labor and incidental items required to complete the work.

The cost of finishing the deck surface and any surface grinding needed to satisfy the required tolerance and achieve a satisfactory riding surface profile after erection shall be included in the pay item DIAMOND GRINDING DECK SURFACE.

No additional payment will be made for extra concrete, reinforcing steel and prestressing necessitated by approved modifications to the segments or structure for the purposes of the Contractor’s construction methods. Nor will payment be made for temporary tendons which are approved to be left in the structure, either stressed or unstressed, for the convenience of the Contractor’s operations.

No separate or additional payment shall be made for additional ducts or attachments for utility conduits or additional steel angles for the longitudinal joint.

No separate or additional payment shall be made for Access Doors and Vermin Doors and associated components detailed in the plans.

No separate payment shall be made for the preparation and submission of the required shop drawings, casting manual, erection manual, all survey control, quality control, and like production control measures.

Periodic partial payment will be made for precast concrete segments stored in the casting yard. Payment will be made for sixty-five (65) percent of the bid price per cubic yard of concrete, per pound of reinforcement and per pound of prestressing in the segments when the segment has been cast and accepted by the Engineer. The Engineer’s acceptance is only for the purpose of providing payment for the fabrication of the segments. The quality of the segments delivered to the site and erected in their final position, is solely the Contractors responsibility and should be ensured by the Contractors QC plan. Payment for prestressing which is an integral part of the precast segment shall be paid at full bid price for the weight of prestressing in the segment after it has been stressed, grouted and approved. Payment for thirty (30) percent of the bid prices stated above will be made when the segment has been erected and epoxy joining and post-tensioning have been completed in an acceptable manner. The remaining five (5) percent of the bid prices will be paid when all necessary repairs and finishing of the concrete surfaces have been completed and accepted. All payments shall be subject to retainage as specified elsewhere.

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONCRETE IN STRUCTURES, PRECAST SUPERSTRUCTURE 7000 PSI (HPC)</td>
<td>CUBIC YARD</td>
</tr>
<tr>
<td>CONCRETE IN STRUCTURES, PRECAST SUBSTRUCTURE 6000 PSI (HPC)</td>
<td>CUBIC YARD</td>
</tr>
<tr>
<td>CONCRETE IN STRUCTURES, PRECAST SUBSTRUCTURE 8000 PSI (HPC)</td>
<td>CUBIC YARD</td>
</tr>
<tr>
<td>REINFORCEMENT STEEL IN STRUCTURES, EPOXY COATED</td>
<td>LBS</td>
</tr>
</tbody>
</table>

THE FOLLOWING SECTION IS ADDED:

**SECTION 529 - PRECAST SEGMENTAL CASTING FORMS AND ERECTION EQUIPMENT**

529.01 Precast Segment Production

**ROUTE 36 OVER THE SHERWSBURY RIVER**

**HIGHLANDS BRIDGE**

**MONMOUTH COUNTY**

Page 160
Description

This item consists of all work necessary for establishing and putting into operation superstructure and substructure segment casting facilities. It includes preparatory work, operations, acquisition or lease of real property, acquisition or lease of segment manufacturing equipment, acquisition or lease of equipment for the handling, transport and storage of the segments within the casting facility only, and all other work or operations that must be performed, or for which costs are incurred, prior to the manufacture of the precast concrete segments, including engineering services such as shop drawings.

529.02 Erection Equipment

Description

This item consists of all work necessary for acquiring and putting into operation superstructure and substructure segment erection equipment. It includes all preparatory work for, the acquisition or lease of proprietary erection equipment of any kind, the design, fabrication, testing, delivery, installation and operation of purpose-made segment erection equipment, acquisition or lease of equipment for handling, transport and storage of the segments, and all other work supplementary equipment or operations that must be performed, or for which costs are incurred, in order to erect precast concrete segments, including all associated engineering such as special design services, shop drawings and erection manuals and the like.

Erection Equipment includes all items necessary to handle, transport and erect segments. This includes such things as segment lifters, transports, cranes, temporary stability towers, closure devices, erection trusses or gantries, stability beams, winches, cat-heads, scaffolds, falsework and similar items of temporary construction equipment necessary to erect segments in the structure.

529.01 Basis of Payment.

3.1 Precast Segment Production.

Preparatory operations for superstructure and substructure segment casting will be paid for separately at the Contract Lump Sum price for Precast Segment Production. Partial payments for precast segmental casting forms and erection equipment shall be made only after the review and approval by the Engineer of the Contractor’s (Precaster’s and Erector’s) Quality Control Plans for the casting and erection of segments, respectively. Partial payments will be made in accordance with the following:

1. Upon production of documentary evidence, such as paid invoices, canceled checks or similar executed financial instruments, the cost for the acquisition of the casting forms for the precast segments by purchase, lease or manufacture will be paid up to a limit of 25% of the Lump Sum Price bid for this item.
2. When the first precast superstructure segment has been cast out of the first operable casting form and the segment is approved and accepted by the Engineer, will be paid up to a limit of 25% of the Lump Sum Price bid.
3. Thereafter, when each succeeding superstructure segment has been cast out of any operable casting form and approved and accepted by the Engineer, 5% of the Lump Sum Price bid will be paid for each segment up to a limit of 50% of the Lump Sum Price bid (i.e., 5% for each of the next ten acceptable segments).

The balance of the Lump Sum Price not paid after completion of casting will be paid after completion of casting and acceptance of the last segment.

This item is distinctly separate from any full or partial payment for the precast concrete segments themselves that are measured and paid for under items for “Precast Concrete Segmental Construction” and “Post-Tensioning System”.

3.2 Erection Equipment
Erection Equipment will be paid for separately at the Contract Lump Sum Price Precast Segment Erection. Partial payments for precast segmental casting forms and erection equipment shall be made only after the review and approval by the Engineer of the Contractor’s (Precaster’s and Erector’s) Quality Control Plans for the casting and erection of segments, respectively.

Partial payments will be made in accordance with the following:

1. Upon production of documentary evidence, such as paid invoices, canceled checks or similar executed financial instruments, the cost of acquiring the erection equipment by purchase, lease or manufacture will be paid up to a limit of 25% of the Lump Sum Price bid for this item when that equipment has been delivered to the site and placed into operation.

2. When the first precast superstructure segment has been erected, approved and accepted by the Engineer, 25% of the Lump Sum Price bid will be paid.

3. Thereafter, when each succeeding superstructure segment has been erected, approved and accepted by the Engineer, 5% of the Lump Sum Price bid shall be paid for each segment up to a limit of 50% of the Lump Sum Price bid (i.e., 5% for each of the next ten acceptable segments).

The balance of the lump sum price not paid shall be paid after erection and acceptance of the last segment.

Load testing of erection equipment, where required, is deemed to be included in this item and all other pay items for the structure and shall not be paid for separately.

This item is distinctly separate from any full or partial payment for the precast concrete segments themselves that are measured and paid for under items for “Precast Concrete Segments” and “Post-Tensioning System”.

The total sum of payments under this item shall not exceed the original contract bid amount regardless of the fact that the Contractor may have, for any reason, shutdown his work on the Project and moved equipment away from the Project and then back again.

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRECAST SEGMENT PRODUCTION</td>
<td>LUMP SUM</td>
</tr>
<tr>
<td>PRECAST SEGMENT ERECTION EQUIPMENT</td>
<td>LUMP SUM</td>
</tr>
</tbody>
</table>

THE FOLLOWING SECTION IS ADDED:

**SECTION 530 - POST-TENSIONING SYSTEM**

530.01 General

1.1 Description

The work specified in this Section shall consist of furnishing, installing, stressing and grouting prestressing steel in accordance with the details shown on the plans and the requirements of these Specifications.

It shall also include the furnishing and installing of any appurtenant items necessary for the particular prestressing system used, including but not limited to anchorage assemblies, additional reinforcing bars required to resist stresses caused by anchorage assemblies, ducts, vents, inlets, outlets and grout used for pressure grouting ducts.

1.2 Definitions and Terminology

1.2.1 Post-Tensioning Systems Definitions.

1. Actual Ultimate Tensile Strength: The actual breaking strength obtained in tests of a single representative strand or bar, breaking outside the anchorage. For multi-strand or bar tendons, AUTS equals the AUTS of a single tendon element (strand, bar) times the number of such
elements in the tendon. Representative samples must be from the same coil of strands or the same bar from which strands or bars are cut and used in connection efficiency tests. (Reference PTI “Acceptance Standards for Post-tensioning Systems”. See also, “GUTS” and “MUTS”).

2. Anchor Nut: The threaded device that screws onto a threaded bar and transfers the force in the bar to the bearing plate.

3. Anchor Plate: That part of the anchorage hardware that bears directly on the concrete and by which the tendon force is transmitted to the structure.

4. Anchorage Assembly: an assembly of various hardware components that secure a tendon at its ends after it has been stressed and imparts the tendon force into the concrete.

5. Anchorage Zone: The general expression for combined general and local zones: see general zone, Local zone.

6. Anticipated Set: The wedge set assumed to occur in the design calculation of the post-tensioning forces at the time of load transfer; see Set.

7. Bar: High strength steel bars, normally available from 5/8 to 1-3/4 inch diameter and usually threaded with a very coarse thread.

8. Basic Bearing Plate: Flat plate bearing directly against concrete meeting the analytical design requirements. Covered by this definition are square, rectangular, or round plates, sheared or torch cut from readily available steel plate, normally ASTM A-36.

9. Bearing Plate: Any steel hardware that transfers the tendon force into a structure.

10. Confinement Reinforcement: Non-prestressed reinforcement in the local zone. Confinement reinforcement in the concrete ahead of tendon anchorages is limited to the local zone. Confinement reinforcement consists of spirals orthogonal reinforcing bars, or a combination of both. For basic bearing plates confinement reinforcement is required in that volume of concrete in which compressive stresses exceed acceptable limits for unreinforced concrete as determined by rational analysis. For special bearing plates, confinement reinforcement is system dependent as determined by tests on individual anchorages. Test block reinforcement, in the portion surrounding the special bearing plate and immediately ahead of it, must represent the confinement reinforcement required in the local zone for that particular system.

11. Coupler: A device used to transfer the prestressing force from one partial-length prestressing tendon to another. (Strand couplers are not permitted.)

12. Duct: Material forming a conduit to accommodate post-tensioned tendon installation and provide an annular space for the grout which protects the prestressing steel.

13. Family of Systems: Group of post-tensioning tendon assemblies of various sized which use common anchorage devices and design. All components within the family of systems are furnished by a single supplier and have a common design with varying sizes.

14. General Zone: The region in which the concentrated prestressing force spreads out to a more linear stress distribution over the cross section of the structural member (Saint Venant Region). It includes the local zone. The general zone extends from the anchorage along the axis of the member for a distance equal to the overall depth of the member. The height of the general zone is equal to the overall depth of the member.

15. Guaranteed Ultimate Tensile Strength: The tensile strength of the material that can be assured by the Manufacturer. GUTS should not be confused with “FPU” the specified ultimate tensile strength (AASHTO LRFD). (The term “GUTS” has been replaced by two definitions, “MUTS” and “AUTS” by the Post-Tensioning Institute.)

16. Local Zone: The local anchorage zone is the volume of concrete surrounding and immediately ahead of the anchorage device where concrete compressive stresses exceed acceptable values for unconfined concrete (concrete without confinement reinforcement). The local zone is defined as a rectangular prism of concrete surrounding the bearing plate and any integral confinement reinforcement. The transverse dimensions of the prism are equal to those of the bearing plate, including any integral confinement reinforcement, plus the supplier’s specified minimum edge covers. The length of the local zone extends over the confinement reinforcement. For anchorage devices with multiple bearing surfaces, the local zone extends over the distance from the loaded concrete surface to the bottom of each bearing surface of the anchorage device plus the maximum dimension of that bearing surface.
17. Minimum Ultimate Tensile Strength: When measured as a force, for a single strand or bar breaking outside of the anchorage or the multiple of those single strand or bar forces for multi-strand or bar tendons; MUTS is the force equal to the nominal cross-sectional area of strand, or bar, times their nominal ultimate tensile stress. (Reference PTI “Acceptance Standards for Post-Tensioning Systems”. See also, AUTS and GUTS.)

18. Post-Tensioning: A method of prestressing where tensioning of the tendons occurs after the concrete has reached a specified strength.

19. Post-Tensioning Scheme or Layout: The pattern, size and locations of post-tensioning tendons shown by the Engineer of Record on the Contract Plans.

20. Post-Tensioning System: An assembly of specific models of hardware, including but not limited to anchorage assembly, local zone reinforcement, wedge plate, wedges, inlet, outlet, couplers, duct, duct connections and grout cap, used to construct a tendon of a particular size and type. The entire assembly must meet the system pressure testing requirement. Internal and external systems are considered independent of one another.

21. Prestressing Steel: The steel element of a post-tensioning tendon, which is elongated and anchored to provide the necessary permanent prestressing force.

22. Set: The total movement of a point on the strand just behind the anchoring wedges during load transfer from the jack to the permanent anchorages. Set movement is the sum of slippage of the wedges with respect to the anchorage head and the elastic deformation of the anchor components. For bars, set is the total movement of a point on the bar just behind the anchor nut at transfer and is the sum of slippage of the bar and the elastic deformation of the anchorage components.

23. Sheathing: General term for the duct material surrounding the prestressing element to provide corrosion protection or conduit for installation.

24. Special Bearing Plate: Any hardware that transfers tendon anchor forces into the concrete but does not meet the analytical design requirements. Covered by this definition are devices having single or multiple plane bearing surfaces, and devices combining bearing and wedge plate in one piece. They normally require confinement reinforcement.

25. Strand: An assembly of several high strength steel wires wound together. Strands usually have six outer wires wound in long-pitch helix around a single straight wire of a similar diameter.

26. Tendon: A single or group of prestressing elements and their anchorage assemblies, which impart a compressive force to a structural member. Also included are ducts, grouting attachments, grout and corrosion protection filler materials or coatings. The main prestressing element is usually a high strength steel member made up of a number of strands, wires or bars.

27. Tendon Size: The number of individual strands of a certain strand diameter or the diameter of a bar.

28. Tendon Type: The relative location of the tendon to the concrete shape, internal or external.

29. Wedge: A conically shaped device that anchors the strand in the wedge plate.

30. Wedge Plate: The hardware that holds the wedges of a multi-strand tendon and transfers the tendon force to the anchorage assembly (commonly referred to as anchor head).

31. Wire: A single, small diameter, high strength steel wire, typically the basic component of strand.

1.2.2 Post-Tensioning Grout Related Definitions

1. Admixture: A material, usually a liquid or powder that is used as an ingredient of the cementitious grout and is added immediately before or during mixing.

2. Bleed: The autogenous flow of mixing water within or its emergence from, newly placed grout, caused by the settlement of the solid materials within the mass.

3. Contamination: Any foreign material found in a tendon at any point in time.

4. Cavitation: Air trapped during the grouting process through an irregular flow of grout through the duct. Cavitation can occur when grouts are injected from high points in the tendon profile or by a poor combination of grouting rate and viscosity, in which the grout traps air as it moves to the low point and does not completely fill the duct.

5. Final Set: A degree of stiffening of the grout mixture greater than the initial set, indicating the time required for the grout to stiffen sufficiently to resist, to an established degree, the penetration of a weighted test needle.
6. Fluidity: A measure of time, expressed in seconds necessary for a stated quantity of grout to pass through the orifice of a flow cone.

7. Grout: A mixture of cementitious materials and water with or without mineral additives or admixtures, proportioned to produce a consistency that may be pumped without segregation of the constituents when injected into the duct to fill the space around the prestressing steel.

8. Grout Cap: A device which contains the grout and forms a protective cover sealing the post-tensioning steel at the anchorage.

9. Grout Pipe: A small diameter pipe usually of plastic attached at a grout vent (inlet or outlet).

10. Grout Vent: see “vent”.

11. Initial Set: A degree of stiffening of the grout mixture less than the final set, indicating the time required for the grout to stiffen sufficiently to resist, to an established degree, the penetration of a weighted test needle.

12. Inlet: Tubing or duct used for injection of the grout into the duct (see also “vent”).

13. Outlet: Tubing or duct to allow the escape of air, water, grout and bleed water from the duct (see also “vent”).

14. Permeability to Chloride: A measure of the grout’s ability to resist chloride ion penetration.

15. Port or Grout Port: see “vent”.

16. Potable Water: Water as defined by EPA (Environmental Protection Agency) drinking water standards.

17. Pressure Rating: The estimated maximum pressure that water in a duct or in a duct component can exert continuously with a high degree of certainty that failure of the duct or duct component will not occur (commonly referred to as working pressure).

18. Recharge: The ability of water, outside of the post-tensioning tendon, to migrate through some path and enter the tendon, usually, through the anchorage or at a breach in the duct.

19. Set Time: The lapsed time for the addition of mixing water to a cementitious mixture until the mixture reaches a specified degree of rigidity as measured by a specific procedure.

20. Setting: The process, due to the chemical reactions, occurring after the addition of mixing water, which results in a gradual development of rigidity of a cementitious mixture.

21. Thixotropic: The property of a material that enables it to stiffen in a short time while at rest, but to acquire a lower viscosity when mechanically agitated.

22. Volume Change: The change in volume produced by continued hydration of cement, exclusive of effects of the applied load and change in thermal or moisture content.

23. Vent or Grout Vent: An attachment to a duct through which grout is injected (inlet) or released (outlet) – also, a special hole in the anchorage or bearing plate which serves the same purpose. Vents may also be used for inspection of grout by inserting a probe or endoscope.

24. Water-Reducing Admixture: An admixture that either increases the slump of freshly mixed grout without increasing the water content or that maintains the slump with reduced amount of water due to factors other than air entrainment.

1.3 Contractor Proposed Options

Alternate designs using a post-tensioning scheme other than that shown on the plans may be submitted for the Engineer’s approval provided that the proposed alternate scheme fulfills the following requirements:

1. The prestress system is a type described in and meeting the requirements of this Specification.

2. The net compressive stress in the concrete after all losses is at least as large as that provided by the post-tensioning shown on the plans.

3. The distribution of individual tendons at each cross section generally conforms to the distribution shown on the plans.

4. The ultimate strength of the structure with the proposed post-tensioning scheme meets the requirements of Section 5 of the “AASHTO LRFD Bridge Design Standard Specifications” and shall be equivalent to or greater than the ultimate strength provided by the original design.

5. Stresses in the concrete and prestressing steel at all sections and at all stages of construction meet the requirements of the Design Criteria noted on the plans.

6. All provisions of the Design Criteria noted on the plans shall be satisfied.
7. The Contractor fully designs and details the elements where the alternate post-tensioning scheme is proposed to be used.
8. Transverse post-tensioning anchors shall be placed into the form before the concrete is cast. Temporary blockouts to allow later installation of anchors shall not be allowed.
9. The Contractor submits complete shop drawings including post-tensioning scheme and system, reinforcing steel, and concrete cover; and design calculations (including short and long term prestress losses) for the Engineer’s approval.
10. Any alternate post-tensioning system approved by the Engineer, which results in a change in quantity from that shown on the Contract Documents, will be paid based on the quantity actually used and accepted or the plan quantity, whichever is less, and at the unit bid price. If the approved alternate post-tensioning scheme or system is under a VECP (Value engineering Change Proposal), the method of payment will be in compliance with the VECP agreement.
11. Calculations and details for alternative post-tensioning systems shall be signed and sealed by a Professional Engineer registered in the State of New Jersey.
12. Alternate post-tensioning systems and layouts shall provide structural redundancy that is equivalent to the post-tensioning layout shown on the Contract Documents in the event of the loss of one of the permanent post-tensioning tendons.

1.4 Shop Drawings

Shop drawings are required for the integration of the post-tensioning system, reinforcement and other embedded items, including those for the Contractor’s means and methods of construction for precast and cast-in-place components. The Contractor shall submit detailed shop drawings that address the requirements of Plans and Specifications as follows:

1.4.1 A complete description of, and details covering, each of the prestressing systems to be used for permanent and temporary tendons, including, but not necessarily limited to:
1. Designation of the specific prestressing steel, dimensions, details and materials for all manufactured components such as anchorage devices, wedges, nuts, bar couplers, ducts, materials and accessories according to the post-tensioning system to be used.
2. Tendon profile and clearances, duct supports, connections of ducts, connections at temporary bulkheads and the like, complying with the plans and the limitations of the selected post-tensioning system.
3. Location and details of grout inlets and outlets, at anchorages, low-points, high-points and other required inspection points and the direction of grouting.
4. Size, type, connections and sealing details for permanent grout caps.
5. Protection system materials and application limits.
6. Details covering assembly and installation of each type of prestressing tendon.
7. Equipment, dimensions and clearances to be used in the prestressing operations.
8. Procedure and sequence of operations for prestressing and securing tendons.
9. Procedure for releasing temporary or permanent prestressing steel elements.
10. Parameters to be used to calculate the typical tendon force such as; expected friction coefficients, anchor set and prestress steel relaxation curves.

1.4.2 A table detailing the prestressing jacking sequence, jacking forces and initial elongations of each tendon at each stage of erection for all prestressing.

1.4.3 Complete details of the anchorage system for prestressing including certified copies of the reports covering tests performed on prestress anchorage devices as required herein, and details for any reinforcing steel needed due to stresses imposed in the concrete by anchorage plates.

1.4.4 For the operation of grouting prestressing tendons; the materials and proportions for grout, details of equipment for mixing and placing grout and methods of mixing and placing grout (also, locations and details of inlets and outlets for grouting and the direction of grouting).
1.4.5 Calculations to substantiate the prestressing system and procedures to be used including stress-strain curves typical of the prestressing steel to be furnished, required jacking forces, elongation of tendons during tensioning, seating losses, short-term prestress losses, long term prestress losses, temporary over stressing, stresses in prestress anchorages including distribution plates and reinforcing steel needed in the concrete to resist stresses imposed by prestress anchorages. These calculations shall show a typical tendon force and anticipated losses from friction, wobble, anchor set, and anticipated adjustment for thermal affects.

Elongation calculations shall be revised when necessary to properly reflect the modulus of elasticity of strand tendons as determined from in-place friction testing.

1.4.6 Details of the apparatus and method to be used by the Contractor for the Testing of Prestressing Tendons by the Contractor as required by the Materials Section of this Specification.

1.4.7 Calculations for post-tensioning shall be signed and sealed by a Professional Engineer registered in the State of New Jersey.

530.02 Materials

2.1 General

The materials to be incorporated into work covered by this Section shall conform to the requirements set out herein.

Use of a post-tensioning system is subject to the approval of the Engineer. Only post-tensioning systems of proper type and size for the tendons shown on the plans shall be used. Substitution of components from different post-tensioning systems shall not be allowed. Post-tensioning systems shall utilize tendons fully encapsulated in anchorages and ducts. Systems that transfer prestress force by bonding the prestress steel directly to concrete shall not be used. For permanent applications, the use and location of bar couplers is subject to approval by the Engineer. For external tendon, systems utilizing “Diablos” at deviators shall not be allowed.

All post-tensioning material shall be stored in a weatherproof building, shed or container until the time of use.

2.2 Prestressing Steel

1. Strand: Unless otherwise noted on plans, strand shall be uncoated, Grade 270, low relaxation 7-wire strand conforming to requirements of ASTM A-416 “Standard Specification for Steel Strand, Uncoated Seven Wire Strand for Prestressed Concrete”. For the substructure only, strands shall be corrosion protected with epoxy coating in accordance with ASTM-A882, Supplement S1.

2. Thread-Bar: Unless otherwise noted on the plans, prestress bars shall be uncoated, Grade 150, high strength deformed thread bars, Type II, conforming to the requirements of ASTM A-722, “Standard Specification for Uncoated High Strength Steel Bar for Prestressing Concrete”.

3. Wires: Unless otherwise noted on the plans, wire shall be uncoated, low relaxation wire conforming to the requirements of ASTM A-421.

2.3 Thread-Bar Couplers

Thread-bar couplers shall meet the requirements of ASTM A-722. Bar couplers shall be used only at locations specifically shown on the plans or approved by the Engineer. A bar coupler shall develop at least 95 percent of the required ultimate strength of the bar with a minimum elongation of two percent when tested in the unbonded condition measured in 10 foot gauge lengths, without failure of the coupler or the thread-bar.

Testing of couplers shall be performed using samples of the prestressing bar to be used on the project. The test specimen shall be assembled in an unbonded state and during testing the anticipated set shall not be exceeded.
Only threaded type couplers shall be used with post-tensioning thread bars. Post-tensioning thread-bars shall be threaded into 1/2 the length of the coupler ± 1/4 inch so that when two bars are mated in a coupler, the length of each bar positively engaged in the coupler shall be half the coupler's length within the acceptable tolerances. No coupling or splicing will be permitted with strands.

2.4 Post-Tensioning Anchorages

All prestressing steel shall be secured at the ends by means of permanent type anchoring devices. Prestress anchorages shall develop at least 95 percent of the actual ultimate tensile strength of the prestressing steel, when tested in an unbonded state, without exceeding the anticipated set.

Anchorages shall be tested to meet or exceed the testing requirements of the AASHTO LRFD Bridge Construction Specifications. Written certification shall be provided to the Engineer.

The anchorage system shall be so arranged that the prestressing force in the tendon may be verified prior to the removal of the stressing equipment.

For tendon anchorages, the design and furnishing of any reinforcement (in addition to the reinforcement shown on the plans) which is needed to resist bursting and splitting stresses imposed on the concrete by the proposed anchorage system shall be the responsibility of the Contractor at his expense.

Prestress anchorage devices shall effectively distribute prestressing loads to the concrete and shall conform to the following requirements.

1. Anchorages shall be designed so that the average concrete bearing stress is in compliance with the “AASHTO LRFD Bridge Design Specifications”.

2. Bending stresses in the plates or assemblies induced by the pull of the prestressing steel shall not exceed the yield point of the material in the anchor plate when 95 percent of the ultimate strength of the tendon is applied. Nor shall it cause visual distortion of the anchor plate as determined by the Engineer.

The body of the anchorage shall be galvanized in accordance with ASTM 123. Other components of the anchorage including wedges, wedge plate and local zone reinforcement are not required to be galvanized. The bearing surface and wedge plate shall be made from ferrous metal. All anchorages shall be equipped with a permanent grout cap that is vented and bolted to the anchorage.

Wedge plates shall have centering lugs or shoulders to facilitate alignment with the bearing plate. Anchorages shall have a grout vent suitable for inspection from either the top or front of the anchorage. The vent shall facilitate the dual purpose of grouting or post-grouting inspection by drilling, if necessary, using a straight bit, and by insertion of a probe or endoscope. The geometry of the grout outlets must facilitate being drilled using a 3/8 inch diameter straight bit to facilitate both inspection directly behind the anchor plate.

Trumpets associated with anchorages shall be made from either ferrous metal or polypropylene plastic material conforming to the material requirements of corrugated plastic duct. The thickness of the trumpet at the transition location (choke point) shall not be less than the thickness of the duct. Alternately, the trumpet material may be a polyethylene or polyolefin containing antioxidant(s) with a minimum Oxidation Induction Time (OIT) according to ASTM D-3895 of not less than 20 minutes. Test the remolded finished polyolefin material for stress crack resistance using ASTM F-2136 at an applied stress of 348 psi resulting in a minimum failure time of 3 hours.

2.5 Permanent Grout Caps

Anchorages shall be fitted with a permanent grout cap made from fiber reinforced polymer or ASTM A-240 Type 316L stainless steel. The resins used in the fiber reinforced polymer shall be either nylon Acrylonitrile-Butadiene-Styrene or polyester. For products made from nylon, the cell class of the nylon according to ASTM...
D-5989 shall be S-PA0141 (weather resistant), S-PA0231 or S-PA0401 (ultimate strength no less than 10,000 psi with UV stabilizer added). The cap shall have an “O” ring or precision fitted flat gasket seal against the bearing plate. The grout cap shall have a grout vent oriented to the top of the cap. Grout caps shall be rated for a minimum pressure of 150 psi. Use ASTM A-240 Type 316L stainless steel bolts to attach the grout cap to the anchorage. Certified test reports of the chemical analysis of stainless steel caps is required for verification.

2.6 Grout Vents (Inlets and Outlets), Valves and Plugs

All inlets and outlets shall be equipped with pressure rated mechanical shut-off valves or plugs. Grout vents at inlets and outlets, valves, vent plugs or caps shall be rated for a minimum pressure rating of 150 psi. Grout vents (inlets and outlets) shall have a minimum inside diameter of ¾ inch for strand and 3/8 inch for single bar tendons and four-strand duct. Dual mechanical shut-off valves shall be provided when performing vertical grouting.

All permanent attachments to anchorages and ducts for grout vents (inlets and outlets) and threaded vent plugs or caps shall be made of ASTM A-240 Type 316 stainless steel, nylon or polyolefin materials. For products made from nylon, the cell class of the nylon according to ASTM D0-5989 shall be S-PA0141 (weather resistant), S-PA0231 or S-PA0401 (ultimate strength no less than 10,000 psi with UV stabilizer added). Products made from polyolefin shall contain antioxidant(s) with a minimum Oxidation Induction Time (OIT) according to ASTM D-3895 of not less than 20 minutes. The finished polyolefin material shall be tested to satisfy stress crack resistance using STM F-2136 at an applied stress of 348 psi with a minimum failure time of 3 hours.

Temporary items, not part of the permanent structure, may be made of any suitable material.

Grout vents (inlets and outlets) shall be provided at locations designated on the Shop Drawings, in accordance with the requirements in this Specification for construction and installation (below).

2.7 Ducts

2.7.1 General

Only plastic duct, steel pipe or a combination of plastic duct and steel pipe shall be used for ducts. All connectors, connections and components of post-tensioning system hardware shall be sufficiently air and water tight to pass the pressure test requirements herein. Smooth plastic duct shall be used for external post-tensioning systems. Corrugated plastic duct shall be used for all internal post-tensioning systems except where steel pipe is required. The use of “Diablos” is prohibited.

All duct material shall be sufficiently rigid to withstand loads imposed during placing of concrete and internal pressure during grouting while maintaining its shape, remaining in proper alignment and remaining watertight.

The duct system, including splices and joints shall effectively prevent entrance of cement paste or water into the system and shall effectively contain pressurized grout during grouting of the tendon.

The interior diameter of ducts for single bars shall be at least 1/2 inch greater than the nominal diameter of the bar measured across the upstanding deformations. For prestressing bars with couplers, the entire length of duct shall be 1/2 inch larger than the diameter of the coupler. The interior diameter of ducts for tendons consisting of more than one strand, bar or wire shall be such that the interior area of the empty duct is not less than 2.5 times the net area of the prestressing steel.

2.7.2 Duct Type Designation

Key to Duct Material: A - Galvanized Rigid Steel Pipe    C - Corrugated Plastic
B - Corrugated Metal (not used)    D - Smooth Plastic
Except as otherwise designated in the plans, the type of duct material for specific applications shall be as follows:

<table>
<thead>
<tr>
<th>Number of Strands in Tendon</th>
<th>Tendon Radius (R) Ft.</th>
<th>Duct Type Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5&quot;Ø</td>
<td>0.6&quot;Ø</td>
<td></td>
</tr>
<tr>
<td>4 (Transverse Flat Duct)</td>
<td>10 or more</td>
<td>C</td>
</tr>
<tr>
<td>1 to 13</td>
<td>1 to 8 (Round Duct)</td>
<td>A, B, C</td>
</tr>
<tr>
<td>14 to 18</td>
<td>9 to 13</td>
<td>A, B, C</td>
</tr>
<tr>
<td>19 to 32</td>
<td>14 to 20</td>
<td>A, B, C</td>
</tr>
<tr>
<td></td>
<td>30* or more</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 to 30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 to 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A, B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.5 to 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50* or more</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25 to 50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 to 25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A, B, C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A, B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

*For Type C duct material (corrugated plastic), this radius is the minimum allowed for a tendon unless otherwise approved by the Engineer based on test data as specified in Section 2.8.3.

NOTES:
1. Type D duct material shall only be used for those portions of a tendon not embedded in concrete.
2. External ducts shall be Type D.
3. Type A duct material shall be used throughout the entire length of the particular segment where an external tendon is embedded in a deviation block, beam or diaphragm.
4. Type A duct material which is embedded in a deviation block, beam, diaphragm, or footing shall be bent to a uniform radius along a curve extending between tangent points located at least one inch inward from the face of the deviation block, beam, diaphragm, or the footing layout shown in the Plans.
5. Type B duct material shall NOT be used for this project.

2.8 Specific Material Properties of Ducts and Attachments

2.8.1 Type A - Galvanized Rigid Steel Pipe

Steel pipe duct shall be galvanized steel pipe conforming to the requirements of ASTM A-53, Type 3, Grade B. The nominal wall thickness of the pipe shall not be less than that of Schedule 40. The pipe shall be bent so as to accurately conform to the alignment of the tendon taking into consideration the minimum bending radius shown in the contract plans or shop drawings.

2.8.2 Type B - Corrugated Metal (Not used for this project)

Corrugated metal duct shall be fabricated with either welded or interlocked seams and bent without crimping or flattening. Sections of duct shall be connected with positive ferrous metal connectors that prevent angle changes at joints.
Duct and metal connectors shall be fabricated from galvanized sheet steel meeting the requirements of ASTM 525, Coating Designation G90. Areas of zinc coating damaged by welding or in fabricating interlocked seams shall be repaired by painting with a zinc duct-zinc oxide paint conforming to Federal Specifications TT-P-640 or MIL-P-21035.

Joints between sections of duct shall have no sharp edges within contact of the prestressing steel.

For strand and wire tendons, the duct thickness shall be 26 gauge up to 2-5/8 inches diameter. Ducts larger than 2-5/8 inches diameter shall be 24 gauge. For bar tendons, the duct thickness shall not be less than 31gauge.

2.8.3 Type C - Corrugated Plastic (HDPP)

1. Material for Corrugated Plastic Duct (HDPP)

Plastic ducts shall not be made from recycled material. Only seamless fabrication methods shall be used to manufacture ducts. Corrugated duct shall be manufactured from non-colored, unfilled polypropylene meeting the requirements of ASTM D-4101 “Standard Specification for Polypropylene Plastic Injection and Extrusion Materials” with a cell classification range of PP0340B14541 to PP0340B67884. The duct shall be white in color containing antioxidant(s) with a minimum Oxidation Induction Time (OIT) according to ASTM D-3895 of 20 minutes and contain a non-yellow light stabilizer. Duct shall have a minimum thickness as defined in the following table:

<table>
<thead>
<tr>
<th>Duct Shape</th>
<th>Duct Diameter</th>
<th>Duct Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat</td>
<td>Any size</td>
<td>0.08 inches</td>
</tr>
<tr>
<td>Round</td>
<td>0.9 inches</td>
<td>0.08 inches</td>
</tr>
<tr>
<td>Round</td>
<td>2.375 inches</td>
<td>0.08 inches</td>
</tr>
<tr>
<td>Round</td>
<td>3.0 inches</td>
<td>0.10 inches</td>
</tr>
<tr>
<td>Round</td>
<td>3.35 inches</td>
<td>0.10 inches</td>
</tr>
<tr>
<td>Round</td>
<td>4.0 inches</td>
<td>0.12 inches</td>
</tr>
<tr>
<td>Round</td>
<td>4.5 inches</td>
<td>0.14 inches</td>
</tr>
<tr>
<td>Round</td>
<td>5.125 inches</td>
<td>0.16 inches</td>
</tr>
<tr>
<td>Round</td>
<td>5.71 inches</td>
<td>0.16 inches</td>
</tr>
</tbody>
</table>

Plastic duct shall be corrugated with a pitch not less than 1/10 of the radius of the duct.

2. Minimum Bending Radius for Corrugated Plastic (HDPP)

In addition to the component testing stated herein, the manufacturer shall establish through testing, the minimum bending radius for the duct. The test shall consist of a modified duct wear test as described in Chapter 4, Article 4.1.7 or FIB Technical Report, Bulletin 7, titled “Corrugated Plastic Duct for Internal Bonded Post-Tensioning”. The test apparatus shall be identical to the wear test apparatus with the same clamping force as a function of the number of strands in the duct; however, modify the procedure as follows: do not move the sample along the strand to simulate wear; the test duration will be 7 days. Upon completion of the test duration, remove the duct and the minimum wall thickness along the strand path must not be less than 0.06 inch for duct up to 3.35 inches diameter and not less than 0.08 inch for duct greater than 3.35 inches in diameter.

3. Testing Requirements for Corrugated Plastic

The duct system components and accessories shall meet the requirement of Chapter 4, Articles 4.1 through 4.1.8 of FIB Technical Report, Bulletin 7 entitled “Corrugated Plastic Duct for internal Bonded Post-Tensioning” as modified herein. (Copies of the technical...
The requirements in FIB Technical Report, Bulletin 7, are modified as follows: the lateral load resistance test (FIB 4.1.4), shall be conducted without the use of a duct stiffener plate and using a load of 150 lbs. for all sizes’ wear resistance of duct (FIB 4.1.7) must not be less than 0.06 inch for duct up to 3.35 inches in diameter and not less than 0.08 inch for duct greater than 3.35 inches in diameter; bond behavior of duct (FIB 4.1.8) must achieve 40% GUTS in a maximum length of 16 duct diameters.

To satisfy the intent of these tests, the results for static pull-out tests from previous projects utilizing identical duct and prestressing steel with similar concrete and grout material may be submitted to the Engineer in lieu of executing new pull-out tests. However, if the previous results are unacceptable or if there is a significant difference in the materials used, then the Contractor shall provide results from new tests for this project.

4. Corrugated Duct Connections and Fittings

All splices, joints, couplings and connections between ducts and to anchorages shall be made using devices or methods (i.e. mechanical couplers) producing a smooth interior alignment with no lips or kinks. All connections and fittings shall be airtight. Duct tape is not permitted to join or repair duct connections. Connections and fittings shall be made from polyolefin materials containing antioxidant stabilizer(s) meeting the requirements of the Materials Section of this Specification.

2.8.4 Type D - Smooth Plastic for External Tendons

2.8.4.1 Properties of Smooth Plastic Duct

Smooth duct shall be manufactured from 100% virgin polyethylene resin meeting the requirements of STM D-3350 with a minimum cell class of 344464C. Resin shall contain antioxidant(s) with a minimum Oxidative Induction Time (OIT) according to ASTM D-3895 of 40 minutes. Duct shall have a dimension ratio (DR) of 17.0 or less as established by either ASTM D-3055 or STM F-714 as appropriate for the manufacturing process used. Unless stated otherwise, duct shall be black.

Smooth duct shall meet the minimum pressure rating (working pressure) of 100 psi and be manufactured to either of the following Specifications: ASTM D-3035 “Standard Specifications for Polyethylene (PE) Plastic Pipe (DR-PR) based on Controlled Outside Diameter” or ASTM F-714 “Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter”.

2.8.4.2 Connections

Splices between sections of plastic duct shall be made by heat welding techniques in accordance with the duct manufacturer’s instructions, or by mechanical couplers meeting the requirement of this Specification. All connections shall have a minimum pressure rating (working pressure) of 100 psi. Connections shall have a smooth interior alignment with no lips or kinks.

All connections between steel pipe embedded in concrete and plastic duct shall be made using a mechanical coupler, electrofusion coupler or a circular sleeve (boot) made of Ethylene Propylene Deine Monomer (EPDM), having a minimum pressure rating (working pressure) of 100 psi. EPDM materials shall have 100% quality retention as defined by STM D-1171 Ozone Chamber Exposure Method B.
EPDM sleeves shall have a minimum wall thickness of 3/8 inch and be reinforced with a minimum of four ply polyester reinforcement. Use 3/8 inch wide power seated band clamps of 316 stainless-steel on each end of the sleeve (boot) to seal against leakage of grout. The band clamps shall be installed with an 80 to 120 lb seating force.

Steel pipe and plastic duct may be connected directly to each other when the outside diameters do not vary more than ±inch. A reducer shall be used when the tolerance is outside this limit.

2.9 Shipping and Storage of Ducts

Duct shall be furnished with end caps to seal the duct interior from contamination. Ducts shall be shipped in bundles which are capped and covered during shipping and storage. Ducts shall be protected against ultraviolet degradation, crushing, excessive bending, dirt contamination and corrosive elements during transportation, storage and handling. End caps supplied with the duct shall not be removed until the duct is incorporated into the bridge component. Duct shall be stored in a location that is dry and protected from the sun. Storage must be on a raised platform and completely covered to prevent contamination: in if necessary, duct shall be washed before use to remove any contamination.

2.10 Mechanical Couplers and Heat Shrink Sleeve Requirements

Mechanical couplers shall be made from stainless steel, plastic or a combination of these materials. Plastic resins for couplers shall meet the requirements for plastic ducts. Grade 316 stainless steel shall be used for metallic components.

Heat shrink sleeves shall have uni-directional circumferential recovery and be manufactured specifically for the size of the duct being coupled consisting of an irradiated and cross linked high density polyethylene backing for external applications. Furnish adhesive having the same bond value to steel and polyolefin plastic materials. The heat shrink sleeves shall have an adhesive layer that will withstand 150° F operating temperature, meeting the requirements of the following table:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Minimum Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Fully Recovered Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peel Strength</td>
<td>ASTM D-1000</td>
<td>29 psi</td>
</tr>
<tr>
<td>Softening Point</td>
<td>ASTM E-28</td>
<td>162° F</td>
</tr>
<tr>
<td>Lap Shear</td>
<td>DIN 30 672M</td>
<td>87 psi</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D-638</td>
<td>2,900 psi</td>
</tr>
<tr>
<td>Hardness</td>
<td>ASTM D-2240</td>
<td>46 Shore D</td>
</tr>
<tr>
<td>Water absorption</td>
<td>ASTM D-570</td>
<td>Less than 0.05%</td>
</tr>
<tr>
<td>Color</td>
<td>Heat Recovery test</td>
<td>Yellow</td>
</tr>
<tr>
<td>Minimum Recovery</td>
<td></td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Black</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23%</td>
</tr>
</tbody>
</table>

2.11 Duct System Test Requirements

2.11.1 General
For each family of post-tensioning systems, a pressure test shall be performed on an assembled system as defined herein. For each family of post-tensioning systems two assemblies shall be tested (largest and smallest) from the family. The post-tensioning assembly shall include at least one of each component required to make a tendon from grout cap to grout cap. If applicable, plastic duct to steel pipe connection shall be included.

2.11.2 Grouting Component Assembly Pressure Test

The anchorage and grout cap shall be assembled with all required grouting attachments (grout tube, valves, plugs, etc.). The opening in the anchorage where the duct connects shall be sealed. Condition the assembly by maintaining a pressure of 150 psi in the system for 3 hours. After conditioning, the assembly must sustain a 150 psi internal pressure for 5 minutes with no more than 15 psi reduction in pressure. For systems using the same anchorages, grout caps and grouting attachments as a previously approved system, the Grouting Component Assembly Pressure Test may include documentation from a previous submittal with written certification that the same components are being utilized in both anchorages.

2.11.3 External Duct System

System testing for external duct shall consist of two additional tests. (1) The anchorage and its connection to the duct/pipe assembly must be tested in accordance with and meet the requirements for internal duct systems (duct/pipe assembly consists of all components internal to the diaphragm concrete). Test the assembly at 1.5 psi. (2) The duct and pipe assembly consisting of all external duct connections (welded duct splices, duct/pipe, etc.) and a grout vent must comply with the following test. The assembly shall be conditioned by maintaining a pressure of 150 psi in the system for 3 hours. After conditioning, the assembly must sustain a 150 psi internal pressure for five minutes with no more than 15 psi reduction in pressure. The length of the test pipe assembly for the second test shall be 15 feet.

2.11.4 Internal Duct System

The assembly shall be tested for compliance with the requirements of Chapter 4, Article 4.2, Stage 1 and Stage 2 Testing contained in FIB Technical Report, Bulletin 7 titled “Corrugated Plastic Duct for Internal Bonded Post-Tensioning”. For bar systems modify the system test length to 15 feet.

For systems being tested for use in precast segmental construction that use duct couplers at match-cast joints, this test shall be modified to include one duct coupler which is to be used at the segment joint. The coupler shall be tested for proper functioning by casting it into a two part concrete test block using match-cast techniques. Blocks shall be at least 12”x12”x12”. After the concrete has hardened, the blocks shall be separated and the surfaces cleaned of any bond breaker materials. An external apparatus shall be used to clamp the blocks together and maintain 40 psi pressure on the block cross-section during the pressure test. Epoxy shall NOT be applied between the blocks for this portion of the test. Pressurize the duct within the test block to 5 psi and lock-off the outside air source. The assembly must sustain a 5 psi internal pressure for five minutes with no more than a 0.5 psi reduction in pressure. The duct coupler blocks shall then be separated from the duct system by removing the clamping device. A 1/16 inch layer of epoxy shall be applied on the face of both blocks and the blocks shall be clamped together, maintaining a pressure of 40 psi on the block cross-section for 4 hours. The clamping force shall then be released and the blocks shall be carefully demolished and examined. The coupler and the attached ducts should be intact and free of epoxy, and properly attached without crushing, tearing or other signs of failure.

2.11.5 Acceptability from Previous Tests

To satisfy the intent of the above tests, results from previous projects utilizing identical ducts and similar concrete may be submitted to the Engineer in lieu of executing new tests. However, if the
2.12 Sampling and Testing of Prestressing Elements

All testing shall be done in accordance with ASTM Specifications.

The following samples of materials, devices and test certifications as designated by the Engineer shall be furnished by the Contractor at his expense.

1. Three randomly selected samples, each five feet long, of post-tensioning bar, per manufacturer, per size of bar, per heat of steel, with a minimum of one sample per shipment.
2. Three randomly selected samples, each five feet long, of prestressing strand for each size of strand from each shipment, with a minimum number of one sample for every ten reels delivered.
3. If bar couplers are to be used, three samples with two specimens each consisting of four foot lengths of the specific prestressing bar coupled with a bar coupler from the materials to be used on the project.
4. One unit of each prestress anchorage to be used on the project.
5. For each type of duct material intended for the project, one sample, four feet long, from each production lot or per 10,000 linear feet, whichever is greater.

With each sample of prestressing steel strand or bar furnished for testing, a certification shall be submitted to the Engineer stating the manufacturer’s minimum guaranteed ultimate tensile strength for that sample.

Samples shall be furnished at least 90 days in advance of the time they are to be incorporated into the work.

The Engineer reserves the right to reject any material or device which is determined to be defective or was damaged subsequent to testing.

2.13 Lots and Identification (Contractor's Quality Control)

A “Lot” is that parcel of components as described herein. The manufacturer of prestressing steel, prestress anchorages and bar couplers shall assign an individual number to each Lot of strand, wire, bar or devices at the time of manufacture. All bars of each size and mill heat of steel and all strands from each manufactured reel, bundle or package shipped to the project shall be identified by tag or other acceptable means as to Manufacturer's Lot number. The Contractor shall be responsible for establishing and maintaining a procedure by which all prestressing materials and devices can be continuously identified with the manufacturer's Lot number. Items which at any time cannot be positively identified as to Lot number shall not be incorporated into the work.

Low relaxation strand shall be clearly identified as required by ASTM A-416. Any strand not so identified will not be acceptable.

The Contractor shall furnish manufacturer's certified reports covering the tests required by this Specification. A certified test report stating the guaranteed minimum ultimate tensile, yield strength, elongation and composition shall be furnished for each lot of prestressing steel. When requested, typical stress-strain curves for prestressing steel shall be furnished. A certified test report stating strength when tested using the type prestressing steel to be used in the work shall be furnished for each Lot of prestress anchorage devices.

2.14 Testing of Prestressing Tendons by the Contractor

2.14.1 General

The Contractor shall perform certain testing of prestressing tendons as specified herein.

2.14.2 In-Place Friction Test of Tendons
For tendons in excess of 100 feet long, a minimum of one tendon in a tendon group performing the same function shall be tested in place. Functional tendon groups are cantilever tendons, continuity tendons, draped external tendons or continuous profiled tendons passing through one or more spans, etc. The selected tendon will represent the size and length of the group of tendons being tested. The in-place friction test is not required on projects with straight tendons used in flat slabs or precast voided slabs.

The test procedure shall consist of stressing the tendon at an anchor assembly with a load cell or a second certified jack at the dead end to 80% of ultimate tendon strength in eight equal increments. For each increment, the gauge pressure, elongation and load cell force shall be recorded. Account shall be taken of any wedge seating in both the live end (i.e. back of jack) and the dead end (i.e. back of load cell) and any friction within the anchorages, wedge plates and jack as a result of slight deviations of the strands through these assemblies. For long tendons requiring multiple jack pulls with intermediate temporary anchoring, an accurate account shall be kept of the elongation at the jacking end allowing for intermediate wedge seating and slip of the jack’s wedges.

If elongation’s fall outside a ±7% range compared to the anticipated elongations, reasons shall be sought and detailed calculations made to confirm that the final tendon forces are in agreement with the approved Plans.

In reconciling theoretical and actual elongations, the value of the expected friction and wobble coefficients shall not be varied by more than ±10%. Significant shortfall in elongations is indicative of poor duct alignments and/or obstructions. Corrections or compensations for such elongations shall be made in a manner proposed by the Contractor and reviewed and approved by the engineer at no additional cost.

The Engineer requires one successful friction test for each tendon group for the project.

If there are irreconcilable differences between forces and elongations, or other difficulties during the course of routine stressing operations, the Engineer may require additional in-place friction tests.

The apparatus and methods used to perform the test must be submitted to the Engineer for approval. Tests must be conducted in the Engineer’s presence.

Test reports of the “In-Place Friction Test” shall be submitted to the Engineer within two weeks after successful installation of the tested tendon.

2.14.3 Payment for Testing

The above testing will not be paid for separately but will be incidental to the price paid for the post-tensioning.

2.15 Grout Materials and Properties

2.15.1 General

Grout for tendons shall consist of Portland cement and mineral admixtures for partial cement replacement, other specified or approved admixtures which impart low water content, flow, fluidity, minimum bleeding, non-shrink and, when necessary, set retarding properties to the grout. Any admixture containing chlorides, sulphites, fluorides or nitrates shall not be used in the grout. Gas evolving expansion agents and/or additives containing free aluminum or other components which produce hydrogen, carbon dioxide or oxygen gas shall not be used. For this project, grout shall have enhanced corrosion-resisting properties such as increased resistance to chloride penetration. There
shall be no deliberate addition of materials containing chlorides. Grout shall be mixed using potable water.

Only commercial, pre-packaged, cement-based, enhanced, grout mixtures, meeting the Requirements of this Specification, shall be used for this project subject to approval by the Engineer. Grout shall be stored in a location that is both dry and convenient to the work. Storage in the open must be on a raised platform and with adequate waterproof covering to protect the material. On site storage of grout is limited to a maximum period of one month.

Post-tensioning grout shall be formulated for proper use in either horizontal, vertical or repair applications. Grout fluidity shall be strictly maintained by production grouting flow-cone testing.

2.15.2 Classification of Grouts

Two classifications of grouts are recognized to reflect different requirements depending on exposure conditions. Aggressive exposures conditions apply to this Project.

“Normal Grout” is to be used only in non-aggressive exposure conditions. The primary constituents of Normal Grout are cement and water. Chemical admixtures may be required, but mineral admixtures such as silica fume and fly ash would not normally be compulsory to meet the performance criteria for Normal Grout. In general, Normal Grout will not have thixotropic properties. Normal grout shall not be used on this project.

“Enhanced Grout” for aggressive exposure conditions shall be used for this project. Enhanced Grout will normally contain both mineral admixtures for partial cement replacement and chemical admixtures to provide improved corrosion protection and resistance to bleed. Enhanced Grout may or may not have thixotropic properties, depending on the admixtures used. Enhanced Grout shall be supplied in the form of commercial, pre-packaged, cement-based grout mixtures, meeting the requirements of this Specification, subject to approval by the Engineer.

2.15.3 Water for Grout

Water shall be potable, clean and free of injurious quantities or substances (chlorides, sulfides, sulfates and nitrates) known to be harmful to Portland cement or prestressing steel. Water shall have chloride, sulfide, sulfate, and nitrate contents not greater than 500, 100, 650 and 13 ppm respectively.

Water used for grouting tendons shall be tested for the chemicals noted above at regular intervals not to exceed 120 days. Water shall be tested at the location where the water is placed into containers for the project. If the water is stored in containers, which might contaminate it (e.g. unlined metal tanks) then the Engineer can request that tests be performed on water coming from the storage tanks. The Contractor shall provide the Engineer with copies of test reports for the stored water.

2.15.4 Required Physical Properties of Grout

The following physical properties of grout are required to be satisfied.

Laboratory trial batches of the proposed grout mix shall be prepared using the same materials to be used on the job site. Trial batches shall be subjected to the tests described in this Section at a Laboratory approved by the Engineer to demonstrate that the proposed grout mix meets the requirements of this Specification. Testing shall be performed by personnel experienced in testing of grouts, and under temperature and humidity conditions expected at the site.
Grout material qualification laboratory testing requirements may be waived at the discretion of the Engineer provided the Contractor proposes to use a commercial pre-packaged grout that has previously met the requirements of this Specification as independently certified by a Laboratory approved by the Engineer.

Prior to beginning grouting operations, the Contractor shall furnish the Engineer with a report detailing the results of all laboratory testing, including the types and number of tests performed, test procedures, results and comparison of results with specified values.

Enhanced Grout shall meet or exceed the physical properties listed in Table 1 and Table 2 when mixed, prepared and tested at a normal temperature of 65°F to 78°F in a laboratory approved by the Engineer.

Grout cube strength tests are prequalification requirements for use of proposed mix. Grout cubes are also required for quality control during production grouting (See construction requirements Section 3).

Table 1 - Physical Property Requirements for Enhanced Grout

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>Requirement</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water-Cementitious Material Ratio</td>
<td>Maximum 0.45</td>
<td>n/a</td>
</tr>
<tr>
<td>Setting Time</td>
<td>Minimum 3 hours</td>
<td>ASTM C-953</td>
</tr>
<tr>
<td></td>
<td>Maximum 12 hours</td>
<td></td>
</tr>
<tr>
<td>Grout Cube Strength</td>
<td>Min. 3,000 psi at 7 days</td>
<td>ASTM C-942</td>
</tr>
<tr>
<td></td>
<td>Min. 5,000 psi at 28 days</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 - Additional Physical Property Requirements for Enhanced Grout

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>Requirement</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Chloride Ions</td>
<td>Maximum 0.08% by weight of cementitious material</td>
<td>ASTM C-1152</td>
</tr>
<tr>
<td>Fine Aggregate (if utilized)</td>
<td>99% passing the No. 50 Sieve (300 micron)</td>
<td>ASTM C-136*</td>
</tr>
<tr>
<td>Hardened Height Change @ 24 hours and 28 days</td>
<td>0.0% to + 0.2%</td>
<td>ASTM C-1090**</td>
</tr>
<tr>
<td>Expansion</td>
<td>≤ 2.0% for up to 3 hours</td>
<td>ASTM C-940</td>
</tr>
<tr>
<td>Wet Density – Laboratory</td>
<td>Report maximum and minimum obtained test value lb/ft³</td>
<td>ASTM C-185</td>
</tr>
<tr>
<td>Wet Density – Field</td>
<td>Report maximum and minimum obtained test value lb/ft³</td>
<td>ASTM C-138</td>
</tr>
<tr>
<td>Compressive Strength 28 day (Average of 3 cubes)</td>
<td>≥7,000 psi</td>
<td>ASTM C-942</td>
</tr>
<tr>
<td>Initial Set of Grout</td>
<td>Minimum 3 hours</td>
<td>ASTM C-953</td>
</tr>
<tr>
<td></td>
<td>Maximum 12 hours</td>
<td></td>
</tr>
<tr>
<td>Fluidity Test***</td>
<td>Efflux Time from Flow Cone:</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Immediately after mixing</td>
<td>Minimum 20 Seconds</td>
<td>Maximum 30 Seconds</td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum 9 Seconds</td>
<td>Maximum 20 Seconds</td>
</tr>
<tr>
<td>Fluidity Test***</td>
<td>Efflux Time from Flow Cone:</td>
<td></td>
</tr>
<tr>
<td>30 minutes after mixing with remixing for 30 sec</td>
<td>Maximum 30 Seconds</td>
<td>ASTM C-939</td>
</tr>
<tr>
<td></td>
<td>Or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum 30 Seconds</td>
<td>ASTM C-939****</td>
</tr>
<tr>
<td>Bleed @ 3 hours</td>
<td>Maximum 0.0 percent</td>
<td>ASTM C-940*****</td>
</tr>
<tr>
<td>Permeability @ 28 days</td>
<td>Maximum 2500 coulombs at 30 V for 6 hours</td>
<td>ASTM C-1202******</td>
</tr>
</tbody>
</table>

*ASTM C-117 procedure shall be modified to use a #50 sieve. The percent passing the #50 sieve after washing the sieve shall be determined.

**ASTM C-1090 shall be modified to include verification at both 24 hours and 28 days.

***Adjustments to flow rates shall be achieved by strict compliance with the manufacturer’s recommendations. The time of efflux is the time to fill a one liter container placed directly under the flow cone.

****Grout fluidity shall meet either the standard ASTM C-939 flow cone test or the modified test, as follows. The ASTM C-939 flow cone test shall be modified by filling the cone to the top instead of to the standard level. The efflux time shall be the time to fill a one liter container placed directly under the flow cone.

*****ASTM C-940 shall be modified to conform with the wick induced bleed test as follows:

1. The wick shall be a 20 inch length of ASTM A-416 seven wire 0.5 inch diameter strand. The strand shall be degreased with acetone or hexane solvent and a wire brush to remove any surface rust on the strand before temperature conditioning. The strand shall be wrapped with 2 inch wide duct or electrical tape at each end prior to cutting to avoid splaying of the wires when it is cut.
2. All the dry ingredients, mixing water, prestressing strand and test apparatus shall be conditioned overnight at 65 to 75°F.
3. The conditioned dry ingredients shall be mixed with conditioned mixing water and 800 ml of the resulting grout placed into a 1,000 ml graduate cylinder. The level of the top of the grout shall be recorded.
4. The strand shall be inserted into the graduated cylinder, centered and fastened so it remains essentially parallel to the vertical axis of the cylinder. The level of the top of the grout shall be recorded.
5. The mixed specimen shall be stored at the temperature range in (b) above.
6. The level of the bleed water shall be measured every 15 minutes for the first hour and hourly for two successive readings thereafter.
7. The amount of bleed water, if any, shall be calculated at the end of the three hour test period and the resulting expansion per the procedures outlined in ASTM C-940, with the quantity of bleed water expressed as a percent of the initial grout volume. Note if the bleed water remains above or below the top of the original grout height. Note if any bleed water is absorbed into the specimen during the test.
When evaluating grouts, the ASTM C-1202 procedure shall be modified to perform the test at
30 volts rather than 60 volts. Testing shall be performed on grout samples at 28 days of age. For
grouts containing pozzolanic mineral admixtures, testing may be performed on grout samples at 90
days of age.

2.15.5 Simulated Field High Temperature Fluidity Test.

A conditioned laboratory high temperature grout fluidity test shall be conducted as described below,
using production grouting equipment utilizing both mixing and storage tanks. Grout must conform to
the requirements of Section 2.15.4 including initial fluidity test. For the test to be successful, the grout
must have an efflux time of not greater than 30 seconds at the end of the one hour test period. Efflux
time may be determined by either ASTM C-939 or the modified ASTM C-939 described herein.

1. Test shall be performed in a temperature conditioned laboratory. The room, grout, water,
duct, pump, mixer and all other equipment to be used shall be conditioned to a temperature of
90°F for a minimum of 12 hours prior to the test.
2. 400 feet (± 10 feet) of duct (tube) for the test with a nominal inside diameter of 1 inch shall be
used for the test.
3. The grout shall be mixed to the specified water content and pumped through the duct until the
grout discharges from the outlet end of the duct and is returned to the pump.
4. The grout test period shall start one hour after the duct has been completely filled with grout.
The time to circulate the grout through the duct shall be recorded and the grout shall be
constantly circulated into the commercial grout mixer storage tank.
5. The grout shall be pumped and re-circulated for a minimum of one hour.
6. At 15 minute intervals throughout the test period, the pumping pressure at the inlet, grout
temperature, and fluidity at the discharge outlet shall be recorded.

2.15.6 Accelerated Corrosion Test Method (ACTM)

An accelerated corrosion test shall be performed as outlined in Appendix B of the “Specification for
Grouting of Post-Tensioning Structures” published by the Post-Tensioning Institute. The time to
corrosion for both the grout being tested and the control sample using a 0.45 water-cement ratio neat
glout shall be reported.

A grout that shows a longer average time to corrosion in the ACTM than the control sample and the
time to corrosion exceed 1,000 hours is considered satisfactory.

2.15.7 Variation in Testing for Specific Applications

2.15.7.1 Horizontal Applications

Horizontal grout applications are defined as grouting of all superstructure tendons and
transverse substructure tendons in the pier cap. All physical requirements defined in Section
2.15 are applicable for grouts in horizontal applications.

2.15.7.2 Vertical Applications

Vertical grout applications are defined as grouting of substructure column tendons. All
physical requirements defined in Section 2.15 are applicable for grouts used in vertical
applications. In addition, the Schupack Pressure Bleed Test Procedure for Cement Grouts for
Post-Tensioned Structures as outlined in Appendix C of the “Specification for Grouting of
Post-Tensioned Structures” published by the Post-Tensioning Institute shall be performed.
The percent bleed for the grout tested shall be reported. The grout shall be tested at the
specified pressure of 100 psi. An acceptable test will result in no bleed water (0.0 percent).

2.15.7.3 Repair Applications
Repair applications are used to augment grouting operations which did not completely fill the duct or anchorage. Repairs may be made with the same grout approved for use in the tendons as long as the volume of the void is less than 0.5 gallons. In all other cases, a non-sanded grout meeting the requirements of Sections 2.15.4 and 2.15.6 with a modified maximum permeability of 2,800 coulombs (ASTM C-1202 at 30 volts) shall be used. Non-sanded grouts shall have a 95% passing on the #100 sieve and 90% passing the #170 sieve as determined by ASTM C-33. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C-117 modified for sieve size.

2.15.8 Acceptance by Previous Tests

The Engineer may waive the requirements for these particular tests based upon satisfactory prior performance of the proposed pre-packaged grout material, mixing and installation methods and independently certified by a Laboratory approved by the Engineer.

2.16 Grout Supply Quality Control

The Contractor shall provide to the Engineer, a copy of grout quality control data sheets from the Manufacturer, for each lot number and shipment of grout material supplied to the site. Material with a total time from manufacture in excess of six months must be retested and certified by the supplier before use or be removed from the project and be replaced by approved materials. A lot is that parcel of material making up a particular shipment.

2.17 Type Q Epoxy Compound for Anchorage Pour-Backs.

Epoxy resin compounds for the protection of post-tensioning anchorage shall be two-component systems and shall not contain any volatile solvent. The compounds shall be basically pure reactive material with a maximum ash content of 2% and shall have simple mix ratios of one to one or two to one of shall be supplied in pre-measured containers in which all of the contents of both packages are to be mixed.

Non-sagging gels are grades of mixed compounds that will not perceptibly flow under their own weight on a vertical surface in the unhardened state. Pour-able compounds are grades of mixed compounds sufficiently fluid that they (either neat or filled) can be cast into and will take the shape of a mold.

These epoxy materials are to be used to protect the anchorages of post-tensioning tendons or bars and other uses indicated in the plans. The material shall produce a low exothermic reaction and have flow and fill characteristics suitable for machine base plate applications. The material will be extended with the aggregate supplied by the manufacturer. Mix with the full aggregate loading unless the use of less aggregate is approved by the Engineer.

The material shall be factory pre-proportioned including factory supplied aggregate. Products shall be delivered in original containers with manufacturer’s name, date of manufacture, product identification label and batch numbers. Materials must be within the manufacturer’s recommended shelf life. The product shall be stored and conditioned in full compliance with manufacturer’s recommendations.

The epoxy compound plus aggregate mix shall meet or exceed the specified physical properties stated herein as determined by the following standard ASTM test methods.

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength Cubes 7 day Cure @ 77°F</td>
<td>&gt; 10,000 psi</td>
<td>ASTM C-579B</td>
</tr>
<tr>
<td>Tensile Strength @ 7 day</td>
<td>&gt; 2100 psi</td>
<td>ASTM C-307</td>
</tr>
<tr>
<td>Flexural Strength @ 7day Cure @ 77°F</td>
<td>&gt; 3600 psi</td>
<td>ASTM C-580</td>
</tr>
<tr>
<td>Property</td>
<td>Test Value</td>
<td>Test Method</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>-----------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Modulus of Elasticity 7 day Cure @ 77ºF</td>
<td>&lt; 2,100,000 psi</td>
<td>ASTM C-580</td>
</tr>
<tr>
<td>Coefficient of Thermal Expansion @ 74 to 210ºF</td>
<td>&lt; 20 x 10^-6 in/inºF</td>
<td>ASTM C-531</td>
</tr>
<tr>
<td>Peak Exotherm, Specimen 12 x 12 x 3 inch</td>
<td>&lt; 150ºF</td>
<td>ASTM D-2471</td>
</tr>
<tr>
<td>Slant Shear @ 7 days (Bond Strength to Concrete)</td>
<td>&gt; 3000 psi</td>
<td>ASTM C-882</td>
</tr>
<tr>
<td>Thermal Compatibility</td>
<td>5 Cycles Passed</td>
<td>ASTM C-884</td>
</tr>
<tr>
<td>Linear Shrinkage @ 7 days</td>
<td>0.025%</td>
<td>ASTM C-531</td>
</tr>
<tr>
<td>Flowability and Bearing Area</td>
<td>90% Contact area</td>
<td>ASTM C-1339</td>
</tr>
<tr>
<td>Gel Time, Specimen 12 x 12 x 3 inch</td>
<td>&lt; 4:00 (hr.)</td>
<td>ASTM D-2471</td>
</tr>
</tbody>
</table>

2.18 Elastomeric Coating System

2.18.1 General Requirements

This section defines the requirements for an elastomeric polyurethane waterproof coating system (prime and subsequent coats). This system is to be used to provide an elastomeric coating providing a waterproof barrier over post-tensioning anchorages or other areas designated in the plans. The components of the coating system must be supplied by a single manufacturer and sold as a waterproof coating system. The surface preparation and application of the coating system must be applied in strict accordance with the manufacturer’s specifications.

2.18.2 Certification

A written certification shall be provided from the manufacturer that the product meets the requirements of this Section. The manufacturer must have quality control standards conforming to ISO 9000 Standards.

2.18.3 Physical Properties

The elastomeric coating system is composed of several coats. The use of an epoxy prime coat is dependant upon the requirements of the manufacturer’s waterproofing system. The polyurethane chemistry may be either waterborne aromatic (moisture-curing) or aromatic (moisture-sensitive). The minimum thickness of the system shall not be less than 30 mils. The cured coating system shall meet the following requirements:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness, Shore A</td>
<td>Between 60 and 90</td>
<td>ASTM D-2240</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>≥ 750 psi</td>
<td>ASTM D-412</td>
</tr>
<tr>
<td>Elongation</td>
<td>≥ 400 %</td>
<td>ASTM D-412</td>
</tr>
<tr>
<td>Tear Strength</td>
<td>≥ 70 psi</td>
<td>ASTM C-957</td>
</tr>
<tr>
<td>Abrasion Resistance H-18 wheels 1000 gm/wheel</td>
<td>≤ 350 mg loss / 1000 revs.</td>
<td>ASTM C-957</td>
</tr>
<tr>
<td>Crack Bridging 1000 Cycles</td>
<td>System Passes</td>
<td>ASTM C-957</td>
</tr>
<tr>
<td>Elongation Recovery</td>
<td>≥ 94%</td>
<td>ASTM C-957</td>
</tr>
</tbody>
</table>

2.18.4 System Modifications for Use on Bridge Substructure

Supply the elastomeric coating system with an aliphatic polyurethane top coating. When applied to bridge substructures, match the color to the color scheme shown in the plans. If no color scheme is shown on the plans utilize a color similar to Federal Color Standard No. 595B, Table VIII, and Shade No. 36622.
2.19 Type F-1 Epoxy Compound

Type F-1 epoxy compound for filling voids and repairing vertical and other surfaces shall be a trowelable low modulus, non-sagging gel epoxy compound capable of bonding to wet surfaces with the following properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Shall match gray color No. 36622 of Federal Standard No. 595a</td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>Gel</td>
<td></td>
</tr>
<tr>
<td>Maximum sand loading</td>
<td>2.25 parts sand to one part mixed epoxy by volume</td>
<td></td>
</tr>
<tr>
<td>Elongation in tension minimum</td>
<td>10% by ASTM D 638, seven day cure</td>
<td></td>
</tr>
<tr>
<td>Wet bond to Steel and Concrete</td>
<td>250 psi by Florida Test Method FM 5-23</td>
<td></td>
</tr>
</tbody>
</table>

2.20 Magnesium Ammonium Phosphate Concrete (MAPC)

MAPC is intended to be used to repair block-outs and holes in post-tensioned boxes and girders and other locations required by the Contract Documents. The manufacturers’ recommendations for preparing the surfaces and for mixing, placing and curing the concrete shall be followed. Accurate control of the quantity of water used for mixing this material is required.

The MAPC material shall meet or exceed the specified physical properties stated herein as determined by the following standard ASTM test methods.

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength at 28 days</td>
<td>&gt; 8,500 psi</td>
<td>ASTM C-109*</td>
</tr>
<tr>
<td>Flexural Strength at 28 days, Specimen 1</td>
<td>&gt; 600 psi</td>
<td>ASTM C-348*</td>
</tr>
<tr>
<td>Specimen 1 9/16 x 1 9/16 x 6 5/16 inches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slant Shear Bond at 14 days</td>
<td>&gt; 2,500 psi</td>
<td>ASTM C-882*</td>
</tr>
<tr>
<td>Freeze Thaw Resistance</td>
<td>RDF 80%</td>
<td>ASTM C-666***</td>
</tr>
<tr>
<td>Initial Set Time</td>
<td>15 minutes at 95°F minimum</td>
<td>ASTM C-266</td>
</tr>
<tr>
<td>Scaling Resistance</td>
<td>No scaling</td>
<td>ASTM C-672 [ASTM C-672M]</td>
</tr>
<tr>
<td>Shrinkage at 28 days</td>
<td>≤0.03%</td>
<td>ASTM C-596</td>
</tr>
<tr>
<td>Sulfate Resistance after 52 week of immersion</td>
<td>≤ 0.1%</td>
<td>ASTM C-1012</td>
</tr>
<tr>
<td>Chloride Absorption, Weight Change At 21 days</td>
<td>≤ 1.5 %</td>
<td>NCHRP T-244**</td>
</tr>
<tr>
<td>Specimen 4 inch cubes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Modified test methods for air curing instead of moist curing.
** Use cube specimens meeting the requirements of ASTM C-109.
*** 300 cycles.

2.21 Payment for Testing

All testing of components, materials and all laboratory and field tests required for this project shall be incidental to the price paid for post-tensioning.
530.03 Construction Requirements

3.1 Protection of Prestressing Steel

3.1.1 Before Installation of Tendons in Ducts

All prestressing steel shall be protected against physical damage at all times from manufacture to grouting or encasing in concrete. Prestressing steel that has sustained physical damage at any time shall be rejected. Any reel that is found to contain broken wires shall be rejected and the reel replaced. The wire must be bright and uniformly colored, having no foreign matter or pitting on its surface.

Prestressing steel shall be packaged in containers for protection of the steel against physical damage and corrosion during shipping and storage. A corrosion inhibitor, which prevents rust or other results of corrosion, shall be placed in the package or form, or shall be incorporated in a corrosion inhibitor carrier type packaging material. The corrosion inhibitor shall have no deleterious effect on the steel or concrete or bond strength of steel to concrete. Inhibitor carrier type packaging material shall conform to the provisions of Federal Specifications MIL-P-3420. Packaging or forms damaged from any cause shall be immediately replaced or restored to original condition.

The prestressing steel shall be stored in a manner which will at all times prevent the packing material from becoming saturated with water and allow a free flow of air around the packages. If the useful life of the corrosion inhibitor in the package expires, it shall immediately be rejuvenated or replaced.

At the time the prestressing steel is installed in the work, it shall be free from loose rust, loose mill scale, dirt, paint, oil, grease or other deleterious material. Removal of tightly adhering rust or mill scale will not be required. Prestressing steel that has experienced rusting to the extent it exhibits pits visible to the naked eye shall not be used in the work.

The shipping package shall be clearly marked with the heat number and with a statement that the package contains high-strength prestressing steel and care is to be used in handling, and the type, kind and amount of corrosion inhibitor used, including the date when placed, safety orders and instructions for use shall also be marked on the package or form. Specifically designate low relaxation (stabilized) strands per requirements of ASTM A-416. Strands not so designated will be rejected.

3.1.2 After Installation of Tendons in Ducts

After installation in the ducts, prestressing steel shall be protected from corrosion and the duct system shall be sealed to prevent moisture intrusion from the time of tendon installation to the time of grouting. In addition, all grout vents shall be closed or plugged at all times during the period prior to grouting except that low-point drainage vents shall remain open and point downward. (See Section 3.2.5 for protection of ducts prior to installing tendons.)

Grouting shall proceed as soon as possible after installation and stressing of the tendons. The time from installing the tendons in an unstressed condition to grouting after stressing shall not exceed the following without approval of the Engineer:

- Very damp atmosphere (RH > 70%) or over salt water - 7 calendar days
- Moderate to dry atmosphere (RH < 70%) - 10 calendar days

In this context, the “RH” is the average annual relative humidity for the site. For this project, the maximum time shall be 7 calendar days.

Any light surface discoloration or corrosion forming during this period shall not be cause for rejection of the prestressing steel.
Flushing of grout is not permitted and vacuum grouting is required to repair all voids and blockages. Flushing of ducts is only permitted if a lubricant is required to reduce the friction or if a corrosion inhibitor is used due to temperatures below the minimum specified. When flushing is permitted by the Engineer, use flush water containing slack lime (calcium hydroxide) or quicklime (calcium oxide) in the amount of 0.17 lb/gal.

Except when waived by the Engineer in writing, failure to grout tendons within the time limit specified above will result in stoppage of the affected work in accordance with direction provided by the Engineer.

3.1.3 Tendon Protection between Installation and Stressing

Measures shall be taken to protect the prestressing steel when there is a period of more than 24 hours between installation of the tendons in ducts and stressing. Bare strand projecting out of an anchorage shall be wrapped in continuous plastic sheeting and sealed using waterproof tape extending from the tendon anchorage, and the anchorage opening shall be sealed with plastic and waterproof tape in a sufficient manner to prevent moisture intrusion. All grout vents shall be closed or plugged, all duct connections shall be sealed and drainage vents shall be open, pointing downward.

3.1.4 Tendon Protection During Staged or Segmental Construction

When plans provide for the tendons to be installed in one unit or segment, either longitudinally, transversely or vertically, with a length of bare strand left projecting for purposes of threading into another unit or segment during later erection operations, the provisions described in Section 3.1.3 shall apply. All of the prestressing steel shall be protected immediately after it is first installed in the first unit or segment until the tendon is grouted in the second unit or segment.

3.1.5 Use of Temporary Corrosion Inhibitors

It is the intent of the Specifications that the tendons be grouted within the time limit specified above. Corrosion inhibitors shall be considered when grouting cannot be accomplished due to temperatures below the specified minimum. Corrosion inhibitors shall be VPCI or NJDOT approved alternatives. The prestressing steel shall be so protected until grouted.

3.1.6 Extended Periods for Ungrouted Tendons

Ungrouted tendons for extended periods will be permitted given strict compliance with the following specifications.

Allowance for increase in time between stressing and grouting of tendons will only be allowed for post-tensioning which cannot be grouted within the lower temperature limits set forth in this specification, and with the approval of the Engineer. The Contractor shall take every effort to minimize the length of time and number of ungrouted post-tensioning tendons or bars during winter months. Grouting of ungrouted post-tensioning shall take top priority when temperature limits allow grouting operations to continue.

For anchorages where a permanent grout cap is not specified, a rigid temporary cap capable of providing a seal against moisture intrusion for the duration of time the post-tensioning is ungrouted shall be used. This cap shall be placed within 48 hours of stressing. Permanent caps shall be used where applicable.

All grout ports and vents shall remain plugged, sealed or otherwise capped, and all duct connections shall be sealed, except minimum number of low vent ports allowing full drainage from any
condensation shall be left open. All open vent ports shall not be exposed to the weather for the full length of time the post-tensioning remains ungrouted.

Upon inspection, if ungrouted post-tensioning shows signs of corrosion (other than light surface rust with no pitting) the Contractor shall immediately take corrective measures. Corrective measures may include, but are not necessarily limited to, re-establishing moisture tight seals, alternate corrosion protection, external heating and grouting, tendon replacement and restressing.

Details for protecting ungrouted post-tensioning through extended periods and the procedures for expedient grouting of the ungrouted post-tensioning shall be submitted as a part of the Grouting Operation Plan submittal outlined below.

3.2 Installation of Ducts, Grout Injection Ports and Outlet Vents

3.2.1 General

All post-tensioning anchorages, ducts, inlet and outlet pipes, miscellaneous hardware, reinforcing bars, and other embedded items shall be accurately and securely fastened at locations shown on the plans or on the approved Shop Drawings or as otherwise approved by the Engineer. Ducts for tendons shall be made using the minimum number of duct splices possible.

3.2.2 Tolerances

In their final position post-tensioning ducts shall be within the following tolerances:

<table>
<thead>
<tr>
<th>Tolerances</th>
<th>Vertical position inches</th>
<th>Lateral position inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal tendons in slabs or in slab regions of larger members:</td>
<td>±1/4</td>
<td>± 1/2</td>
</tr>
<tr>
<td>Longitudinal draped superstructure tendons in webs: Tendon over supports or in middle third of span</td>
<td>±1/4</td>
<td>±1/4</td>
</tr>
<tr>
<td>Tendon in middle half of web depth</td>
<td>±1/2</td>
<td>±1/4</td>
</tr>
<tr>
<td>Longitudinal, generally horizontal, superstructure tendons usually in top or bottom of member:</td>
<td>±1/4</td>
<td>±1/4</td>
</tr>
<tr>
<td>Horizontal tendons in substructures and foundations:</td>
<td>± 1/2</td>
<td>± 1/2</td>
</tr>
<tr>
<td>Vertical tendons in webs</td>
<td>Longitudinal position: ±1</td>
<td>Transverse position: ±1/4</td>
</tr>
<tr>
<td>Vertical tendons in pier shafts</td>
<td>±1/2</td>
<td>±1/4</td>
</tr>
</tbody>
</table>

In all other cases, tendons shall not be out of position by more than ± 1/4 inch in any direction.

Entrance and exit angles of tendon paths at anchorages and/or at faces of concrete shall be within ± 3 degrees [± 5%] of desired angle measured in any direction and any deviations in the alignment shall be accomplished with smooth transitions without any kinks.

Angle changes at duct joints must not be greater than ± 3 degrees [± 5%] in any direction and must be
accomplished with smooth transitions without any kinks.

Anchorages shall be located within ± 1/4 inch of desired position laterally and ± 1 inch along the tendon except that minimum cover requirements must be maintained.

Anchorage confinement reinforcement in the form of spirals, multiple U shaped bars or links, shall be properly centered around the duct and to start within 1/2 inch of the back of the main anchor plate.

If conflicts exist between the reinforcement and post-tensioning duct, the position of the post-tensioning duct shall prevail and the reinforcement shall be adjusted locally with the Engineer’s approval.

3.2.3 Ducts

Ducts shall be accurately aligned and located as shown on the plans or according to the approved Shop Drawings and as required herein. All internal ducts shall be secured in position at regular intervals not exceeding 30 inches for steel pipes, 24 inches for round plastic duct and 12 inches for flat ducts to prevent movement, displacement or damage from concrete placement and consolidation operations. The method and spacing of duct supports shall be shown on appropriate Shop Drawings. Any additional mild reinforcing or other devices required to support post-tensioning ducts shall be supplied by the Contractor at no additional expense to the Owner.

For external tendons, ducts shall be straight between connections to internal pipes at anchorages, diaphragms and deviation saddles and shall be supported at intermediate locations, as required, according to the plans or approved shop drawings.

All duct alignments, including curves and straight portions, shall be smooth and continuous with no lips, kinks or dents. This also applies to curves in pre-bent steel pipe.

All ducts shall be carefully checked and repaired as necessary before placing any concrete.

After installation of ducts, until grouting is complete, all ends of ducts, connections to anchorages, splices, vents (inlets and outlets) shall remain sealed at all times. An absolute seal shall be provided of anchorage and duct termination locations by using plumber’s plugs or equal. Grout vents (inlets and outlets) shall be installed with plugs or valves in the closed position. Low point drainage outlets shall be left open. The use of duct tape shall not be permitted. Ducts shall be carefully inspected and repaired before placing of the concrete is started. Care shall be exercised during placement of the concrete to avoid displacing or damaging the ducts.

All splices, joints, couplings, vent connections (inlets and outlets) and valves shall be part of the approved post-tensioning system. Approved shrink-sleeve material may be used to repair duct. The use of duct tape to repair or seal duct shall not be permitted.

3.2.4 Grout Vents (Inlets and Outlets) and Drains

Grout pipes shall be installed on each duct to serve as injection or evacuation vents during grouting and to allow the escape of air, water, grout and bleed water. Drainage vents, point downward, shall be provided at low points of tendon profile to allow any accumulated moisture to be drained prior to installing tendons.

The length of an inlet or outlet shall be sufficient to extend out of the concrete to allow for proper closing. At all high points the outlet shall connect at the uppermost part of the duct profile.

Inlets and Outlets shall be placed at locations shown on the Contract Plans, on the Approved Shop Drawings, and/or the approved Grouting Operation Plan (below). Locations shall be as follows:
1. At the top of each tendon anchorage
2. At top of each grout cap.
3. At each high point of the duct profile when the vertical distance between the highest and lowest point is more than 20 inches.
4. At a location between 3 feet and 6 feet past high points of the duct on the downstream side opposite the direction of grouting.
5. At all low points. The vent (outlet) shall be free draining.
6. At major changes in the cross section of the duct.
7. At each side of PT bar-couplers.
8. At a distance between 3 feet and 6 feet from each high point in the direction of grout flow.
9. For external tendons, provide vents as close to the inside face of the diaphragm as practical, located on the top of the duct.
10. At other locations required by the engineer.

Grout pipes shall extend a sufficient distance out of the concrete member to allow for proper closing of valves.

Vents shall be mortar tight and shall provide means for injection of grout through the vents and for sealing the vents.

All inlet and outlets shall be permanently sealed to prevent water infiltration to the grouted tendon. Sealing details are to be submitted for approval to the engineer.

All grout injection and vent pipes shall be fitted with positive mechanical shut-off valves. Vents and injection pipes shall be fitted with valves, caps or other devices capable of withstanding the pumping pressures.

3.2.5 Care and Protection of Ducts, Vents, Anchorages and Blockouts

Care shall be taken to ensure that all ducts, anchorages, blockouts, openings and vents are kept clean and free of debris, fuel, oils, other contaminants and site trash at all times prior to and after installing the tendons. Temporary plugs, seals and covers shall be used. Minor damage to ducts may be repaired by removing the local damage and splicing duct or couplers onto the intact section (prior to the placing of concrete). Repair of major duct damage requires the removal and replacement of the entire duct section.

Connections from grout hose to inlet and ejection ports and to vents shall be kept free from dirt and are airtight.

3.2.6 Internal Tendon Duct Pressure Test before Placing Concrete

All internal ducts, except longitudinal ducts in individual segments of segmental box girders, shall be pressure tested before placing concrete. The duct shall be sealed at the anchorage or construction joint termini and tested with compressed air to determine if connections require repair. In the presence of the engineer, the duct shall be pressurized to 1.5 psi and locked-off from the outside air source. If the pressure loss exceeds 0.15 psi, leaks in the duct shall be sealed using methods approved by the engineer and retested.

3.2.7 Placing Concrete

Methods used to place and consolidate concrete shall not displace or damage any of the post-tensioning ducts, anchorage assemblies, splices and connections, reinforcement or other embedded items. Duct splices shall be made so as to prevent duct kinks during concrete placement.
mandrels shall be used as needed to maintain duct alignment and shape.

3.2.8 Proving of Post-Tensioning Ducts after Placing Concrete

Upon completion of concrete placement, longitudinal post-tensioning ducts shall be proven to be free and clear of any obstructions or damage and are able to accept the intended post-tensioning tendons by passing a torpedo through the ducts. The torpedo shall have the same cross-sectional shape as the duct and that is a 1/4 inch smaller all around than the clear, nominal inside dimensions of the duct. No deductions shall be made to the torpedo section dimensions for tolerances allowed in the manufacture or fixing of the ducts. For straight ducts, the torpedo shall be at least 2 feet long. For curved ducts, the torpedo length shall be determined so that when both ends touch the outermost wall of the duct, the torpedo is 1/4 inch clear of the innermost wall. If the torpedo will not travel completely through the duct, the Engineer may reject the member, unless a workable repair is made to clear the duct. The torpedo must pass through the duct easily, by hand, without resorting to excessive effort or mechanical assistance.

Proving of ducts using a torpedo is not required for external tendons or for transverse tendons.

3.2.9 Problems and Remedies

The Engineer will reject ducts or any part of the work found to be deficient. No remedial or repair work shall be performed without the Engineer’s approval.

3.2.10 Installing Tendons

If a tendon duct has been contaminated with chlorides, it shall be thoroughly flushed before placing the prestressing strands using lime treated potable water. The last two gallons of flushing water shall be tested for presence of chlorides and oils. Chlorides in the water must be less than 600 ppm. If chloride levels exceed 600 ppm, flushing shall continue until the chloride level is below 250 ppm. Oil-free compressed air shall then be blown through the duct to remove any excess water.

Strands may be pushed or pulled through the ducts to make up a tendon using methods which will not snag on any lips or joints in the ducts. Strands which are pushed should be rounded off the end of the strand or fitted with a smooth protective cap. During the insertion of the post-tensioning strand into the duct, the strand shall not be intentionally rotated by any mechanical device.

Alternatively, strands may be assembled to form the tendon and pulled through the duct using a special steel wire sock (“Chinese finger”) or other device attached to the end. The ends of the strands may not be welded together for this purpose. The end of the pre-assembled tendon shall be rounded for smooth passage through the duct.

All strands shall be cut using an abrasive saw or an approved plasma cutter. Flame cutting is not allowed.

Permanent tendons shall not be installed before the completion of testing as required by these Specifications or Plans, with the sole exception of the tendon to be tested in the “In Place Friction Test”.

3.3 Post-Tensioning Operations

3.3.1 General

3.3.1.1 Concrete Strength
Post-tensioning shall only be applied when the concrete has attained the required compressive strength as determined from test cylinders cured under the same conditions as the structural concrete.

3.3.1.2 Stressing Tendons

All post-tensioning steel shall be tensioned with hydraulic jacks so that the post-tensioning force is not less than that required by the plans or approved shop drawings, or as otherwise approved by the Engineer. Monostrand jacks shall not be used to stress tendons with five or more strands.

3.3.1.3 Maximum Stress at Jacking

The maximum temporary stress (jacking stress) in post-tensioning steel shall not exceed 80% of the specific minimum ultimate tensile strength. Tendons shall not be overstressed to achieve elongation.

3.3.1.4 Initial and Permanent Stress

The post-tensioning steel must be anchored at initial stresses that will result in the long term retention of permanent stresses or forces of no less than those shown on the plans or the approved shop drawings. Unless otherwise approved by the Engineer, the initial stress after anchor set must not exceed 70% of the specified ultimate tensile strength of the post-tensioning steel.

Permanent stress and permanent force are the stress and force remaining in the post-tensioning steel after all losses, including long term creep and shrinkage of concrete, elastic shortening of concrete, relaxation of steel, losses in the post-tensioning steel from the sequence of stressing, friction and unintentional wobble of the ducts, anchor set, friction in the anchorages and all other losses peculiar to the post-tensioning system.

3.3.1.5 Stressing Sequence

Except as noted on the plans, approved Shop Drawings or Erection or Post-Tensioning Manual, the permanent post-tensioning tendons shall be stressed from both ends. The required force may be applied at one end and subsequently at the other end or simultaneously at both ends.

Single end stressing is permitted when the following are satisfied:
1. Space limitations prohibit double end stressing.
2. The calculated elongation of the post-tensioning steel at the second end is 1/2 inch or less and wedges are power seated.
3. Single end stressing applied at alternate ends of paired adjacent post-tensioning tendons is required to produce a symmetrical force distribution in agreement with the plan design.

For construction in stages where some tendons are required to be stressed before others, install and stress tendons in accordance with the plans or approved shop drawings or as otherwise approved by the Engineer.

3.3.2 Stressing Jacks

3.3.2.1 Stressing Equipment

Each jack shall be equipped with a pressure gauge having an accurate reading dial at least six inches in diameter for determining the jack pressure.
3.3.2.2 Calibration

Prior to use for stressing on the project, each jack and its gauge shall be calibrated as a unit. Initial jack calibration shall be done, using a proven load cell, by the post-tensioning supplier or by an independent testing laboratory, approved by the Engineer. The calibration shall consist of three test cycles with the cylinder extension of the jack in various positions (i.e. 2 inch, 4 inch, 8 inch stroke). At each pressure increment, the forces from each test cycle shall be averaged to obtain an average force. Calibration shall be done with the cylinder extension approximately in the position that it will be when applying the final jacking force and with the jacking assembly in an identical configuration to that which will be used at the job site (i.e. same length hydraulic lines). Load cells used for calibration shall have been calibrated within the last 12 months. Certified calibration calculations and a calibration chart, both in English units of measure, shall be furnished to the Engineer for each jack and gauge unit. Documentation denoting the load cell(s) calibration date and tractability to NIST (National Institute of Standards and Technology) along with the jack/gauge calibration shall be provided.

Recalibration of each jack shall be done at six month intervals and at other times when requested by the Engineer. At the option of the Contractor, calibrations subsequent to the initial laboratory calibration may be accomplished by the use of a master gauge. The master gauge shall be calibrated at the same time as the initial calibration of the jacks, and shall be part of the unit for each jack. The data recorded during the initial calibrations shall be furnished to the Engineer for use in the field. The master gauge shall be supplied by the Contractor in a protective waterproof container capable of protecting the calibration of the master gauge during shipment. The contractor shall provide a quick-attach coupler next to the permanent gauge in the hydraulic lines which enables the quick and easy installation of the master gauge to verify the permanent gauge readings. The master gauge shall remain in the possession of the Engineer for the duration of the project.

If a jack is repaired or modified, including replacing the seals or changing the length of the hydraulic lines, the jack shall be recalibrated by the approved testing laboratory. No extra compensation will be allowed for the initial or subsequent jack calibrations or for the use and required calibration of a master gauge.

3.3.3 Stressing of Tendons

The tensioning process shall be so conducted that tension being applied and the elongation of the post-tensioning steel may be measured at all times. A permanent record shall be kept of gauge pressures and elongations at all times and shall be submitted to the Engineer. The post-tensioning force may be verified as deemed necessary by the Engineer.

For all tendons, excluding post-tensioning bars with lengths less than 20 feet, the tendon force measured by gauge pressure shall agree within 7% of the theoretical elongation or the entire operation shall be checked and the source of error determined and remedied to the satisfaction of the Engineer before proceeding with the work. Elongations shall be measured to the nearest 1/16 inch. In determining why the measured tendon force and the theoretical elongation do not agree, the Contractor may elect to establish that the apparent modulus of elasticity of the post-tensioning steel varies from the value shown in the general notes to the plans by conducting a bench test on a full size tendon in accordance with a procedure approved by the Engineer. This test may be performed at a site remote from the project and shall be witnessed by a representative sent by the Engineer. Equipment for tensioning the tendons must be furnished by the manufacturer of the system. Should agreement between pressure gauge readings and measured elongations fall outside the acceptable tolerances, the Engineer may require without additional compensation to the Contractor, additional in-place friction tests in accordance with the Materials Section 2.14.2.
The anchor force for all permanent post-tensioning bars with lengths less than 20 feet shall be verified with a lift-off after initial stressing operations. The resulting lift-off shall be within ±7% of the expected final anchor force as specified in the plans.

3.3.4 Friction

The Contract Plans were prepared based on the assumed friction and wobble coefficients and anchor set noted on the plans. Calculations shall be submitted to show a typical tendon force diagram, after friction, wobble and anchor set losses, on the shop drawings based upon the expected actual coefficients and values for the post-tensioning system used. These coefficients and values shall be shown on the shop drawings.

If, in the opinion of the Engineer, the actual friction significantly varies from the expected friction, revise post-tensioning operations so the final tendon force is in agreement with the plans.

When friction must be reduced, graphite with no corrosive agents may be used as a lubricant subject to the approval of the Engineer. Lubricants shall be flushed from the duct as soon as possible after stressing is completed by use of lime treated potable water. After ducts have been flushed, they shall be immediately and thoroughly blown dry with oil-free air.

3.3.5 Wire Failures in Post-Tensioning Tendons

Multi-strand post-tensioning tendons having wires that have failed by breaking or slippage during stressing may be accepted providing that:
1. The completed structure must have a final post-tensioning force of at least 98% of the design total post-tensioning force at the affected sections.
2. At any stage of erection, the post-tensioning force across a mating surface must be at least 98% of the force required for that stage.
3. Any single tendon must have no more than 5% reduction in cross-sectional area of the post-tensioned steel due to the wire failure.

If these conditions cannot be met, then the affected tendon(s) shall be removed and replaced. Previously tensioned strands shall not be re-used unless approved by the Engineer. Any of these conditions may be waived by the Engineer when the Contractor is able to propose an acceptable means of restoring the post-tensioning force lost due to wire failure or slippage.

3.3.6 Cutting of Post-Tensioning Steel

Post-tensioning steel shall be cut by an abrasive saw or an approved plasma-cutter within 3/4 to 1-1/2 inches away from the anchoring device. Flame cutting of prestressing steel is not allowed.

3.3.7 Record of Stressing Operations

The Contractor shall keep a record of the following post-tensioning operations for each tendon installed:
1. Project name, Financial Project ID.
2. Contractor and/or subcontractor.
3. Tendon location, size and type.
4. Date tendon was first installed in ducts.
5. Reel number for strands and heat number for bars.
6. Tendon cross-sectional area.
7. Modulus of elasticity.
8. Date stressed.
9. Jack and Gauge numbers per end of tendon.
10. Required jacking force.
11. Gauge pressures.
12. Elongations (theoretical and actual).
13. Anchor sets (anticipated and actual);
14. Stressing sequence (i.e. tendons to be stressed before and after).
15. Stressing mode (one end/ two ends/ simultaneous).
16. Witnesses to stressing operation (Contractor and inspector).
17. Date grouted.

Any other relevant information shall be recorded. A complete copy of all stressing and grouting operations shall be provided to the Engineer.

3.3.8 Duct Pressure Field Test

After stressing and before grouting internal or external tendons, all grout caps, inlets and outlets shall be installed and the tendon tested with compressed air to determine if duct connections require repair. In the presence of the Engineer, pressurize the tendon to 50 psi and lock-off the outside air source. Record the pressure loss for one minute. A pressure loss of 25 psi will be acceptable. If the pressure loss exceeds 25 psi, leaking connections shall be corrected using methods approved by the Engineer and retested.

3.3.9 Cleaning and Flushing Tendons

Tendons shall not be flushed with water except as directed by the Engineer. If flushing is to be performed as directed by the Engineer, the inside of the duct system shall be flushed with water (under pressure) meeting the requirements of Section 3.2.10 to remove all traces of the contaminants. Following the flushing operation, water shall be totally drained from within the duct system and it shall be blown out with compressed oil-free air to the extent necessary to dry the prestressing steel and inside surfaces of the ducts. The waste fluid flushed from the duct system shall be captured and disposed of properly.

3.3.10 Tendon Protection

Within four hours after stressing, install grout caps and seal all other tendon openings. If acceptance of the tendon is delayed, all tendon openings and open ends of the anchorages shall be temporarily sealed. If tendon contamination occurs, the tendon shall be removed and replaced.

3.3.11 Re-Use of Temporary PT Bars

Post-tensioning bars used to apply temporary post-tensioning may be reused as temporary bars if they are undamaged.

3.4 Grouting

3.4.1 General

After post-tensioning and anchoring of a tendon has been completed and accepted, the annular space between the prestressing steel and the duct shall be grouted in accordance with this Specification. Also grout all empty ducts. The interval between post-tensioning and grouting shall be limited as specified above. Immediately after post-tensioning, all grout vents, anchorages, and duct connections of each tendon shall be temporarily sealed-to prevent entrance of air and water until just prior to tendon grouting.

At least six weeks before grouting commences, the Contractor shall submit to the Engineer for review and approval a "Grouting Operation Plan". Written approval of the plan by the Engineer is required.
before grouting proceeds. Any adjustments to the plan as a result of trials or mock-ups shall be incorporated. Grouting operations shall be under the supervision of a qualified and experienced person, acceptable to the Engineer.

At a minimum the Grouting Operation Plan shall address the following:
1. Names and proof of training for the grouting crew and the crew supervisor in conformance with this specification.
2. Type, quantity, and brand of materials used in grouting including all certifications required.
3. Type of equipment furnished, including capacity in relation to demand and working condition, as well as back-up equipment and spare parts.
4. General grouting procedure.
5. Duct pressure test and repair procedures.
6. Method to be used to control the rate of flow within ducts.
7. Theoretical grout volume calculations.
8. Mixing and pumping procedures.
9. Direction of grouting.
10. Sequence of use of the inlets and outlet pipes.
11. Procedures for handling blockages.
13. Contractor's QC forms that are to be signed daily by Grout Supervisor.

Before grouting operations commence, a joint meeting shall be held with the Contractor, Grouting Crew, Owner, and Engineering Inspection Team to discuss and understand the grouting operation plan, required testing and corrective procedures.

3.4.2 Grouting Personnel Qualifications

All grouting operations shall be carried out by workers trained for the tasks required. Grouting shall be performed under the immediate control of a person skilled in the various aspects of grouting, and having experience on at least four previous and satisfactorily completed projects of a similar size and scope. This person shall be named and shall furnish proof of experience as required by the Engineer.

Grouting Supervisors must have ASBI Grouting Certification and/or previous experience on satisfactorily completed projects of a similar size and scope.

3.4.3 Supplies

Before grouting operations start, an adequate supply of water and compressed air for clearing and testing the ducts, mixing and pumping the grout shall be provided. Where water is not supplied through the public water supply system, a water storage tank of sufficient capacity must be provided.

A sufficient supply of grout material shall be available to complete the planned grouting operation.

3.4.4 Equipment

3.4.4.1 General

Grouting equipment shall consist of measuring devices for water, a high-speed shear colloidal mixer, a storage hopper (holding reservoir) and a pump with all the necessary connecting hoses, valves, and pressure gauge. Pumping equipment shall have sufficient capacity to ensure that the post-tensioning ducts to be grouted can be filled and vented without interruption at the required rate of injection in not more than 30 minutes.

An air compressor and hoses with sufficient output to perform the required functions shall be provided.
Vacuum grouting equipment (volumetric measuring type) shall be provided prior to the start of grouting operations and retained on the job during the duration of tendon grouting operations.

3.4.4.2 Mixer, Storage Hopper

A high speed shear colloidal mixer shall be provided capable of continuous mechanical mixing to produce a homogeneous and stable grout free of lumps and undispersed cement. The colloidal grout machinery will have a charging tank for blending and a holding tank. The blending tank must be equipped with a high shear colloidal mixer. The holding tank must be kept agitated and at least partially full at all times during the pumping operation to prevent air from being drawn into the post-tensioning duct.

Water shall be added during the initial mixing by use of a flow meter or calibrated water reservoir with a measuring accuracy equal to one percent of the total water volume.

3.4.4.3 Grout Pumping Equipment

Grout pumping equipment capable of continuous operation shall be provided which will include a system for circulating the grout when actual grouting is not in progress.

The equipment will be capable of maintaining pressure on completely grouted ducts and will be fitted with a valve that can be closed off without loss of pressure in the duct.

Grout pumps will be positive displacement type and will provide a continuous flow of grout and will be able to maintain a discharge pressure of at least 145 psi.

Pumps will have seals adequate to prevent oil, air or other foreign substances entering the grout and to prevent loss of grout or water. The capacity will be such that an optimal rate of grouting can be achieved.

A pressure gauge having a full scale reading of no more than 300 psi will be placed at the duct inlet. If long hoses (in excess of 100 feet) are used, two gauges shall be provided, one at the pump and one at the inlet.

The diameter and rated pressure capacity of the grout hoses must be compatible with the pump output.

3.4.4.4 Vacuum Grouting Equipment

Vacuum grouting equipment shall be provided at the job site concurrently with all pressure grouting operations, consisting of the following:

1. Volumeter for the measurement of void volume.
2. Vacuum pump with a minimum capacity of 10 cfm and equipped with a flow-meter capable of measuring amount of grout being injected.
3. Manual colloidal mixers and/or dissolvers (manual high speed shear mixers), for voids less than 20 liters in volume.
4. Standard colloidal mixers, for voids 20 liters and greater in volume.

3.4.4.5 Availability of Testing Equipment

Equipment for field-testing shall be available at the job site.

3.4.4.6 Stand-by Equipment
3.4.5 Grout Testing During Grouting Operations

Acceptance testing for grout physical properties shall be performed during grouting operations. Enhanced Grout is required to have the physical properties in the table below when mixed, prepared and tested on-site during grouting operations.

Test shall be performed to confirm the accuracy of the volume-measuring component of the vacuum grouting equipment each day before performing any grouting operations. Either water or grout shall be used for testing standard testing devices with volumes of 0.5 gallons and 6.5 gallons and an accuracy of equal to or less than 4 ounces. One test shall be performed with each device. The results must verify the accuracy of the void volume-measuring component of the vacuum grouting equipment within 1% of the test devise volume and must verify the accuracy of the grout volume component of the vacuum grouting equipment within 5% of the test devise volume. The Engineer shall be present when any tests are performed.

During grouting operations the fluidity of the grout must be strictly maintained within the limits determined by use of either test method in Section 2.15.4. Fluidity tests shall be performed for each tendon to be grouted. The correct water to cementitious ratio must be maintained. Grout which tests outside the allowable flow rates shall not be used.

Grout materials shall be conditioned as required to limit the grout temperature at the inlet end of the grout hose to 90°F. Prior to performing repair grouting operations, grout materials shall be conditioned as required to limit the grout temperature at the inlet end of the grout hose to 85°F. The temperature of the grout at the inlet end of the grout hose shall be checked hourly.

At the beginning of each days grouting operation, a wick induced bleed test shall be performed in accordance with Section 2.15.4. If zero bleed is not achieved at the end of the required time period, grouting of any new or additional tendons shall not proceed until the grouting operations have been adjusted and further testing shows the grout meets the specified requirements.

### Physical Property | Frequency of Testing* | Requirement | Test Method
--- | --- | --- | ---
Pumpability and Fluidity | For each 2 cubic yards of grout or every 2 hours of grouting: One (1) test after mixing and before injection, and One (1) test on grout collected at duct outlet | Non-Thixotropic Grouts Flow Cone Efflux Time: 1) Immediately after mixing: Min. 20 sec., Max. 30 sec. 2) After collection at duct outlet: Max. 30 sec. Thixotropic Grouts** Modified Flow Cone Efflux Time: 1) Immediately after mixing: Min. 9 sec., Max. 20 sec. 2) After collection at duct outlet: Max. 30 sec. | A Modified ASTM C-939**STM C-939

*Each test shall be performed at least once per grouting operation.

**Grouts containing anti-bleed admixtures or silica fume may have thixotropic characteristics. The modified version of ASTM C-939 involves filling the flow cone to the top instead of the standard
level, and the efflux time is measured as the time to fill a 1 liter container placed directly under the flow cone.

3.4.6 Grouting Operations

3.4.6.1 General

Tendons shall be grouted in accordance with the procedures set forth in the approved grouting operation plan. All empty ducts shall also be grouted.

3.4.6.2 Temperature Considerations

The maximum grout temperature must not exceed 90°F at the grout inlet. Chilled water and/or pre-cooling of the bagged material to maintain mixed grout temperature below the maximum allowed temperature shall be used. Grouting operations shall be prohibited when the temperature of the grout is below 45°F. Grouting operations shall be prohibited when the ambient temperature is below 40°F or is 40°F and falling. When it is anticipated that the ambient temperature will fall below 32°F, ducts shall be kept free of water so as to avoid freeze damage to ducts.

3.4.6.3 Mixing and Pumping

The grout shall be mixed with a metered amount of water to produce a uniformly blended, homogeneous grout. The mix shall be continuously agitated until grouting is complete.

3.4.6.4 Injecting Grout

All grout outlets shall be opened before starting the grouting operation. Tendons shall be grouted in accordance with the Grouting Operations Plan.

Unless approved otherwise by the Engineer, grout shall be pumped at a rate of 16 feet to 50 feet of duct per minute. Normal grouting operations shall be conducted at a pressure range of 10 psi to 50 psi measured at the grout inlet; the maximum pumping pressure of 145 psi at the grout inlet shall not be exceeded.

Grout pumping methods shall ensure complete filling of the ducts and complete encasement of the steel. Grout must flow from the first and subsequent outlets until any residual water or entrapped air has been removed prior to closing the outlet.

Grout shall be pumped through the duct and continuously discharged at the anchorage and grout cap outlets until all free water and air has been discharged and the consistency of the grout is equivalent to that of the grout being pumped into the inlet. The anchorage outlet shall be closed and a minimum of 2 gallons of grout shall be discharged from the grout cap into a clean receptacle. The grout cap outlet shall then be closed.

For each tendon, immediately after uncontaminated uniform discharge begins, a fluidity test shall be performed using the flow cone on the grout discharged from the anchorage outlet. The measured grout efflux time will not be less than the efflux time measured at the pump or minimum acceptable efflux time as given in Section 2.15.4 (above). Alternately, the grout fluidity may be checked using the Wet Density method contained in Section 2.15.4 (above). The measured density must fall within the established values. The density at the final outlet must not be less than the grout density at the inlet. If the grout fluidity is not acceptable, additional grout shall be discharged from the anchorage outlet and grout fluidity retested. This cycle shall continue until acceptable grout fluidity is achieved. Properly discard grout used for testing fluidity.
After all outlets have been bled and sealed, the grout pressure shall be raised to ±75 psi and the inlet valve sealed. Wait two minutes to determine if any leaks exist. If leaks are present, they shall be fixed using methods approved by the Engineer. The above process shall be repeated until no leaks are present. If no leaks are present, the pressure shall be reduced to 5 psi and a minimum of ten minutes shall elapse for any entrapped air to flow to the high points. After the minimum ten minutes period has expired, the pressure shall be raised as needed to discharge grout at each high point outlet to eliminate any entrapped air or water. The process shall be completed by locking-off at a pressure of 30 psi.

If the actual grouting pressure exceeds the maximum allowed, the inlet will be closed and the grout will be pumped at the next outlet, which has just been, or is ready to be closed as long as a one-way flow is maintained. Grout will not be pumped into a succeeding outlet from which grout has not yet flowed. If this procedure is used, the outlet/inlet, which is to be used for pumping will be fitted with a positive shut-off and pressure gage.

When complete grouting of the tendon cannot be achieved by the steps stated herein, the grouting operation shall stop. After waiting 48 hours, the tendon shall be filled with grout in accordance with the procedure outlined in Section 3.4.9.

All waste grout and liquids shall be captured and disposed of properly.

3.4.7 Vertical Grouting

All vertical tendons that have strands as the prestressing steel shall be fitted with a standpipe at the upper end of the tendon to store bleed water and grout and maintain the grout level above the level of the post-tensioning plate and anchorage. The standpipe will be designed and sized to maintain the level of the grout at an elevation which will assure that bleeding will at no time cause the level of the grout to drop below the highest point of the upper anchorage device. The standpipe shall be designed to allow all bleed water to rise into the standpipe, not into the uppermost part of the tendon and anchorage device.

After the grout is discharged, check the grout fluidity as described in Section 3.4.6. As grouting is completed, the standpipe shall be filled with grout to a level, which will assure that, as settlement of grout occurs, the level of grout will not drop below the highest point in the upper anchorage device. If the level of grout drops below the level of the highest point in the anchorage device, additional grout shall immediately be added to the standpipe. After the bleed water is absorbed and the grout has hardened, the standpipe shall be removed. In the presence of the Engineer, visually inspect for voids using an endoscope or probe. All voids found in the duct shall be filled using volumetric measuring vacuum grouting processes.

For vertical tendons in excess of 100 feet or if the grouting pressure exceeds the maximum recommended pumping pressure specified in Section 3.4.6, then the grout shall be injected at increasingly higher vents (which become injection locations) which have been or are ready to be closed as long as a one-way flow of grout is maintained. Grout will be allowed to flow from each outlet until all air and water have been purged prior to using that outlet for pumping.

3.4.8 Construction Traffic and Operations Causing Vibrations

During grouting and for a period of 4 hours upon completion of grouting, eliminate vibrations from all sources such as moving vehicles, jackhammers, compressors, generators, pile driving operations, soil compaction, etc., that are operating within 300 feet down-station and 300 feet up-station of the ends of the span in which grouting is taking place.

3.4.9 Post-Grouting Inspection
Grout vents (inlets and outlets) shall not be opened or removed until the grout has cured for 24 to 48 hours. Inspections shall be performed within one hour after the removal of the inlet/outlet.

After the grout has cured, all outlets located at anchorages and high points along the tendon shall be opened to facilitate inspection. All high points along the tendon as well as inlets or outlets located at the anchorages shall be drilled and inspected. Depending on the geometry of the grout inlets, drilling may be required to penetrate to the inner surface of the trumpet or duct. Drilling equipment shall automatically shut-off when steel is encountered. Unless grout caps are determined to have voids by sounding, caps shall not be drilled. Inspection of grout shall be performed in the presence of the Engineer using endoscopes or probes. Within four hours of completion of the inspections, all voids shall be filled using the vacuum injection grouting process.

All anchorage and inlet/outlet voids that are produced by drilling for inspection purposes shall be sealed and repaired as specified in Section 3.4.10. The inlet/outlet shall be removed to a minimum depth of 2 inches. An injection tube extending to the bottom of the drilled holes shall be used for backfilling with epoxy.

Post grouting inspection of tendons having a length of less than 150 feet shall be based on the following statistical frequency for inspection:

1. For the first 20 tendons, all outlets located at anchors and tendon high points shall be inspected by drilling and probing with an endoscope or probe. If one or more of the inspection locations are found to contain a defect (void), testing all tendons shall continue until 20 consecutive tendons have been inspected and no voids have been found.

2. When no defects are detected as defined in No. 1 above, the frequency of inspection can be reduced to inspect every other tendon (50%). If a defect is located, the last five tendons grouted shall be inspected and Step 1 repeated for a new cycle of 100% tendon inspection.

If tendon grouting operations were prematurely terminated prior to completely filling the tendon, then the duct shall be drilled into and voided areas explored with an endoscope. Probing shall not be allowed. The location and extent of all voided areas shall be determined. Grout inlets shall be installed as needed and the voids filled using volumetric measuring vacuum grouting equipment.

3.4.10 Post-Grouting Sealing of Grout Vents

Shut off valves shall not be opened at injection or evacuation vent pipes, nor shall pipes or caps be removed until the grout has set and inspection of vents has been accepted.

Intermediate grout vent pipes (inlets and outlets) along an internal tendon (including rigid steel pipes in diaphragms) shall be installed straight to facilitate possible drilling and inspection for complete grout filling using, if necessary, an endoscope. Place threaded plastic caps in all inlet/outlet locations required in the plans. The inlet/outlet locations shall be repaired as shown on the plans using an approved Type F-1 epoxy compound meeting the requirements of Material Section above. The surface to receive the epoxy material shall be prepared in strict compliance with the manufacturer’s recommendations.

3.4.11 Record of Grouting Operations

The Contractor shall keep a record of all grouting operations for each tendon installed, stressed and grouted. This shall include, but shall not necessarily be limited to the following:

1. Tendon or group of tendons grouted in one continuous operation.
2. Date grouted.
3. Number of days from stressing to grouting, per tendon.
4. Type of grout mix and additives.
5. Fluidity of grout (flow-cone) per batch for both newly mixed and 30 minute, rested grout.
6. Density of grout per batch of fresh mix.
7. Location of injection vent and direction of grout flow (note; injection vent may not necessarily be at an end anchorage).
8. Applied grouting pressure during normal pumping and maximum pressure sustained for two minutes after closing all vents grouting.
9. Theoretical volume of grout anticipated in order to fill the duct or ducts.
10. Actual quantity of grout in place in the duct(s) after grouting (for one grout mixing and injection operation, this is the quantity mixed less the quantity wasted at the vents, less the quantity remaining in the mixer and injection equipment).
11. Summarize any difficulties encountered and corrective action taken.
12. Witnesses to grouting operation (Contractor and Inspector).

Within 72 hours, the Contractor shall provide the Engineer with a complete copy of all tendon stressing and grouting operations.

3.5. Protection of Post-Tensioning Anchorages

After acceptance of grouting, all miscellaneous material (tie wire, tape, plastic, etc.) used for temporary protection or sealing shall be removed prior to carrying out further work to protect anchorages.

Details for anchor protection shall be shown on the Shop Drawings in accordance with the plans and the following requirements.

3.5.1 Installation of Anchor Protection

Anchorage protection shall be installed within seven days from the satisfactory completion of the grouting. The application of the elastomeric coating may be delayed for up to 90 days after grouting. Use plastic or stainless steel threaded caps to plug all grout inlets/outlets.

3.5.1.1 Pour-Backs

An approved Type Q epoxy compound meeting the requirements of the Materials Section (above) shall be used to construct pour-backs at anchorages.

All laitance, grease, curing compounds, surface treatments, coatings and oils shall be removed by grit blasting or water blasting the substrate surface using a minimum 10,000 psi nozzle pressure. Surfaces shall be flushed with potable water and blown dry. Surfaces must be clean, sound and without any standing water. In case of dispute, ACI 503 shall be used for substrate testing and a minimum of 175 psi tension (pull-off value) shall be attained.

The epoxy shall be mixed and placed per manufacturer’s current standard technical guidelines. All pour-backs shall be constructed with leak proof forms to create neat lines. The epoxy compound may require pumping for proper installation. Forms shall be constructed so as to maintain a liquid head to insure intimate contact with the concrete surface. Vents shall be provided as needed to allow for the escape of air to insure complete filling of the forms. Pour-backs shall provide a minimum cover over the grout cap of 1-1/2 inches for anchors in the superstructure and 3 inches for anchors in the substructure.

3.5.1.2 Elastomeric Coating

Exposed surfaces of pour-backs or grout caps shall be coated with an approved elastomeric coating system meeting the requirements of the Material Section above. The coating thickness shall be 30 to 45 mils. The application of the elastomeric coating may be delayed up to 90 days after grouting; however, surface cleaning shall be performed immediately prior to application with sufficient time to allow for drying.
Elastomeric coating shall have a final, cured color to the approval of the Engineer.

Concrete surfaces, grout caps or other substrates shall be structurally sound, clean and dry. Concrete must be a minimum of 28 days old. All laitance, grease, curing compounds, surface treatments, coatings and oils shall be removed by grit blasting or water blasting using a minimum 10,000 psi nozzle pressure to establish the anchor pattern. Blow the surface with compressed air to remove the dust or water. For elastomeric coated pour-backs which are to receive an approved cosmetic or aesthetic coating, apply a manufacturer’s approve primer over the elastomeric coating before applying the approved cosmetic or aesthetic coating.

A concrete test block 2 x 4 feet with a similar surface texture to the surfaces to be coated shall be constructed. A vertical face shall be coated with the elastomeric coating system chosen. The number of coats required for a finished coating thickness of 30 to 45 mils without runs and drips shall be determined. The elastomeric coating shall be mixed and applied per manufacturer’s current standard technical specifications. Spray or roller application is permitted (spray application preferred). Have the coating manufacturer representative on site to supervise and comment on the application of the elastomeric coating onto the test block. Coatings shall be applied by personnel with a minimum of three years experience applying similar polyurethane systems. Credentials of these persons shall be submitted to the Engineer for review and consideration for approval.

3.5.2 Anchors Inside a Hollow Box

In particular, this applies to anchors at interior diaphragms, deviator ribs or anchor blisters. Providing that the structure is otherwise sealed from all sources of leaks through the bridge deck into the hollow core, and is drained at all low spots, against blisters, ribs or diaphragms, so water, from any source including condensation, cannot accumulate against an anchorage, the protection of the anchors shall be as follows:
1. Permanent grout cap.
2. Elastomeric seal coat that shall be applied over the grout cap and overlapping onto adjacent structural concrete by a minimum of 6 inches all around the extremities of the anchor plate.

3.5.3 Anchors at Surfaces Exposed to Weather Action

The following applies to anchors in expansion joint diaphragms, at ends of girders under expansion joint devices or strip seals, substructures or other similar surfaces directly exposed to weather or potential run-off or leakage. The protection of the anchors at these locations shall be as follows:
1. Permanent grout cap.
2. Encapsulating pour-back with Type Q epoxy compound.
3. Elastomeric seal coat that shall be applied over the grout cap and overlapping onto adjacent structural concrete by a minimum of 12 inches all around the extremities of the anchor plate.

Concrete details under the expansion joint shall incorporate a drip flange (not a v-groove) to provide a positive, protective edge for the top of the elastomeric seal coat.

3.5.4 Protection to Transverse Tendon Anchor in Recess or Block-Out in Edge of Top Slab

For transverse tendon anchors in the top slab, the protection of the anchors shall be as follows:
1. Permanent grout cap.
2. Encapsulating pour-back with Type Q epoxy compound or Magnesium Phosphate Ammonium Concrete (MAPC).
3. For recesses under a traffic surface (not under a permanent traffic barrier), a Methyl Methacrylate seal applied to the block-out pour-back and an area extending 6 inches outside
the perimeter. Methyl Methacrylate shall be applied after deck grinding (milling) and grooving and any excess material removed as per manufacturer’s instructions.

For each individual edge anchor in a recess, the surface of the pour-back shall be even with adjacent face of the slab edge and the top of the deck slab.

3.6 Repair of Lifting and Access Holes:

Temporary lifting and access holes shall be filled with Magnesium Ammonium Phosphate Concrete meeting the requirements of the Materials Section (above). Immediately before casting the concrete (within 24 hours), the mating concrete surfaces shall be mechanically cleaned and roughened to remove any laitance and expose the small aggregate. Grit blasting or water blasting using a minimum 10,000 psi nozzle pressure is required. Surfaces shall be flushed with water and blown dry. The material shall be mixed, placed and cured in strict compliance with the manufacturer’s recommendations.

Upon completion of the deck grooving, repaired holes, block-outs and an area extending 6 inches outside the perimeter of the repair shall be coated with Methyl Methacrylate. Methyl Methacrylate shall be applied and surplus removed strictly in accordance with the manufacturer’s instructions.

Alternately, a Type Q Epoxy compound meeting the requirements of the above Materials Section may be used for the repair material.

530.04 Method of Measurement

The quantity of post-tensioning tendons to be paid for under this Section will be the computed weight, in pounds, of permanent post-tensioning steel tendons entered into the completed structure and accepted. Measurement will be the theoretical plan length measured from anchorage to anchorage (measured from front face of the bearing plate) with no allowance made for waste or extension past the bearing faces. No measurement will be made for temporary post-tensioning, which will be considered incidental to the item “Post-Tensioning Tendons”.

For quantity determination, the following unit weights will be used:

<table>
<thead>
<tr>
<th>Prestressing System</th>
<th>Weight per Unit Length lb/ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 inch diameter 7 wire strand</td>
<td>0.52</td>
</tr>
<tr>
<td>0.6 inch diameter 7 wire strand</td>
<td>0.74</td>
</tr>
<tr>
<td>1 inch high strength deformed bar</td>
<td>3.01</td>
</tr>
<tr>
<td>1 1/4 inch high strength deformed bar</td>
<td>4.39</td>
</tr>
<tr>
<td>1 3/8 inch high strength deformed bar</td>
<td>5.56</td>
</tr>
<tr>
<td>1 3/4 inch high strength deformed bar</td>
<td>9.28</td>
</tr>
</tbody>
</table>

530.05 Basis of Payment

Post-tensioning tendons will be paid for at the Contract unit price per pound of steel tendon, completed and accepted. Payment will be full compensation for furnishing, installing, stressing and grouting all temporary and permanent post-tensioning tendons. Payment also includes anchorage assemblies and associated supplemental reinforcing steel required by the supplier, post-tensioning system hardware which is not embedded in concrete, ducts, grout and grouting, all testing, protection of post-tensioning anchorages, vents, inlets, outlets and all labor, materials, tools, equipment and incidentals necessary for completing the work in accordance with the Contract Documents. This payment also includes corrosion inhibitors and approved lubricants in the tendon ducts for friction control and flushing lubricants or contaminants from the ducts.

If the Contractor constructs the structure with an accepted alternate not detailed on the plans, payment will be
based on the unit price bid extended by either the quantities shown in the Contract Documents or the actual quantities used and accepted, whichever is less.

Permanent post-tensioning strand or bar tendons which are an integral part of individual precast concrete segments or units will be measured and paid for under this item and will not be considered incidental to the cost of those precast concrete segments or units.

Payment for post-tensioning will be made following successful placement, stressing, grouting, inspection, protection and approval by the Engineer. Full payment for post-tensioning tendons, within precast segmental concrete structure units, may occur prior to erection of the segments into final position when ducts have been grouted and anchorage protection system applied and the segmental unit otherwise approved for placement by the Engineer.

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>POST-TENSIONING STEEL STRAND IN SUPERSTRUCTURE (LONGITUDINAL)</td>
<td>POUNDS</td>
</tr>
<tr>
<td>POST-TENSIONING STEEL STRAND IN SUPERSTRUCTURE (TRANSVERSE)</td>
<td>POUNDS</td>
</tr>
<tr>
<td>POST-TENSIONING STEEL BARS IN SUPERSTRUCTURE</td>
<td>POUNDS</td>
</tr>
<tr>
<td>POST-TENSIONING STEEL STRAND IN SUBSTRUCTURE, EPOXY COATED</td>
<td>POUNDS</td>
</tr>
<tr>
<td>POST-TENSIONING STEEL BARS IN SUBSTRUCTURE</td>
<td>POUNDS</td>
</tr>
</tbody>
</table>

THE FOLLOWING SECTION IS ADDED:

SECTION 531 - EPOXY JOINING OF PRECAST CONCRETE SEGMENTS

531.01 Description.

The work consists of furnishing, mixing and applying a two-component epoxy bonding system to the match-cast faces of all joints between precast concrete superstructure and/or substructure segments in accordance with the Contract Documents.

The work covered by this section shall also include temporary post-tensioning across a joint, if required, by provisions contained elsewhere.

This specification covers use of normal-setting epoxy bonding agents and slow-setting epoxy bonding agents.

In its workable state, epoxy bonding agent must provide lubrication along the keys as the precast concrete segments are brought together. In its hardened state, epoxy bonding agent must provide a watertight seal between precast concrete segments and transfer shear stresses across the joints at the shear keys.

531.02 Materials.

2.1 General.

Epoxy bonding agents for match-cast joints between precast segments shall be thermosetting 100 percent solid compositions that do not contain solvent or any non-reactive organic ingredient except for required coloring pigments. Epoxy bonding agents shall be of two-components, a resin and a hardener. Both components shall be distinctly pigmented, so that mixing produces a third color similar to the concrete in the segments.

Epoxy bonding agents shall be insensitive to damp conditions during application, and after curing, the epoxy shall exhibit high bonding strength to cured concrete, good water resistance, low creep characteristics and tensile strength greater than the concrete.

Epoxy bonding agents shall comply with ASTM C-881, Types VI and VII, Grade 3.

2.2 Packaging, Identification and Use.
The components shall be packaged in two parts in sealed containers, pre-proportioned in the proper reacting ratio, ready for combining and mixing in accordance with the manufacturer's instructions. Each container shall bear a label designating the manufacturer's name, the type component (resin or hardener), the range of substrate (surface of concrete) temperature over which application is suitable, material classifications, the date of formulation, the shelf life of the material and the manufacturer's Lot number.

Material from containers that are damaged or have been previously opened shall not be used. Combining of epoxy bonding agent components from bulk supplies will not be permitted. Only full buckets of components will be mixed immediately after opening.

The Manufacturer shall furnish instructions for the safe storage, handling, mixing and application of the material.

2.3 Classification of Epoxy Material.

Epoxy bonding agents that remain workable for a short time (about one hour or less) are referred to herein as "normal-set epoxy". Epoxy bonding agents that remain workable over an extended open time (about eight hours) are referred to herein as "slow-set epoxy".

2.4 Formulation for Temperature Range.

Epoxy bonding agents shall be formulated to provide application temperature ranges that are suitable for erection of segments with substrate temperatures between 40°F and 115°F. There shall be a minimum of three, and preferably four, formulations dividing the overall range into approximately equal sub-ranges that overlap by at least 5°F.

Additionally, each of these formulations shall be identified as either normal-set or slow-set epoxies as defined by the Contact Time (below).

2.5 Samples for Testing and Certified Test Reports.

For quality control purposes, for each manufactured lot, the Contractor shall furnish to the Engineer certified test reports from an approved testing laboratory indicating that the epoxy bonding agent material has passed all required tests. Upon request, the Contractor shall also furnish to the Engineer, samples of the epoxy bonding agent material for independent testing.

2.6 Physical Requirements and Qualification Tests.

Epoxy bonding agents proportioned as designated by the Manufacturer and mixed in accordance with the manufacturer's recommendations shall meet the physical requirements given below. The components of the epoxy bonding agent shall be conditioned to the temperature at which testing is to be done prior to mixing the test specimen.

2.6.1 Consistency (Sag-Flow). This property determines application workability of the epoxy bonding agent. Mixed epoxy bonding agent shall be tested and conform to the prescribed consistency in accordance with ASTM C-881 at the maximum temperature of the temperature range for the formulation being tested. The average sag-flow shall not exceed 1/4 inch.

2.6.2 Gel Time. This property is the period of time during which the epoxy bonding agent remains workable in the mixing container and during which it must be applied to the match-cast joint surfaces.

The mixed epoxy bonding agent shall be tested and conform to the prescribed gel time in accordance with ASTM C-881 at the maximum temperature of the temperature range for the formulation being tested. The gel-time shall be at least 30 minutes.
2.6.3 Contact Time (Open Time) and Contact Strength. This property is the workable period of time allowable between mixing of the components of the epoxy bonding agent, application of the epoxy to the joint face(s), and joining the segments under an approximately uniform pressure of 40 psi.

The contact time (open time) of the mixed epoxy bonding agent shall be:

<table>
<thead>
<tr>
<th>Epoxy Type</th>
<th>Required Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal-Set Epoxy</td>
<td>60 Minutes, Minimum</td>
</tr>
<tr>
<td>Slow-Set Epoxy</td>
<td>8 Hours, Minimum</td>
</tr>
</tbody>
</table>

The above contact time (open time) shall be deemed acceptable if a slant cylinder test specimen, prepared and tested in accordance with the conditions below, sustains the following stress (contact strength) on the slant plane calculated as the axial (vertical) load divided by the area of the slant ellipse:

<table>
<thead>
<tr>
<th>Epoxy Type</th>
<th>Stress at Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal-Set Epoxy</td>
<td>1,000 psi at 48 hours after joining.</td>
</tr>
<tr>
<td>Slow-Set Epoxy</td>
<td>1,000 psi at 14 days after joining.</td>
</tr>
</tbody>
</table>

The cement mortar / concrete material for the slant-cylinder test shall have a compressive strength of at least 4,500 psi at 28 days when tested to ASTM C-39. The slant-cylinder test procedure shall be in accordance with ASTM C-882 with the following modifications.

1. Prior to the application of the epoxy bonding agent the concrete specimens shall be soaked in water for 24 hours at the maximum temperature of the application temperature range for the formulation being tested.
2. The two-components of the epoxy bonding agent shall be brought to the maximum of the application temperature for the formulation being tested before being mixed and applied to the specimens.
3. The sloped surfaces of the concrete specimens shall be dried for ten minutes on an absorbent material. Immediately after drying, the epoxy bonding agent shall be applied to both sloped surfaces to a thickness of 1/16 inch.
4. Joining of the sloped surfaces shall be delayed for the following period of time, measured from the time the epoxy was mixed:
<table>
<thead>
<tr>
<th>Epoxy Type</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal-Set Epoxy</td>
<td>60 Minutes</td>
</tr>
<tr>
<td>Slow-Set Epoxy</td>
<td>8 Hours</td>
</tr>
</tbody>
</table>
5. During the period between mixing of the epoxy and joining of the sloped surfaces, the specimens shall be uncovered and maintained at the maximum temperature of the application range for the formulation tested.
6. The specimens shall then be assembled together and cured at the maximum temperature of the formulation range (48 hours for normal-set and 14 days for slow-set epoxies) prior to testing.

NOTE: For slow-set epoxy, an additional test specimen shall be made and tested to failure at 24 hours. The formulation of the slow-set epoxy is acceptable only if the epoxy bonding agent exhibits a brittle break.

2.6.4 Compressive Yield Strength.

This property is the compressive yield strength of the epoxy bonding agent at various ages. Comparison of this property between batches is an indication of the level of quality control achieved in manufacturing the material.

The required compressive yield strength of the epoxy bonding agent shall be in accordance with ASTM C-881 when tested using ASTM Method D-695 with the following conditions:

1. Epoxy bonding agent shall be poured into the mold for forming specimens within ten minutes after starting mixing of the components.
2. The specimens shall be cured at the minimum temperature of the formulation range for a period of 24 hours.
3. The compressive yield strength shall be at least:
   - Normal-Set Epoxy 2,000 psi at 24 hours
   - 7,000 psi at 48 Hours
   - Slow-Set Epoxy 1,000 psi at 36 Hours and
   - 2,000 psi at 72 Hours

2.6.5 Bond Strength.

This property is the strength of epoxy bonding agent as it bonds with concrete. Bond strength shall be
in accordance with ASTM C-881 and the test is conducted on a slant cylinder according to ASTM C-
882 with the following modifications.
1. The test cylinder of concrete shall have a compressive strength of at least 7,000 psi at seven
days age.
2. The specimens shall be prepared as for item 3 (contact time and contact strength) above.
3. The required bond strength of the epoxy-concrete interface - calculated as the axial (vertical)
load divided by the area of the slant ellipse - shall be at least:
   - Normal-Set Epoxy 1,000 psi at 48 Hours
   - Slow-Set Epoxy 1,000 psi at 14 Days

2.6.6 Heat Deflection Temperature of Epoxy Bonding Agent.

The heat deflection temperature shall be in accordance with ASTM C-881 - i.e. 120ºF at 14 days -
when the specimen is tested using ASTM Method D-648.

2.6.7 Alternative Preparation of Slant Cylinder Specimens.

Test specimens of concrete may be prepared in standard 6 by 12 inch cylinder molds to have a height
at midpoint of 6 inches and an upper surface with a slope at 30 degrees (±1 degree) with the vertical.
The upper and lower portions of the specimen with the slant surfaces may be formed through the use
of an elliptical insert or by sawing a full sized 6 by 12 inch cylinder. If desired, 3 by 6 inch or 4 by 8
inch specimens may be used.

The sloped surfaces shall be free from bumps, edges or high spots over 1/32 inch in magnitude and the
sloped surfaces shall not deviate from plane by more than 1/8 inch. After moist curing and after the
concrete has attained the required compressive strength, slant surfaces shall be prepared by light
sandblasting or stoning and washing with clean water.

After the concrete halves have been joined with epoxy bonding agent according to the required
conditions for the property being tested, the joined specimen shall be tested in accordance with ASTM
C-39 (Test method for Compressive Strength of Cylindrical Concrete Specimens).

2.7 Epoxy Bonding Material Qualification Tests, Quality Control, Quality Assurance and Certification of Supply.

2.7.1 Qualification Tests.

Results of Qualification Tests for each formulation temperature range of the epoxy bonding agent shall
be provided from an independent laboratory engaged by the Manufacturer and approved by the
Engineer. Independent qualification tests shall be required for each Manufacturer and formulation
temperature range of epoxy bonding agent. An epoxy bonding agent, or formulation, will not be
accepted unless it meets the Qualification Tests. Qualification Tests from previous applications of the
same epoxy formulations may be accepted by the Engineer. However, new material shall be made and
supplied for this project (i.e. old stock shall not be used.).
For Quality Control, the Contractor shall provide the Engineer with certified copies of reports of routine tests by the Manufacturer for each lot of epoxy bonding agent supplied to the project. Routine, quality control tests shall be made for consistency (sag-flow), gel-time, and compressive yield strength for each lot.

2.7.3 Quality Assurance.

For Quality Assurance, the Contractor shall provide the Engineer with certified copies of reports of repeat Qualification Tests made by an independent laboratory engaged by the Manufacturer and approved by the Engineer. Only one repeat Qualification Test shall be required for each formulation for each Manufacturer in addition to the initial Qualification Tests - providing that the material demonstrates good performance in use and application on site and that each lot meets the Quality Control requirements. If performance fails to satisfy job-site use, then the Engineer may require additional Qualification Tests, or other approved action by the Contractor, to maintain the quality.

531.03 Construction Requirements.

3.1 General.

An epoxy bonding agent meeting the requirements of this specification shall be applied to joining surfaces of all precast concrete match-cast segments.

Prior to the manufacture of epoxy for the project, a site meeting will be held with representatives from the Owner, Engineer, Contractor and epoxy Manufacturer, to discuss the appropriate temperature ranges, storage and handling, mixing and application of the epoxy.

3.2 Substrate Temperatures and Epoxy Formulation.

The epoxy bonding agent shall be applied only when the substrate temperature of both surfaces to be joined is between 40°F and 115°F. The formulation of epoxy bonding agent shall have an application temperature range that conforms to the substrate temperature of the surfaces to be joined. If the surfaces have different substrate temperatures, the formulation for the higher temperature shall be used during hot weather periods and the formulation for the lower temperature during cold weather periods.

The Contractor shall plan his erection and post-tensioning operations such that the time lapse from the initial mixing of components for the first batch of epoxy bonding agent, closing the joint and applying the minimum required contact pressure, does not exceed 70 percent of the contact time for the particular formulation.

3.3 Contact Pressure.

The purpose of the minimum and as uniform as possible contact pressure is to ensure proper mating of the surfaces and squeezing of the epoxy to completely fill and seal the joint with a finished thickness as even as possible.

A minimum, closing, contact pressure of 40 psi shall be applied to each epoxy joint during the curing period* for the epoxy. The pressure on the new joint shall be as uniform as possible, consistent with the Contractor's means and methods of erection. The Contractor's means and methods of erection shall ensure the minimum required contact pressure for the curing period. Contact pressure may be attained through combinations of weight and temporary and/or permanent post-tensioning.

The minimum contact pressure may be increased at any time after the epoxy has taken an initial set*. However, the minimum contact pressure may only be reduced after the epoxy in the joint has properly hardened and cured. If the minimum contact pressure is reduced, the joint shall not be subject to local tensile stress for a further 7 days or until the span, cantilever or pier column is complete, whichever is the earliest.
Prior to construction, the Contractor shall submit to the Engineer for review, details addressing how the required contact pressure and duration will be achieved for the erection of segments.

*Initial Set and Curing Period - in the context of the erection of the segments, the initial set and curing periods are as follows.

For a given temperature formulation the initial set is the point at which the epoxy in the joint has fully gelled. Without the use of artificial means to accelerate the process, this time, as a minimum, is the gel-time for the type of epoxy, application and conditions of use.

For a given temperature formulation the curing period is the time required for the epoxy to become fully hardened after application and closing of the joint under the contact pressure. Without the use of artificial means of heating or accelerating the cure, for a normal-set epoxy, this period is usually 24 hours and for a slow-set epoxy, usually at least 72 hours.

3.4 Qualifications of Contractor's Personnel.

The work of mixing, handling and applying the epoxy bonding agent shall be under the direct supervision of a person who has extensive knowledge of and experience in the use of this material. The Engineer may require the Contractor to arrange for a technical representative of the manufacturer to be at the site as an advisor at the beginning of this operation.

The Contractor shall ensure that all personnel who will be working with the epoxy bonding agent are thoroughly familiar with the safety precautions necessary when handling this material.

3.5 Cleaning of Surfaces to be Joined.

The surfaces to which the epoxy bonding agent are to be applied shall be free from oil, form release agent, laitance or any other deleterious material that would prevent the epoxy bonding agent from bonding to the concrete surface. The surfaces shall be cleaned by light sandblasting in a manner that does not destroy the surface shape and profile of the mating surfaces.

The mating faces shall have a dry surface with no free moisture on them at the time the epoxy-bonding agent is applied. Free moisture will be considered to be present if a dry rag, after being wiped over the surface, becomes damp.

3.6 Mixing Epoxy Bonding Agent.

Only epoxy bonding agent components from full containers, opened immediately prior to being mixed shall be used. Components, for which the shelf life indicated on the containers has expired, shall not be used. Each container of a component shall be thoroughly mixed prior to combining components.

The two-components of the epoxy bonding agent shall be combined and thoroughly mixed in strict accordance with the manufacturer's recommendations using a properly sized mechanical mixer operating at no more than 600 rpm.

Mixing of the epoxy bonding agent shall be scheduled so that the material in a batch is applied to the face of the joint within 20 minutes after the components are combined. It is recommended that the mating surfaces be brought within approximately 18 inches of each other prior to mixing epoxy. At his discretion, the Engineer may require a dry run to check fit of the surfaces before applying epoxy.

3.7 Applying Epoxy Bonding Agent.

The epoxy bonding agent shall be applied immediately after mixing. It shall be uniformly applied to a nominal thickness of 1/16 inch in accordance with the manufacturer's recommendations with a spatula or by gloved
hand. The material shall be applied to both of the faces to be joined. No material shall be placed within ½ inch of a post-tensioning duct except, regardless of spacing, epoxy bonding agent shall be applied between all adjacent internal post-tensioning ducts.

No epoxy bonding agent shall be used from a batch for which the time since combining components exceeds 20 minutes.

3.8 Mating of Segments.

Immediately after each mating surface has been covered with epoxy, the segments shall be brought together and the contact pressure applied. After applying the contact pressure, a discernable bead line of epoxy bonding agent must be apparent along the entire exposed edges of a joint. If a bead is not properly extruded, or if the filling of the joint with epoxy is incomplete, the Contractor shall take appropriate action to seal the joint and modify procedures, to the approval of the Engineer.

3.9 Cleaning Joints and Swabbing Ducts.

All excess epoxy bonding agent shall be cleaned from exterior surfaces of the concrete segment in such a way as to not damage or stain the concrete surface. Excess epoxy squeezed from the joint shall be captured and not allowed to free fall from the structure.

Immediately after concrete segments are joined, a swab shall be passed through each empty post-tensioning duct to smooth out any epoxy bonding agent in the duct. When slow-set epoxy is used, the swab shall be passed through all the segments adjacent to uncured epoxy after each new segment is erected.

3.10 Thermal Controls.

1. Cooling in Hot Weather.

Epoxy joining shall not proceed if the substrate temperature exceeds 115°F. The Contractor may take precautions to keep the mating surfaces cool by shading and/or wetting with clean water except that the above requirements for dry mating surfaces at the time of application of epoxy shall be strictly followed.


If the Contractor elects to erect segments in cold weather when the substrate temperature of the joint surfaces of concrete segments is below 40°F, then he shall provide an artificial environment to increase the substrate temperature subject to the following restrictions.

a. The artificial environment shall be created by an enclosure surrounding the joint through which warm air is circulated, or heat provided by radiant heaters.

b. The temperature of the concrete substrate shall be raised to at least 40°F to a depth of approximately 3 inches beneath the surfaces to be joined.

c. Localized heating shall be prevented and the temperature of the substrate shall not exceed 95°F at any point on the surface of a joint. Direct flame heating of the concrete shall not be allowed.

d. The temperature of substrate surfaces shall be maintained between 40°F and 95°F for at least 24 hours after joining of the surfaces for normal-set epoxy and 72 hours for slow-set epoxy.

e. Epoxy jointing may proceed if the substrate is above the minimum temperature for the formulation and air temperature is above 45°F and rising.

The Contractor may propose, for review by the Engineer, an optional method of raising and maintaining the substrate temperature of the joint surfaces. Any optional method shall meet the restrictions set out above. The Engineer will base his approval of an optional method on it accomplishing an environment suitable for the epoxy bonding agent to perform satisfactorily.
3.11 Failure to Comply with Time Limits or Incomplete Jointing.

If the time limit between mixing of the epoxy bonding agent and the application of the contact pressure is exceeded, or if the joint is incompletely filled and sealed, then the concrete segments shall be separated. All epoxy shall be removed from the faces using spatulas and approved solvent. Cleaning materials shall be on-hand in the event of an aborted joining. Epoxy shall not be re-applied until the faces have been properly cleaned and solvents dispersed, for a period of 24 hours. No additional payment shall be made for this work.

3.12 Failure to Provide Watertight Seal.

In the event that water seepage through the deck slab at an epoxy precast segment joint becomes evident; the Contractor shall take measures to seal the joint such as applying gravity feed low viscosity concrete crack sealer or epoxy pressure injection. Proposed methods for sealing leaking segment joints shall be submitted to the Engineer for approval. Gravity fed sealers shall not be used after the concrete wearing course has been placed. No additional payment will be made for sealing leaking segment joints.

3.13 Shimming of Joints.

Shimming of joints with fiber-glass matting to correct alignment shall not normally be allowed. In extreme circumstances, and on a case-by-case basis, the Engineer may permit shimming. In such cases, the Contractor shall submit proposals for and obtain the approval of the Engineer prior to any shimming.


1. General

Removal of temporary post-tensioning providing the minimum contact pressure, or removal of independent means of support to segments, shall be in accordance with the Contractor's approved means and methods of erection.

2. Cantilever Segment Support

A maximum of two segments can be supported in cantilever beyond an epoxy joint that has developed a state of substantial cure but not full cure. For this purpose, substantial cure is defined as that state in which the epoxy will transfer an average shear stress of 250 psi across a joint of two plane surfaces. It is an intermediate condition between initial set and full cure (see “Contact Pressure” above).

In cold weather use, on site, the Contractor shall leave a sample of the epoxy mixed and applied to each joint so that the degree of set and cure can be ascertained. The sample shall be approximately ½ pint and shall be spread out to a thickness of about 1/16 inch on a piece of dry plywood or concrete at the location of the joint. Erection shall not proceed unless the epoxy has firmly set and is not tacky or sticky to the touch.

3.15 Record of Segment Joining.

On a weekly basis, or as otherwise agreed with the Engineer, the Contractor shall provide the Engineer with the following information, for the period when precast segments are being erected;

1. General
   a. Weather conditions.
   b. Air temperature at the site on an hourly basis.

2. For Each Joint;
   a. Location of joint by segment numbers.
   b. Date and time of day of jointing.
   c. Lot number for the epoxy bonding agent components.
d. When application of epoxy began, the temperature of the concrete surface of the joint at the middle of each concrete segment.

e. Time of mixing the first batch of epoxy bonding agent applied to the joint.

f. Time of applying the specified contact pressure to the joint.

3. Results of any on-site tests performed that week.

531.04 Method of Measurement.

Epoxy joining of precast concrete segments will not be measured.

531.05 Basis of Payment.

Separate payment will not be made for the work of epoxy joining of precast concrete segments. The cost of this work, including all testing and any temporary post-tensioning to achieve contact pressure across joints, shall be included in payment for the precast concrete items.

THE FOLLOWING SECTION IS ADDED:

SECTION 532 - EXPANSION JOINT, MODULAR

532.01 Description

This work shall consist of furnishing and installing shop-fabricated modular expansion joint systems, of the general size, configuration, and joint movement specified, in accordance with this specification and in conformity to the lines, elevations, locations, details, and notes shown on the Plans or established by the Engineer.

532.02 Qualification

Each lot of seals and adhesives furnished under this specification shall be identified by product name and manufacturer, shall be products that have been tested by the manufacturer or a commercial laboratory and shall comply with these specifications.

532.03 Certification

Certified copies of the qualification test results for the continuous seals, indicating that the tested materials comply with this specification, shall be submitted to the Engineer for approval. Sampling, if directed, shall be submitted to the Engineer. From each lot, seal samples shall be one (1) piece two (2) feet long.

532.04 Acceptance

Material acceptance will be based upon evaluation of certified test results submitted, upon laboratory test of sampled material, or upon evaluation of both certificates and tested samples.

532.05 Requirements

The expansion joints shall be as manufactured by:

- Watson-Bowman Acme, 95 Pineview Drive, Amherst, New York 14428;
- D.S. Brown Company, P.O. Box 158, North Baltimore, Ohio 45872-0158; or an approved equal. The fabricator shall be certified AISC Category III or AISC-major steel bridges.

The expansion joint manufacturer shall have at least five (5) years recent experience in manufacturing modular expansion joints for bridges similar to those furnished under this contract. All modular expansion joints under this contract shall be furnished by the same manufacturer.

The expansion joint assembly consists of a modular, multiple seal joint system that will allow movements as shown and noted in the Plans. The configuration of the expansion joint system shall consist of preformed neoprene strip seals mechanically held in place by steel edge and separation beams. Each separation beam shall be supported by an independent support bar which is welded to the separation beam. The support bars shall be suspended over the joint opening by sliding elastomeric bearings. An equidistant control system shall be incorporated which develops its maximum compressive force when the joint is at its maximum opening. The expansion joint system shall not incorporate any bolted connections between the separator beams and support bars.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
The expansion joint shall seal the deck surface to prevent water from passing through to below the deck. The expansion joint system shall be continuous across the full width of the roadway and turned up into the traffic barriers and/or sidewalk/curbs. Transverse joints in the seals and/or seal retaining elements will not be permitted. The neoprene seal elements shall be recessed and designed to be self-cleaning. They shall be positively gripped by the transverse support beams throughout the range of anticipated movement and provided with end plugs. Each elastomeric sealing element shall be limited to a maximum three inches of movement per seal.

The expansion joint components shall be designed to support an HL-93 Live Load Vehicle per AASHTO LRFD Bridge Design Specifications, 3rd Ed. and for fatigue criteria based on ADTTSL = 10,000.

Detailed design calculations showing that the modular expansion joint device can meet impact and fatigue requirements shall be prepared and stamped by a Professional Engineer licensed in the state of New Jersey. Three (3) copies of the calculations shall be submitted to the Engineer for review and shall be approved prior to fabrication. The expansion joint seals shall accommodate movements as shown in the Plan design notes, without binding or debonding.

All steel surfaces, except the surfaces under stainless steel or those to be bonded to TFE or those in direct contact with the seal, shall be protected against corrosion by painting.

All structural steel members, connections both welded and bolted and other components shall be fatigue tested per the requirements described below and the documentation of such testing submitted to the Engineer for review and approval prior to fabrication.

1. **Materials.** Manufactured components, including the edge beams, center beams, strip seals, support bars, bearings, springs, and support bar boxes shall be furnished by one (1) manufacturer. All steel members or components shall be ASTM A709 Grade 50 structural steel. Stainless steel shall be ASTM A167 or A240 Type 304 and shall be used for contact areas of steel on sliding surfaces; Connection bolts, nuts and washers shall be ASTM A307 or A325, galvanized in accordance with ASTM B695; Fasteners securing removable and replaceable items shall be Type 316 stainless steel; and stud anchors shall be ASTM A108.

Concrete for the blockouts shall meet the requirements of Class P-4 (High Performance Concrete). The elastomeric sealing element shall be a vulcanized elastomeric virgin polychloroprene (neoprene) locking strip seal. The seal shall be one (1) piece full length of the expansion joint. The sealing elements shall conform to ASTM designation D2628, modified to omit the recovery test and as noted herein.

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirements</th>
<th>ASTM Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type A Durometer</td>
<td>60 ± 5</td>
<td>D2240</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>2000 psi (Min.)</td>
<td>D412</td>
</tr>
<tr>
<td>Elongation at Break</td>
<td>250% (Min.)</td>
<td>D412</td>
</tr>
<tr>
<td>Compression Set @72 hours</td>
<td>40% (Max.)</td>
<td>D395</td>
</tr>
<tr>
<td>212° F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The seals shall be resilient and shall not soften excessively or become brittle between -30°F to 160°F. The neoprene seals shall be installed with a lubricant/adhesive recommended by the seal manufacturer. Adhesives shall meet the requirements of ASTM D4070. Certifications shall be supplied in accordance with ASTM D4070 Part 5.1.1. Adhesives shall be stored at temperatures between 50°F and 80°F and shall be used within 270 days after the date of manufacture.

Support bar bearings shall be fabricated from solid urethane bonded to a steel substrate to which is bonded a polytetrafluoroethylene (PTFE) self-lubricating surface. Urethane and PTFE materials shall conform to manufacturer’s specifications and AASHTO LRFD Bridge Construction Specifications. Equalization springs, which work counter to the compression forces of the sealing elements, shall be used to maintain equalized
expansion properties for each element across the joint. The springs shall be a dense polyurethane foam elastomeric.

The support bars shall incorporate stainless steel sliding surfaces to minimize resistance to joint movements, be supported above, below and laterally as required to prevent lifting, transmit bearing loads, and maintain positioning of bar, and shall not be less than two inches in width and three inches in height. Each separator bar shall be welded to its own dedicated support bar.

The neoprene seals, support bar bearings, and equalization springs shall be removable and replaceable.

2. Fabrication. The expansion joints shall be fabricated according to the requirements herein. Shop welds splicing main beams, or connections to the main beams shall be full penetration welded and 100 percent non-destructively tested in accordance with AWS D1.5 Bridge Welding Code.

The joints shall be shop assembled with all components, including neoprene seals, in one continuous unit (no field splices). The shop-assembled unit(s) shall include the roadway channels and all anchor plates for both sides of the joint.

The shop-assembled unit(s) shall be adjusted to proper alignment and secured for shipping, ready to be set in place in the new construction.

The expansion joint shall be fabricated and shipped with the joint setting dimension as shown on the plans or the approved shop drawings. Once in place, the setting dimensions shall be adjusted to proper ambient temperature dimension by means of prestressing devices furnished by the manufacturer which shall accompany the expansion joint assembly to the job site.

All steel components, except stainless steel, shall be metalized. The same coating system should be used for all steel components.

The thickness of the coating shall be 6-8 mils. The wire used for the metalizing shall consist of 100% zinc. Surface preparation and application shall conform to SSPC-CS 23.00, Guide for Thermal Spray Metallic Coating Systems. Metalizing of the surfaces of the retainers to which the glands will be bonded is not required. These surfaces may be masked to prevent the buildup of overspray within the retainer groove. All metalized surface that will be in contact with freshly poured concrete shall be shop-coated with an epoxy barrier coat that conforms to the epoxy coat of SS 910. The barrier coat shall be two (2) to three (3) mils dry film thickness.

Metalized surfaces damaged during shipment or installation and field welded areas shall be field repaired. These areas shall be cleaned in accordance with SSPC-SP11 A Power Tool Cleaning to Bare Metal @ and subsequently coated with the epoxy intermediate coat in accordance with SS 910. The Contractor may employ alternate coatings for touch-up purposes subject to the approval of the Engineer.

3. Fatigue Testing. Constant amplitude fatigue testing shall be performed to determine $F_{SR}$ for all structural members, connections both welded and bolted, and components.

The allowable limit state fatigue stress range of 100 million cycles shall be based on a survival probability of 95 percent.

The test loading shall be applied so that the vertical and horizontal loading are applied simultaneously. Testing shall be performed so that the horizontal load is 20 percent of the vertical load.

Fatigue testing shall be done by a nationally recognized independent testing laboratory paid for by the manufacturer. Results of previous fatigue test may be used.

The transverse center beams, support bars, bearings, and other structural elements shall be designed and fatigue tested following the provisions in Chapter 14 of AASHTO LRFD Bridge Design Specifications, 3rd Ed.
532.06 **Preparations for Installation.** The Contractor shall submit an installation procedure for the specific expansion joints that he plans on utilizing. This plan will be in accordance with the recommendations from the joint manufacturer. This plan will include at a minimum:

- Step-by-step installation procedures
- Method for securing the joint
- Method for adjusting the joint for temperature considerations
- Method for insuring rideability
- Method for placing surrounding concrete, reinforcing and post-tensioning
- Method for attaching the barrier rail cover plates

The Contractor shall also have a representative from the joint manufacturer on site during the installation of at least the first joint of each type and provide written certification that the joint was installed properly. This written certification shall be submitted to the Engineer.

After deck concrete has been milled in adjacent spans and up to the deck joint blockouts for the full width of the bridge, final adjustment of the modular joints shall be made with respect to the roadway surface prior to placing blockout concrete.

Temporary supports shall be provided as required to maintain proper alignments. After the joint has been adjusted for the correct temperature setting, all existing concrete bonding surfaces shall be primed with epoxy polysulfide grout no sooner than two (2) hours prior to adhesive bonding. The cleaned groove shall be solvent cleaned as described above.

532.07 **Installation.** Immediately prior to adhesive application, bonding surfaces shall be clean, dry and warmer than 50°F, and they shall be maintained at or above this temperature until the adhesive has cured. Adhesive shall be applied liberally to both steel and elastomeric bonding surfaces using a stiff brush if necessary to achieve a complete and relatively uniform coat. Then the bulbed edges of the elastomeric seal shall be inserted into the anchor grooves. After installation, excess adhesive shall be removed from the exposed seal surfaces.

The joint seal shall be installed with equipment specifically for the installation of elastomeric strip seals. This equipment shall not elongate the seal longitudinally, cause structural damage to the seal, nor twist, distort, or cause other malformations in the completed seal. Equipment that does not provide a properly installed seal shall not be used.

The complete, installed expansion devices shall be tested for water tightness, by filling the joint opening, or portions thereof as designated by the Engineer, with a three (3) inch minimum depth of water for a period of not less than six (6) hours. Leaking seals shall be removed, the bonding surfaces cleaned of all adhesive, and the seals replaced and retested. This water tightness test shall be performed again after joint installation in the field.

The joint assembly manufacturer shall furnish technical assistance to the Contractor and Engineer, through the services of a technical representative, during installation of all expansion joint systems. The manufacturer’s technical representative shall be present during the installation of at least one assembly to verify the proper joint installation procedure including anchoring the joint support elements to the bridge’s structure elements. Where special instructions are not contained herein or elsewhere in the Specifications, direction for the installation shall be according to the recommendations of the technical representative.

The Contractor shall be responsible for informing the manufacturer of the date of installation, and advance notice shall be given with sufficient time for proper coordination and scheduling of operations.

532.08 **Shop Drawings.** All work shall conform to approved shop drawings, prepared in accordance with the requirements herein. Shop drawings shall include procedures for installation of neoprene seal, replacement of neoprene seal, and replacement of springs and sliding bearings.
The contractor shall submit details of the expansion joint system to be used together with installation and waterproofing plans to the engineer for approval prior to fabrication of the joint assembly. These drawings shall include but not be limited to the following:

a. Plans, elevation and section of the joint system for each movement rating and roadway width showing dimensions and tolerances.
b. All ASTM, AASHTO, or other material designations.
c. Method of installation including but not limited to sequence, setting relative to temperature, anchorage during setting, and installation at curbs.
d. Corrosion protection system.
e. Details of temporary supports for shipping and handling.
f. Design calculations for all structural elements. The design calculations shall include a fatigue design and a strength design (when appropriate) for all structural elements, connections, and splices. All welded center beam splices shall be shown on the shop plans.
g. Welding procedures shall be in accordance with AASHTO/AWS D1.5-95 Bridge Welding Code.

Shop drawings shall also include details of additional reinforcing steel in deck slab required around joint blockouts, as shown in the Plans or as required by the joint manufacturer. The deck slab at the joint location shall be formed with a void of sufficient size for the placement of the expansion joint device. The length, width and depth of this blockout shall be verified by the Contractor and coordinated with the manufacturer and shall be as shown on the plans or the approved shop drawings. The Contractor shall be responsible for coordinating the proper fit of reinforcing steel and post-tensioning steel as applicable with the expansion joint.

Shop drawings covering all details, for Modular Expansion Joints are required. One (1) sepia and four (4) prints shall be submitted to the Engineer for review and approval.

532.09 Method of Measurement.

Payment for accepted quantities of the installed joint shall be based on the sealed length of the joint measured horizontally along the centerline of the modular expansion joint seal complete in place and accepted. This payment shall include the cost of furnishing, testing, cleaning and placing the modular expansion seals, primers and adhesives; furnishing and installing structural steel angles or extrusions an anchor plates welded thereto, steel plates, additional deck slab reinforcing steel at blockouts, angles, bolts, shims, and all other miscellaneous metal work required for the bonding surfaces, steel parapet/median cover plates, technical support, and all other incidentals necessary to complete this work according to Plans and Special Provisions. The dimension noted in the payment item is the required movement rating for the expansion joint.

532.10 Basis of Payment.

Payment shall be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>EXPANSION JOINT, MODULAR – 9 INCHES MOVEMENT</th>
<th>EXPANSION JOINT, MODULAR –13 INCHES MOVEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LINEAR FEET</td>
<td>LINEAR FEET</td>
</tr>
</tbody>
</table>

No additional payment shall be made for all miscellaneous steel cover plates and connectors at sidewalk, barriers, and curbs. Payment for miscellaneous steel cover plates and connectors shall be included in the modular expansion joint pay items.

THE FOLLOWING SECTION IS ADDED:

SECTION 533 - EXPANSION JOINT, SWIVEL JOINTS

533.01 Description

This work shall consist of furnishing and installing shop-fabricated swivel modular expansion joint systems, of the general size, configuration, and joint movement specified, in accordance with this specification and in conformity to the lines, elevations, locations, details, and notes shown on the Plans or established by the Engineer.
533.02 Qualification
Each lot of seals and adhesives furnished under this specification shall be identified by product name and manufacturer, shall be products that have been tested by the manufacturer or a commercial laboratory and shall comply with these specifications.

533.03 Certification
Certified copies of the qualification test results for the continuous seals, indicating that the tested materials comply with this specification, shall be submitted to the Engineer for approval. Sampling, if directed, shall be submitted to the Engineer. From each lot, seal samples shall be one (1) piece two (2) feet long.

533.04 Acceptance
Material acceptance will be based upon evaluation of certified test results submitted, upon laboratory test of sampled material, or upon evaluation of both certificates and tested samples.

533.05 Requirements
The swivel expansion joints shall be as manufactured by:
Watson-Bowman Acme, 95 Pineview Drive, Amherst, New York 14428;
D.S. Brown Company, P.O. Box 158, North Baltimore, Ohio 45872-0158; or an approved equal. The fabricator shall be certified AISC Category III or AISC-major steel bridges.

The swivel expansion joint manufacturer shall have at least five (5) years recent experience in manufacturing swivel modular expansion joints for bridges similar to those furnished under this contract. All swivel modular expansion joints under this contract shall be furnished by the same manufacturer.

The modular expansion joint system shall be a single support bar system. Horizontal support of the center beam on the support bar shall be sliding and resilient in torsion. The load carrying function of the joint assembly shall be separated from the water sealing function. The expansion joint shall be designed with a control system which renders the individual control of each center beam possible. Equal spacing of the center beams shall not be assured by a sequentially arranged spring based control mechanism. Center beams shall be able to be exchanged individually while maintaining functionality of the joint system.

The swivel expansion joint shall seal the deck surface to prevent water from passing through to below the deck. The swivel expansion joint system shall be continuous across the full width of the roadway and turned up into the traffic barriers and/or sidewalk/curbs. Transverse joints in the seals and/or seal retaining elements will not be permitted. The neoprene seal elements shall be recessed and designed to be self-cleaning. They shall be positively gripped by the transverse support beams throughout the range of anticipated movement and provided with end plugs. Each elastomeric sealing element shall be limited to a maximum three inches of movement per seal.

The swivel expansion joint components shall be designed to support an HL-93 Live Load Vehicle per AASHTO LRFD Bridge Design Specifications, 3\textsuperscript{rd} Ed. and for fatigue criteria based on ADTT\textsubscript{SL} = 10,000. Detailed design calculations showing that the swivel modular expansion joint device can meet impact and fatigue requirements shall be prepared and stamped by a Professional Engineer licensed in the state of New Jersey. Three (3) copies of the calculations shall be submitted to the Engineer for review and shall be approved prior to fabrication. The swivel expansion joint assemblies shall be capable of simultaneously allowing longitudinal and transverse movements as shown in the Plans.

All steel surfaces, except the surfaces under stainless steel or those to be bonded to TFE or those in direct contact with the seal, shall be protected against corrosion by painting.

All structural steel members, connections both welded and bolted and other components shall be fatigue tested per the requirements described below and the documentation of such testing submitted to the Engineer for review and approval prior to fabrication.

1. Materials. Manufactured components, including the edge beams, center beams, strip seals, support bars, bearings, springs, and support bar boxes shall be furnished by one (1) manufacturer. All steel members or
components shall be ASTM A709 Grade 50 structural steel. Stainless steel shall be ASTM A167 or A240 Type 304 and shall be used for contact areas of steel on sliding surfaces; Connection bolts, nuts and washers shall be ASTM A307 or A325, galvanized in accordance with ASTM B695; Fasteners securing removable and replaceable items shall be Type 316 stainless steel; and stud anchors shall be ASTM A108.

Concrete for the blockouts shall meet the requirements of Class P-4 (High Performance Concrete). The elastomeric sealing element shall be a vulcanized elastomeric virgin polychloroprene (neoprene) locking strip seal. The seal shall be one (1) piece full length of the swivel expansion joint. The sealing elements shall conform to ASTM designation D2628, modified to omit the recovery test and as noted herein.

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirements</th>
<th>ASTM Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type A Durometer</td>
<td>60 ± 5</td>
<td>D2240</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>2000 psi (Min.)</td>
<td>D412</td>
</tr>
<tr>
<td>Elongation at Break</td>
<td>250% (Min.)</td>
<td>D412</td>
</tr>
<tr>
<td>Compression Set @72 hours</td>
<td>40% (Max.)</td>
<td>D395</td>
</tr>
<tr>
<td>212°F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The seals shall be resilient and shall not soften excessively or become brittle between -30°F to 160°F. The neoprene seals shall be installed with a lubricant/adhesive recommended by the seal manufacturer. Adhesives shall meet the requirements of ASTM D4070. Certifications shall be supplied in accordance with ASTM D4070 Part 5.1.1. Adhesives shall be stored at temperatures between 50°F and 80°F and shall be used within 270 days after the date of manufacture.

Support bar bearings shall be fabricated from solid urethane bonded to a steel substrate to which is bonded a polytetrafluoroethylene (PTFE) self-lubricating surface. Urethane and PTFE materials shall conform to manufacturer’s specifications and AASHTO LRFD Bridge Construction Specifications. Equalization springs, which work counter to the compression forces of the sealing elements, shall be used to maintain equalized expansion properties for each element across the joint. The springs shall be a dense polyurethane foam elastomeric.

The support bars shall incorporate stainless steel sliding surfaces to minimize resistance to joint movements, be supported above, below and laterally as required to prevent lifting, transmit bearing loads, and maintain positioning of bar, and shall not be less than two inches in width and three inches in height. Each separator bar shall be welded to its own dedicated support bar. The neoprene seals, support bar bearings, and equalization springs shall be removable and replaceable.

2. Fabrication. The swivel expansion joints shall be fabricated according to the requirements herein. Shop welds splicing main beams, or connections to the main beams shall be full penetration welded and 100 percent non-destructively tested in accordance with AWS D1.5 Bridge Welding Code.

The joints shall be shop assembled with all components, including neoprene seals, in one continuous unit (no field splices). The shop-assembled unit(s) shall include the roadway channels and all anchor plates for both sides of the joint.

The shop-assembled unit(s) shall be adjusted to proper alignment and secured for shipping, ready to be set in place in the new construction.

The swivel expansion joint shall be fabricated and shipped with the joint setting dimension as shown on the plans or the approved shop drawings. Once in place, the setting dimensions shall be adjusted to proper ambient temperature dimension by means of prestressing devices furnished by the manufacturer which shall accompany the swivel expansion joint assembly to the job site.
All steel components, except stainless steel, shall be metalized. The same coating system should be used for all steel components.

The thickness of the coating shall be 6-8 mils. The wire used for the metalizing shall consist of 100% zinc. Surface preparation and application shall conform to SSPC-CS 23.00, Guide for Thermal Spray Metallic Coating Systems. Metalizing of the surfaces of the retainers to which the glands will be bonded is not required. These surfaces may be masked to prevent the buildup of overspray within the retainer groove. All metalized surface that will be in contact with freshly poured concrete shall be shop-coated with an epoxy barrier coat that conforms to the epoxy coat of SS 910. The barrier coat shall be two (2) to three (3) mils dry film thickness.

Metalized surfaces damaged during shipment or installation and field welded areas shall be field repaired. These areas shall be cleaned in accordance with SSPC-SP11 A Power Tool Cleaning to Bare Metal @ and subsequently coated with the epoxy intermediate coat in accordance with SS 910. The Contractor may employ alternate coatings for touch-up purposes subject to the approval of the Engineer.

3. Fatigue Testing. Constant amplitude fatigue testing shall be performed to determine $F_{SR}$ for all structural members, connections both welded and bolted, and components.

The allowable limit state fatigue stress range of 100 million cycles shall be based on a survival probability of 95 percent.

The test loading shall be applied so that the vertical and horizontal loading are applied simultaneously. Testing shall be performed so that the horizontal load is 20 percent of the vertical load.

Fatigue testing shall be done by a nationally recognized independent testing laboratory paid for by the manufacturer. Results of previous fatigue test may be used.

The transverse center beams, support bars, bearings, and other structural elements shall be designed and fatigue tested following the provisions in Chapter 14 of AASHTO LRFD Bridge Design Specifications, 3rd Ed.

533.06 Preparations for Installation. The Contractor shall submit an installation procedure for the specific swivel expansion joints that he plans on utilizing. This plan will be in accordance with the recommendations from the joint manufacturer. This plan will include at a minimum:

- Step-by-step installation procedures
- Method for securing the joint
- Method for adjusting the joint for temperature considerations
- Method for insuring rideability
- Method for placing surrounding concrete, reinforcing and post-tensioning
- Method for attaching the barrier rail cover plates

The Contractor shall also have a representative from the joint manufacturer on site during the installation of at least the first joint of each type and provide written certification that the joint was installed properly. This written certification shall be submitted to the Engineer.

After deck concrete has been milled in adjacent spans and up to the deck joint blockouts for the full width of the bridge, final adjustment of the modular joints shall be made with respect to the roadway surface prior to placing blockout concrete.

Temporary supports shall be provided as required to maintain proper alignments. After the joint has been adjusted for the correct temperature setting, all existing concrete bonding surfaces shall be primed with epoxy polysulfide grout no sooner than two (2) hours prior to adhesive bonding. The cleaned groove shall be solvent cleaned as described above.
533.07 **Installation.** Immediately prior to adhesive application, bonding surfaces shall be clean, dry and warmer than 50°F, and they shall be maintained at or above this temperature until the adhesive has cured. Adhesive shall be applied liberally to both steel and elastomeric bonding surfaces using a stiff brush if necessary to achieve a complete and relatively uniform coat. Then the bulbed edges of the elastomeric seal shall be inserted into the anchor grooves. After installation, excess adhesive shall be removed from the exposed seal surfaces.

The joint seal shall be installed with equipment specifically for the installation of elastomeric strip seals. This equipment shall not elongate the seal longitudinally, cause structural damage to the seal, nor twist, distort, or cause other malformations in the completed seal. Equipment that does not provide a properly installed seal shall not be used.

The complete, installed expansion devices shall be tested for water tightness, by filling the joint opening, or portions thereof as designated by the Engineer, with a three (3) inch minimum depth of water for a period of not less than six (6) hours. Leaking seals shall be removed, the bonding surfaces cleaned of all adhesive, and the seals replaced and retested. This water tightness test shall be performed again after joint installation in the field.

The joint assembly manufacturer shall furnish technical assistance to the Contractor and Engineer, through the services of a technical representative, during installation of all swivel expansion joint systems. The manufacturer’s technical representative shall be present during the installation of at least one assembly to verify the proper joint installation procedure including anchoring the joint support elements to the bridge’s structure elements. Where special instructions are not contained herein or elsewhere in the Specifications, direction for the installation shall be according to the recommendations of the technical representative.

The Contractor shall be responsible for informing the manufacturer of the date of installation, and advance notice shall be given with sufficient time for proper coordination and scheduling of operations.

533.08 **Shop Drawings.** All work shall conform to approved shop drawings, prepared in accordance with the requirements herein. Shop drawings shall include procedures for installation of neoprene seal, replacement of neoprene seal, and replacement of springs and sliding bearings.

The contractor shall submit details of the expansion joint system to be used together with installation and waterproofing plans to the engineer for approval prior to fabrication of the joint assembly. These drawings shall include but not be limited to the following:

a. Plans, elevation and section of the joint system for each movement rating and roadway width showing dimensions and tolerances.

b. All ASTM, AASHTO, or other material designations.

c. Method of installation including but not limited to sequence, setting relative to temperature, anchorage during setting, and installation at curbs.

d. Corrosion protection system.

e. Recommendations for storage of the joint system and details of temporary supports for shipping and handling.

f. Design calculations for all structural elements. The design calculations shall include a fatigue design and a load factor design for all structural elements, connections, and splices. All welded splices shall be shown on the shop plans.

g. Welding procedures shall be in accordance with AASHTO/AWS D1.5-95 Bridge Welding Code.

Shop drawings shall also include details of additional reinforcing steel in deck slab required around joint blockouts, as shown in the Plans or as required by the joint manufacturer. The deck slab at the joint location shall be formed with a void of sufficient size for the placement of the swivel expansion joint device. The length, width and depth of this blockout shall be verified by the Contractor and coordinated with the manufacturer and shall be as shown on the plans or the approved shop drawings. The Contractor shall be responsible for coordinating the proper fit of reinforcing steel and post-tensioning steel as applicable with the swivel expansion joint.
Shop drawings covering all details, for Swivel Modular Expansion Joints are required. One (1) sepia and four (4) prints shall be submitted to the Engineer for review and approval.

533.09 Method of Measurement.

Payment for accepted quantities of the installed joint shall be based on the sealed length of the joint measured horizontally along the centerline of the swivel modular expansion joint seal complete in place and accepted. This payment shall include the cost of furnishing, testing, cleaning and placing the modular expansion seals, primers and adhesives; furnishing and installing structural steel angles or extrusions an anchor plates welded thereto, steel plates, additional deck slab reinforcing steel at blockouts, angles, bolts, shims, and all other miscellaneous metal work required for the bonding surfaces, steel parapet/median cover plates, technical support, and all other incidentals necessary to complete this work according to Plans and Special Provisions. The dimension noted in the payment item is the required movement rating for the swivel expansion joint.

533.10 Basis of Payment.

Payment shall be made under:

Pay Item
EXPANSION JOINT, SWIVEL JOINT – 12 INCHES MOVEMENT LINEAR FEET

No additional payment shall be made for all miscellaneous steel cover plates and connectors at sidewalk, barriers, and curbs. Payment for miscellaneous steel cover plates and connectors shall be included in the swivel modular expansion joint pay items.

THE FOLLOWING SECTION IS ADDED:

SECTION 534 - DIAMOND GRINDING OF CONCRETE DECK SURFACE

534.01 Description.

The following work shall include the development of a detailed procedure for evaluating the deck riding surface smoothness, as well as performing the deck grinding including the sidewalk area, and all measurements described herein to evaluate the adequacy of deck riding surface.

The Contractor shall employ casting, erection and grinding procedures that will produce an average profile index of 12 inches per mile or less. Local area indexes up to 15 inches per mile may be accepted with applicable price adjustments.

534.02 Equipment.

A power driven, self-propelled machine having diamond blades and capable of grinding the surfaces of the concrete to the specified smoothness tolerances shall be used. Equipment that will cause strain or damage to the deck surface, excessive ravels, aggregate fractures, spalls, or disturbance of transverse or longitudinal joints shall not be used.

534.03 Construction Requirements.

A. Initial Surface Smoothness Measurements. Upon completion of superstructure erection (independently for each permanent traffic direction), the bridge deck riding surface shall be tested using a profilograph in accordance with the test procedure outlined in Section C.4. The Contractor shall furnish, calibrate, and operate the profilograph in accordance with the specific test procedure, in the presence of the Engineer, and shall submit the surface trace results for analysis by the Engineer. Prior to profilograph measurements, all objects and equipment shall be removed from the bridge deck surface and the surface shall be vacuumed clean of any debris.

An average profile index for the entire bridge length (per traffic direction) will be determined by the Contractor and recorded as the initial profile index.

B. Profile Grinding. From the initial profilograph measurements, the Contractor shall determine the optimal grinding depth at all points of the roadway surface, with appropriate allowance for the subsequent 0.25 inch deep transverse saw cut grooves.
After profile grinding has been conducted, the bridge deck riding surface shall again be tested using a profilograph in accordance with the test procedure outlined in Section C.4. The Contractor shall similarly furnish, calibrate, and operate the profilograph in accordance with the specific test procedure, in the presence of the Engineer, and shall submit the surface trace results for analysis and acceptance by the Engineer. Prior to profilograph measurements, all objects and equipment shall be removed from the bridge deck surface and the surface shall be vacuumed clean of any debris.

An average profile index for the entire bridge length (per traffic direction) will be determined by the Contractor in accordance with Section C.5a and recorded as the post grinding profile index. Profiles will be obtained to within 6 feet of the barrier or curb line. The profile trace will also be analyzed by the Engineer in accordance with Section C.5b. The Contractor and Engineer shall compare and reconcile any differences between the independent profile trace analyses. The locations of existing bumps in excess of 0.4 inch will be marked on the profile trace.

Local areas, which are represented by high points having deviations in excess of 0.4 inches in 25 feet or less, represent “must correct” areas and shall be corrected. In addition, the surface shall meet, at all locations, a 0.20 inch in 10 foot straightedge check made transversely across the deck. After correction of individual deviations in excess of 0.4 inches in 25 feet or less, the Contractor shall take corrective action to reduce the average profile index to 12 inches per mile or less. If the average profile index exceeds 12 inches per mile, the Contractor shall provide a plan for corrective action for approval before implementation. Approval of the corrective plan will in no way relieve the Contractor of responsibility for meeting rideability requirements. In all cases, a minimum of 3¾ inches of cover over reinforcing steel shall be maintained. Corrections shall be made, as directed by the Engineer, using only approved abrasive grinding equipment utilizing diamond cutting blades mounted on a self-propelled machine that has been designed for the grinding of concrete pavements. The equipment shall be such that it will not cause strain or damage to the deck surface, excessive ravel, aggregate fractures, spalls, or disturbance of transverse or longitudinal joints. Grinding shall be performed parallel to, or at right angles to, the bridge deck centerline. Bush hammers and impact devices will not be permitted. Where surface corrections are made, the Contractor shall re-establish a uniform surface texture comparable to the surrounding uncorrected concrete in both appearance and skid resistance in accordance with Section E. Expansion joint installation shall be delayed and the joint temporarily bridged to facilitate operation of the profilograph and corrective equipment across the joint wherever feasible. It shall be the Contractor's responsibility to schedule profilograph testing. Requests for profilograph test inspection and monitoring shall be made by the Contractor to the Engineer at least 5 days prior to need.

When the profile index exceeds 12 but does not exceed 15 inches per mile, the Contractor may elect to attempt to reduce the profile index through corrective grinding or may elect to accept a contract price adjustment. The contract unit price for Precast and/or Cast-In-Place Superstructure Concrete will be adjusted as described herein relative to the surface tolerance of the bridge deck riding surface. To obtain the price adjustment as a percentage of the Initial Contract Price for deficiencies in the surface tolerance or average profile index, the factors listed in Table 1 shall apply. Incentive price adjustments, Table 1 Schedule A, will be based on the initial profile index prior to any corrective work. The price adjustments in Schedule B for 100% payment or pay reductions apply to sections where corrective action has been performed. There will be no additional payment for the work involved in any “must grind” bump removal or profile index corrective grinding.

### Table 1
Adjustment of Contract Price for Profile Index Surface Tolerance

<table>
<thead>
<tr>
<th>Schedule A (Initial or Uncorrected)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 or less</td>
<td>105</td>
</tr>
<tr>
<td>Over 1 to and including 4</td>
<td>104</td>
</tr>
<tr>
<td>Over 4 to and including 5</td>
<td>103</td>
</tr>
<tr>
<td>Over 5 to and including 6</td>
<td>102</td>
</tr>
<tr>
<td>Over 6 to and including 7</td>
<td>101</td>
</tr>
<tr>
<td>Over 7 to and including 12</td>
<td>100</td>
</tr>
<tr>
<td>Over 12 to and including 13</td>
<td>98</td>
</tr>
<tr>
<td>Over 13 to and including 14</td>
<td>95</td>
</tr>
</tbody>
</table>
C. Determination of the Profile Index Value.

1. Scope.
   a. This section describes the procedures used for determining the pavement Profile Index from profilograms made with the Profilograph, and also describes the procedure used to locate individual high areas. The profilogram is recorded on a scale of one inch equal to 25 feet longitudinally and full scale vertically. The determination of the Profile Index involves measuring "scallop"s that appear outside a "blanking" band. The determination of individual high areas involves the use of a special template.

2. Apparatus.
   a. Profilograph. The profilograph shall be a California type profilograph, or approved equal. It shall be hand-propelled of aluminum construction, on a frame at least 25 feet in length supported upon wheels having no common axle. The wheels shall be arranged in a staggered pattern such that no two wheels cross the same bump at the same time. It shall have a profile wheel assembly which when connected to a profilograph chart will record on chart paper as one-inch equals 25 feet of longitudinal motion and one-inch, or full scale of vertical profile.

   b. Plastic Scale. The plastic scale is 1.70 inches wide and 21.12 inches long representing a pavement length of 528 feet or one tenth mile at a scale of 1" = 25'. At the center of the scale is an opaque band 0.2 inch wide extending the entire length of 21.12 inches parallel to the opaque band on either side are five scribed lines 0.1 inches apart. The lines serve as a scale to measure excursions ("scallop")s of the graph above or below the blanking band.

   c. Plastic Template. The plastic template is a 3 inch by 5 inch by 1/16 inch thick device having a line one inch scribed on one face with a hole or scribed mark at either end. A one inch long slot is cut through the template at a distance of 0.4 inch from and parallel to the scribed line. This one inch line corresponds to a horizontal distance of 25 feet on the horizontal scale of the profilogram chart.

   d. Calibration Blocks. Three steel calibration blocks with dimensions of 0.25 ± 0.01", 0.50" ± 0.01" and 1.00" ± 0.01" are used for calibration check on vertical displacement mechanism.

3. Calibration.
   a. Longitudinal Distance. Prior to testing, lay out a 1,000 ft. test section at the job site with intervals of 100, 200, 300 and 1000 feet marked on the pavement. With the Profilograph in the operational mode, push it at a walking pace over the test section eventing each premarked distance on the chart paper. Divide the 1000 feet distance by the length of chart paper produced by the distance to obtain the chart scale factor. This factor should be 25 (1" = 25'). If the calculated scale factor deviates from 25 by more than 5%, the equipment shall not be used until satisfactory corrections have been made. The calculated chart scale factor shall be used in all calculations in determining the Profile Index.

   b. Vertical Displacement. Prior to testing, place the three calibration blocks on the pavement at the job site. With the Profilograph in the operational mode, push it at a walking pace so that the profile wheel passes directly over the calibration blocks. The entire tearing surface of the wheel shall be on the calibration block. Measure the displaced distance on the chart paper. The vertical displacement is recorded on a scale of one-inch equal to one-inch full scale. If the measured displacement deviates from the calibrated block thickness of more than 5%, the equipment shall not be used until satisfactory corrections have been made.

4. Procedure
**a. Operation.** With the profile wheel in the down position, engage the profilograph chart gears by turning the drive engage cam. The slight movement of the recording drum crank will engage the gears if they did not mesh when the drive engage cam was turned. Sideslip and crabbing adjustments should be made where necessary.

The profilograph will be moved longitudinally along the pavement at a speed no greater than 3 mph, to minimize bounce. Pavement profiles will be taken 3 feet from and parallel to each edge of pavement for pavement placed at 12-foot width or less. When pavement is placed at a greater width than 12 feet, the profile will be taken 3 feet from parallel to each edge and from the approximate location of each planned longitudinal joint. Additional profiles may be taken only to define the limits of an out-of-tolerance surface variation.

**b. Testing.** The testing will be performed on a lot-by-lot basis. A lot is defined as 5,600 sq. yards of full width pavement, starting with the beginning of mainline pavements. If the final section paved at the end of the project is less than 5,600 sq. yards, but greater than 300 sq. yards, this section will be considered a lot.

---

5. **Profile Evaluation.**

**a. Determination of Profile Index (PRI).** After obtaining the profilograph chart for the pavement under study, place the plastic scale over the profile in such a way as to "blank out" as much of the profile as possible. The "scallops" above and below the blanking band should approximately balance. When the chart trace skews across the paper, the profile should be broken into short sections and the blanking band repositioned on each section.

**(1) Method of Counting and Analysis.** Starting at the right end of the scale, measure and total the height of all scallops appearing both above and below the blanking band. Each scallop is measured to the nearest 0.05 inch. Write this total on the profile sheet near the left end of the measured section together with a small mark to align to scale when moving to the next section. Unless short portions of the profile line visible outside the blanking band project 0.03 inch or more and extend longitudinally for 0.08 inch or more on the profilogram, they are not included in the count. After scallops occurring in the first 1000 feet are totaled, slide scale to left, aligning the right end of the scale with the small mark previously made, and proceed as before. If the last section counted is not an even 1000 feet, its length should be scaled to determine its length in feet. An example follows:

<table>
<thead>
<tr>
<th>Section Length, feet</th>
<th>Counts, tenth of an inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>15.0</td>
</tr>
<tr>
<td>1000</td>
<td>14.5</td>
</tr>
<tr>
<td>1000</td>
<td>13.5</td>
</tr>
<tr>
<td>760</td>
<td>12.0</td>
</tr>
<tr>
<td>3760</td>
<td>55.0</td>
</tr>
</tbody>
</table>

The Profile Index is determined as "inches per mile in excess of the 0.2 inch blanking band" and is converted from counts as follows, using figures from above:

Length = 3760 feet = 0.712 miles

Total Count = 55.0 tenths of an inch

Profile Index (PRI) = \( \frac{1 \text{ mile} \times \text{total count in inches}}{\text{length of profiles in miles}} \)

\[
PRI = \frac{1.0 \text{ mi} \times 5.50}{0.712 \text{mi}} = 7.72
\]

(NOTE: that the formula used the count in inches rather than tenths of an inch and is obtained by dividing the count by ten).

Profile Indexes may be averaged for two or more profiles of the same section of road if the profiles are of the same length. Specifications will state which profile to use when computing the average PRI for control of construction operations.

**(2) Limitations of Count in 1000 feet Sections.** When the specifications limit the amount of roughness in "any 1000 feet section", the scale is moved along the profile and counts made at various locations to find those sections, if any that do not conform to...
specifications. The limits are located on the profile and can later be located on the pavement preparatory to grinding.

(3) Limits of Counts - Joints. When counting profiles, a day’s paving is considered to include the last portion of the previous day’s work which includes the daily joint. Profilograph readings when approaching such joints should be taken in conformance with current specifications.

(4) Average Profile Index for the Whole Job. When averaging Profile Indices to obtain an average for the job, the average for each day must be "weighted" according to its limit. This is done by totaling the counts for the 1000 feet sections of a given line or lines and using the total length of the line in the computation for determining the Profile Index.

b. Determination of High Points in Excess of 0.4 inch. Using the plastic template, the location of bumps to be reduced can be determined from the profilograph chart.

(1) Locating High Points in Excess of 0.4 inch. At each prominent peak or high point on the profile trace, place the template so that the scribe marks at each end of the scribed line intersect the profile trace to form a chord across the base of the peak or indicated bump. The line on the template need not be horizontal. With a sharp pencil, draw a line using the slot in the template as a guide. Any portion of the trace extending above this line will indicate the approximate length and height of deviation in excess of 0.4 inch.

(2) Where the distance between easily recognizable low points of the chart is less than one inch (i.e., 25 feet along the pavement), a shorter chord length shall be used in making the scribed line on the template tangent to the trace at the low points. It is the intent of this requirement that the baseline for measuring the height of bumps be as near to 25 feet or one inch on the chart as possible, but in no case to exceed this value. When the distance between prominent low points is greater than 25 feet (one inch on the chart), make the ends of the scribed line intersect the profile trace when the template is in a nearly horizontal position.

534.04 Basis of Payment.
Payment will be made under:

THE FOLLOWING IS ADDED:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIAMOND GRINDING DECK SURFACE</td>
<td>SQUARE FEET</td>
</tr>
</tbody>
</table>

THE FOLLOWING SECTION IS ADDED:

SECTION 535 ARCHITECTURAL CONCRETE

535.01 Description
This work shall include but is not limited to the following:
1) Precast architectural concrete pylon facings and caps with controlled architectural finishes.
2) Precast architectural concrete- shop fabricated concrete elements which are reinforced but not necessarily prestressed.
3) Integration with other materials including granite for engraved text, ceramic tile, and bronze memorial plaques.
4) Cast in place bases for the light poles on the bridge.
5) Semi-transparent potassium silicate concrete colorant and coating applied to visible surfaces of precast architectural concrete abutment monuments after erection.

535.02 Materials
The material for the architectural concrete shall be in accordance with PCI MNL 122; "Architectural Precast Concrete" Precast/ Prestressed Concrete Institute (1989).
Care shall be taken to prevent staining and damage to visible finished surfaces wherever Architectural Precast elements are in contact with fresh cast in place concrete.

MOLD MATERIALS
Provide molds and, where required, form-facing materials of metal, plastic, wood, or another material that is nonreactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes.
Pattern: No 16992 "Coarse Sandblast" by Fitzgerald Formliners Inc. or a similar product as selected by the Engineer together with the Architect from the manufacturers full range of formliners textures.
Mold Formliner Panel Size: Use largest size available from manufacturer to avoid butt joints wherever possible. Minimum panel size shall be four feet by ten feet. Joints in finished concrete elements of larger size must be undetectable.

Joints Between Adjacent Mold Panels: Formliner sheets shall have edges designed so that the texture appears continuous across the joint rendering the joint invisible. Texture shall appear continuous across both horizontal and vertical butt joints.

Mold Material Manufacturers and Products: Provide products made by one of the following manufacturers or by "Approved Equal."
Fitzgerald Formliners Inc.
Spec. Formliners Inc.
Universal Form Clamp Co.
Greenstreak Corporation.

REINFORCING MATERIALS
Conform to the requirements of NJDOT Standard Specification Section 501.

CONCRETE MATERIALS
Requirements of NJ DOT Standard Specification for Concrete Materials apply to this Article.

FLASHINGS AND ACCESSORIES
Flashings, Counterflashings, and Reglets: Stainless steel formed from 24 gauge [0.0250 inch] Type 316 soft temper or stretcher leveled sheet depending on conditions.

STAINLESS-STEEL CONNECTION MATERIALS
Welding Electrodes: Comply with AWS standards.
Accessories: Provide clips, hangers, plastic shims, and other accessories required to install precast architectural concrete units.
Manufacturers of Accessories: Products by Halfen Anchoring Systems Inc. or approved equal.
Stainless-Steel Plate: ASTM A 666, Type 316, of grade suitable for application.
Stainless-Steel Bolts and Studs: ASTM F 593, alloy 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.
Stainless-Steel Headed Studs: ASTM A 276.

GROUT MATERIALS
Conform to requirements for grout in NJ DOT Specification Section 914 "Portland Cement Concrete, Mortar, and Grout."
Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application.

MORTAR MATERIALS
Conform to requirements for mortar in NJDOT Standard Specification Section 501
CONCRETE MIXES
Prepare concrete in conformance with NJDOT Standard Specification Section 501 for each type of concrete required.

BEARING PADS
Provide bearing pads for precast architectural concrete units as follows:
Frictionless Pads: Tetrafluoroethylene, glass-fiber reinforced, bonded to stainless-steel plate, of type required for in-service stress.

Manufacturer for potassium silicate based products described in this Section is KEIMFARBEN GMBH of Diedorf, Germany. Provide products by Basis of Design manufacturer or comparable products equal in color quality, durability, and type to Basis of Design Product as approved by the Engineer, together with the Architect. The cementitious coating materials shall be obtained from one source and by a single manufacturer.

BRONZE MATERIALS
Bronze plaques shall be provided for the Borough Crests shown on the plans. The crests are to be installed on the exterior of the abutment monuments as shown. A firm with an established reputation in the making of metal artwork shall be used to supply the bronze plaques. Each plaque shall be cast as one solid piece of bronze with a minimum 3/8” thickness. Samples of the material and finish for each plaque shall be submitted together with the chemical composition of the plaque for approval prior to casting the plaques. The concrete surface on which the plaque is to be applied shall be rubbed smooth and flat in order that the plaque be anchored to the concrete with 3/8” diameter brass lugs 4” long. The lugs shall be tapped into reinforced spots cast on the back of the plaque. Lugs shall be well roughed and shall be made secure with quick setting cement. There will be no measurement or payment in connection with this work. The cost of the bronze plaques shall be included in the Architectural Concrete Items where applicable.

535.03 Shop Drawings
Shop drawings shall be submitted for approval prior to any work on architectural concrete and shall include:
Product Data: For each type of product indicated.
Design Mixes: For each concrete mix.
Detailed fabrication and installation of precast architectural concrete units shall be submitted which indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement. Indicate separate face and backup mix locations and thicknesses. Indicate locations and extent of dry joints if two-stage casting is proposed. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories. Indicate locations and details of anchorage devices to be embedded in other construction.

The contractor shall submit Samples for Initial Selection: For each type of finish indicated on exposed surfaces of precast architectural concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 1ft by 1 ft by 4 inches.

The contractor shall submit Samples of the concrete colorant and coating applied to the abutment monuments. The concrete color shall be a natural gray. Architect shall identify one or more colors to be developed further into Verification Samples.

A. Samples for Verification: Of each color to be applied, with texture to simulate actual conditions. Apply to samples of actual substrate or gypsum panels treated to resemble substrate.

1. Provide stepped Samples, defining each separate coat. Use representative colors when preparing Samples for review.
2. Provide a list describing materials and applications used for each coat of each Sample.
3. Label each Sample.
4. Submit Samples on the following substrates for the Architect's review of color and texture only: Select sample submissions required to suit Project. Add other requirements as necessary.
a. Treated Concrete: Two 24-inch-square Samples for each color and texture.

5. Resubmit Samples, as requested, until required color and texture are achieved.

535.04 Prequalification
The contractor shall utilize an experienced fabricator and installer who has completed precast architectural concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance. The fabricator must participates in Precast Concrete Institute's Plant Certification program and be designated a PCI-certified plant for Group A, Category A1--Architectural Cladding and Load Bearing Units.

An independent testing agency, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548 shall be utilized.

The contractor shall utilize an independent testing agency indicating compliance of cementitious coatings with requirements indicated based on comprehensive testing within the last two years of current product formulations.

The contractor shall engage an experienced applicator who can demonstrate thorough familiarity with coating application requirements and who has completed coating system applications similar in material and extent to those indicated for the Project with a record of successful in-service performance.

535.05 Standards
All architectural concrete shall conform to the following Design Standards:
ACI 318M and the design recommendations of PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."
Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, shall comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
Product Options: Drawings indicate size, profiles, and dimensional requirements of precast concrete units and are based on the specific types of units indicated. Other fabricators' precast concrete units complying with requirements may be considered.
Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.4, "Structural Welding Code--Reinforcing Steel."
Sample Panels: Before fabricating precast architectural concrete units, produce sample panels to establish the approved range of selections made under sample Submittals. Produce a minimum of 3 sets of full-scale sample panels, approximately 4 feet long by 4 feet high, to demonstrate the expected range of finish, color, and texture variations.
Locate panels where indicated or, if not indicated, as directed by Engineer together with Architect.
Repair Methods: In presence of Engineer and Architect, damage part of an exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of surface blemishes to match adjacent undamaged surfaces.
Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work. Demolish and remove sample panels when directed.

535.06 Mockups
Mockups: Before installing precast architectural concrete units, build mockups to verify selections made and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
Build mockups at the project site, or as directed by Engineer together with Architect.
Mockup shall include pylon wall panel including exterior corner and coffered recesses. Show completed joint treatment specified. Horizontal and vertical butt joints of formliner sheets.
Notify Engineer and Architect seven days in advance of dates and times when mockups will be constructed.
Obtain Engineer's approval of mockups before starting fabrication.
Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work. Demolish and remove mockups when directed.
Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
A preinstallation Conference shall be conducted at Project site to verify compliance with the requirements of this specification.

Benchmark Samples (Mockups for Cementitious Coating):
1) Benchmark samples to be at least 100 sq. ft. Protect from damage during construction.
2) The Manufacturer’s Technical Specialist shall prepare a benchmark sample, which will be the basis of comparison for visual attributes for the specified finish.
3) After completion of the specified on-site instruction by the Manufacturer’s Technical Specialist, the applicator shall provide a second coat benchmark finish sample, which shall be equivalently identical to the Manufacturer’s Sample.
4) After benchmark samples are approved, these surfaces will be used to evaluate coating systems.
5) Obtain the Architect's approval of benchmark samples before proceeding with coating application.
6) Final approval of colors will be from benchmark samples.

535.07 Construction Requirements
The precast architectural concrete units shall be delivered to the Project site in such quantities and at such times to ensure continuity of installation. The units shall be stored at the Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible. The units shall be lifted and supported only at designated lifting and supporting points as shown on shop drawings.

The contractor shall furnish anchorage items to be embedded in or attached to other construction without delaying the Work. The fabricator shall provide setting diagrams, templates, instructions, and directions, as required, for installation. Fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:
Universal Concrete Products Corp. of New Jersey Inc.
DiSanti Concrete Products Inc.
High Concrete Structures Inc.
J and R Slaw Inc.
Nitterhouse Concrete Products Inc.

MOLD FABRICATION
Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing operations. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concreting. Coat form liner with form-release agent. Maintain molds to provide completed precast architectural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

Edge and Corner Treatment: Uniformly quirk formed as shown on Drawings.

FABRICATION
Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
Furnish loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast architectural concrete units to supporting and adjacent construction.
Cast-in reglets, slots, holes, and other accessories in precast architectural concrete units to receive cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.
Cast-in openings larger than 10 inches in any dimension.
Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and PCI MNL 117 for fabricating, placing, and supporting reinforcement. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces. Place reinforcement to maintain at least 3/4 inches minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Reinforce precast architectural concrete units to resist handling, transportation, and erection stresses. Place face mix to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting, and placing concrete. Place backup concrete to ensure bond with face mix concrete. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 117. Identify pickup points of precast architectural concrete units and orientation in structure with permanent markings, complying with markings indicated on the shop drawings. Imprint or permanently mark casting date on each precast architectural concrete unit on a surface that will not show in finished structure. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Discard precast architectural concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by the Engineer together with the Architect.

FABRICATION TOLERANCES
Fabricate precast architectural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with the following product tolerances:

Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
- 10 feet or under, plus or minus 1/8 inch.
- 10 to 20 feet, plus 1/8 inch, minus 3/16 inch.
- 20 to 40 feet, plus or minus ¼ inch.
Each additional 10 feet, plus or minus 1/16 inch.

Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
- 10 feet or under, plus or minus ¼ inch.
- 10 to 20 feet, plus ¼ inch, minus 3/8 inch.
- 20 to 40 feet, plus or minus 3/8 inch.
Each additional 10 feet, plus or minus 1/8 inch.

Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch per 6 feet or 5/8 inch total, whichever is greater.

Length and Width of Block-outs and Openings within One Unit: Plus or minus ¼ inch.

Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus ¾ inch.
Bowing: Plus or minus L/360, maximum 1 inch.

Local Smoothness: ¼ inch per 10 feet.
Warping: 1/16 inch per 1 foot of distance from the nearest adjacent corner.
Tipping and Flushness of Plates: Plus or minus ¼ inch.

Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch.

Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
Weld Plates: Plus or minus 1 inch.
Inserts: Plus or minus ½ inch.
Handling Devices: Plus or minus 3 inches.
Reinforcing Steel and Welded Wire Fabric: Plus or minus ¼ inch where position has structural implications or affects concrete cover; otherwise, plus or minus ¼ inch.
Location of Rustication Joints: Plus or minus 1/8 inch.
Location of Opening within Panel: Plus or minus ¼ inch.

Flashing Reglets: Plus or minus ¼ inch.
Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch.
Reglets for Glazing Gaskets: Plus or minus 1/8 inch.
Electrical Outlets, Hose Bibs: Plus or minus ½ inch.

Haunches: Plus or minus ¼ inch.
Allowable Rotation of Plate, Channel Inserts, Electrical Boxes: 2-degree rotation or ¼ inch maximum over the full dimension of the unit.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
FINISHES
Finish exposed-face surfaces of precast architectural concrete units to match approved design reference sample panels and mockups as approved by the Engineer together with the Architect.
Finish exposed top bottom and back surfaces of precast architectural concrete units to match face-surface finish wherever both surfaces remain visible after installation.
Finish unexposed surfaces of precast architectural concrete units by float finish.

SOURCE QUALITY CONTROL
Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.
Defective Work: Precast architectural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

EXAMINATION
Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
Do not install precast concrete units until supporting concrete has attained minimum design compressive strength.

INSTALLATION
Install clips, hangers, and other accessories required for connecting precast architectural concrete units to supporting members and backup materials.
Install precast architectural concrete. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
Install bearing pads as precast concrete units are being assembled.
Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
Remove projecting hoisting devices and use sand-cement grout to fill voids within recessed hoisting devices flush with surface of concrete.
Anchor precast architectural concrete units in position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after anchoring and grouting are completed.
Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.
Protect precast architectural concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
At bolted connections, use lock washers or other acceptable means to prevent loosening of nuts.
Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
Pointing: Fill exposed horizontal and vertical joints completely solid with mortar of color and texture specified in New Jersey DOT Standard Specifications and as required by the Engineer, together with the Architect. Point mortar joints with convex round pointing tool. Promptly remove mortar material from precast surfaces before it affects finishes or hardens.

ERECTION TOLERANCES
Install precast architectural concrete units level, plumb, square, true, and in alignment without exceeding the non-cumulative erection tolerances of PCI MNL 117, Appendix I.
Install precast architectural concrete units level, plumb, square, and true, without exceeding the following noncumulative erection tolerances.
Plan Location from Building Grid Datum: Plus or minus ½ inch.
Plan Location from Centerline of Steel or other reference point identified by the Engineer: Plus or minus ½ inch.
Top Elevation from Nominal Top Elevation: As follows:
Exposed Individual Panel: Plus or minus ¼ inch.
Non-exposed Individual Panel: Plus or minus ¼ inch.
Exposed Panel Relative to Adjacent Panel: 1/8 inch.
Non-exposed Panel Relative to Adjacent Panel: ½ inch.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Support Elevation from Nominal Support Elevation: As follows:
   Maximum Low: ¼ inch.
   Maximum High: ¼ inch.
   Maximum Plumb Variation over the Lesser of Height of Structure or 100 feet: 1 inch.
   Plumb in Any 10 feet of Element Height: ¼ inch.
   Maximum Jog in Alignment of Matching Edges: 1/8 inch.
   Joint Width (Governs over Joint Taper): Plus or minus 1/8 inch.
   Maximum Joint Taper: 1/16 inch.
   Joint Taper in 10 feet: 1/16 inch.
   Maximum Jog in Alignment of Matching Faces: 1/8 inch.
   Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: ¼ inch.

FIELD QUALITY CONTROL
Testing: NJ DOT reserves the right to engage a qualified independent testing and inspecting agency to perform field tests and inspections.
Field welds and connections using high-strength bolts will be subject to tests and inspections.
Testing agency will report test results promptly and in writing to Contractor and Architect.
Remove and replace work that does not comply with specified requirements.
Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

REPAIRS
Repair exposed exterior surfaces of precast architectural concrete units to match color, texture, and uniformity of surrounding precast architectural concrete if permitted by Architect.
Remove and replace damaged precast architectural concrete units if repairs do not comply with requirements.

CLEANING
Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.
Wash and rinse according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.

CEMENTITIOUS COATINGS
Deliver materials to the Project site in the manufacturer's original, new, unopened packages and containers bearing manufacturer's name and label, and the following information.
Store materials not in use off of ground and in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg. F. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue. Comply with all manufactures requirements for storage and application temperatures, cleaning, substrate conditions and preparation and number of coats.

General: Apply cementitious coatings to exposed surfaces indicated. Where an item or surface is not specifically mentioned in the schedules, coat with same color as similar adjacent materials or surfaces. Appearance of coating shall match appearance of coatings on approved mock-ups.
Number of Coats: Apply KEIM Concretal coating in three coats as listed:
   Base Coat: Concretal coating mixed with Concretal Dilation.
      a. Allow Base Coat 24 hours drying time. Then inspect base coat and remediate unsatisfactory conditions before proceeding with Finish Coat Application.
   Two Finish Coats: Two separately applied coats of Concretal coating mixed with Concretal Dilation.
      a. Allow 24 hours minimum drying time between application of coats.
Application Procedures: Apply cementitious coatings by brush according to manufacturer's written instructions and as further defined at manufacturer’s training session and preparation of mock-up.
   Brushes: Use brushes identified by manufacturer as best suited for material being applied.
Minimum Coating Spreading Rate: Apply each material at not less than the manufacturer's recommended spreading rate. Provide total cured material thickness indicated or as recommended by the manufacturer.
Number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by the manufacturer.

Brush Application: Brush-out and work brush coats into surfaces in an even film, filling all pores and voids at rate recommended by the manufacturer to achieve cured material thickness indicated. Maintain wet edge during application to each architectural element, such as panels. Finish coat with smooth strokes required to match technique and quality of finish approved on mock-ups.

Material and Equipment Maintenance: Store materials not in use in tightly covered containers. Maintain tools and equipment in clean condition, free from caked material and residue.

Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work not complying with specified requirements.

535.08 Method of Measurement
No measurement will be made for the architectural concrete items and cementitious coating. Payment will be made on a lump sum basis.

535.09 Basis of Payment
Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABUTMENT MONUMENTS</td>
<td>LUMP SUM</td>
</tr>
<tr>
<td>LIGHTPOLE PILASTERS</td>
<td>LUMP SUM</td>
</tr>
</tbody>
</table>

The payment for the Architectural Concrete items includes all materials, coatings, equipment, mockups, testing, fabrications and placement required for complete installation including all accessories, hardware, joints, tiles and plaques associated with the items.

THE FOLLOWING SECTION IS ADDED:

SECTION 536 – BRIDGE OPERATION AND MAINTENANCE DURING CONSTRUCTION

536.01 Description. The contractor shall be responsible for the operation, maintenance and repairs of the existing bridge components from the start of Stage 2 until the bascule span is demolished. During this period the Contractor shall be responsible for operating and maintaining the existing bridge uninterrupted for pedestrian, vehicle and marine traffic. The Department will meet with the Contractor over the first 3 months to review operations and maintenance history. The Contractor shall maintain a log of all operation and maintenance activities and submit them to the Department on a monthly basis. Completed forms shall be submitted to the Engineer and Mr. Ahmad Ghorbani at the Bureau of Maintenance Engineering – Bridge Section, 1035 Parkway Avenue, Trenton, NJ, 08625 for record. The Sample Forms are included in the attachment for contractor’s use; see Forms EL-45CER, EL-45DCER, EL-45EER, and EL-45MER. In the event of an operational or bridge malfunction, the contractor shall notify the Resident Engineer and contact Mr. Larry Sroka, Manager, Bureau of Maintenance Engineering and Operations at (609) 530-5528 and Mr. Ahmad Ghorbani, Project Engineer, Bureau of Maintenance Engineering – Bridge Section at (609) 530-3737.

A. Maintaining Existing Facilities. The Contractor shall maintain the existing electrical and mechanical components of the bridge operating system in operation condition at all times until the bascule span is demolished. This includes, but is not limited to, navigation lights, traffic signals, warning and barrier gates, roadway lights, fenders, bridge lighting and heating and any other electrical equipment necessary to conform to the above requirements. The arrangement of any temporary facilities and controls shall be approved by the Engineer. Lane closures shall be in accordance with the requirements listed on the maintenance of traffic plan sheets.

The maintenance shall include regular greasing, coupling seal replacement, brake adjustments, brake shoe replacement, fluid changes including proper disposal of waste grease and oil, electrical control maintenance, Fire Alarm System Maintenance, up-keep for the Operator’s House including, but not limited to, cleaning, garbage removal, snow removal from sidewalk and stairs to provide for safe access to Operator’s Houses, snow removal for operation of traffic/barrier gates and
also repairs to any breakdowns during construction period. Snow plowing and salt spreading on the highway will be done by the State except as described herein. The following is a summary of typical required bridge maintenance for the movable bridge:

1. **Weekly and Monthly Greasing** – Trunnion bearings, four (4) and toe lock guide assemblies, two (2) assemblies - require weekly lubrication. All open gears and remaining bearings shall require monthly greasing. For location of movable components requiring greasing, the contractor shall refer to the Machinery Lubrication Chart in the attachment to the Specifications. As-built plans for the existing bridge are located at NJDOT, Trenton office and as-built plans of Route 36, Sec. 3 - Electrical and Mechanical Rehabilitation contract are located at NJDOT Freehold office, Movable Bridge Engineering Unit.

2. **Span Lock Reducer Lubrication - Oil Reservoir** – Fluid requires replacement once a year with the first replacement six (6) months after the award of the Project.

3. **Flexible Shaft Couplings (Motor Couplings)** – Grease requires purging and replacement after two (2) years with the first purging and replacement six (6) months after the award of the project.

4. **Electrical Maintenance** – The work shall include, but is not limited to, the following tasks:
   - Contact cleaning and tightening of connections of electrical panel components in the operator’s house.
   - CCTV system maintenance and repositioning and relocation of cameras to get a clear view of the channel for bridge openings during construction.
   - Relamping of street lights, Operator’s House lights, navigational lights, traffic signal lights and traffic/barrier gate lights as necessary.
   - Adjusting warning/barrier gate holding brakes as necessary to ensure that the gates do not lower under wind load and vibration.

5. **Emergency Call-outs** – The work shall include, but is not limited to, the following tasks:
   - The Center toe span lock device may often seize up during the summer months: action requires possible cooling down of the joint and re-lubricate to allow normal movements. The frequency of this seizing up depends on the nature of the summer season.
   - Fire Alarm System located on Bridge Operator’s House needs to be maintained as required.
   - Any structural repairs such as fender repairs, steel repairs and concrete repairs.
   - Any mechanical and electrical repairs not covered under Greasing and Electrical Maintenance. The Contractor shall contact NJDOT Maintenance to determine available spare parts in case of emergency.

The Contractor and Engineer will examine all the required facilities on the bridge and will note items requiring modification prior to the start of mandated maintenance. The Contractor shall be responsible for disposal of lubrication oil, grease and hydraulic fluids in accordance with all applicable environmental regulations.

Upon issuance of a report of non-operating items to the Engineer, the Engineer will make arrangements with the Contractor or other parties to repair any mal/non-functioning items. Contractor shall assume the full responsibility for maintenance of the bridge once these non-operating items are addressed but no later than the start of Stage 2 work.

Thirty (30) days prior to assuming responsibility for operation of the bridge, the Contractor shall submit to the Engineer for approval an Emergency Bridge Operation Response Plan (EBORP) explaining the Contractor’s planned response to open the bridge in the event that the bridge fails to open. The EBORP shall detail the Contractor’s list of emergency response personnel and equipment. If the bridge fails to operate for any reason, the Contractor is required to respond to the project site with emergency personnel and equipment within two (2) hours from when the bridge becomes un-operational to address emergencies. Should the contractor fail to respond, causing the State to respond with its own forces to restore bridge operation, the Contractor agrees to pay the State the following damages:

- US Coast Guard Civil Penalty of $25,000 per day for every offense in 2008 or the cost stated in the US Coast Guard regulations at the time of offense; PLUS
- $5,400.00 per every offense for mobilizing State’s forces and equipment; PLUS
$1,125.00 per hour for roadway user cost if traffic detour is required; PLUS
The Contractor shall be held liable for any lawsuits and damages assessed against the State by marine operation for its losses

Approved EBORP shall be kept at the Operator’s House for record.

536.02 Materials and Workmanship. All electrical equipment and its installation shall conform to the requirements of the 2000 AASHTO LRFD Movable Highway Bridge Specifications with current interims, except as may be otherwise provided herein.

All work shall conform to the requirements of the current national electrical code and to any applicable local rules and ordinances. The Contractor shall obtain any required permits and approvals of all departments or agencies having jurisdiction.

All equipment and materials, except those designated to be reused, shall be new. All equipment, materials and workmanship shall be manufactured and erected to the satisfaction of the Engineer.

The Contractor shall coordinate all mandated lubrication of the bridge machinery with the engineer. The following lubrications presently used by the Department are recommended for the mandated weekly and monthly greasing required for the bridge.


2. **Open Gears** – Lubriplate 3000 which is unleaded, diluent type, non-chlorinated open gear grease with sus. 7000 at 210 degrees F (98.3 degrees C) viscosity, water resistant, anti-wear/extreme pressure type.

3. **Enclosed Gears (Lock Machinery Reducer)** – Oil to be coordinated with lubricant presently used by the Department or Mobil SHC 632 or approved equal.

4. **Lock Bar Guides** – Grease to be coordinated with lubricant presently used by the Department or Mobil Mobitalc 375 NC or approved equal.

5. **Flexible Shaft Couplings (Motor Couplings)** – Grease to be coordinated with lubricant presently used by the Department or Falk LTG or approved equal.

536.03 Bridge Operating Personnel. During the reconstruction period from April 1st thru November 30th, bridge openings are required on an “on demand” basis from 7 AM to 11 PM and on signal from May 15th to Oct 15th, on the hour and half hour from 7AM to 8PM, 7 days a week. During this period the Contractor shall provide two bridge operators at the bridge. From 11 PM to 7 AM (April 1st thru November 30th) and from December 1st thru March 31st (24 hours per day) the draw need only open if two hours notice is given. During these periods, when signal is given, the Contractor is required to respond to the project site with two bridge operators within two hours to operate the bridge.

The Contractor shall provide six (6) employees for training as bridge operators (operators must have the ability to speak, write and communicate in English). The basic qualifications of a Bridge Operator is the ability to seat the bridge safely without causing damage to the bridge structure by using eye-hand coordination to operate semi-automatic and manual controls. The individual must have good communicative skills, as they will be required to operate marine band radios to transmit and receive messages from mariners, as well as communicate with the general public and law enforcement agencies. The individual must have the ability to use sound judgment and good common sense when dealing with day-to-day situations that arise.

The Contractor shall provide names and resumes of these operators to the Engineer and the US Coast Guard for approval prior to beginning training. Bridge opening time for construction and test purposes, shall be limited to certain hours for training and testing as directed by the Engineer. The Contractor shall have available on call at the bridge a person who is knowledgeable as to the bridge workings and be able to perform electrical trouble shooting.

During the initial week of employment, all new operators will be instructed with the normal operating procedure by the Department’s Chief Bridge Operator. Once they are ready to be certified, the Department will observe their performance and certify their ability to correctly operate the structure. The Sample Form used for certification of the Operator is included in the attachment; see Form “Bridge Operator’s Certification”. Once Operators are certified to operate the bridge by the Department; the complete certification form shall be submitted to the Engineer and one copy shall be kept at the Bridge Operator’s Room for record. Operators shall not be allowed to operate the bridge unless certified by the Department. It is the Contractor’s responsibility to provide adequate training and get operators certified. Normally, one (1) week of training is required prior to certifying an Operator for safe operation of the bridge. The Department
will pay for the one week of training for each Operator. If an Operator leaves during employment or after receiving the training, the Department will not pay for any additional training required to train additional Operators.

536.04 Method of Measurement.

Bridge Operators will be measured for each Month.
Greasing will be measured for each Month.
Electrical Maintenance will be measured for each Month.
Emergency Call-Outs will not be measured for payment.

536.05 Basis of Payment. Payment will be made under

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRIDGE OPERATORS</td>
<td>MONTH</td>
</tr>
<tr>
<td>GREASING</td>
<td>MONTH</td>
</tr>
<tr>
<td>ELECTRICAL MAINTENANCE</td>
<td>MONTH</td>
</tr>
<tr>
<td>EMERGENCY CALL-OUTS</td>
<td>LUMP SUM</td>
</tr>
</tbody>
</table>

Separate payment will not be made for up-keep of the Operator’s Houses. Up-keep shall include, but is not limited to, cleaning, garbage removal, snow removal from sidewalk and stairs to provide for safe access to Operator’s Houses and snow removal for operation of barrier/traffic gates. All costs thereof shall be included in the pay item “BRIDGE OPERATORS”.

Payment for Greasing per Month includes cost for four weekly greasings and one monthly greasing as specified herein and all incidental items associated with this greasing/lubrication work.

Separate payment will not be made for the material and labor costs associated with the work required for the fluid replacement at the span lock reducers nor for motor coupling grease replacement. All cost thereof shall be included in the pay item “GREASING”.

Payment for Electrical Maintenance includes labor cost associated with the electrical maintenance work as specified herein. Material cost required for this work will be paid under item “EMERGENCY CALL-OUTS”.

The price bid for “EMERGENCY CALL-OUTS” shall be a fixed price lump sum (FPLS) in the amount of one hundred thousand dollars ($100,000). This pre-entered amount is not to be altered in any manner by the bidder. Should the amount shown be altered, the altered figures shall be discarded and the pre-entered price and amount will be used to determine the total amount bid for this contract. This FPLS shall constitute an allowance against which the Contractor shall be paid. Payment for “EMERGENCY CALL-OUTS” will be made on the basis of actual costs calculated under the provisions under subsection 109.03. FORCE ACCOUNT PAYMENT for all repairs.

Separate payment will not be made for providing the EBORP as required in Subsection 536.01 of this specification. All costs associated with this item of work shall be included in related pay items.
DIVISION 600 - INCIDENTAL CONSTRUCTION

SECTION 602 - PIPES

602.01 Description.
THE FOLLOWING IS ADDED:
This work shall also consist of the installation of Ductile Iron Water Pipe, appurtenances, construction of thrust blocking and/or saddles at bends, tees and any other fittings and disinfection of all newly installed water mains as shown on the Contract Drawings or as directed by the Engineer.

The Contractor shall test all piping, valves and appurtenances installed under these Contract Documents. Testing shall be performed concurrent with installation. Unless otherwise approved by the Engineer no more than 1000 feet of pipe shall be installed without being tested.

602.02 Materials.
THE ENTIRE SUBSECTION IS CHANGED TO:

Materials shall conform to the following Subsections:

- Ductile Iron Culvert Pipe ................................................................. 913.02
- Ductile Iron Water Pipe ................................................................. 913.03
- Concrete Pipe .................................................................................. 913.04
- Corrugated Aluminum Alloy Culvert Pipe and Pipe Arches .......... 913.05
- Corrugated Steel Culvert Pipe and Pipe Arches .......................... 913.07
- Corrugated Steel Sewer Pipe and Pipe Arches ......................... 913.08
- High Density Polyethylene (HDPE) pipe ................................. 913.11
- Mortar and Grout ........................................................................... 914.03
- Gaskets .......................................................................................... 919.08
- FRP Pipe ..................................................................................... 913.10

Portland cement concrete for pipe plugs, encasements, or saddles shall conform to Section 914.

Where corrugated metal culvert pipe is designated, corrugated aluminum alloy culvert pipe or corrugated steel culvert pipe may be used.

Where corrugated metal culvert pipe arch is designated, corrugated aluminum alloy culvert pipe arch or corrugated steel culvert pipe arch may be used.

End sections shall be of the same material as the pipe or pipe arch to which the end sections are attached, except that end sections for HDPE pipe for outfall systems shall be concrete.

For jacked pipe, reinforced concrete culvert pipe shall conform to Subsection 913.04 except that the pipe shall be Class V, Wall B, tongue and groove type.

The tube material shall conform to the requirements of ASTM F 1216. The tube shall be fabricated to a size that, when installed, conforms to the internal circumference and length of the original pipe.

The wall color of the interior tube surface after installation shall not be of a dark or non-reflective nature that could inhibit proper closed-circuit television inspection.

All HDPE pipe shall be type S (smooth interior with annular corrugations), with gasketed silt-tight joints according to AASHTO M294.

All HDPE pipes shall be in compliance with the requirements of the National Transportation Product Evaluation Program’s (NTPEP) evaluation of HDPE and thermoplastic pipe. NTPEP test results shall be furnished to the Resident Engineer and to the Bureau of Materials Engineering and Testing before construction operation.

All FRP pipe shall conform to ASTM D 2996.

Ductile Iron Pipe And Fittings

A. General Ductile iron pipe shall conform to the latest specifications as adopted by the American National Standards Institute, Inc., (ANSI) and the American Water Works Association (AWWA). Specifically, ductile iron pipe shall conform to ANSI/AWWA C151/A21.51

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
The pipe shall be coated outside with a bituminous coating in accordance with ANSI/AWWA C151/A21.51. The pipe interior shall be cement mortar lined and seal coated in compliance with the latest revision of ANSI/AWWA C104/A21.4. The cement mortar lining shall be double thickness.

B. Pipe Class

The class of pipe to be furnished shall be in accordance with Table 1 and the below listed notes.

Table 1
RATED WORKING PRESSURE AND MAXIMUM DEPTH OF COVER FOR DUCTILE IRON PIPE MANUFACTURED IN ACCORDANCE WITH ANSI/AWWA C151/A21.51

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type 1</td>
<td>Type 2</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>0.25</td>
<td>350</td>
<td>32</td>
</tr>
<tr>
<td>8</td>
<td>50</td>
<td>0.27</td>
<td>350</td>
<td>25</td>
</tr>
<tr>
<td>12</td>
<td>50</td>
<td>0.31</td>
<td>350</td>
<td>17</td>
</tr>
<tr>
<td>16</td>
<td>50</td>
<td>0.34</td>
<td>350</td>
<td>13</td>
</tr>
<tr>
<td>20</td>
<td>50</td>
<td>0.36</td>
<td>300</td>
<td>10</td>
</tr>
<tr>
<td>24</td>
<td>50</td>
<td>0.38</td>
<td>250</td>
<td>8</td>
</tr>
</tbody>
</table>

Notes:

1. Larger pipe sizes up to 54-inch can be installed as Class 50 with cover up to nine (9) feet and an operating pressure of 200 psi. When trench depths exceed fifteen (15) feet for pipe sizes of 16-inch or larger, Class 51 pipe should be used.

2. The thickness of Class 50 ductile iron pipe is adequate to support 3/4 and 1-inch corporations. For the installation of equipment requiring a larger tap (e. air relief valves or larger corporations) a full saddle is required due to limited wall thickness.

3. There are special conditions where a larger wall thickness is required. At treatment plant or booster station sites where frequent excavation can be anticipated in the vicinity of pipe, Class 54 pipe shall be installed to minimize external damage to the pipe from trenching equipment. Class 56 pipe is required where the pipeline is laid on a river channel bottom to prevent external damage to the pipe and minimize 'the potential for costly pipe replacement.

C. Testing

Each length of pipe shall be subjected to a hydrostatic proof test as required by ANSI/AWWA C151/A21.51.

D. Joints

1. Mechanical and Push-On
Mechanical and push-on joints including accessories shall conform to ANSI/AWWA C111/A21.11.

2. Flanged

Flanged joints shall conform to ANSI/AWWA C110/A21.10 or ANSI B16.1 for fittings and ANSI/AWWA C115/A21.15 for pipe. Flanged joints shall not be used in underground installations except within structures.

All flanged joints shall be furnished with 1/8-inch thick, red rubber or styrene butadiene rubber gaskets. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in American Standard for Wrench Head Bolts and Nuts and Wrench Openings (ANSI B18.2). For bolts of 1-3/4-inches in diameter and larger, bolt studs with a nut on each end are recommended. Material for bolts and nuts shall conform to ASTM A107.

Fittings:

A. Ductile Iron Fittings

Standard fittings shall be ductile iron conforming to ANSI/AWWA C110/A21.10. Compact ductile iron fittings shall meet the requirements of ANSI/AWWA C153/A21.53.

1. Working Pressures

Fittings shall be suitable for the following working pressures unless otherwise noted:

<table>
<thead>
<tr>
<th>Size</th>
<th>Compact Ductile Iron</th>
<th>Standard Ductile Iron</th>
</tr>
</thead>
<tbody>
<tr>
<td>3” – 24”</td>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td>30” – 48”</td>
<td>350</td>
<td>250</td>
</tr>
</tbody>
</table>

2. Coating and Lining

The fittings shall be coated with a bituminous coating in accordance with ANSI/AWWA C110/A21.10 and lined inside with cement mortar and seal coated in accordance with ANSI/AWWA C104/A21.4. The cement mortar lining shall be double thickness.

B. Joints

1. Mechanical and Push-On

Mechanical and push-on joints including accessories shall conform to ANSI/AWWA C111/A21.11.

2. Flanged

Flanged joints shall meet the requirements of ANSI/AWWA C115/A21.15 or ANSI B16.1. Flanged joints shall not be used in underground installations except within structures.

All flanged joints shall be furnished with a minimum 1/8-inch, thick red rubber or styrene butadiene rubber gasket. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in ANSI B18.2. For bolts of 1-3/4-inches in diameter and larger, bolt studs with a nut on each end are recommended. Material for bolts and nuts shall conform to ASTM A107.

3. Restrained
When restrained joints are required, for pipe and fittings, they shall be of the boltless push-on type which provides joint restraint independent of the joint seal. Restrained system shall be suitable for the following working pressures:

<table>
<thead>
<tr>
<th>Size</th>
<th>Pounds per Square Inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>4” – 12”</td>
<td>250</td>
</tr>
<tr>
<td>14” – 24”</td>
<td>350</td>
</tr>
<tr>
<td>30” – 50”</td>
<td>250</td>
</tr>
</tbody>
</table>

Drawings:

Dimensions shown on Contract Drawings are approximate only. Contractor shall verify all piping geometry in the field and shall be responsible for insuring proper alignment and fit of all piping consistent with the intent of the Contract Drawings. Field layout drawings shall be submitted as required for approval.

Contractor's Responsibility for Material:

The Contractor shall carefully examine all material for defects. Material which is known, or thought, to be defective shall not be installed. The Engineer reserves the right to inspect all material and to reject all defective material shipped to the job site or stored on the site. Failure of the Engineer to detect damaged material shall not relieve the Contractor from his total responsibility for the completed work if it leaks or breaks after installation. Lay all defective material aside for final inspection by the Engineer to determine if corrective repairs may be made, or if the material is to be rejected. The Engineer shall determine the extent of the repairs. Contractor to classify defective pipe prior to Engineer’s inspection as follows:

1. Damage to interior and/or exterior paint seal coats.
2. Damage to interior cement-mortar lining.
3. Insufficient cement-mortar lining thickness.
4. Poor quality interior paint seal coat.
5. Pipe out of round.
6. Damaged pipe barrel area to a point where pipe class thickness is reduced.
7. Denting or gouges in plain end of pipe.

The Contractor shall be responsible for all material, equipment, fixtures and devices furnished and such materials, equipment, fixtures and devices shall comply with the requirements and standards of all Federal, State and local laws, ordinances, codes, rules and regulations governing safety and health. The Contractor shall be solely responsible for the safe storage of all material furnished to or by him until it has been incorporated in the completed project and accepted by the Engineer. Pipe, fittings, valves, hydrants and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against other pipe. Handling of this material is to be in accordance with AWWA C600-87.

602.03 Construction Requirements

Inspection:

Video Inspection of Pipe:
Text for subpart 1 shall be changed to the following:

Video inspection of pipe has been waived for this project.

THE FOLLOWING IS ADDED AFTER THE LAST PARAGRAPH:
All work shall be under the general supervision of the Engineer. However, New Jersey American Water shall at all times have a supervisor present on the project to assure compliance with their standards.
After the installation of water mains normal flushing often proves inadequate to remove all the entrapped air, loose debris and other objects that may have been left in the main during installation. Therefore, after the installation of water mains it may be necessary to use polyurethane foam pigs and/or polyurethane hard foam swabs to remove all foreign matter from the pipeline (i.e. "pig" the pipeline).

Cleaning per the requirements of this section shall be performed prior to testing and disinfection of the main.

Protection during Flushing and Cleaning:

The Contractor shall assure that an adequate amount of flushing water at sufficiently high pressures exists and that disposal of the water can be done safely. Do not flush a large main supplied by a single smaller one as the volume available is usually inadequate for flushing.

Prior to flushing, or cleaning, the Contractor shall notify Owner, Engineer and the following:

a. Fire Department
b. Other utilities, such as gas, electric and telephone companies, who may have underground facilities in the area.
c. Customers who may be inconvenienced by reduced pressure or dirty water.

Isolate the section to be flushed from the system. Close valves slowly to prevent water hammer.

Open the fire hydrant or blow-off valve slowly until the desired flow rate is obtained. When flushing from a dry barrel fire hydrant, use the gate valve upstream of the hydrant for throttling purposes. Open the hydrant valve fully to prevent water from escaping into the ground through the fire hydrant barrel drain.

Minimize worker injury risks by following adequate safety precautions. A safety program should include the education and training of workers in accident prevention, emergency response, and first aid techniques. Prepare specific safety rules for your equipment operators, excavation crews and main flushing and cleaning crews.

Many of the valves to be operated during flushing operations may be in or close to traffic in the street. When operating these valves warn or detour nearby traffic with the use of signs or flags. Place vehicles with warning lights to protect workers. One member should watch for traffic while the other operates the valve. Wear brightly colored safety vests at all times.

An energy dissipater will avoid damage to property and the flooding of streets. Attach an energy dissipater directly to a fire hydrant, blow-off assembly, fire hose or vehicle. An energy dissipater connected to a fire hose, while providing the ability to control the direction of flow, requires means of securing its position. Do not allow crew members to hold energy dissipaters in place. Dissipaters will move violently if not held securely. Use the flushing crew vehicle to secure the position of an energy dissipater.

The heavy flow of water may create traffic problems. If this is unavoidable, place traffic signs well ahead of the flushing site. Keep children away from the flow of flushing water.

The safety considerations just discussed also apply to main cleaning. If excavation is required during main cleaning operations, crews will most likely be working in the street as will crews operating valves during cleaning operations. Ensure that traffic is diverted safely around the immediate working areas by using traffic signs and a flag person. Wear brightly colored safety vests and hard hats near excavation areas at all times.

Materials and Equipment:

Contractor shall furnish the foam cleaning plugs, labor and equipment as needed to pig all pipelines, and shall furnish all materials required for the expulsion of air and other debris from pipelines.
As the cleaning described in this section pertains to new water mains, the use of pipe cleaning plugs which utilize Bristles, wire brushes, carbide abrasives, steel studs or any other Type abrasive is not permitted unless specifically approved by the Engineer.

The Contractor is to consult a manufacturer of pipe cleaning plugs, such as Knapp Polly Pig (Houston, Texas), to determine the type and size of cleaning plug best suited for the application. Two types of plugs shall be considered and are described as follows:

A. Swabs

Swabs used for cleaning mains shall be made of polyurethane foam. This foam has a density of 1 to 2 lb./cu. ft. Swabs shall be purchased from commercial manufacturers of swabs for pipe. Both soft and hard grade foam swabs are available. New mains are typically cleaned with hard foam swabs.

B. Pigs

The other type of cleaning plug available is called a pig. Pigs, if used, shall be commercially manufactured for the specific purpose of cleaning pipes. They shall be made of polyurethane foam weighing 2 to 15 lb./cu.ft. Pigs are bullet shaped and come in various grades' of flexibility and roughness.

C. Sizing of Plugs

Use swabs cut into cubes and cylinders slightly larger than the size of the pipe to be cleaned. Cubes one inch larger in dimension than the nominal diameter of the pipe being cleaned have worked well for cleaning pipes up to 12- inches in diameter.

For mains greater than 12-inches in diameter, the swab diameter must be considered individually for each operation. For new mains, swabs 3-inches larger than the pipe diameter have worked well. Swabs for the larger mains are usually 1- 1/2 times the diameter in length.

Use pigs typically 1/4 -inch to 1/2-inch larger in diameter than the pipe to be cleaned.

Consult suppliers for the proper size of plug to use on the specific job.

Plug Installation and Removal:

In general, the Contractor shall furnish all equipment, material, and labor to satisfactorily expose cleaning wyes, or other entry or exit points. Remove cleaning wye covers, etc., as required by the Engineer and to insert the plugs into the mains.

If approved by the Engineer, stripped fire hydrants, air valves and blow-offs may serve as entry and exit points for smaller sized mains. The Engineer will examine these appurtenances and the connecting laterals to ensure that adequate openings exist through which a plug may be launched.

If these appurtenances are used, a special launcher to ease the insertion and launching of the plug is required. If available a pressurized water source such as a fire hydrant can be used to launch the plug. If water from the system is not available nearby, use a water truck with pump.

If hydrants are used as entry and exit points, the Contractor shall, under Engineer’s supervision, remove the internal mechanisms and plug the drains. Insert the plug and replace the cap with a special flange with a 2-1/2-inch fitting. Connect the 2-1/2-inch fitting with a pressure gauge and valve to a pressurized water source. After the last valve isolating the section to be cleaned is closed, open the hydrant supply valve. Propel the swab or pig into the main by opening the exit valve.
In mains greater than 8-inches, Wyes shall be used at the entry and exit points. Fabricate the wye section one size larger than the main to ease the insertion and extraction of the plug. The use of wyes, as with the previously mentioned appurtenances, requires an outside source of pressurized water for launching. Cap the wye with a flange with a 2 to 6 inch fitting for connecting with the pressurized water source.

Many pigs, since they are less flexible than swabs, are harder to insert into a pipe. Other methods acceptable to insert pigs include:
1. winching with a double sling,
2. winching with a rope attached to the pig,
3. compression with a banding machine prior to insertion, and
4. the use of a specially designed tapered steel pipe which is removed after use.

During swab or pig installation, leave as much water as possible in the main to be cleaned. The water suspends the material being removed from the pipe and minimizes the chance of the material forming a solid plug. Water in the pipe also keeps the swab or pig from traveling through the pipe at excessive rates. If swabs or pigs travel too fast they will remove less material. The swab or pig will also wear more rapidly in such a case.

At the exit point or blow-off, install a wye long enough to house the swab or pig. Attach temporary piping to the end cap to allow the drainage of the water.

Where expulsion of the cleaning plugs is required through a dead end main, the Contractor shall prevent backflow of purged water into the main after passage of the cleaning plug. This can be accomplished by installing mechanical joint bends and pipe joints to provide a riser out of the trench. Additional excavation of the trench may serve the same purpose and is acceptable.

Pre-Cleaning Procedures

Preplan and prepare for the Engineer’s review, a written cleaning plan.

Suggested procedures prior to cleaning include the following:

1. Identify mains to be cleaned on a map. Mark the location of the entry, water supply and exit points, any blow-offs to be used, main gates to be closed, and the path of the swab or pig.
2. Under the Engineer’s supervision, inspect and operate all valves and hydrants to be used in the cleaning operation. Ensure that all operate correctly and that a tight shutdown is possible.
3. Check location and type of hydrants, launch and exit location, and blow-offs to be used. Make blow-off tap connections if necessary.
4. The Owner will notify customers served by the main to be cleaned that their water will be off for a specified period on the day of the cleaning.
5. The Owner will identify customers who may require temporary services during the main cleaning operation. The Contractor shall provide the temporary connections.
6. Determine the number and size of plugs to be used.

Cleaning Procedure:

After approval by the Engineer of the Contractor’s cleaning plan the following cleaning procedures as applicable shall be performed by the Contractor:

A. Swab Cleaning Procedures

1. Open the water supply upstream of the swab. Throttle the flow in the main at the discharge (plug exit) point so that the swab passes through the main at a speed of 2 to 4 fps. At this velocity, swabs will effectively clean pipes for distances of up to 4000 feet before disintegrating to a size smaller than the main. Use pitot gauges at the exist hydrant or blow-off to estimate the flow rate in the main.
2. Note the time of entry of the swab into the main and estimate its time or arrival at the exit point. If the swab does not reach the exit point in the estimated time plus ten minutes, then a blockage has probably occurred. Reverse the flow in the main and note the time required for the swab to reach the original entry point. From the return travel time,
approximate the location of the blockage. The Engineer may require a swab to which a transmitter has been attached to be used to accurately locate a blockage.

3. Once the first swab has been recovered, typically, make two to three runs of four to five swabs each depending on how quickly flushing water clears. Continue operations until the water behind the swabs emerging at the exit clears up within one minute. Account for all swabs inserted into the main.

4. After the last swab has been recovered, flush the main to remove swab particles. This may require up to an hour or flushing.

B. Pig Cleaning Procedures
1. Remove all air valves along the line. This will provide pressure relief should the pig suddenly stop and assure that no air is trapped in the main.
2. If the pig is inserted directly into the main, set it in motion by opening the upstream gate valve and a downstream fire hydrant or blow-off valve (usually the valve on the capped end at the exit point). If the pig is launched from a wye, fire hydrant, or other appurtenance, use an external pressurized water source to inject the pig into the main as described in Section Plug Installation and Removal.
3. Once the pig is in motion in the main, control its speed by throttling the discharge at a downstream fire hydrant or blow-off. Operate pigs typically at 1 fps. This slow speed will help prevent pressure surges when the pig passes through undersized valves, enters smaller pipes, or turns through tees or crosses. Speeds of up to 2 fps. can be used on straight runs with no restrictions or sharp turns.
4. Make sufficient passes of the pig to obtain thorough cleaning. Two pigs may be used in tandem to save time and water. Sufficient cleaning is established when the water discharging after the pig becomes clear within one minute.

Post Cleaning Procedure:
After successful completion of cleaning the main shall be tested, flushed and disinfected in accordance with applicable sections of these Specifications.

Trenching, Backfilling and Compacting

Submittals:
All materials to be used for backfill, including common fill and bedding materials, shall be approved by Engineer prior to placing the materials in the pipe trench. All backfill and bedding materials whether obtained from the trench excavation or from an off-site source must be tested as directed by the Engineer.

Samples of the materials shall be submitted to an approved testing agency for analysis. The test results and report stating that the materials meet the requirements of these Specifications and the Specifications of Federal, State and local authorities (where applicable) shall be submitted to the Engineer for approval prior to placing the materials in the pipe trench.

Profiles And Topography:
Contours, topography and profiles of the ground shown on the Drawings are believed to be reasonably correct, but are not guaranteed to be absolutely so and are presented only as an approximation.

The Contractor shall accept the construction site with conditions the same as existed at the time of bidding.

Fill Material:
Material for backfilling shall be earth materials entirely free from vegetation, trash, lumber, frozen, soft or organic materials. No stones or rock larger than the sizes listed below will be permitted in the backfill:

- Common Fill-Type A: No stones or rocks larger than 1-inch
- Common Fill-Type B: No stones or rocks larger than 4-inches
Common fill material may be obtained from the trench excavation provided it has been tested in accordance with the requirements of Section Submittals above and approved by the Engineer. If approved material obtained from the trench excavation is insufficient to complete the backfill, the Contractor shall obtain the necessary approved common fill materials from an off-site source.

**Bedding Material:**

Materials used for bedding and the haunch around the pipe shall be a course to fine sandy material with maximum stone size of 1-inch. The material shall conform to ASTM D2487 "Standard Method for Classification of Soils for Engineering Purposes" using the "Unified Soil Classification System", except where a higher standard is required elsewhere in the Contract Documents or by rules or regulations of Federal, State or local governmental bodies having jurisdiction over the site of the Work.

The material shall meet a Class II designation. Soil types GW, GP, SW and SP, non-cohesive, well graded and containing some fines are included in this Class. Where voids, finer grained soils or movement may allow migration of this material, a filter fabric as directed by the Engineer will be used in the trench bottom and sides before the select fill bedding is placed.

Bedding material may be obtained from the trench excavation provided it has been tested in accordance with the requirements of Section Submittals above and approved by the Engineer. If the approved material obtained from the trench excavation is insufficient to complete the bedding, the Contractor shall obtain the necessary tested and approved bedding materials from an off-site source.

**Filter Fabric:**

Filter fabric shall be non-woven, synthetic fiber material with sieve design to not permit the select material in the pipe bedding and haunching to migrate into the surrounding soils. The material shall have a minimum thickness of 15 mils, tensile strength of 130 lbs., elongation at break of 62% and trapezoidal tear strength of 70 lbs.

**Protection Of Trees:**

Special care shall be taken to avoid damage to trees and their root system. Machine excavation shall not be used when, in the opinion of the Engineer, it would endanger the tree. In general, where the line of trench falls within the limits of the limb spread, headers are required across the trench to protect the tree. The operation of all equipment, particularly when employing booms, the storage of materials, and the disposition of excavation shall be conducted in a manner which will not injure trees, trunks, branches or their roots unless such trees are designated for removal.

**Trench Support:**

Unsupported open cut excavation for mains will not be permitted where trenching may cause danger to life, unnecessary damage to street pavement, trees, structures, poles, utilities, or other private or public property. During the progress of the work, whenever and wherever it is necessary, the Contractor shall, at his expense, support the sides of the excavation by adequate and suitable sheeting, shoring, bracing or other approved means. Such trench support materials and equipment shall be maintained and remain in place until backfilling operations have progressed to the point where the supports may be withdrawn without endangering property.

**Trench Excavation and Bottom Preparation**

**A. General Excavation**

General excavation shall consist of the satisfactory removal and disposal of all materials taken from within the limits of the Work contracted, meaning the material lying between the original ground line and the finished ground line as shown on the Drawings regardless of whether the original ground line is exposed to air or is covered by water. Excavation below existing ground line to enable any required construction or removals is included. It is distinctly understood that any reference to earth, rock, silt, debris or other materials on the Drawings or in the Specifications is solely for the
Owner’s information and shall not be taken as an indication of classified excavation or the quantity of earth, rock, silt, debris or other material encountered.

All excavation shall be made to the lines and grades indicated on the Drawings or established in the field by the Engineer.

Excess excavated materials and excavated materials unsuitable for backfilling shall be properly disposed of by the Contractor clear of the site. The Contractor shall furnish to Engineer satisfactory evidence that an appropriate disposal site will be used.

B. Rock Excavation

The Contract includes a unit price for rock excavation, the excavation shall include the removal, hauling, stockpiling and/or proper disposal of all material required to be excavated which requires systematic blasting, barring and wedging for removal, boulders or loose rock of one cubic yard or more in volume, and material which cannot be loosened or broken down by ripping in a single pass with a hydraulic ripper or other devices and equipment designed to remove rock. No payment will be made for rock removal unless the Contractor gives prompt notice to the Engineer upon encountering such material and prior to its removal. The Engineer’s determination as to whether the material meets the definition of rock and Engineer’s measurement of the volume of rock removal for which the Contractor is entitled to payment will be final and conclusive.

C. Blasting Rock

The Contractor must notify Engineer, in advance, of his intention to use blasting. The Engineer will require evidence that the proposed blasting will comply fully with Laws or Regulations.

No blasting of rock shall be done where limited or prohibited by any Federal, State or local laws or regulations or in violation of any limitation or restriction contained in any right-of-way or wherever specifically prohibited in any Drawing or other Contract Document; nor will any such blasting be done within forty (40) feet of any pipe or structure without specific permission from the Engineer. Blasts shall be properly covered and the pipe or structure properly protected. Warning shall be given to all persons in the vicinity. Blasting shall be at the risk of the Contractor who shall be liable for all damages to persons or property. Necessary permits shall be secured and paid for by the Contractor. It is the Contractor’s responsibility to perform whatever pre-blast surveys and investigations may be required by the circumstances and/or by Federal, State or local laws.

D. Trench Width

Widths of trenches shall be held to a minimum to accommodate the pipe and appurtenances. The trench width shall be measured at the top of the pipe barrel and shall conform to the following limits:

Earth

Minimum: Outside diameter of the pipe barrel plus 8 inches, i.e., 4 inches each side.

Maximum: Nominal pipe diameter plus 24 inches.

Rock

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter</th>
<th>Minimum: Outside diameter of the pipe barrel plus the pipe barrel plus 16 inches, i.e., 8 inches each side.</th>
<th>Outside diameter of the pipe barrel plus 24 inches, i.e., 12 inches each side.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 inches or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 inches or larger</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Maximum: Nominal pipe diameter plus 24 inches.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
E. Excessive Trench Width

If, for any reason the trench width exceeds the maximum trench width defined in Paragraph D, "Trench Width", the Contractor shall provide additional bedding and backfill material as specified in Sections Fill Materials and Bedding Materials to fill the additional width of trench, at no cost to the Owner.

F. Trench Depth

(1) General. All trenches shall provide for a minimum of 36 inches of cover over top of the pipe barrel go the top of the finished grade of the roadway unless otherwise authorized by the Engineer.

(2) Earth. The trench shall be excavated to the depth required, so as to provide a uniform and continuous bearing and support for the pipe barrel on solid and undisturbed ground at every point between joints, except that it will be permissible to disturb the finished trench bottom over a maximum length of 18 inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle. When required, bell holes shall be provided. The finished trench bottom shall be accurately prepared by means of hand tools.

(3) Rock. Where excavation is made in rock or boulders, the trench shall be excavated 8 inches below the pipe barrel for pipe 12 inches in diameter or less, and 12 inches below the pipe barrel for 16 inch diameter pipe and larger. All loose material shall be removed from the trench bottom. After preparation of the trench bottom, a pipe bed shall be prepared using bedding material as specified in Section Bedding Materials.

(4) Unsuitable Bottom. When unsuitable material is found below subgrade, as determined by the Engineer, Contractor shall remove the material to a depth determined by the Engineer, and provide compacted bedding material as specified in Section Bedding Materials to backfill the trench in the area where unsuitable material has been excavated.

Trench Backfilling:

A. Backfill to Centerline of Pipe Barrel All trench excavation shall be backfilled immediately after pipe is laid. Compacted bedding material as described in Section Bedding Materials shall be used to backfill the trench from the bottom of the pipe barrel to the centerline of the pipe barrel. The material shall be placed in uniform 6 inch loose layers and each layer compacted so as to eliminate the possibility of settlement, pipe misalignment or damage of joints.

B. Backfill to 12 inches over Pipe Barrel From the centerline of the pipe barrel to an elevation of 12 inches over the top of the pipe barrel, Common Fill Type A, as described in Section Fill Materials, shall be used as backfill material. Care shall be taken to avoid injuring or moving the pipe.

C. Remaining Trench Backfill

From 12 inches above the pipe barrel to the surface, Common Fill-Type B, as described in Section Bedding Materials, shall be used as backfill material. No material shall be used for backfilling that contains frozen earth, rock, large stones, boulders, or other unsuitable material. The Contractor may use mechanical equipment to place the backfill. This shall be done in such a manner that the material does not free fall, but shall be so placed that it will flow onto the previously placed material. The Contractor shall consolidate the backfill in such a manner as will insure the minimum possible settlement and the least interference with traffic. No compacting of the backfill with mechanical equipment, such as wheeled vehicles, will be permitted unless sufficient cover is provided over the pipe to prevent damage to the pipe.

D. Surface Conditions

The trench surface shall be regularly attended to during the course of the Contract. The Contractor shall take prompt corrective measures to correct any settlement or wash-out. The trench surface shall be maintained in a safe condition and shall not interfere with natural drainage.

E. Deficiency of Backfill

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Any material required for backfilling the trenches or for filling depressions caused by settlement or wash-out shall be supplied and placed by the Contractor at his expense.

Trench Maintenance:

The Contractor shall be responsible for the condition of the trenches for a period of one (1) year from the date of the final acceptance of the Contractor’s work, or as required by state, county or local authorities, and any materials required for filling depressions caused by settlement or washout shall be supplied and placed by the Contractor at his expense.

**Cast-in-Place Concrete**

**Materials**

A. **Portland Cement** shall be Type I or Type III and conform to “Specification for Portland Cement” ASTM C-150.

B. **Air-Entraining Agent** for approved manufacture shall be added in accordance with manufacture’s directions to the normal Portland cement to entrain 4½ percent air +/- 1 percent with all other ingredients and strength as specified. Air-entraining admixtures shall conform to “Specifications for Air-Entraining Admixtures for Concrete” ASTM C-260.

C. **Concrete Aggregates** shall conform to “Specifications for Concrete Aggregates” ASTM C-33. Coarse aggregates shall be maximum of 1½ inches in size in footings and plain concrete. Pea gravel shall be used for sections 3 inches or less in thickness.

D. **Water** used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalies, organic materials or other deleterious substances. In effect, the water used shall be potable water.

E. **Reinforcing Bars** shall be billet steel grade (60,000 psi minimum yield) and conforming to the requirements of ASTM A-615, Grade 60. Reinforcing bars shall be new stock, free from rust, scale or other coating tending to destroy or reduce bond.

F. **Welded Wire Mesh** shall conform to “Specifications for Welded Steel Wire Fabric for Concrete Reinforcements” ASTM A-185.

G. **Pre-molded Expansion Joint Material** shall be provided where shown on the Drawings or directed by the WATER COMPANY. This non-extruding compressible joint material shall conform to the requirements of “Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction”, ASTM D-1751.

**Concrete Mixes**

Ready-mixed concrete shall conform to “Specifications for Ready-Mixed Concrete”, ASTM C-94.

All concrete mixes shall be capable of producing a dense durable concrete. The compressive strength of the concrete shall be able to attain the following minimum strengths within 28 days:

- 2,500 psi – sidewalks, curbs and pipe encasement
- 3,000 psi – thrust blocking, manhole bases and road pavement

Water/cement ratio for the concrete shall not exceed a maximum as shown in Table 4.4 of the ACI Standard 318 latest strength data from field experience or trial mixtures are not available. A workable concrete with minimum slump of 3 inches and a maximum slump of 5 inches shall be produced not exceeding the water/cement ration.

**Formwork**

All forms shall be built mortartight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incident to the construction operations. Forms shall be constructed and maintained so as to prevent warping and the opening of joints.
The forms shall be substantial and unyielding and shall be so designed that the finished concrete will conform to the proper dimensions and contours. The design of the forms shall take into account the effect of vibration of concrete as it is placed.

**Placing Reinforcing Steel**

All steel reinforcement shall be accurately placed in the positions shown on the plans and firmly held during the placing and setting of concrete. When placed in the work, it shall be free from dirt, detrimental rust, loose scale, paint, oil or except where spacing is less than one foot in each direction when alternate intersections shall be tied.

Distance from the forms shall be maintained by means of stays, blocks, ties, hangers or other approved supports. Continuous high chairs will not be permitted.

All reinforcement shall be furnished in full lengths indicated on the plans, will not be permitted without the approval of the Engineer. Splices shall be permitted without the approval of the otherwise shown on the plans, bars shall be lapped 36 diameters to make the splice.

Welded wire meshed shall be lapped at least 1½ meshes plus end extension of wires but not less than twelve (12) inches in structural slabs. Welded wire mesh shall be lapped at least ½ mesh plus end extension of wires but not less than six (6) inches in slabs on the ground.

**Conveying and Placing Concrete**

Concrete shall be conveyed from mixer to the forms as rapidly as practical by approved methods which will prevent segregation and loss of ingredients.

All concrete shall be placed in the dry. Formwork shall be cleaned of dirt and construction debris, water and snow and ice removed. After the forms have been inspected, the concrete shall be deposited in approximately horizontal layers to avoid flowing along the forms. All concrete shall be deposited continuously or in layers of a thickness such that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams and planes of weakness within the sections: a monolithic structure, the component parts of which are securely bonded together, shall be produced. During placing, the concrete shall be compacted by suitable means and shall be worked around the reinforcement and embedded fixtures and shall be into corners and angles of forms, care being taken to avoid over-working which may result in segregation.

Concrete shall not be dropped into forms from a height greater than 5 feet. In depositing from a greater height, a spout shall be used, or the forms shall be provided with openings to limit the height of drop. When special methods of placing are used, the approval of the Engineer shall be obtained.

Concrete shall directed through chutes to prevent it from striking reinforcement or sides of the form above the level of placement. Avoid segregation and coating of the surfaces with paste which may dry before concrete reaches its level.

If pumping of the concrete is chosen by the Contractor as a method of placing concrete, the Contractor shall submit a concrete mix design to the Engineer for approval prior to placing any concrete by pumping.

**Thrust Blocking**

See the Specifications Special Conditions for the number and sizes of the thrust blocking. Blocking shall be constructed back against the vertical face of undisturbed earth or sheeting left in place. The concrete shall be prevented from enclosing more than half the circumference of the pipe and shall be kept away from joints or bolts in the piping.

Thrust blocking for hydrants shall be placed to allow the hydrant to drain.
Placing Concrete in Cold Weather

No concrete shall be placed when the atmospheric temperature is below 35°F. Without written consent of the Engineer, when directed by the Engineer, the Contractor shall enclose the structure in such a way that the concrete and air within the enclosure can be kept above 60°F for a period of seven (7) days after placing the concrete.

If high early strength cement is used, these periods may be reduced, as directed by the Engineer.

The Contractor shall supply such heating apparatus as stoves, salamanders or steam equipment and the necessary fuel. When dry heat is used, means of maintaining atmospheric moisture shall be provided. All aggregates and mixing water shall be heated to a temperature of at least 70°F not more than 60°F at the time of placing in the forms. In case of extremely low temperatures, the Engineer may, at their discretion, raise the minimum limiting temperatures for water, aggregates and mixed concrete.

Crossing Utility Lines:

Materials for temporary support, adequate protection, and maintenance for all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his own expense.

Obstructions by Other Utility Structures:

Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, branch connections to main sewers, or drains, the obstruction shall be permanently supported, relocated, removed or reconstructed by the Contractor in cooperation with the owners of such utility structures. Before proceeding the Contractor must reach an agreement with the Engineer on method to avoid obstruction.

No deviation shall be made from the required line or depth except with the consent of the Engineer.

Repairs:

Existing pipes or conduits crossing the trench, or otherwise exposed, shall be adequately braced and supported to prevent trench settlement from disrupting the line or grade of the pipe or conduit, all in accordance with the directions of the Engineer. Utility services broken or damaged shall be repaired at once to avoid inconvenience to customers. Storm sewers shall not be interrupted overnight. Temporary arrangements, as approved by the Engineer, may be used until any damaged items can be permanently repaired. All items damaged or destroyed by construction and subsequently repaired must be properly maintained by the Contractor.

Relocation:

Where it is necessary to relocate an existing utility or structure, the work shall be done in such a manner as is necessary to restore it to a condition equal to that of the original facility. No such relocation shall be done until approval is received from the owner of the utility or structure being changed.

Separation between Water Lines and Sewers:

Parallel Installation:

Water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the State Environmental Protection Agency may allow deviation on a case-by-case basis, if supported by data from the Engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

Crossings:

Whenever water mains must cross building drains, storm drains, or sanitary sewers, the water main shall be laid at such an elevation that the bottom of the water main is 18 inches above the top of the drain or sewer. This vertical
separation shall be maintained for the portion of the water main located within 10 feet horizontally of any sewer or drain it crosses. The 10 feet is to be measured as a perpendicular distance from the drain or sewer line to the water line.

Exception:
When it is impossible to obtain the proper horizontal and vertical separation as stipulated above the Engineer is to be notified. If directed by the Engineer both the water main and sewer line shall be constructed of cast iron, ductile iron, galvanized steel or protected steel pipe having mechanical joints. Other types of joints of equal or greater integrity may be used at the discretion of the Engineer after consultation with the State Environmental Protection Agency. Thermoplastic pipe may be used provided mechanical or solvent weld pipe joints are used. These shall be pressure-tested to assure water tightness before backfilling. Where water mains must cross under a sewer, additional protection shall be provided by:

(1) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line,

(2) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line.

(3) That the length of the water line be centered at the point of the crossing so that the joints shall be equidistant and as far as possible from the sewer.

Through the Engineer the State Environmental Protection Agency shall be consulted when any of the above conditions cannot be met to discuss the use of double casing or concrete encasement of sewer and/or water lines as possible alternatives.

Pressure and Leakage Tests:

Equipment:
The pump, pipe connections, and all necessary apparatus for the pressure and leakage tests, except gauges and metering devices, shall be furnished by the Contractor.

The Owner will furnish gauges and metering devices for the tests, but the Contractor shall make all excavations and backfills, and furnish all necessary assistance for conducting the tests.

General:
After the pipe has been laid, thrust backing cured (min. 5 days) and the trench completely or partially backfilled, the entire pipeline, or any section thereof, shall be subjected to hydrostatic pressure and leak tests in accordance with ANSI/AWWA C600-87, Section 4 - Hydrostatic Testing.

The Contractor may, at his option, completely backfill the trench or partially backfill the trench over the center portion of each pipe section to be tested. The Engineer may however direct the Contractor to completely backfill the trench if local traffic or safety conditions require such action.

The pipeline will be subjected to a hydrostatic pressure of no less than 100 psi above the normal operating pressure for operating pressures that do not exceed 200 psi. For operating pressures in excess of 200 psi, the pipeline will be subjected to a hydrostatic pressure that is 1.5 times the normal operating pressure, but no more than the design rating of the pipe.

After installation of a tapping sleeve and valve but prior to making the tap into the main the tapping sleeve and valve assembly shall be tested. The required test pressure shall be determined in the same manner as for pipe but no pressure drop will be allowed during the test. Test pressure must be maintained for 15 minutes for acceptance.

Filling and Testing:
Each segregated section of pipeline will be slowly filled with water insuring that all air is expelled. Extreme care must be taken to insure all air is expelled from the pipeline during the filling of pipe with water. The line shall stand full of water for twenty-four hours prior to testing to allow all air to escape. If necessary, tap the main at points of
highest elevation so that air can be expelled as the pipe is filled with water. After successful completion of filling and air expulsion, but prior to testing, the corporation stops shall be removed and the taps tightly plugged.

The specified test pressure, measured at the point of lowest elevation, will then be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. If the elevation of the high point of the pipeline being tested is such that the pressure during testing will be below 85% of the required test pressure the Engineer will require a separate test to be performed on this section of pipeline. In lieu of a separate test the test pressure measured at the lowest elevation may be increased, within the pressure rating of the pipeline material, such that resulting pressure at the highest point exceeds 85% of the required test pressure. The test pressure will not vary by more than 2.5 psi and the test will be of at least two-hour duration.

A leakage test will be conducted concurrently with the pressure test. Leakage is defined as the quantity of the water measured as make-up water (volumetrically in a container or meter) that must be supplied into the newly laid pipeline to maintain pressure within 5 psi of the test pressure after the air in the pipeline has been expelled and the pipe filled with water.

No pipeline installation will be accepted by the Engineer if the leakage is greater than that shown in the following table:

<table>
<thead>
<tr>
<th>Avg. Test Pressure psi</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24</th>
<th>30</th>
<th>36</th>
<th>42</th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0.30</td>
<td>0.45</td>
<td>0.60</td>
<td>0.90</td>
<td>1.20</td>
<td>1.50</td>
<td>1.80</td>
<td>2.25</td>
<td>2.70</td>
<td>3.15</td>
<td>3.60</td>
</tr>
<tr>
<td>125</td>
<td>0.34</td>
<td>0.50</td>
<td>0.67</td>
<td>1.01</td>
<td>1.34</td>
<td>1.68</td>
<td>2.01</td>
<td>2.52</td>
<td>3.02</td>
<td>3.53</td>
<td>4.03</td>
</tr>
<tr>
<td>150</td>
<td>0.37</td>
<td>0.55</td>
<td>0.74</td>
<td>1.10</td>
<td>1.47</td>
<td>1.84</td>
<td>2.21</td>
<td>2.76</td>
<td>3.31</td>
<td>3.86</td>
<td>4.41</td>
</tr>
<tr>
<td>175</td>
<td>0.40</td>
<td>0.60</td>
<td>0.79</td>
<td>1.19</td>
<td>1.59</td>
<td>1.99</td>
<td>2.38</td>
<td>2.98</td>
<td>3.58</td>
<td>4.17</td>
<td>4.77</td>
</tr>
<tr>
<td>200</td>
<td>0.42</td>
<td>0.64</td>
<td>0.85</td>
<td>1.27</td>
<td>1.70</td>
<td>2.12</td>
<td>2.55</td>
<td>3.19</td>
<td>3.82</td>
<td>4.46</td>
<td>5.10</td>
</tr>
<tr>
<td>225</td>
<td>0.45</td>
<td>0.68</td>
<td>0.90</td>
<td>1.35</td>
<td>1.80</td>
<td>2.25</td>
<td>2.70</td>
<td>3.38</td>
<td>4.05</td>
<td>4.73</td>
<td>5.41</td>
</tr>
<tr>
<td>250</td>
<td>0.47</td>
<td>0.71</td>
<td>0.95</td>
<td>1.42</td>
<td>1.90</td>
<td>2.37</td>
<td>2.85</td>
<td>3.56</td>
<td>4.27</td>
<td>4.99</td>
<td>5.70</td>
</tr>
<tr>
<td>275</td>
<td>0.50</td>
<td>0.75</td>
<td>1.00</td>
<td>1.49</td>
<td>1.99</td>
<td>2.49</td>
<td>2.99</td>
<td>3.73</td>
<td>4.48</td>
<td>5.23</td>
<td>5.98</td>
</tr>
<tr>
<td>300</td>
<td>0.52</td>
<td>0.78</td>
<td>1.04</td>
<td>1.56</td>
<td>2.08</td>
<td>2.60</td>
<td>3.12</td>
<td>3.90</td>
<td>4.68</td>
<td>5.46</td>
<td>6.24</td>
</tr>
<tr>
<td>350</td>
<td>0.56</td>
<td>0.84</td>
<td>1.12</td>
<td>1.69</td>
<td>2.25</td>
<td>2.81</td>
<td>3.37</td>
<td>4.21</td>
<td>5.06</td>
<td>5.90</td>
<td>6.74</td>
</tr>
<tr>
<td>400</td>
<td>0.60</td>
<td>0.90</td>
<td>1.20</td>
<td>1.80</td>
<td>2.40</td>
<td>3.00</td>
<td>3.60</td>
<td>4.50</td>
<td>5.41</td>
<td>6.31</td>
<td>7.21</td>
</tr>
<tr>
<td>450</td>
<td>0.64</td>
<td>0.96</td>
<td>1.27</td>
<td>1.91</td>
<td>2.55</td>
<td>3.19</td>
<td>3.82</td>
<td>4.78</td>
<td>5.73</td>
<td>6.69</td>
<td>7.64</td>
</tr>
</tbody>
</table>

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

The table has been generated from the formula: \( L = \frac{(SD(P)1/2)}{133.200} \) where \( L \) is the allowable leakage in gallons per hour, \( S \) equals the length of pipe in feet, \( D \) is the nominal pipe diameter in inches and \( P \) is the test pressure in PSIG.

Should any test disclose damaged or defective materials or leakage greater than that permitted, the Contractor shall, at his expense, locate and repair and/or replace defective materials. The tests shall be repeated until the leakage is within the permitted allowance and is satisfactory to the Engineer.

Submittals:
The Contractor shall prepare and submit to the Engineer schedules and procedures for testing of all parts of the water main installed in accordance with these Contract Documents. The schedule shall be submitted seven days prior to any testing.
Disinfecting Pipelines:

The Contractor shall flush and disinfect all pipelines installed under this Contract.

The New Jersey American Water will furnish water for testing, flushing and disinfecting pipelines. New Jersey American Water will also perform bacteriological testing.

Due to the toxicity of chlorine fumes, men performing work under this Section shall be equipped with all safety equipment and shall be attended by other personnel who are in the vicinity where work is to be performed.

The forward of AWWA Standards B300-87 and B301-87 contain information and additional reference material regarding the safe handling of hypochlorites and liquid chlorine. The Contractor shall familiarize himself with this information prior to performing any disinfection work.

Contractor shall furnish chlorine liquid and injection equipment and/or calcium hypochlorite (HTH) as needed to complete the disinfection of all pipelines.

Liquid chlorine contains 100% available chlorine and is packaged in steel containers usually of 100 lb, 150 lb, or 1 ton net chlorine weight. Liquid chlorine is to be furnished in accordance with AWWA B301-87.

Calcium hypochlorite is available in granular form or in approximately 5-g tablets, and contains approximately 65% available chlorine by weight. The material should be stored in a cool, dry, and dark environment to minimize its deterioration.

Calcium hypochlorite is to be furnished in accordance with AWA B300-87.

With the exception of the tablet method, all pipelines shall be pressure and leak tested, flushed, and cleaned of debris and dirt prior to application of the disinfectant. The tablet method requires the pipeline to be kept completely clean and dry during construction.

Methods to be used for disinfection are those detailed in ANSI/AWWA C-651-86 (water mains).

Water Mains

Three (3) methods' of chlorination are described below. Information in the forward of AWWA Standard C651 will be helpful in determining the best method to be used.

A. Tablet Method:

The tablet method consists of placing calcium hypochlorite granules and tablets in the water main as it is being installed and then filling the main with potable water when installation is completed.

NOTE: This method may be used only if the pipes and appurtenances are kept clean and dry during construction.

Placing of calcium hypochlorite granules:

During construction, calcium hypochlorite granules- shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500 foot intervals. The quantity of granules shall be as shown in Table 1.

Note: This procedure must not be used on solvent welded plastic or on screwed joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

Placing of calcium hypochlorite tablets:
During construction, 5-g calcium hypochlorite tablets shall be placed in each section of pipe and, also one such tablet shall be placed in each hydrant, hydrant branch and other appurtenances. The number of 5-42 tablets required for each pipe section shall be 0.0012d L rounded to the next higher integer, where D is the inside pipe diameter in inches and L is the length of the pipe section in feet. Table 2 shows the number of tablets required for commonly used sizes of pipe. They shall be attached by a food grade adhesive such as *Permatex Form-A Gasket No. 2 and *Permatex clear RTV Silicone adhesive or equal. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top.

Filling and Contact:

When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 fps. Precautions shall be taken to assure that air pockets are eliminated. This water shall remain in the pipe for at least 24 hours. If the water temperature is less than 5°C (41°F), the water shall remain in the pipe for at least 48 hours. Valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service.

### TABLE 1

<table>
<thead>
<tr>
<th>Calcium hypochlorite</th>
<th>Pipe Diameter Granules</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>.5</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>16 and larger</td>
<td>8</td>
</tr>
</tbody>
</table>

### TABLE 2

<table>
<thead>
<tr>
<th>Pipe Diameter (inches)</th>
<th>Length of Pipe Section, ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13 or less</td>
</tr>
<tr>
<td></td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
</tr>
</tbody>
</table>

*Table 1 shows the number of tablets required for commonly used sizes of pipe. They shall be attached by a food grade adhesive such as *Permatex Form-A Gasket No. 2 and *Permatex clear RTV Silicone adhesive or equal. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top.

*Table 2: Number of 5-g Hypochlorite Tablets Required for Dose of 25 mg/L.*

*Based on 3.25 g available chlorine per tablet, any portion of tablet rounded to next higher number.

**B. Continuous Feed Method**

The continuous feed method consists of placing calcium hypochlorite granules in the main during construction (optional), completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and filling the main with potable water chlorinated so that after a 24-hour holding period in the main there will be a free chlorine residual of not less than 10 mg/L.
Placing calcium hypochlorite granules:

The purpose of this procedure is to provide a strong chlorine concentration in the first flow of flushing water that flows down the main. This procedure is recommended particularly where the type of pipe is such that this first flow of water will flow into annular spaces at pipe joints.

Preliminary flushing:

Prior to being chlorinated, the main shall be filled to eliminate air pockets and shall be flushed to remove particulates. The flushing velocity in the main shall be not less than 2.5 fps unless the Engineer determines that conditions do not permit the required flow to be ‘discharged to waste. Table 3 shows the rates of flow required to produce a velocity of 2.5 fps in pipes of various sizes.

NOTE: Flushing is no substitute for preventive measures during construction. Certain contaminants such as caked deposits resist flushing at any feasible velocity.

<table>
<thead>
<tr>
<th>Pipe Diam. In.</th>
<th>Flow Required to Produce 2.5 fps Velocity in Main qpm</th>
<th>Size of Tap on Mainb In.</th>
<th>Hydrant Outlets Number</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>100</td>
<td>15/16</td>
<td>1</td>
<td>2 1/2</td>
</tr>
<tr>
<td>6</td>
<td>220</td>
<td>1 3/8</td>
<td>1</td>
<td>2 1/2</td>
</tr>
<tr>
<td>8</td>
<td>390</td>
<td>1 7/8</td>
<td>1</td>
<td>2 1/2</td>
</tr>
<tr>
<td>10</td>
<td>610</td>
<td>2 5/16</td>
<td>1</td>
<td>2 1/2</td>
</tr>
<tr>
<td>12</td>
<td>880</td>
<td>2 13/16</td>
<td>1</td>
<td>2 1/2</td>
</tr>
<tr>
<td>16</td>
<td>1565</td>
<td>3 5/8</td>
<td>2</td>
<td>2 1/2</td>
</tr>
</tbody>
</table>

a With a 40 psi pressure in the main with the hydrant flowing to atmosphere, a 2%-inch hydrant outlet will discharge approximately 1000 gpm and a 4%-inch hydrant nozzle will discharge approximately 2500 gpm.

b Size of tap on main, with no significant length of discharge piping.

In mains of 24-inches or larger diameter, an acceptable alternative to flushing is to broom-sweep the main, carefully removing all sweepings prior to chlorinating the main.

Chlorinating the Main:

(1) Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate into the newly laid water main. In the absence of a meter, the rate may be approximated by means such as placing a pitot gauge in the discharge or measuring the time to fill a container of known volume.

(2) At a point not more than 10 feet downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 25 mg/L free chlorine. To assure that this concentration is provided, measure the chlorine concentration at regular intervals in accordance with the procedures described in the current edition of the AWWA Standard Methods.

Table 4 gives the amount of chlorine required for each 100 feet of pipe of various diameters. Solutions of 1 percent chlorine may be prepared with calcium hypochlorite. The solution requires 1 lb. of calcium hypochlorite in 8 gallons of water.

**ROUTE 36 OVER THE SHREWSBURY RIVER**
**HIGHLANDS BRIDGE**
**MONMOUTH COUNTY**
TABLE 4
Chlorine Required to Produce 25 mg/L Concentration in 100 feet of Pipe by Diameter

<table>
<thead>
<tr>
<th>Pipe Diam. In.</th>
<th>100 Percent Chlorine lb.</th>
<th>1 Percent Chlorine Solutions gal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>.013</td>
<td>.16</td>
</tr>
<tr>
<td>6</td>
<td>.030</td>
<td>.36</td>
</tr>
<tr>
<td>8</td>
<td>.054</td>
<td>.65</td>
</tr>
<tr>
<td>10</td>
<td>.085</td>
<td>1.02</td>
</tr>
<tr>
<td>12</td>
<td>.120</td>
<td>1.44</td>
</tr>
<tr>
<td>16</td>
<td>.217</td>
<td>2.60</td>
</tr>
</tbody>
</table>

(3) During the application of chlorine, valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service. Chlorine application shall not cease until the entire main is filled with heavily chlorinated water. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine.

(4) The preferred equipment for applying liquid chlorine is a solution feed vacuum-operated chlorinator to mix the chlorine gas in solution water, in combination with a booster pump for injecting the chlorine gas solution water into the main to be disinfected. It is recommended that direct feed chlorinators not be used. (A direct feed chlorinator is one which operates solely from the pressure in the chlorine cylinder.) Hypochlorite solution may be applied to the water main with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strength as to withstand safely the corrosion caused by the concentrated ’chlorine solutions and the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main.

C. Slug Method

The slug method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to eliminate all air pockets, flushing the main to remove particulates, and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 100 mg/L in order that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period of not less than 3 hours.

The flushing is to be performed in accordance with the flushing procedure described in Section B. Continuous Feed Method.

Chlorinating the main:

At a point not more than 10 feet downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 100 mg/L free chlorine. To assure that this concentration is provided, the chlorine concentration should be measured at regular intervals. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L for at least 3 hours.

The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 mg/L the flow shall be stopped, chlorination equipment shall be relocated at the head of the slug, and as flow is resumed, chlorine shall be applied to restore the free chlorine in the slug to not less than 100 mg/L.

As the chlorinated water flows past fittings and valves, related valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.
Disposal of Heavily Chlorinated Water

After the applicable retention period, heavily chlorinated water should not remain in contact with pipe for more than 48 hours. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use. Contractor shall contact the local sewer department to arrange for disposal of the heavily chlorinated water to the sanitary sewer.

The chlorine residual of water being disposed shall be neutralized by treating with one of the chemicals listed in Table 5. If a sanitary sewer system is unavailable for disposal of the chlorinated water an alternative disposal site must be selected.

The proposed alternative disposal site to which the chlorinated water is to be discharged shall be inspected and approved by the Engineer. A reducing agent shall be applied to the chlorinated water to be wasted to completely neutralize the chlorine residual remaining in the water. (See Table 5 for neutralizing chemicals). Where necessary, federal, state and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

<table>
<thead>
<tr>
<th>Pounds of chemicals required to neutralize various residual chlorine concentrations in 100,000 gallons of water.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual Chlorine Concentration</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>mg/L (SO₂)</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>50</td>
</tr>
</tbody>
</table>

Bacteriological Testing

After final flushing and before the water main is placed in service, a sample or samples will be collected from the end of the line by the Contractor and be tested by the Owner for bacteriological quality in accordance with Standard Methods of the Examination of Water and Wastewater. At least one sample will be collected from the new main and one from each branch. In the case of mains greater than 2500 feet, samples will be collected along the length of the line when possible as well as at its end.

Bacteriological tests must show complete absence of coliforms. If tests show presence of coliform Contractor will be required to perform additional flushing and disinfection of the pipeline until such time acceptable tests are obtained, all at no cost to the Owner. The Contractor will not be charged for the additional testing performed by the Owner.

602.04 Laying of Pipe.
THE FOLLOWING IS ADDED AFTER THE LAST PARAGRAPH:

All pipe shall be laid and maintained to the required lines and depths. Fittings, valves and hydrants shall be at the required locations with joints centered, spigots home and all valve and hydrant stems plumb and otherwise in strict accordance with the Specifications.

All buried steel lugs, rods, brackets and flanged joint bolts and nuts shall be given one (1) coat of Koppers #50 coal tar coating prior to backfilling and polyethylene encased if the specifications require polyethylene encasement of pipe.

No deviation shall be made from the required alignment, depth or grade except with the written consent of the Engineer.
All pipe shall be laid to the depth specified. The depth shall be measured from the final surface grade to the top of the pipe barrel. The minimum pipe cover shall be as shown on the Drawings or as specified in the Specifications Special Conditions.

Do not lay pipe in a wet trench, on subgrade containing frost, and when trench conditions are unsuitable for such work. If all efforts fail to obtain a stable dry trench bottom and the Engineer determines that the trench bottom is unsuitable for trench foundation, he will order in writing the kind of stabilization to be constructed.

Thoroughly clean the pipes and fittings before they are installed and this material shall be kept clean until the acceptance of the completed work. Lay pipe with the bell ends facing in the direction of laying, unless otherwise shown on the Drawings, or directed by the Engineer. Exercise care to insure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs in the pipe line.

No wedging or blocking is permitted in laying pipe unless by written order of Engineer.

Before joints are made, bed each section of pipe the full length of the barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place.

Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.

Walking or working on completed pipeline, except as necessary in tamping and backfilling, is not permitted until trench is backfilled one-foot deep over top of pipes. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.

Take up and replace with new, such in-place pipe sections found to be defective. Replacement work shall be at the Contractor’s expense.

Take necessary precautions to prevent the floating of the pipeline by the accumulation of water in the trench, or the collapse of the pipeline from any cause. Should floating or collapse occur, restoration will be at the Contractor’s expense.

Bedding materials and concrete work for the pipe bedding and thrust restraint shall be as specified previously in Section Trenching, Backfilling and Compacting and Cast-in-Place Concrete respectively.

Take every precaution to prevent foreign material from entering the pipe while it is being placed. During laying operations, do not place debris, tools, clothing, or other materials in the pipe.

Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the close of the day’s work or for other reasons, such as rest breaks or meal periods.

Place enough backfill over the center sections of the pipe to prevent floating.

Carry out the cutting of pipe only with equipment specifically designed for that purpose such as an abrasive wheel, rotary wheel cutter, a guillotine pipe saw or a milling wheel saw. The use of chisels or hand saws will not be permitted. Cut ends and rough edges should be ground smooth and for push-on connections, the cut end should be beveled slightly.

In distributing material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.

If the pipe is to be strung out, it shall be done so in a straight line or in a line conforming to the curvature of the street. Each length of pipe shall be adequately blocked to prevent movement. Stockpiled pipe shall be adequately blocked to prevent movement. No pipe, material, or any other object shall be placed on private property, obstruct walkways or driveways, or in any manner interfere with the normal flow of traffic.
In the case of pre-stressed concrete, gray and ductile iron pipe, special care shall be exercised, during handling temporary storage or construction to avoid damage to the bells, spigots or flanged ends. If damaged pipe cannot be repaired to the Engineer’s satisfaction, it shall be replaced at the Contractor’s expense.

The Contractor shall remove all existing pipe, fittings, valves, pipe supports and blocking and all other items necessary to provide space for making connections to existing pipe and installing all piping which is to be done under this Contract.

The Contractor shall be responsible for maintaining the minimum required distance between the water line and other utility lines in strict accordance with all Federal, State and local requirements and all right-of-way limitations.

If polyethylene encasement is required by the Drawing or Specification Special Conditions, see Section “Piping Specialties” as applicable, for material and installation requirements.

Maximum allowable deflection at the joints for push-on joint pipe shall be as follows providing manufacturer's recommendations are not more stringent:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>thru 12&quot;</td>
<td>2-1/2°</td>
<td>9-1/2&quot;</td>
<td>10-1/2&quot;</td>
</tr>
<tr>
<td>14&quot;-36&quot;</td>
<td>1-1/2°</td>
<td>5-1/2&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>42&quot;-48&quot;</td>
<td>1°</td>
<td>3-1/4&quot;</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

In case the curve is too sharp for the allowable deflection, short lengths of pipe may be used upon approval of the Engineer and at no additional cost to the Owner.

When shown on the Drawings or required by the Specification Special Conditions the Contractor shall furnish air relief valve assemblies in accordance with air blow-off assembly which is shown on Contract plans.

Particular care shall be exercised to that no high points are established where air can accumulate. In the event that unforeseen field conditions necessitate a change in the pipe profile and, in the opinion of the Engineer, the resulting change requires the installation of an air release valve and manhole, install the same as extra Work to the Contract. If the Contractor requests a change in the pipe profile solely for ease of construction, and the requested change requires the installation of an air release valve and manhole as determined by the Engineer, then the cost of furnishing and installing the air release valve and manhole will be at the expense of the Contractor. See Contract plans for details of an air release valve assembly.

Construction Methods to Avoid Contamination:

Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing such organisms. It is essential that the procedures of this section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination.

Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used where it is determined that watertight plugs are not practical and where thorough cleaning will be performed.

Delay in placement of delivered pipe invites contamination.

The more closely the rate of delivery is correlated to the rate of pipe laying, the less likelihood of contamination.

Joints of all pipes in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Yarning or packing material shall consist of molded or tubular rubber rings, or rope of treated paper or other approved materials. Materials such as jute, asbestos or hemp shall not be used. Packing material, shall be handled in a manner that avoids contamination.

No contaminated material or any material capable of supporting prolific growth of microorganisms shall be used for sealing joints. Sealing material or gaskets shall be handled in a manner that avoids contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in closed containers and shall be kept clean.

If dirt enters the pipe, and in the opinion of the Engineer the dirt will not be removed by the flushing operation, the interior of the pipe shall be cleaned by mechanical means and then shall be swabbed with a 1% hypochlorite disinfecting solution. Cleaning with the use of a pig, swab or "go-devil" should be undertaken only when the Engineer has specified such and has determined that such operation will not force mud or debris into pipe joint spaces.

If it is not possible to keep the pipe and fittings dry during installation, every effort shall be made to assure that any of the water that may enter the pipe joint spaces contains an available chlorine concentration of approximately 25 mg/L. This may be accomplished by adding calcium hypochlorite granules or tablets to each length of pipe before it is lowered into a wet trench, or by treating the trench water with hypochlorite tablets.

If the main is flooded during construction, it shall be cleared of the flood water by draining and flushing with potable water until the main is clean. The section exposed to the flood water shall then be filled with a chlorinated potable water that, at the end of a 24 hour holding period, will have a free chlorine residual of not less than 25 mg/L. The chlorinated water may then be drained or flushed from the main. After construction is completed, the main shall be disinfected using the continuous feed or slug method.

602.05 Joining Pipe.

Joints for rigid pipe shall be made with mortar, grout, or gaskets. Other types of joints recommended by the pipe manufacturer may be permitted as approved by the Resident Engineer. Corrugated metal pipe shall be joined by coupling bands.

The use of split couplings for HDPE pipe shall not be permitted unless approved by the Resident Engineer for use in joining field cuts. All joints shall be of the bell and spigot, or bell and spigot type with a gasket according to ASTM F 477 to provide a silt-tight seal. Pipe connections shall be constructed according to the manufacturer’s recommendations for assembly of joint components, lubrications and making of joints. The pipe fittings shall be free of inclusions and visible defects. The ends of the pipe shall be cut squarely so as not to adversely affect joining.

The fiberglass reinforced plastic (FRP) pipe, which hangs from the box girders, passes beneath each of the bridge expansion joint zones. At each bridge expansion joint, a pipe expansion joint (PEJ) is required to accommodate the expected movement. The locations are marked as “PEJ” on the Utility & Drainage Plans. The pipe expansion joint must allow for the longitudinal and vertical movements specified on the “Movement Table” found on bridge drawing “Expansion Joint Details – 3”. The longitudinal movements are specified under dimension “A” from the table and the vertical movements are specified under “rise/fall”.

A. Push-On Joints:

The surfaces with which the rubber gasket comes in contact shall be thoroughly cleaned just prior to assembly.

The gasket shall then be inserted into the groove in the bell. Before starting joint assembly, a liberal coating of special lubricant shall be applied to the gasket and the spigot end. With the spigot end centered in the bell, the spigot end is pushed home.

B. Mechanical Joints

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
All components shall be cleaned and lubricated with soapy water prior to assembly. Slip the follower gland and gasket over the pipe plain end making sure the small side of the gasket and lip of the gland face the bell socket. Insert the plain end into socket. Push gasket into position with fingers, gasket should be evenly seated. Slide gland into position, insert bolts and tighten must by hand. Bolts are then tightened alternately (across from one another) to the following normal torques:

<table>
<thead>
<tr>
<th>Bolt Size</th>
<th>Range of Torque in Foot-Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8”</td>
<td>40 - 60</td>
</tr>
<tr>
<td>3/4”</td>
<td>60 - 90</td>
</tr>
<tr>
<td>1”</td>
<td>70 - 100</td>
</tr>
<tr>
<td>1-1/4”</td>
<td>90 - 120</td>
</tr>
</tbody>
</table>

C. Restrained Joints

1. Ball and Socket

Assemble and install the ball and socket joint according to the manufacturer's recommendations. The joint shall be thoroughly cleaned and lubricated. Check the retainer ring fastener.

2. Push-On

Assemble and install the push-on joint according to the manufacturer's recommendations. The joint shall be thoroughly cleaned and lubricated. Check the retainer ring fastener.

During "pushing home" of any style piping timber shall be placed between the jacking device (backhoe bucket, pipe jack, etc.) and the pipe being driven home.

602.06 Piping Specialties

THE FOLLOWING IS ADDED AFTER THE LAST PARAGRAPH:

Polyethylene Encasement

Polyethylene encasement shall conform to ANSI/AWWA C105/A21.5 Standards. Polyethylene material will deteriorate rapidly when exposed to direct sunlight. Store all polyethylene encasement out of the sunlight. If during the installation period it is anticipated that the polyethylene encasement will be exposed to sunlight for more than two weeks (i.e., an open trench) Type C (black) polyethylene material must be used.

Valve Boxes

All valves shall be provided with valve boxes. Valve boxes shall be of the standard, adjustable, cast iron extension type, three piece, 5-1/4-inch shaft, screw type, and of such length as necessary to extend from valve to finished grade. The valve box shall be hot coated inside and out with coal tar or asphaltic compound.

Valve boxes shall be manufactured by one of the following approved manufacturers: Bingham & Taylor, Mueller, Handley Industries, A.Y. McDonald, Quality Water Products, or Clay and Bailey.

Valve box bases shall conform to the following:

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>4” and smaller</td>
<td>round, 8” in height, 10-7/8” diameter at bottom</td>
</tr>
<tr>
<td>6” and 8”</td>
<td>round, 11” in height, 14-3/8” diameter at bottom</td>
</tr>
<tr>
<td>10” and larger</td>
<td>oval, 11” in height, 15” x 11-1/8” diameter at bottom</td>
</tr>
</tbody>
</table>
Rods, Bolts, Lugs and Brackets

All steel rods, bolts, lugs and brackets shall be ASTM A36 or A-307 carbon steel as a minimum requirement. After field installation all steel surface shall have one coat of Koppers #50 coal tar coating applied before backfill.

Retaining Glands

All retaining glands shall be ductile iron with ductile iron set screws. Pressure ratings for use with ductile iron pipe shall be 150 psi.

Installation

See pipe installation specifications for general installation.

Piping shall be encased in polyethylene to prevent contact with surrounding backfill and bedding material in areas shown or designated by the Engineer. Polyethylene material shall be installed in accordance with ANSI/AWWA C105/A21.5 Standards.

Service taps for polyethylene encased pipe shall following the procedure described in AWWA Standard C600-87 Section 7.1.

Valve boxes shall be supported so that no load can be transmitted from the valve box to the valve. See Contract plans for details. Tops shall be set at established grade.

Valves shall be set at the required locations with joints centered, spigots home and valve stems plumb unless otherwise directed by the Owner.

Tapping sleeves and valve assemblies require pressure testing prior to making the tap. Refer to Specification Section “Pressure and Leakage Tests” for specific requirements.

602.11 Basis of Payment.

THE FOLLOWING PAY ITEMS ARE DELETED:

" X ___ " REINforced CONCRETE CULVERT PIPE ARCH, CLASS ___ LINEAR FOOT
" X ___ " REINforced CONCRETE SEWER PIPE ARCH, CLASS ___ LINEAR FOOT

THE FOLLOWING PAY ITEMS ARE ADDED

" HIGH DENSITY POLYETHYLENE PIPE LINEAR FOOT
VIDEO INSPECTION OF PIPE LINEAR FOOT
DEFLECTION TESTING OF HIGH DENSITY POLYETHYLENE PIPE LINEAR FOOT
6" UNDERDRAIN – PERFORATED LINEAR FOOT
6" UNDERDRAIN – NONPERFORATED LINEAR FOOT
DEWATERING DRAIN WITH GATE VALVE UNIT
8" FRP LINEAR FOOT
12" FRP LINEAR FOOT
18" FRP LINEAR FOOT
15" FRP LINEAR FOOT
OUTLET PIPE – FRP LINEAR FOOT
TEE – FRP UNIT
REDUCER – FRP UNIT
PIPE EXPANSION JOINT UNIT
PIPE SUPPORT DETAIL LUMP SUM
2.5 DEG RADIUS SWEEP ELBOW – FRP UNIT
8 INCH POLYVINYL CHLORIDE PIPE LINEAR FOOT
4 INCH POLYVINYL CHLORIDE SANITARY SERVICE PIPE LINEAR FOOT
2" THICK FIBERGLASS INSULATION SQUARE FOOT

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
THE FOURTH PARAGRAPH IS CHANGED TO:

Separate payment will not be made for material used as a temporary cover over corrugated aluminum alloy culvert pipe or HDPE pipe.

THE FOLLOWING IS ADDED AFTER THE LAST PARAGRAPH:

Separate payment will not be made for thrust blocks, couplings, joints, water service reconnections, cleaning water pipes and fittings, water pressure tests and disinfection, but all costs shall be included in the unit bid price for ductile iron water pipe.

SECTION 603 – INLETS AND MANHOLES

603.01 Description.
THE FOLLOWING IS ADDED:

Manufactured Treatment Devices (MTD’s):
The Manufactured Treatment Devices (MTD’s) consist of precast concrete structures with chambers for the treatment and removal of oil and sediment removal system.

603.02 Materials.
THE FOLLOWING IS ADDED:

Manufactured Treatment Devices (MTD’s):
The Manufactured Treatment Devices (MTD’s) shall consist of a precast concrete chamber fitted with suitable hydraulic controls to provide removal of sediment and oil from stormwater entering the chamber. Each MTD shall be capable of long-term removal of 50% of the total suspended solids in the stormwater passing through the unit. When part of a treatment train in conjunction with the Sand Filter, the overall system shall be capable of long-term removal of 90% of the total suspended solids in the stormwater passing through the unit. The system shall not re-suspend trapped sediments or re-entrain floating contaminants at flow rates up to the and including the peak treatment capacity listed.

The Stormwater Treatment Device Summary on Sheet U&D-1 provides the locations for the MTD’s on the project. It also provides design parameters regarding the device model, basin area total, basin area impervious, quality design flow, and 15-year design flow. These design parameters, along with the requirements described in the New Jersey Stormwater BMP Manual, Chapter 9.6, Design Criteria A thru F, must be used when selecting the MTD for each specified location. The “device model” listed on Sheet U&D-1 meets the requirements of the NJDEP, however “or equal” devices can be used as approved by NJDEP.

The selected MTD shall be of a type approved by NJDEP. As of October 27, 2006 approved device manufacturers included:

- Stormwater Management, Inc.
- Vortechics, Inc.
- CDS Technologies, Inc.
- Stormceptor Group of Companies
- BaySaver Technologies, Inc.
- Hydro International
- AquaShield, Inc.

A current list of approved devices can be found at:
http://www.state.nj.us/dep/dsr/bscit/CertifiedMain.htm

Direct access shall be provided by means of standard NJDOT manhole frames and covers.
The MTD system shall be of a type that has been installed and in use successfully for a minimum of 5 years. The manufacturer of the said system shall have been regularly engaged in the engineering design and production of such systems.

The MTD manufacturer shall furnish documentation that supports all product performance claims and details storage capacities and maintenance requirements.

The contractor shall submit, to the Engineer, prior to the installation of the MTD, an affidavit regarding patent rights stating that any suit or claim against the Department due to alleged infringement rights shall be defended by the contractor who will bear all costs, expenses and attorney’s fees incurred thereof.

The MTD’s shown on the contract drawings where designed by Jacobs in conjunction with engineers at CDS Technologies, Inc. If an approved alternate to the MTD shown on the contract drawing is chosen by the contractor, the contractor shall be required to submit for approval to NJDEP the following: pertinent shop drawings, pipe layouts, product data sheets and computations for the selected MTD.

Butyl mastic sealant for joints shall conform to ASTM C 990.
Internal metal components shall be 6.35 millimeters thick aluminum alloy 5052-H32 conforming to ASTM B 209.
Internal plastic components shall be high-density polyethylene conforming to ASTM D 1248, D 3350, and F 894.
The MTD shall be capable of sustaining HS20-44 loading requirements.
Precast sections shall have tongue and groove or ship lap joints.
Pipe openings shall be sized to accept pipes of the specified sizes and shall be sealed with hydraulic cement conforming to ASTM C 595M.
The MTD shall adhere to the minimum performance specifications listed below.

603.06 Precast Concrete Inlets and Manholes.
THE FOLLOWING IS ADDED:

Manufactured Treatment Devices (MTD’s):

The contractor shall utilize a crane of appropriate size for the construction of the manufactured treatment devices.
Excavation and backfilling shall be in conformance with Subsection 603.03.
The base unit shall be placed on a coarse aggregate (size No. 57) bedding layer o a minimum thickness of six inches after compaction on the concrete foundation. The coarse aggregate bedding layer shall be checked for level prior to setting and the precast base section shall be checked for level at all four corners after it is set. If the slope from any corner to any other corner exceeds 0.5 percent the base section shall be removed and the course aggregate bedding layer re-leveled.

Butyl mastic sealant shall be applied to all joints of the treatment system just prior to setting subsequent sections.
The space between the pipe and the pipe opening shall be sealed with hydraulic cement.
The circular swirl chamber shall be bolted to the side walls at the 3 tangent points and/as recommended by the manufacturer. The bottom edges of the swirl chamber and side walls at the tangent points shall be sealed with a butyl mastic sealant and/or as recommended by the manufacturer.

Prior to setting the precast roof section, butyl mastic sealant shall be placed along the top of the underflow baffle wall, using more than one layer of mastic to obtain a thickness of at least one inch greater than the nominal gap between the top of the baffle and the roof section. The nominal gap shall be determined either by field measurements or the shop drawings. The construction of the flow controls shall be according to the manufacturer’s recommendations. After placement of the roof section has compressed the butyl mastic sealant in the gap, finish sealing the gap with approved non-shrink grout on both sides of the gap using the butyl mastic as a backing material to which to apply the grout. Non-shrink grout shall be applied to the joints at the side edges of the baffle walls.

After setting the precast roof section of the stormwater treatment system, set precast concrete manhole riser sections or masonry, if required, to the height required to bring the manhole frame and cover to grade. Fill the outside joints with a comparatively dry mortar (one part cement and two parts sand) and finish flush with the adjoining surfaces. Precast sections shall be set in a manner that will result in a watertight joint.

Plug holes in the concrete sections made for handling or other purposes with a non-shrink grout or by grout in combination with concrete plugs.

Where holes must be cut in the precast sections to accommodate pipes, do all cutting before setting the sections in place to prevent any subsequent jarring which may loosen mortar joints.

All stormwater treatment systems shall be filled with water up to the lowest pipe invert and tested for exfiltration. Any loss of water constitutes a system that is no watertight and the leak shall be found and corrected.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
The swirl chamber shall be tested for leaks by adding water to that portion of the system outside the chamber to a level just below the lowest opening in the chamber. If water flows into the swirl chamber, the leak must be found and corrected as recommended by the manufacturer. If leaks appear on the outside of the system, the inside joints shall be cleaned and caulked as recommended by the manufacturer and to the satisfaction of the Engineer.

Working drawings and design calculations shall be submitted to the Engineer for approval in accordance with subsection 105.04.

603.12 Method of Measurement.
THE FOLLOWING IS ADDED TO THIS SUBSECTION:

Manufactured Treatment Devices (MTDs):

Manufactured Treatment Devices of the various types will be measured by the number of each. Each MTD shall be considered to include the treatment device unit and its respective inflow and outflow pipe segments. No additional payment beyond the payment for the system, shown on the plans, will be made for reconfiguring the piping system to accommodate the selected MTD.

603.13 Basis of Payment.
THE FOLLOWING IS ADDED TO THIS SUBSECTION:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANUFACTURED TREATMENT DEVICE</td>
<td>UNIT</td>
</tr>
<tr>
<td>SCUPPER – TYPE A (“SCA”) – 20 ¼&quot;X21 ¾&quot;X17 ½”</td>
<td>UNIT</td>
</tr>
<tr>
<td>SCUPPER – TYPE B (“SCB”) – 37 5/8&quot;X17 ½&quot;X11”</td>
<td>UNIT</td>
</tr>
</tbody>
</table>

Separate payment will not be made for pipe connectors, excavation, coarse aggregate bedding and all incidental construction required for the manufactured treatment device.

SECTION 605 - CURBS

605.07 Concrete Curbs.
A. Limitations.
THE SECOND ITEM OF THIS SUBPART IS CHANGED TO:

2. Concrete curb shall not be constructed from November 1 to March 15 except at the following locations:
   Rte 36 K/L Ramp

SECTION 607 – SIDEWALKS AND DRIVEWAYS

607.02 Materials.
THE ENTIRE SUBSECTION IS CHANGED TO:

HMA shall conform to Section 903 except that the composition of the mixture for the top layer may also include up to 20 percent of RAP. Portland cement concrete shall conform to Section 914 except that driveways shall attain a strength of not less than 3,000 pounds per square inch in three days. Other materials shall conform to the following Subsections:

<table>
<thead>
<tr>
<th>Material</th>
<th>Subsection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Aggregate</td>
<td>901.09</td>
</tr>
<tr>
<td>Prime Coat:</td>
<td></td>
</tr>
<tr>
<td>Cut-back Asphalt, Grade MC-30 or MC-7</td>
<td>904.02</td>
</tr>
<tr>
<td>Tack Coat:</td>
<td></td>
</tr>
<tr>
<td>Cut-back Asphalt, Grade RC-70 or RC-T</td>
<td>904.02</td>
</tr>
<tr>
<td>Emulsified Asphalt, Grade RS-1, SS-1, or SS-1h</td>
<td>904.03</td>
</tr>
<tr>
<td>Cationic Emulsified Asphalt, Grade CSS-1 or CSS-1h</td>
<td>904.03</td>
</tr>
<tr>
<td>Curing Materials</td>
<td>905.03</td>
</tr>
<tr>
<td>Preformed Expansion Joint Filler</td>
<td>908.01</td>
</tr>
</tbody>
</table>

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Reinforcement Steel............................................................................................................ ................ 915.03
Detectable Warning Surfaces.................................................................................................... .......... 905.06
Dense-graded aggregate for base course used with HMA sidewalk shall conform to Subsection 901.08.

SECTION 611 – MONUMENTS

611.01 Description.

THE FOLLOWING IS ADDED TO THE END OF THIS SECTION:

This work shall also consist of installing monuments provided by NPS at the completion of the project to delineate the park boundary lines.

611.04 Monuments.

THE FOLLOWING IS ADDED TO THE END OF THIS SECTION:

Monuments to delineate NPS boundary lines shall be provided by the NPS to the Contractor’s surveyor for installation after construction has been completed on the east end of the project.

SECTION 612 – BEAM GUIDE RAIL

612.04 Beam Guide Rail End Treatment.

THE SECOND, THIRD AND FOURTH PARAGRAPHS ARE CHANGED TO:

Slotted guide rail (flared) terminals shall be FLEAT 350 (Flared Energy Absorbing Terminal) as manufactured by Road Systems, Inc.

Extruder (tangent) terminals shall be either ET-2000 PLUS (Guardrail End Treatment) by Trinity Highway Safety Products, Inc. or SKT 350 (Sequential Kinking Terminal) by Road Systems, Inc. For the ET-2000 PLUS, the 50 foot configuration shall be used with 12 foot 6 inch panels. Seven “SYT” and one “HBA” posts shall be used.

Telescoping guide rail end terminals shall be either CAT 350 (Crash Cushion Attenuating Terminal) by Trinity Highway Safety Products, Inc. or Brakemaster 350 by Energy Absorption Systems.

612.08 Beam Guide Rail on Bridges.

THE FOURTH PARAGRAPH IS DELETED.

612.10 Method of Measurement

THE FOLLOWING IS ADDED TO THE END OF THIS SECTION:

Attachment of “guiderail attached to temporary sheeting” to precast concrete construction curb barrier shall not be paid separately, but shall be included in the cost of “Guiderail Attached to Temporary Sheeting”.

612.11 Basis of Payment.

THE FOLLOWING PAY ITEM IS ADDED:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUIDERAIL ATTACHED TO TEMPORARY SHEETING</td>
<td>LINEAR FOOT</td>
</tr>
</tbody>
</table>

The cost of the item “Guiderail Attached to Temporary Sheeting” shall include the cost of installation and removal of the guide rail.

SECTION 614 – FENCES

614.02 Materials.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
THE FOLLOWING IS ADDED:
The color of the pedestrian fencing shall match the Federal Standard 595B colors, color chip number 36622.

### 614.09 Basis of Payment.

THE FOLLOWING PAY ITEM IS ADDED:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEDESTRIAN FENCING</td>
<td>LINEAR FOOT</td>
</tr>
</tbody>
</table>

### SECTION 615 – METAL RAILING

### 615.05 Basis of Payment.

THE FOLLOWING PAY ITEM IS ADDED:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEEL RAILING</td>
<td>LINEAR FOOT</td>
</tr>
</tbody>
</table>

### SECTION 617 - TRAFFIC CONTROL

### 617.02 Materials.

THE ENTIRE SUBSECTION IS CHANGED TO:

Materials shall conform to the following Subsections:
- Removable Wet Weather Pavement Marking Tape and Removable Black Line Masking Tape........ 912.12
- Temporary Pavement Markers........................................................................................................... 912.16

### 617.03 Traffic Control Devices.

THE FOLLOWING IS ADDED TO THE FIRST PARAGRAPH:

Traffic Control devices shall be NCHRP-350 crash test compliant by the NJDOT implementation dates stated in the table below and shall be duly certified, if necessary.

<table>
<thead>
<tr>
<th>Traffic Control Device Category</th>
<th>Commonly used NJDOT Traffic Control Devices</th>
<th>AASHTO/FHWA implementation date for newly purchased Devices</th>
<th>NJDOT implementation date for newly purchased Devices</th>
<th>NJDOT deadline by which devices must be NCHRP-350 compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Vertical panel, portable sign supports, and type III barricades</td>
<td>10/1/2000</td>
<td>1/1/2003</td>
<td>8/15/2003</td>
</tr>
</tbody>
</table>
4. Portable, usually trailer-mounted, devices such as lighting supports, flashing arrows panels, temporary traffic signals, and changeable message signs used in or adjacent to the traveled way to be announced 6/15/2005 6/15/2007

Note: Resident Engineer’s approval shall be obtained to use traffic control devices that are certified NCHRP 350 compliant, but not listed in the table.

Newly purchased devices shall be NCHRP-350 compliant. A list of NCHRP 350 compliant and FHWA approved devices can be found at:


NCHRP-350 non-compliant, yet adequately serviceable category 3 traffic control devices, such as truck-mounted attenuators (TMA) purchased prior to 10/01/1998, will be allowed to be used until 03/15/2005 upon submitting new purchase documentation to the Resident Engineer.

3. **Illuminated Flashing Arrows.** The solar powered arrow boards approved for use on projects are:
   a. Work Area Protection – Arrowmaster Model WAAW–15-SB
   b. Solar Technology Inc. – Silent Sentinel
   c. Trafcon Industries Inc. – Model TC1-15S
   d. Protect-O-Flash Inc. – Model No. M-90 (LED bulbs only)
   e. TRACOM (Trailer Component Mfg., Inc.)

THE FOLLOWING IS ADDED TO THE END OF THIS SECTION:

7. **Portable Trailer Mounted CCTV Camera Assemblies.** The Portable Trailer Mounted CCTV Camera Assembly shall be Part No. ECCS09100 as manufactured by EarthCAM or approved equal and shall meet at the minimum following specifications:
   a. Trailer Platform
      (1) Single Axle steel welded trailer
      (2) 2” adjustable ball hitch
      (3) Heavy-duty safety chains
      (4) Single drop torsion suspension
      (5) Self lubricating wheel spindles
      (6) Maximum size, including tongue, 12 ft long by 6 ft wide by 8 ft high
      (7) Maximum payload 3500 pounds
      (8) Tire size F7815
      (9) Spare wheel mounted and locked on trailer
      (10) DOT approved lighting package to include electrical brake lights and marker lights
      (11) Primer and paint customers, choice of color
      (12) Fitted with manual telescoping outriggers with adjustable jacks sized to counter full mast extension
      (13) Custom fabricated mounts for all options installed
      (14) All equipment secured to prevent theft or separation from platform
      (15) Stainless steel hardware to prolong trailer life
      (16) 24/7 operation in all weather conditions
      (17) Wheel locks to secure trailer while deployed
      (18) Two locking 36 x 24 x 12 NEMA-4 equipment boxes for electronic components and camera storage
      (19) One locking 12 x 12 x 8 NEMA-4 equipment box for operational controls
(20) Max trailer weight of 3500 lbs when fully configured  
(21) Wheels removable when trailer in deployed position  
(22) Operational manual

b. Mast

(1) 150 lbs payload capacity  
(2) 32’ of extension with capability to mount antenna at 20’, 25’ or top, maximum nested length of mast is 10  
(3) 9 sections  
(4) Un-guyed  
(5) Locking collars allow the mast to remain extended indefinitely without air pressure  
(6) All exterior aluminum surfaces are anodized and sealed for long life  
(7) Custom fabricated mount for cameras  
(8) Folds down during transport for better height clearance  
(9) Spiral conduit for cables  
(10) Compactly retracts when mast is nested into storage container at bottom of mast  
(11) Automatically hydraulic (pneumatic) operation

c. Electrical System

(1) 12 VDC battery operated with multi crystal solar electric panel  
(2) Fuse panel to protect electronics  
(3) Two 120 watt solar panels on collapsible mounts  
(4) 400 watt wind generator as secondary power sources  
(5) Charge controller automatically switches charging sources  
(6) Gasoline or fuel generated as backup power sources  
(7) Charge monitor will automatically activate generator when needed  
(8) Isolated 12 VDC starting battery  
(9) Automatic shutdown on low fuel, oil, high temperature, full battery charge  
(10) To provide auxiliary power for deployment

d. Inverter. The purpose of the inverter is to provide main power when (AC) power is available  
Battery charger  
(1) All bacles in weather tight conduit with sealed connections to equipment boxes

e. Electronics

(1) Cellular (CDMA), microwave, or 802.11 bandwidth option  
(2) Onboard Ethernet switch to connect cameras, bandwidth, and monitoring devices  
(3) Halogen floodlight to provide light for deploying trailer in the dark  
(4) Work lights in all cabinets  
(5) Remote trailer diagnostics (battery level, charging output, etc)

f. Camera and Software

(1) The characteristics of the camera shall include:  
   a. Weather resistant power coated aluminum case with stainless steel hardware fittings, gray polyester powder coat, anodized  
   b. Impact resistant viewing window  
   c. Minimum resolution of NTSC 704 (H) x 480 (V)  
   d. Backlight compensation  
   e. Image stabilization  
   f. Sensitivity 0.02 lux NIR Mode  
   g. Auto/Manual Focus  
   h. Auto/Manual White Balance  
   i. Motorized Zoom maximum 16x optical 10x digital  
   j. Motorized Pan-Tilt, pan 360º  
   k. Thermostatically controlled heater and defroster -50º to 140ºF operating range  
   l. Windshield wiper  
   m. IR Illuminator  
   n. 24/7 operation in all weather conditions  
   o. time and date stamp  
   p. max power consumption 70 VA
(2) The characteristics of the software shall include:
   a. Remote control of pan, tilt and zoom
   b. Ability to display streaming video in MPEG format, motion-JPEG, and single snapshot JPEG images, remotely central selectable through software
   c. Preset controls of pan/tilt/zoom combinations. All presets to be accessible from drop-down menu with descriptive name of preset. First 8 preset shall have quick launch icons with graphical representation of the preset view.
   d. Ability to display all the project’s web cams in a single view screen
   e. Display of local time and weather conditions including temperature and humidity
   f. Ability to save images to disk or email images
   g. Ability to view archived images via a graphical calendar control. Archived images should be stored at least every five minutes
   h. Three levels of password protection admin, user & guest, individual user accounts
   i. Remote camera diagnostics and “self-healing” automatic problem rectification
   j. Ability to monitor and control the cameras from one location over the web.

617.10 Traffic Directors.
THE FOLLOWING NEW SUBPART IS ADDED

   C. Emergency Towing Service. Thirty days before the start of Construction Operations, the Contractor shall provide an Emergency Towing Service Plan for approval by the Resident Engineer, which shall indicate the type, quantity, and location of towing equipment to be used.

   Emergency towing service shall be provided during those periods of time when construction operations require closure of a lane or lanes of traffic or as directed by the Resident Engineer. Emergency towing service shall consist of having personnel and equipment at the designated locations on the project site capable of removing disabled vehicles, without damage to the vehicle, from the construction zone to the nearest location that will permit the disabled vehicle to be legally parked without interfering with traffic. Emergency towing service shall respond immediately upon notice of a disabled vehicle by the Resident Engineer or Contractor personnel.

617.15 Removable Pavement Marking Tape.
THE SUBSECTION HEADING AND ENTIRE SUBSECTION ARE CHANGED TO:

617.15 Removable Wet Weather Pavement Marking Tape.

   Removable wet weather pavement marking tape shall be installed at designated locations and according to the Manufacturer’s recommendations. The tape shall be white or yellow and shall be installed in single or double lines, as designated.

   The surface upon which the tape is to be installed shall be prepared according to Subsection 618.05. Removable wet weather pavement marking tape shall be installed on dry surfaces, when the surface temperature is between 50 ºF and 150 ºF and when the ambient temperature is 50 ºF and rising, and when the weather is otherwise favorable as determined by the Engineer. The tape shall not be overlapped, and only butt splices shall be used.

   To ensure maximum adhesion, the tape shall be tamped and a truck shall be driven slowly over the tape several times. The tape shall be removed when no longer required for traffic control.

   Removable tape that has become damaged and is no longer serviceable shall be replaced immediately and will not be measured for payment. Tape that is damaged by construction operations shall also be replaced without additional compensation.

617.16 Method of Measurement.
THE SIXTEENTH PARAGRAPH IS CHANGED TO:

   Removable wet weather pavement marking tape will be measured by the linear foot of 4-inch wide strips, deducting the gaps.

THE FOLLOWING IS ADDED

   Emergency Towing Service will be measured by the number of hours at the project site.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Portable Trailer Mounted CCTV Camera Assemblies will be measured by the number of units.

617.17 Basis of Payment.
DELETE THE FOLLOWING PAY ITEM:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>REMOVABLE PAVEMENT MARKING TAPE</td>
<td>LINEAR FOOT</td>
</tr>
</tbody>
</table>

ADD THE FOLLOWING PAY ITEMS:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>REMOVABLE WET WEATHER PAVEMENT MARKING TAPE</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>EMERGENCY TOWING SERVICE</td>
<td>HOURS</td>
</tr>
<tr>
<td>PORTABLE TRAILER MOUNTED CCTV CAMERA ASSEMBLIES</td>
<td>UNIT</td>
</tr>
</tbody>
</table>

SECTION 618 - TRAFFIC STRIPES AND MARKINGS

618.01 Description.
THE FOLLOWING IS ADDED TO THIS SUBSECTION:

Removal of pavement reflectors and castings consists of the removal and disposal of existing raised pavement markers, including the lenses when still intact.

Removal and replacement of pavement reflector lenses consists of the removal of existing pavement reflector lenses and installing new mono–directional or bi–directional pavement reflector lenses.

618.03 Equipment.
THE ENTIRE SUBSECTION TEXT IS CHANGED TO:

The epoxy resin striping and liquid system striping equipment shall be so designed, equipped, maintained, and operated that the material is properly applied in variable widths at a consistent temperature. The striping equipment shall include a tachometer and a pressure gauge and a calibrated holding vessel for each component. The holding vessels for all pigments and hardeners shall have thermometers for measuring the temperature of the vessel contents. The striping equipment shall be equipped with a separate power unit for the pumps used in the mixing and distribution of the components. The following shall be furnished with each striping equipment:

1. A calibration sheet that shows the number of the truck body, the capacity thereof, and an outage table in increments of not over ½ inch. This calibration sheet must be certified by the manufacturer or testing agency.
2. A metal rod for each holding vessel, with accurate divisions marked and consecutively numbered starting at the bottom. The rod shall be not less than 1 foot longer than the depth of the vessel.
3. Slip-proof steps with handrail to reach ground level.
4. Slip-proof catwalk with handrail, running along the top of the vessel.
5. Fire extinguisher in working order.

The equipment for applying thermoplastic material shall be capable of providing continuous mixing and agitation of the material. The parts of the equipment conveying the material between the main reservoir and the shaping die shall be so constructed to prevent accumulation and clogging. The mixing and conveying parts and the shaping dies or spray gun shall be capable of maintaining the material at optimum plastic temperature. The equipment shall be so constructed to ensure continuous uniformity in the dimensions of the entire stripe or marking. The kettle provided for the melting and heating of the thermoplastic material shall be equipped with an automatic thermostat control device and heated by a controlled heat-transfer liquid rather than by a direct flame. The heating kettle and applicator shall be equipped and arranged to meet the National Board of Fire Underwriters and State and Federal regulations. The parts of the equipment that come in contact with the material shall be easily accessible for cleaning and maintenance.

All equipment for applying traffic stripes or traffic markings shall be equipped with glass bead dispensers of a type that will mechanically and automatically dispense beads uniformly on wet stripes or markings at the rates specified.

Equipment for removing the various types of traffic stripes or traffic markings shall be designed with a vacuum system to remove all millings from the pavement surface and prevent airborne residue from escaping into the atmosphere.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
All equipment including traffic marking tape applicator and retrometer shall be duly calibrated and shall conform manufacturer’s requirements.

618.04 Determination of Acceptability.
THE ENTIRE SUBSECTION TEXT IS CHANGED TO:

The Contractor shall furnish for approval, 20 calendar days before placement, a complete schedule of operations for applying pavement markings, including the number and types of equipment, and procedures for the Project.

When long-life traffic stripes are required on the Project, the Contractor shall furnish the manufacturer’s written instructions for proper use of the materials, including but not limited to, mixing ratios and application temperatures.

The Contractor shall arrange for and have each long-life material manufacturer’s representative on the site for the first full day of applying either long-life traffic stripes or traffic markings to provide technical assistance.

The Contractor shall furnish a LTL-2000 Retrometer for the Engineer’s use in determining the retroreflectance values of the various traffic stripes or traffic markings. This equipment is for the sole use of the Engineer and will become the property of the Contractor after Acceptance.

To meet long-life traffic striping operations, the Contractor shall construct one or more test strips. Each test strip shall consist of approximately 500 linear feet of pavement with white and yellow striping (lane and edge lines) or markings similar to that required for the Project. The test strips shall demonstrate the capability of the proposed materials, equipment, and procedures to produce long-life traffic stripes that comply with the Specifications, including dimensions, appearance (stripes with uniform color and crisp, well defined edges), wet film thickness, drying time, adhesion, and glass beads application and retention. A test strip will be required for each applicator equipment used. Additional test strips may be required when major equipment repairs or adjustments are made or when the traffic stripes fail to comply with the Specifications. Permission to proceed with the striping operations will be given when the test strips are in compliance. Each test strip may remain in place and become part of the finished stripes subject to the requirements of Subsection 618.10.

618.05 Surface Preparation.
THE SECOND PARAGRAPH IS CHANGED TO:

The Contractor shall apply a primer-sealer conforming to NJDEP volatile organic content (VOC) requirements to the areas of HMA and Portland cement concrete surfaces as required, in accordance with the striping manufacturer’s recommendations.

618.07 Long-Life Epoxy Resin Traffic Stripes.
THE SUBSECTION HEADING AND TEXT ARE CHANGED TO:

618.07 Long-Life Traffic Stripes.

The Contractor shall mix epoxy resin material with an automatic proportioning and mixing machine and hot-spray the compound at a temperature between 100 and 130 °F onto thoroughly dry surfaces. The material shall only be placed during anticipated dry weather when the ambient temperature is a minimum of 45 °F and the surface temperature is a minimum of 50 °F. The temperature of the sprayed mixture shall be adjusted as required for prevailing conditions, including the air and pavement surface temperatures, to achieve a no-track drying time of 30 minutes or less. The epoxy resin mixture shall be applied in a wet film thickness of 20 ± 1 mil.

Immediately after, or in conjunction with the epoxy resin application, the Contractor shall apply large glass beads and small glass beads to the wet compound. Each type of bead shall be applied in a uniform pattern and each at a rate of 12 pounds per gallon of epoxy resin material.

The Contractor shall remove all epoxy resin material that has been tracked or spilled in areas outside of the intended placement areas.

Alternate liquid striping materials shall be selected from the approved product list maintained by the Bureau of Materials.

618.08 Long-Life Thermoplastic Traffic Markings.
THE SUBSECTION HEADING AND ENTIRE TEXT ARE CHANGED TO:

618.08 Long-Life Thermoplastic and Preformed Tape Traffic Markings.
The Contractor shall apply preformed thermoplastic or hot extruded thermoplastic or preformed tape traffic markings, using equipment and procedures that produce markings that are straight and have sharp edges; that are the specified color, width, and thickness; that have uniform retroreflectivity; and that are properly bonded to the pavement. The thermoplastic material shall be applied as follows:

1. **Preformed Thermoplastic.** The Contractor shall place preformed thermoplastic traffic marking tape on thoroughly dry surfaces and during anticipated dry weather. The preformed thermoplastic tape shall be melted using the flame from a propane-type torch, according to the manufacturer’s recommendations, to bond the traffic markings permanently in position.

   If required, the Contractor shall apply additional glass beads to the hot-wet material in a uniform pattern, to attain the minimum initial retroreflectance value specified in Subsection 618.10 for thermoplastic tape.

2. **Hot Extruded Thermoplastic.** The Contractor shall heat the thermoplastic material uniformly and apply the melted material at a temperature between 400 and 425 °F; to thoroughly dry surfaces and during anticipated dry weather, when the ambient and surface temperatures are a minimum of 50 °F. The thermoplastic traffic markings shall be extruded on the HMA or portland cement concrete pavement in a thickness of 90 ± 5 mils.

   Immediately after, or in conjunction with the thermoplastic application, the Contractor shall apply, by mechanical means, glass beads to the wet material in a uniform pattern and at a minimum rate of 10 pounds per 100 square feet of markings. Hand throwing of the beads will not be allowed.

3. **Preformed tape.** Preformed traffic tape shall be applied according to the tape manufacturer’s installation instructions. The use of primers or other adhesion promoting agents shall be used according to the recommendations of the tape and primer/agent manufacturers. Applied stripes and markings shall be free from snaking, air bubbles, loose edges or any other condition that may cause early failure as determined by the engineer.

   Tape shall be applied at least 3 inches away from longitudinal joints. In areas where it is not possible to avoid a joint beneath the tape, such as transverse construction joints, short lengths of longitudinal joints or other pavement depressions and irregularities directly beneath the tape, the tape shall be cut or treated according to the tape or marking manufacturer’s recommendations. In no case shall more than two continuous feet of striping tape be placed over a longitudinal joint.

618.10 Defective Stripes or Markings.
THE ENTIRE SUBSECTION TEXT IS CHANGED TO:

The Contractor shall replace long-life traffic stripes or traffic markings determined to be in nonconformance with the Specifications, or not placed at the locations or in the dimensions specified. The defective stripes or markings shall be removed according to Subsection 618.12.

The Contractor shall replace defective long-life traffic stripes based on the following:

1. The entire 10 foot broken line if the line to be replaced is determined to have a deficiency.
2. The entire length of epoxy resin striping determined to have a wet film thickness of less than 19 mils shall be restriped with 20 mils of new epoxy resin, based upon the calculated and measured yields.
3. The entire length of striping shall be replaced where improper curing or discoloration has occurred. Discoloration is defined as localized areas or patches of brown or grayish colored epoxy resin material. When improper curing or discoloration occurs intermittently in intervals of 100 feet or less throughout the striping, the entire length of striping shall be replaced from where it first occurs until where it no longer exists plus 5 feet on each end.
4. The entire length of striping that has failed to bond or adhere to the pavement, or has chipped or cracked, shall be replaced from where it first occurs to where it no longer exists. When more than 25 spots (combined or individual) of chipping, cracking or poor bonding/adhesion has occurred within a 1,000 linear foot distance, the entire 1,000 linear feet shall be replaced.
5. The entire length of 1 mile of striping shall be replaced where the initial retroreflectance value of two of four readings for that 1 mile of 4-inch wide striping is not in compliance with the following:

   As measured with a LTL-2000 Retrometer

<table>
<thead>
<tr>
<th>Type</th>
<th><strong>White</strong> (Millicandelas per square foot per footcandle)</th>
<th><strong>Yellow</strong> (Millicandelas per square foot per footcandle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epoxy Resin</td>
<td>375</td>
<td>250</td>
</tr>
</tbody>
</table>
6. The entire area of striping shall be replaced where the glass bead coverage or retention is deficient, based on yield determinations made during application and on visual comparisons of the production traffic stripes with those of the test strips.

The Contractor shall replace defective long-life thermoplastic traffic markings based on the following:

1. The entire area of marking determined to be less than the required thickness, to have an incorrect color or width, to have failed to bond to the pavement, or to have chipped or cracked shall be replaced. The minimum replacement area is an individual word or symbol, or entire length of longitudinal line from where the deficiency first occurs to where it no longer exists.

2. The entire area of marking shall be replaced where the initial retroreflectance value is less than 375 millicandelas per square foot per footcandle for white or 250 millicandelas per square foot per footcandle for yellow. Initial retroreflectance will be determined as follows:
   - Step 1: Visual night inspections will be made to identify traffic markings that appear to be below the specified minimum value.
   - Step 2: All retroreflectance measurements taken with an LTL-2000 retrometer will be made on a clean, dry surface.
   - Step 3:  
     - a. For word markings, three random retroreflectance measurements will be made on each letter.
     - b. For symbols, nine random retroreflectance measurements will be made over the symbol.
   - Step 4: All retroreflectance measurements within an area will be averaged to determine if the minimum retroreflectance requirements are met.

At no Additional Compensation to the State, the Contractor shall remove all traffic paint where the striping or markings will not be directly under long-life material, replace long-life traffic stripes or traffic markings damaged due to any sawing or sealing of joints in the HMA overlay, and replace all existing pavement reflectors that have been marred by striping or marking material as a result of improperly located traffic stripes or traffic markings.

618.12 Removal of Traffic Stripes or Traffic Markings.
SUBSECTION IS RENAMED AND CHANGED TO:

618.12 Removal and Replacement of Traffic Delineation Devices.

A. Removal of Traffic Stripes, Markings, or Reflectors and Castings. The Contractor shall remove all types of traffic stripes or traffic markings by methods that do not damage the integrity of the underlying pavement or adjacent pavement areas, and that do not cause gouging, or create ridges or grooves in the pavement that may result in compromising vehicular control. Obliterating stripes or markings by painting over them shall not be permitted.

Before starting removal operations, the Contractor shall demonstrate the proposed method to accomplish the complete removal of the reflectors and castings and the removal of approximately 95 percent of the stripe or marking without the removal of more than 1/16 inch of pavement thickness. Area of removal includes the area of the stripe or marking plus 1 inch on all sides. Removal operations shall not be permitted until the method of removal has been approved.

Debris from the removal of traffic stripes and markings shall be disposed of according to Subsection 201.10.

Disposal of pavement reflectors and castings shall be in conformance with Subsection 201.10.

SECTION 619 - SIGNS

619.03 Regulatory and Warning Signs.
THE FIRST PARAGRAPH IS CHANGED TO:

Regulatory and warning signs shall be fabricated of flat aluminum sheets and shall be covered with ASTM D 4956 Type III retroreflective sheeting. Legends, borders, and accessories shall be Type B unless otherwise designated. Signs shall be fabricated according to Subsection 916.08.

619.04 Guide Signs.
THE FIRST PARAGRAPH IS CHANGED TO:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY

Page 273
Guide signs fabricated of extruded aluminum sheets shall be covered with ASTM D 4956, TYPE III, Type VIII or Type IX retroreflective sheeting depending on the following:

1. Guide signs on steel “U” posts shall be fabricated of flat aluminum sheets and shall be covered with ASTM D 4956 Type III retroreflective sheeting. Legends, borders, and accessories shall be Type B unless otherwise designated.
2. Guide signs on overheads and breakaway or non-breakaway posts shall be fabricated of extruded aluminum panels covered with ASTM D 4956 Types VIII or IX retroreflective sheeting. Legends, borders, and accessories shall be Type A.

THE FOLLOWING IS ADDED TO THIS SECTION:

3. NPS Slider Signs are to be fabricated of fiberglass sheets, or such material as shall be approved by the Resident Engineer. Sheets shall be fire, impact and corrosion resistant laminate with nonglare UV inhabited painted surface, and 20+ year life expectancy for legibility, color retention and resistance to normal climatic elements. Copy shall be sandblasted into the material and paint-filled with desired color. A sample of the slider sign, constructed of the proposed material shall be submitted to the Resident Engineer for approval before final fabrication of the slider sign. Separate payment will not be made for slider signs. All costs thereof shall be included in the price bid for GUIDE SIGNS, TYPE GA, STEEL “U” POST SUPPORTS.

4. NPS Hinged Signs are to be fabricated to the same standard as non-hinged signs. Separate payment will not be made for hinged signs. All costs thereof shall be included in the price bid for GUIDE SIGNS, TYPE GA, STEEL “U” POST SUPPORTS. The back of Hinged Signs shall be painted black or covered with a non-reflective black material. A sample of the hinged sign, constructed of the proposed material shall be submitted to the Resident Engineer for approval before final fabrication of hinged signs.

5. Signs designated as “NPS Format” shall be graphically designed according to the National Park Service UniGuide Program document. Separate payment will not be made for NPS Format signs. National Parks Arrowheads appearing on Traffic Signing and Striping Plans shall also be designed according to the UniGuide document. Arrowhead colors are to be provided in accordance with the Pantone Matching System, as appears in the UniGuide, Volume 2, Chapter 2, “Graphic Standards”, Figure 3.3, “Arrowhead Color Standards”. Contractor shall use the multicolor arrowhead with white outline. A sample sign with arrowhead shall be presented to the Resident Engineer for approval before sign fabrication. Separate payment will not be made for NPS signs. All costs thereof shall be included in the price bid for Signs.

6. Signs designated for NPS mounting shall be mounted as shown in the National Park Service UniGuide Program, Volume 1, Chapter 4. Separate payment will not be made for NPS mounting. All costs thereof shall be included in the price bid for GUIDE SIGNS, TYPE GA, STEEL “U” POST SUPPORTS.

Copies of the NPS UniGuide are available by contacting the National Parks Service below:

National Parks Service
Harpers Ferry Center
Tel: 304-535-5050

Mailing Address:
Harpers Ferry Center
PO Box 50
Harpers Ferry WV
25425
Attention: Robert Clark
e-mail: Robert_H_Clark@nps.gov
SECTION 622 - WATER, GAS, AND SANITARY SEWER LINES

622.01 Description.
THE FOLLOWING IS ADDED:

This work shall consist of installation of new ductile iron pipe, couplings, valves, tapping sleeves, lateral gate, valve box, tie rods, concrete, etc. as shown on the Contract Drawings, as specified herein or as directed by the Engineer. The Contractor shall test all tapping sleeves, valves and tapping saddles as shown on the drawings and/or in the Specification or as required by the Resident.

Also, where shown on the plans the Contractor shall furnish and install service lines originating at the water main and terminating at a curb stop connection.

622.02 Materials.
THE FOLLOWING IS ADDED:

Gate Valves

Small Gate Valves

All gate valves. 3 inches through 12 inches, shall be iron body, resilient-seated, nut-operated, non-rising stem, gate valves suitable for buried service. The valves shall be designed for an operating pressure of 200 psi and test pressures to 400 psi. Valves shall be designed to operate in the vertical position. Valves shall comply fully with AWWA Standard C509. Valve ends shall be mechanical joint in accordance with AWWA C111. Stem sealls shall be double 0 ring stem seals. Square operating nuts conforming to AWWA C509 shall be used. Valves shall open (left or right) in accordance with the Owner's standard.

Large Gate Valves

Gate valves larger than 12-inches NPS shall be iron body, double disc, parallel seats, bronze mounted, rubber "0" ring packing seals, and conforming to ANSI/AWWA C500 Standard. All valves shall have openings through the body of the same circular area as that of the pipe to which they are attached. All valves furnished shall open (left or right) in accordance with the OWNER standard.

Testing of valves shall be in accordance with AWWA C500 Section 28. Certified copies of all tests shall be provided prior to shipment. The Engineer reserves the right to observe all tests.

Valves shall have mechanical joint ends unless otherwise designated on the plans or approved by the Engineer. All valves shall be designed for a working pressure of 150 pounds per square inch (psi) and 300 psi test pressure unless otherwise noted on the plans or directed by the Engineer. The Contractor shall make all valves tight under their working pressures after they have been placed and before the main is placed in operation. Any defective parts shall be replaced at the Contractor's expense.


Submittals.

Shop drawings at a scale sufficiently large enough to show pertinent aspects of the gate valves and valve boxes along with appropriate manufacturer’s literature shall be submitted to the Engineer for forwarding and approval by New Jersey American Water before ordering any valves.

Tapping Sleeves, Saddles and Valves

General

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
All tapping sleeves, saddles and valves shall be designed for a working pressure of 200 psig for 12-inch and smaller and 150 psig for sizes larger than 12-inch. Test pressure shall be twice the working pressure.

**Tapping Sleeves and Valves**

The CONTRACTOR shall verify the type of existing pipe and the outside diameter of the pipe on which the tapping sleeve is to be installed.

Tapping sleeves shall be ductile iron or cast-iron dual compression type. The sleeves shall be made in two halves which can be assembled and bolted around the main.

The horizontal tapping valve shall conform to the applicable requirements of AWWA C509. The tapping valves shall have flanged inlets with mechanical joint outlets, enclosed bevel gears, bypass valve, rollers, tracks and scrapers.

Acceptable manufacturers: Mueller, McWane, U.S. Pipe and Waterous.

**Tapping Saddles**

Tapping saddles shall consist of ductile iron outlet castings, attached to the pipeline with high strength steel straps. Castings shall be sealed to pipeline with O-ring seals.

Saddles shall have ANSI A21.10 flanged outlets counterbored for use with tapping valves and tapping equipment.

**Submittals.**

The Contractor shall promptly supply to the Engineer for approvals, shop drawings with details and schedules for all items as-noted in the drawings and/or Specifications and/or required by the Engineer.

Seven (7) copies of all drawings, schedules and brochures shall be submitted for approval. Black line prints, blue line prints or reproducible transparencies are required. Blueprints (white lines on a blue background) are not acceptable. Each submittal shall have the job name on it. Submittals shall be made to the Engineer for forwarding and approval by New Jersey American Water before ordering any material. Submittals that are smaller than 8-1/2 by 11 inches shall be secured to paper 8-1/2 by 11 inches.

**Air Blow-Off Assembly**

**Curb Boxes**

Curb boxes shall be standard, cast iron, sliding or screw type, 1" or 2-1/2" as required, complete with lid and head bolt. Box shall be adjustable from 18-inches to 66-inches.


**Copper Pipe**

Copper pipe shall be Type L or Type K, as specified, meeting the requirements of ASTM Standard B88.

**Corporation Stops**

Corporation stops shall be of the brass, ball valve type manufactured in accordance with AWWA Standard C800. The inlet connection shall have standard AWWA tapered threads unless otherwise required by the ENGINEER. The outlet connection shall be flared copper connection end. The sizes shall range from 1/2" to 2" and shall match the size of specified service line material.
Acceptable manufacturers and model numbers are:

Ford Meter Box Company - FB400 thru FBI600
Mueller - H-15000 Series
A.Y. McDonald - 4701 Series

Curb Stops

Curb stops shall be bronze body construction, ball valves, with Double O-ring stem seals. Curb stops shall conform to AWWA Standard C800. End connections shall be suitable for flared copper connection. If required by the Engineer valves shall be furnished with square gate valve operating nuts. Sizes shall be from 3/4” to 2” and shall match the service line size.

Acceptable manufacturers and model numbers:
Ford Meter Box Company - B Series
Mueller - H-15000 Series
A.Y. McDonald - 6000 Series

Miscellaneous Service Line Fittings

Miscellaneous service line fittings such as couplings, adaptors, saddles, bends, plugs, etc. shall conform to AWWA Specification C800.
Acceptable manufacturers: Ford Meter Box, Mueller, and A.Y. McDonald.

Service Lines

Copper Service Line Material

Copper pipe shall be Type L or Type K, as specified, meeting the requirements of ASTM Standard B88. Pipe size (3/4", 1", 1-1/2", 2") and type are to be determined by the Engineer.

Polyethylene Service Line Material

Polyethylene service line material shall be Class 160 (SDR-7), ultra high molecular weight, conforming to AWWA Standard C901. Pipe sizes to be 3/4", 1", 1-1/2" and 2". Copper tube size (CTS) or iron pipe size (IPS) as per ENGINEER’S requirements.
Acceptable manufacturers: Orangeburg Industries, Continental Industries.

Curb Boxes

Curb boxes shall be standard, 1" or 2-1/2", cast iron, sliding or screw type, complete with lid and head bolt, adjustable from 18-inches to 66-inches. The size to be determined by the Engineer.

Corporation Stops

Corporation stops shall be of the brass, ball valve type manufactured in accordance with AWWA Standard C800. The inlet connection shall have standard AWWA tapered threads unless otherwise required by the Engineer. The outlet connection shall be flared copper connection end or pack joint for polyethylene pipe as required. The sizes shall range from 1/2” to 2” and shall match the size of specified service line material.
Acceptable manufacturers and model numbers are:

Ford Meter Box Company - FB400 thru FBI600
Mueller - H-15000 Series
A.Y. McDonald - 4701 Series

Curb Stops

Curb stops shall be bronze body construction, ball valves, with Double O-ring stem seals. Curb stops shall conform to AWWA Standard C800. End connections shall be suitable for flared copper connection or pack joint for polyethylene pipe as required. If required by the Engineer valves shall be furnished with square gate valve operating nuts. Sizes shall be from 3/4" to 2" and shall match the service line size.

Acceptable manufacturers and model numbers:
Ford Meter Box Company - B Series
Mueller - H-15000 Series
A.Y. McDonald - 6000 Series

Miscellaneous Service Line Fittings

Miscellaneous service line fittings such as couplings, adaptors, saddles, bends, plugs, etc. shall conform to AWWA Specification C800.
Acceptable manufacturers: Ford Meter Box, Mueller, and A.Y. McDonald.

Polyethylene Encasement

Copper service line material (pipe, valves, stops, etc.) installed on mains with polyethylene encasement or other type protective wrap shall be encased in polyethylene. Encasement material and installation shall be per Specification Section “Piping Specialties” and ANSI/AWWA Standard C105/A21.5.

622.03 Construction Requirements.
THE FOLLOWING IS ADDED:

Gate Valves.

Valve Installation

Prior to installation, inspect valves for direction of opening, freedom of operation, tightness of pressure containing bolting, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Correct defective valves or hold for inspection by the Engineer.

Set and join to the pipe in the manner specified in Section 602.04. Provide valves 12-inch and larger with special support, such as crushed stone or concrete pads, so that the pipe will not be required to support the weight of the valve. Set truly vertical.

Provide all valves with a valve box. Set the top of the valve box neatly to the grade of the surface of the existing ground, unless directed otherwise by the Engineer. Do not transfer shock or stress to the valve, and center and plumb the box over the wrench nut of the valve. Do not use valves to bring misaligned pipe into alignment during installation. Support pipe in such manner as to prevent stress on the valve. See Contract plans for a typical valve box installation detail.

Tapping Sleeves, Saddles and Valves

General provisions provided in Specification Section 602.04 shall be strictly followed. Installation of the tapping sleeves, tapping saddle, and tapping valve is to be in accordance with the manufacturer’s instructions.
The tapping procedure is to be in accordance with the tapping machine manufacturer's instructions. After installation of a tapping sleeve and valve but prior to making the tap into the main the tapping sleeve and valve assembly shall be tested. The required test pressure shall be determined in the same manner as for pipe but no pressure drop will be allowed during the test. Test pressure must be maintained for 15 minutes for acceptance. The test shall be made with the valve open using a tapped mechanical joint cap. No leakage is acceptable. The test pressure shall be maintained for 15 minutes minimum.

**Air Blow-Off Assembly**

**Installation**

See Contract plans showing typical installation detail for air blow-off assembly.

**Installation of Corporation Stops**

Tapping of all water mains shall be performed by experienced craftsmen familiar with installation of water service lines.

All taps shall be made with a suitable tapping machine (Mueller, Ford, Hays or Dresser type) using the proper combined drill and tap. Hand held drilling equipment is not acceptable.

Corporation stops shall be inspected for damaged threads and proper operation of the ball valve prior to installation.

Should the water main wall thickness or material (plastic, concrete or A-C pipeline material) be unsuitable for direct tapping, a tapping saddle shall be used.

Proper installation of the corporation stop should allow between 2 and 3 threads to extend beyond the inside wall of the main. If necessary a test tap shall be made with the boring bar marked to the proper depth. The corporation shall not be threaded completely into the pipe such that it becomes shouldered with the main. Lubricants of any type shall not be used when installing the corporation.

Taps made to polyethylene encased water main shall be made using the procedure outlined in AWWA C600-87, Section 7.1.

**Installation of Line and Fittings**

Copper pipe shall be installed between the tap connection and the curb stop or air release valve location making only gradual changes in grade or alignment as required. Sharp bends (greater than 150°) in any direction are not allowed unless approved by the Engineer.

Curb stops shall be installed with the operating nut in the vertical position and the curb box centered over the nut. Curb boxes are to be installed and adjusted to be flush with finished grade. Curb boxes shall have lids installed and locked.

Excavation, backfilling and surface restoration shall be completed in accordance with Section Trenching, Backfilling and Compacting of these Specifications. After completion of service line installation but prior to backfilling the corporation stop shall be opened slowly to fill the line. When the line is full and all air has been removed completely open the corporation. All piping, fittings, and taps shall be visually checked for leaks.

**Service Lines**

Installation of Corporation Stops

---

**ROUTE 36 OVER THE SHREWSBURY RIVER**

**HIGHLANDS BRIDGE**

**MONMOUTH COUNTY**

Page 279
Tapping of all water mains shall be performed by experienced craftsmen familiar with installation of water service lines.

All taps shall be made with a suitable tapping machine (Mueller, Ford, Hays or Dresser type) using the proper combined drill and tap. hand held drilling equipment is not acceptable.

Corporation stops shall be inspected for damaged threads and proper operation of the ball valve prior to installation.

The main may be tapped at the horizontal centerline 2 45 degree as shown on Contract plans for typical service line detail.

Should the water main wall thickness or material (plastic, concrete or A-C pipeline material) be unsuitable for direct tapping, a tapping saddle shall be used.

Proper installation of the corporation stop should allow between 2 and 3 threads to extend beyond the inside wall of the main. If necessary a test tap shall be made with the boring bar marked to the proper depth. The corporation shall not be threaded completely into the pipe such that it becomes shouldered with the main. Lubricants of any type shall not be used when installing the corporation.

Taps made to polyethylene encased water main shall be made using the procedure outlined in AWWA C600-87, Section 7.1.

Installation of Service Line and Fittings

Service lines shall be installed between the tap connection and the curb stop location making only gradual changes in grade or alignment as required. Sharp bends (greater than 150) in any direction are not allowed unless approved by the Engineer.

All plastic service line connections shall use insert stiffeners of the appropriate length and size.

Curb stops shall be installed with the operating nut in the vertical position and the curb box centered over the nut. Curb boxes are to be installed plum and adjusted to be flush with finished grade. Curb boxes shall have lids installed and locked.

Excavation, backfilling and surface restoration shall be completed in accordance with Section Trenching, Backfilling and Compacting of these Specifications. After completion of service line installation but prior to backfilling the corporation stop shall be opened slowly to fill the line. When the line is full and all air has been removed completely open the corporation and close the curb stop. All piping, fittings, and taps shall be visually checked for leaks.

Thrust Restraint

Provide all plugs, caps, tees, and bends (both horizontal and vertical) with concrete reaction backings and/or restrained joint pipe as detailed on the Drawings, or specified in the Specification Special Conditions.

Place concrete reaction backing between undisturbed solid ground and the fitting to be anchored. Concrete reaction backing to be installed in accordance with Specification Cast–in–Place Concrete Section. The backing unless otherwise shown or directed, shall be located as to contain the resultant thrust force and so that the pipe and fitting joints will be accessible for repair.

Temporary thrust restraint at temporary caps or plugs shall be the responsibility of the Contractor. Submit details of temporary restraint to the Engineer for approval.
At connections with existing water mains where there is a limit on the time the water main may be removed from service, use metal harnesses of anchor clamps, tie rods and straps; mechanical joints utilizing set-screw retainer glands; or restrained push-on joints. Metal harnessing may be used by the Contractor in lieu of concrete backing without the approval of the Engineer. Submit details of the proposed installation to the Engineer for approval. For pipe up to 12 inches in size, use a minimum of two 3/4-inch tie rods. For pipe 16-inch in size, four 3/4-inch tie rods are required and for 20-24 inches pipe, six 3/4-inch tie rods are required. For larger pipe sizes, consult the Engineer. Install retainer glands in accordance with the instructions of the particular manufacturer furnishing the glands.

Material for metal harnessing and tie-rods shall be ASTM A-36 or A-307 as a minimum requirement.

622.04 Method of Measurement
THE FOLLOWING IS ADDED AFTER THE LAST PARAGRAPH

Air blow-off assemblies will be measured by the number of units.

622.05 Basis of Payment
THE FOLLOWING PAY ITEM IS ADDED

<table>
<thead>
<tr>
<th>2 INCH COPPER WATER SERVICE PIPE</th>
<th>LINEAR FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR BLOW OFF ASSEMBLY</td>
<td>UNIT</td>
</tr>
</tbody>
</table>

THE FOLLOWING IS ADDED AFTER THE LAST PARAGRAPH:

Payment for thrust blocks, couplings, mechanical joints, cleaning pipes and fittings, water pressure tests and disinfection, will be made in accordance with Section 602.

The unit price for the blow-off assembly shall include all labor, materials, tools, excavation and backfilling; the furnishing, installing and testing of all piping, valves, air valves, fittings, small piping and piping appurtenances and all incidental work required to construct each blow-off assembly complete as shown on the Drawings, as specified and necessary to make a complete and satisfactory installation.

Separate payment for curb stop and curb box will not be made for service line installations.

THE FOLLOWING SECTION IS ADDED:

SECTION 623 – SAND FILTERS

623.01 Description.

This work shall include furnishing and installing two (2) sand filter structures of the general size and configuration in conformance with this specification and in conforming with the lines, elevations, locations, details and notes shown on the contract plans or as established by the engineer.

623.02 Materials.

Portland cement concrete and reinforcement shall conform to the requirements of section 501 – concrete structures of the standard specifications and as modified by these special provisions.

Filter Bed Sand
The sand used in the sand bed must meet the specifications for clean medium aggregate concrete sand in accordance with AASHTO M-6 or ASTM C-33. This must be certified by a professional engineer licensed in the State of New Jersey.

Gravel Layer

ROUTE 36 OVER THE ShREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
There is a gravel layer above and below the sand layer in each of the sand filters. The bottom layer serves as bedding material for the underdrain pipes. The top layer serves to protect the sand layer from washout. The bottom gravel layer must have sufficient thickness to provide a minimum of 2 inches of gravel above and below the underdrain pipes. Both gravel layers should consist of 0.5” to 1.5” clean broken stone or pea gravel. (AASHTO M-43)

Underdrain

The underdrain piping must be rigid schedule 40 pvc pipe in accordance with AASHTO M 278. Perforated 8-inch diameter underdrain piping should have a minimum of 3/8 inch diameter perforations at 6-inch centers with four perforations per annular row. The bottom 120 degrees portion of the underdrain shall not have perforations. The portion of drain piping beneath the sand bed must be perforated. All remaining underdrain piping, including cleanouts, must be nonperforated. All joints must be secure and watertight. Cleanouts must be located at the upstream and downstream ends of the perforated sections of the underdrain and extend to or above the surface of the sand/gravel bed. Additional cleanouts should be installed as needed.

Geotextile Filter Fabric

A layer of geotextile filter fabric shall be placed between the sand layer and bottom gravel layer. It shall be in accordance with ASTM D-751 (Puncture Strength 125 Lb), ASTM D-1117 (Mullen Burst Strength – 400 Psi), and ASTM D-1682 (Tensile strength – 300 lb). The filter fabric shall be 0.08” thick and should have an equivalent opening size of a #80 sieve. The fabric must maintain a 125 gpm per sq. ft flow rate.

Dewatering Drain

A 6 inch dewatering drain controlled by a gate valve shall be installed thru the overflow weir wall between the filter chamber and the outer chamber. The dewatering drain pipe shall consist of nonperforated, rigid schedule 40 pvc pipe in accordance with AASHTO M 278. Its invert shall be set at the elevation of the top of the sand/gravel bed, 3.0’ above the floor slab elevation. The dewatering drain penetration in the overflow weir wall shall be sealed with a flexible strip joint sealant which swells in contact with water to form a tight pressure seal.

623.02 Construction Requirements.

Protection From Construction Sediments

The internal elements (filter layers, etc.) Of the sand filter shall not be constructed prior to completion of all construction and site revegetation. After completion of the filter shell, it may be necessary to divert construction flow through the storm system and filter if a temporary bypass is not available. In particular, sand filter #1 has structural constraints that may eliminate temporary bypass as an option. In this instance, coordination with the erosion and sediment control plans to minimize sediment upstream of the filter shell is required. Periodic inspection and cleanout will be required to remove sediment from the filter shell. Should construction runoff enter the filter system prior to site revegetation, all contaminated materials must be removed and replaced with new clean materials.

Water Integrity Test & Initial Settlement

After completion of the filter shell but before placement of the filter layers, entrances to the structure shall be plugged and the shell completely filled with water to demonstrate water tightness. Maximum allowable leakage is 5 percent of the filter shell and volume in 24 hours. The water should remain in the sand filter for 72 hours total to allow for initial settlement. Pipe inlets and outlets should be adjusted accordingly in needed.

Hydraulic Compaction Of Filter Components

After placement of the underdrain, lower gravel level, and lower geotextile filter fabric, the shell shall be filled with filter bed sand to the level of the top of the sand layer, 2.5’ above the floor slab elevation. Direct clean water into the sediment chamber until both the sediment chamber and filter chamber are completely full. Allow the water to draw down until flow from the underdrain pipe ceases, hydraulically compacting the filter sand. After allowing the sand to dry out for a minimum of 48 hours, refill the shell with sand to a level 2.5’ above the floor slab elevation and place the upper 6 inch gravel layer.

623.03 Method of Measurement.

The work related to the construction of the sand filters will not be measured for payment.
623.04 Basis Of Payment.

Payment for the construction of the sand filters in accordance with these specifications is included under the various pay items which make up the sand filters.

THE FOLLOWING SECTION IS ADDED:

SECTION 624 - JCP&L ELECTRIC FACILITIES

624.01 Description

This section describes the requirements for the installation, relocation and removal of Jersey Central Power and Light (JCP&L) electric utility facilities including conduits, manholes, transformer vaults, handholes, and appurtenances and shall include all work necessary to transfer services including temporary relocations.

624.02 Materials

Except as noted below, JCP&L will supply all materials necessary for the work at no cost to the Contractor. The electric subcontractor must provide JCP&L written notice 30 days in advance of when materials will be required. The electric subcontractor must take delivery of the materials from JCP&L’s storage facility within two weeks of the notice from JCP&L that the material is available. If the electric subcontractor fails to take delivery, the material may not be available, and the Contractor may be required to provide an additional request for materials. Additionally, the Contractor may be required to compensate the Department for any additional handling costs incurred by JCP&L for failure to take delivery within the time required.

The electric subcontractor is responsible for loading the material, delivering it to the job site, and all subsequent handling and delivery within the jobsite. The Contractor shall be responsible for the adequate storage and protection of all materials received from JCP&L. All excess materials furnished by JCP&L shall be returned and delivered to JCP&L’s storage facility. The Contractor shall obtain a receipt for all material received, maintain a documented inventory of materials used and obtain a receipt for all material returned.

The Contractor supplied materials:

1. Tack Coat which shall conform to Subsection 904.03
2. HMA which shall conform to Subsection 903
3. Portland Cement Concrete – which shall conform to Subsection 914
4. Controlled Low Strength Material (CLSM) which shall conform to 919.22

624.03 Construction

General The work of constructing and relocating JCP&L electric facilities may only be performed by an electric subcontractor approved by JCP&L. The following is a list of electric subcontractors that have been previously approved by JCP&L. This list is provided as information only, and shall not be considered an endorsement by the Department of any subcontractor. The Contractor is responsible for soliciting from a subcontractor that will be approved by JCP&L when preparing their Bid. Work restricted to the electric subcontractor shall not preclude the Contractor from performing the work of layout, traffic control, sawcutting, pavement removal, temporary or final pavement restoration, and landscape restoration associated with the work of installing or relocating JCP&L electrical facilities.

Hawkeye, LLC
100 Marcus Blvd
Hauppauge, NY 11788
Tel: 631-447-3100
Fax: 631-776-1847
Att: Charles Gravina - Mgr. Electric Operations
email: cgravina@hawkeyellc.com

Henkels & McCoy, Inc.
985 Jolly Road
Blue Bell, PA 19422
Tel: 215-283-7707
Fax: 215-283-7573
Scheduling of Work and Interruption to Utilities The electric subcontractor shall provide the Engineer and the designated JCP&L representative with a detailed schedule of the electric utility work. The schedule of electric utility work shall include the number of crews, work locations and time of day (such as night shift, day shift, and...
The electric subcontractor shall coordinate all work with the JCP&L representative, and shall notify the Engineer and the JCP&L representative at least two weeks prior to starting electric utility work. The Contractor shall not interrupt existing facilities until approved by the JCP&L representative.

Weather conditions may significantly delay or prevent connections to existing systems between June 1 and September 30. The electric subcontractor may not perform work, which will require electric transmission service interruptions from June 1 through September 30 without the approval of JCP&L. This period may be extended based on weather conditions and system demand requirements as determined by JCP&L. The electric subcontractor shall notify JCP&L at least one month in advance prior to commencing conductor work.

If service transfers are required, the electric subcontractor shall coordinate service transfers with the JCP&L representative. The electric subcontractor shall notify the property owner and all tenants affected by service interruptions or transfers. This work shall be performed to minimize the disruption of the normal operations of the existing facility and minimize the down time to the existing facility. The electric subcontractor shall protect existing facilities during construction and installation of the service transfer.

**Quality Control and Quality Assurance** The Contractor shall at all times provide access to the work by the JCP&L representative. The electric subcontractor shall perform all work in a manner acceptable to the JCP&L representative. The electric subcontractor shall perform all electric utility work in accordance with JCP&L standards and details.

**Safety** The electric subcontractor shall perform work in accordance with applicable OSHA regulations, N.J.S.A. 34:6-47 “High Voltage Proximity Act”, and JCP&L safety standards.

**Abandonment and Removal** Prior to beginning any work, the electric subcontractor shall review condition of all existing electric utility facilities noted to be removed with the JCP&L representative. If the JCP&L representative designates the material to be salvaged, remove the material and deliver it to a JCP&L storage facility. The electric subcontractor shall remove and dispose of all other electrical utility material designated for removal unless otherwise noted on the plans.

**Excavation** When excavation is required in areas of existing pavement and sidewalk, the Contractor shall sawcut full depth existing pavement and sidewalk. The Contractor shall excavate trenches for conduit, manholes and vaults and appurtenances. Any unstable material at the bottom of the excavation shall be removed and backfilled with granular material. Do not excavate trenches more than 300 feet in advance of installing conduit unless approved by the Engineer. The Contractor shall provide and maintain trench crossings where necessary to maintain access. The Contractor shall not leave trenches open overnight unless protected by temporary fencing or by steel plates.

**Existing Utilities** The Contractor shall determine the location of all surface and subsurface structures within the work area, including but not limited to underground electric, telecommunication, gas, and sewer facilities. The Contractor shall protect and support all existing utilities exposed during excavation operations.

**Backfill** The electric subcontractor shall backfill with suitable material in lifts not exceeding 6 inches thick, loose measurement. If the backfill is predominantly granular material, the electric subcontractor shall compact the backfill material with a vibratory plate compactor. For other suitable material, the subcontractor shall compact the backfill material with a vibratory rammer compactor. If adequate compaction of backfilled material is not possible, the Contractor may be required to backfill with CLSM with the approval of the JCP&L representative. CLSM may only be placed when the ambient temperature is at least 30 °F. CLSM may not be placed on frozen ground. The electric subcontractor shall ensure that CLSM is discharged directly from the truck into the trench, and allowed to cure after placement. CLSM may not be used to replace pavement, base courses or drainage layers in the roadway. Excess or unsuitable material shall be removed and disposed as per Subsection 202.12.

**Restoration** The Contractor shall restore any areas disturbed in the performance of electrical utility relocations to its original condition. The Contractor shall provide temporary restoration to the satisfaction of the Engineer where final grading, pavement, or landscaping is otherwise already provided in the plans in these areas. If open cut trenching across a road is required, the Contractor shall restore the pavement in-kind with existing pavement.
**Field Testing** The electric subcontractor shall perform a high-potential test (also known as a dielectric voltage withstand test) on all cables and splices prior to energizing. Testing must be performed by a person who is qualified to operate the test equipment, and is familiar with the cable system. The electric subcontractor must ensure that the cables are disconnected from non-cable systems equipment, and that adequate physical clearances are maintained between all cable ends, energized cables, and electrical grounds and all other equipment are maintained during the test. Prior to performing the test, the electric subcontractor shall verify that all taps or laterals in the circuit are cleared. In the event hot poured compound filled splices and terminations are involved, testing should not be performed until they have cooled to ambient temperature. The relays in the high voltage direct current test equipment shall be set to operate between 5 and 25 milliamperes leakage. The shape of the leakage curve under constant voltage is more important than the absolute leakage current of a “go or no go” withstand test result. The field test voltage is related to the final factory applied dc potentials using a factor of 80 percent.

The high potential test must be performed in the presence of the JCP&L representative. The electric subcontractor shall apply a direct current field test voltage according to the following table:

<table>
<thead>
<tr>
<th>Rated Voltage</th>
<th>dc Hi-Pot Test</th>
<th>dc Hi-Pot Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase to Wall - mils</td>
<td>15 Minutes</td>
<td>kV</td>
</tr>
<tr>
<td>5000</td>
<td>90</td>
<td>25</td>
</tr>
<tr>
<td>8000</td>
<td>115</td>
<td>35</td>
</tr>
<tr>
<td>15000</td>
<td>175</td>
<td>55</td>
</tr>
<tr>
<td>25000</td>
<td>260</td>
<td>80</td>
</tr>
<tr>
<td>28000</td>
<td>280</td>
<td>85</td>
</tr>
<tr>
<td>35000</td>
<td>345</td>
<td>100</td>
</tr>
<tr>
<td>46000</td>
<td>445</td>
<td>130</td>
</tr>
<tr>
<td>69000</td>
<td>650</td>
<td>195</td>
</tr>
</tbody>
</table>

Note: If the leakage current quickly stabilizes, the duration may be reduced to 10 minutes.

After the voltage has been applied and the test level reached, the electric subcontractor shall record leakage current at one-minute intervals. If the leakage current decreases or stays steady after it has leveled off, the cable is considered satisfactory. If the leakage current starts to increase, excluding momentary spurts due to supply-circuit disturbances, the test may be extended to see if the rising trend continues. At the conclusion of the test, the electric subcontractor shall discharge the circuit through the test set and voltmeter circuit. After the potential drops below 95% of the test value, the electric subcontractor shall ground the cable and discharge the circuit. The grounds shall be left on all conductors for a minimum of four times as long as the test voltage was applied.

If the cable fails to meet the requirements of the direct current field test, the electric subcontractor shall remove and replace the cable. The Contractor shall be responsible to reimburse the Department for any additional material costs incurred by the Department.

**Energizing Lines** Energizing lines will be performed by the electric subcontractor with the guidance of the JCP&L representative. Prior to energizing any lines, the electric subcontractor must submit a request to JCP&L. Switching orders may only originate from JCP&L employees. The Contractor must submit a request for permission to energize transmission lines 10 days in advance of when the work will be performed. The Contractor must request permission to energize distribution lines in a manner that will permit the JCP&L representative to submit a request to JCP&L’s Dispatch Office by noon the previous business day.
**As-built** Upon completion of the work, the electric subcontractor shall submit to JCP&L as-built drawings in accordance with JCP&L standards. Prints of construction drawings marked to show the final location are acceptable. The electric subcontractor shall provide a copy of the as-built drawings to the Engineer.

**624.04 Method of Measurement**
ELECTRICAL UTILITY RELOCATION, JCP&L will not be measured, and payment will be made on a lump sum basis.

**624.05 Basis of Payment**
Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELECTRICAL UTILITY RELOCATION, JCP&amp;L</td>
<td>LUMP SUM</td>
</tr>
</tbody>
</table>

THE FOLLOWING SECTION IS ADDED:

**SECTION 625 – TEMPORARY STRUCTURES FOR TRAFFIC STAGING**

**625.01 Description**
This work shall include but is not be limited to the following:
1. Structural steel framing for traffic staging lane and other miscellaneous steel
2. Reinforced concrete for traffic staging lane
3. Protection and selective removal of existing reinforced concrete and concrete encasement
4. Patching, repairs, and restoration
5. Utility support hangers

**625.02 Materials**
Materials shall conform to the following Subsections:
1. Structural Steel and Other Ferrous Metals: Section 917
2. Portland Cement Concrete, Mortar and Grout: Class B Concrete, Section 914
3. Reinforcing Steel: Section 915
4. Miscellaneous: Portland Cement, Type III, Section 919

**625.03 Fabrication and Construction Requirements**
Construction methods shall conform to Division II of the AASHTO Standard Specifications for Highway Bridges. The design of temporary structures and connections shall be submitted for approval according to Subsection 105.04, Concrete Structures Section 501, Steel Structures Section 503 and Selective Removal and Restoration for Temporary Structures for Traffic Staging Section 626.

**625.04 Method of Measurement**
Structural steel shall be measured by weight. Reinforced cast-in-place concrete shall be measured by volume. Reinforcing steel shall not be measured separately. The reinforcing steel for the reinforced cast-in-place concrete shall be in accordance with the contract plans and is included in the pay item “REINFORCED CONCRETE FOR TEMPORARY STRUCTURES”.

**625.05 Basis of Payment**
Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRUCTURAL STEEL FOR TEMPORARY STRUCTURE</td>
<td>POUND</td>
</tr>
<tr>
<td>REINFORCED CONCRETE FOR TEMPORARY STRUCTURE</td>
<td>CUBIC YARD</td>
</tr>
<tr>
<td>REMOVAL OF EXISTING REINFORCED CONCRETE SLAB</td>
<td>SQUARE FEET</td>
</tr>
<tr>
<td>REMOVAL OF EXISTING CONCRETE ENCASEMENT WITH REINFORCEMENT</td>
<td>SQUARE FEET</td>
</tr>
</tbody>
</table>

THE FOLLOWING SECTION IS ADDED:

**SECTION 626 – SELECTIVE REMOVAL AND RESTORATION FOR TEMPORARY STRUCTURES FOR TRAFFIC STAGING**

**626.01 Description**
This work shall include but is not be limited to the following:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
1. Partial removal of concrete slabs
2. Partial removal of reinforcement
3. Partial removal of concrete encasement
4. Removal of all debris from the site
5. Protection of existing fixtures, materials, utilities and equipment items
6. Installation, staged removal and modification of temporary supports
7. Installation and removal of construction barriers
8. Removal of selected portions of the structure
9. Removal and restoration of selected site elements to include, but is not limited to, lighting and plumbing
10. Patching, repairs and restoration

626.02 Definitions
A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the property of NJDOT.
B. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; and store and protect against damage. Reinstall items in the same locations or in locations indicated in the Contract Documents or as directed by the Engineer.
C. Existing to Remain: Protect construction indicated to remain against damage. When permitted by the Engineer, items may be removed to a suitable protected storage location during selected removal and then cleaned and reinstated in their original locations.

626.03 Referenced Sections
A. Section 201.04 – Removal of Bridges, Culverts, and Other Structures
B. Section 201.06 – Removal of Sidewalks, Driveways, and Curbs
C. Section 201.10 – Disposal of Materials and Debris

626.04 Referenced Standards
Occupational Safety and Health Administration (OSHA) – CFR 29 - Part 1926, Standards for the Construction Industry

626.05 Project Conditions
NJDOT Standard Specifications and Special Provisions apply to this section.
A. The residents and traveling public will occupy the bridge immediately adjacent to areas (alongside, above or below) of selective removal. Conduct selective removal work in a manner that traffic operations will not be disrupted. Provide a minimum of 72 hours notice to the Engineer of activities that will affect ongoing operations.
B. Provide temporary barricades and other forms of protection to shield NJDOT personnel and the general public from injury due to selective removal work.
   1. Provide protective measures as required to provide free and safe passage of NJDOT personnel and the general public.
   2. Erect temporary supports for utilities, if required, as directed by the Engineer.
   3. Provide and stage shoring, bracing, or support to ensure structural integrity and to prevent movement, settlement, or collapse of the structure or elements to be removed and adjacent facilities or work to remain. The staging of removal, the installation of structural framing and monitoring of structures shall be supervised by a Licensed Professional Engineer, registered in the State of New Jersey, and employed by the Contractor. Structural removal and shoring staging plans shall also be signed and sealed by a Licensed Professional Engineer registered in the State of New Jersey.
   4. Monitor and measure movements of structures to be removed at removal points prior to, during and after removal. Submit an instrumentation plan indicating monitoring locations, type of instrumentation, sequence and scheduling.
   5. Protect from damage, existing finish work that is to remain in place and become exposed during removal operations.
   6. Protect openings in the slabs with suitable coverings.
   7. Protect existing utilities to remain.
   8. Protect the adjacent structures and traffic during the removal and modification of existing structures.
   9. The use of explosives is prohibited.
  10. The Contractor shall provide all necessary protective measures for removal of materials.
11. Remove protections, shoring, temporary supports, barricades, and equipments at the completion of work.
C. Conduct selective removal operations and debris removal to ensure minimum interference with NJDOT operations, walks, and other adjacent occupied or used facilities.
D. Do not use cutting torches for removal until work area is cleared of flammable materials. Verify the condition of the space before starting flame-cutting operations if approved by the Engineer. Maintain portable fire suppression devices during flame-cutting operations. Firewatcher shall be assigned during flame-cutting operations.
E. Maintain existing utilities to remain in service and protect them against damage during demolition operations. The drain lines under the slabs, if required, must be maintained and restored to their original condition at the completion of construction.
F. Use temporary enclosures and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection. Water sprinkling for dust control is permitted with the approval of the Engineer.
G. Maintain access to and along sidewalks at all times during removal and construction activities.
H. Burning of rubbish or debris is not permitted anywhere on the job site.
I. All concrete removal operations shall be initiated by saw cutting or manual chipping at the perimeter of the section to be removed during that shift.
J. NJDOT assumes no responsibility for actual condition of structures to be selectively removed.
K. Storage or sale of removed items or materials on-site will not be permitted.

626.06 Quality Assurance
A. Work plan and design for structural removal shall be signed and sealed by a Licensed Professional Engineer registered in the State of New Jersey.
B. Engage an experienced firm that has successfully completed selective removal work similar to that indicated for this project.
C. Comply with governing EPA notification regulations before starting selective removal. Comply with hauling and disposal regulations of authorities having jurisdiction.
D. Conduct conference at project site to comply with pre-removal conference requirements.

626.07 Material Ownership
Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the property of NJDOT, all removed materials shall become the Contractor’s property and shall be removed from the site with further disposition at the Contractor’s option.

626.08 Submittals
A. Submit each item in this Part to the Engineer according to the conditions of the Contract unless otherwise indicated.
B. Submit schedule and work plans indicating proposed sequence of operations for selective removal work for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services if required, together with details for dust and noise control protection.
   1. Provide detailed sequence of removal work to minimize interruptions to traffic operations.
   2. Submit removal methods, procedures and equipment to be employed.
   3. Obtain permits as required and furnish the Engineer with copies.
   4. Provide detail information of existing utilities attached to the existing bridge structure.
C. The Contractor shall provide photographs or videotapes of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage caused by removal operations.

626.09 Scheduling
Arrange selective removal schedule so as not to interfere with on-site operations of others.

626.10 Repair Materials
A. Use repair materials identical to existing materials.
   1. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
   2. Use materials whose installed performance equal or surpass that of existing materials.
B. Furnish all materials, tools, equipment, facilities and services required for performing selective removal and restoration work.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY

Page 289
626.11 Examination
A. Verify that utilities have been protected.
B. Survey existing conditions and correlate with requirements indicated to determine extent of selective
removal required.
C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and
salvaged.
D. Survey the condition of bridge to determine whether removing any element might result in structural
deficiency or damage to any portion of the structure or adjacent structures during selective removal.
E. Perform surveys as the work progresses to detect hazards resulting from selective removal activities.

626.12 Preparation
Provide shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be removed and
adjacent facilities to remain.
A. Cease operations and notify the Engineer immediately if safety of any structure appears to be
endangered.
B. Cover and protect equipment and fixtures from damage when removal work is performed in areas where
such items have not been removed.
C. Prior to the commencement of work, the Contractor shall make all necessary arrangements with the
proper authorities for utilities removal and rerouting as required in connection with removal.

626.13 Utility Services
A. Maintain existing utilities indicated to remain in service and protect them against damage during
selective removal operations.
   1. Do not interrupt existing utilities serving occupied or operating facilities, except when
      authorized in writing by the Engineer. Provide temporary services during interruptions to existing
      utilities, as acceptable to the Engineer and to governing authorities.
   2. Provide a minimum of 72 hours notice to the Engineer if shutdown of service is required during
      changeover.
B. If required, locate, identify, disconnect, and seal or cap off indicated utility services serving building or
area to be selectively removed.
   1. The Engineer will arrange to shut off indicated utilities when requested by the Contractor.
   2. Where utility services are required to be removed, relocated, or abandoned, provide bypass
      connections to maintain continuity of service to other parts of the bridge before proceeding with
      selective removal.

626.14 Removal
A. Perform selective removal work in a systematic manner. Use such methods as required to complete work
indicated on Contract Drawings in accordance with removal schedule and governing regulations and codes.
B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or
design are encountered, investigate and measure both nature and extent of the conflict. Submit report to the
Engineer in written, accurate detail. Pending receipt of directive from the Engineer, rearrange selective
removal schedule as necessary to continue overall job progress without undue delay.
C. Cut concrete using power-driven masonry saw or hand tools. Use the minimum size of tools for removal
to avoid vibration, noise and damage to existing structures. The types and sizes of tools used for removal
shall be subject to approval of the Engineer.
D. Locate the equipment for removal throughout structure and promptly remove debris to avoid imposing
excessive loads on supporting walls, slabs, or framing.
E. Provide services for effective pollution controls.

626.15 Disposal of Demolished Materials
Remove from bridge site debris, rubbish, and other materials resulting from removal operations. Transport and
legally dispose of off site. If hazardous materials are encountered during removal operations stop work
immediately, notify the Engineer and restart work only after steps have been taken to correct the condition.
Comply with applicable regulations, laws and ordinances concerning removal, handling, and protection against
exposure or environmental pollution.

626.16 Cleanup and Repair
Upon completion of removal work, remove tools, equipment, and demolished materials from the site. In addition, remove protections and clear off any debris. Repair removal performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start of operations. Repair adjacent construction or surfaces soiled or damaged by selective removal work. Remove all debris from site. The Engineer shall approve the location of containers used to temporarily store debris and the storage location. Excessive dusting from demolition and relocation operation is prohibited.

626.17 Method of Measurement
Design, Installation, Removal, Finishing, Replacement and Temporary; Utilities; Construction Barricades and Forms and all other labor and materials required for work associated with this Section shall be in accordance with the provisions of this specification but shall not be measured for payment separately. All labor and material for this work shall be included under the noted pay items in Section 625.

626.17 Basis of Payment
Design, Installation, Removal, Finishing, Replacement and Temporary; Utilities: Construction Barricades and Forms and all other labor and materials required for work associated with this Section shall be in accordance with the provisions of this specification but shall not be measured for payment separately. All labor and material for this work shall be included under the noted pay items in Section 625.

THE FOLLOWING SECTION IS ADDED:

SECTION 627 – BRICK PAVERS ON MORTARED SETTING BED

627.01 Description
1. Review installation procedures and coordinate this work with other contractors or subcontractors working in the area. Furnish and install temporary barricades and other traffic safety equipment, as required, for public safety and protection of work. Protect adjacent work from damage, soiling, or staining during paving operations.
2. Before starting this work, construct a 20 square foot (approximately) sample panel using bedding depth, materials, pattern, and joints shown on the plans. Construct the sample panel using the range of brick pavers color, texture, and workmanship, proposed for the work. Correct and rebuild sample panel until it is acceptable to the Engineer. Retain the sample panel during construction as a standard for completed paving work.
3. After milling the roadway as shown on the plans, place the mortar setting bed and install clay brick pavers in the areas shown on the plans. This work must be performed by workers with satisfactory records of performance on completed projects of comparable size and quality. Provide references to the Engineer if requested.

627.02 Materials
1. Comply with Standard Specifications for Construction and this special provision. Store granular materials in a well drained area on a solid surface to prevent mixing with foreign materials. Do not use frozen materials or materials mixed or coated with ice or frost.
   A. Pavers – Shall conform to ASTM C 1272 Standard Specification for Heavy Vehicular Paving Brick, for Type R, Application PS and the dimensions shown on the plans. Supply pavers that are uniform in dimension, color and texture based on standards of Highlands Borough. Provide manufacturer’s product data and installation instructions for Brick Paver units.
      1. Provide only sound pavers free of defects that could interfere with proper installation or reduce the service life of the finished work. Minor cracks and minor chipping incidental to methods of manufacture or handling are subject to visual inspection and the Engineer’s acceptance. Excessive cracks and chips will be cause for rejection.
      2. Brick pavers minimum average compressive strength of 10,000 psi.
      3. There must be no efflorescence evident upon visual inspection of the pavers at the project site.
   B. Provide manufacturer’s test data certification, according to the NJDOT latest Quality Assurance Procedures Manual, documenting that the pavers meet these specifications when tested as specified in ASTM C 1272. Conduct freeze – thaw tests not more than 12 months prior to delivery.
   C. Submit a minimum of five full size samples for each paver color. Include the full range of style, size, exposed finish, color, and texture proposed for the work. Color and pattern will be selected by the Engineer based on standards of Highlands Borough.
   D. Protect pavers from damage, chipping, and soiling during delivery and storage. Store pavers off the ground on pallets or wood platforms. Do not use paving units with chips, cracks, voids, discoloration, or other visible defects exceeding the tolerances specified in ASTM C 1272.
2. MORTARED Setting Bed – Conform to section 914 of the standard specifications. Mortared setting bed shall be 3/4" thick after rolling.
3. Paver Joint Filler – Conform to section 908 of the standard specifications.
4. Expansion Joint – Joints between the pavers shall be ½” wide, or will be recommended by the Engineer.

627.03 Construction
1. Mill the area which is shown on the construction plans up to the depth shown.
2. Once the area is milled and cleaned and ready to apply the mortar:
   A. Verify that the surface is dry, uniform, even and ready to support mortar, pavers and imposed loads.
   B. Verify gradients and elevations of the surface are correct.
3. Spread the mortar evenly over the milled surface and screed to ¾ inches. For mortar application:
   A. Sufficient mortar shall be placed to ensure that no delay occurs in laying pavers.
   B. The mortared bedding shall not be subjected to any traffic loading such as vehicular, mechanical or pedestrians.
   C. Ensure that pavers are free of foreign material before installation.
4. Lay the pavers in a pattern based on the Engineer’s guidance. Pavers shall be placed as follows:
   A. Use string lines to ensure that pavers are set true to grade and alignment.
   B. Begin paver installation from a corner, straight edge, base line as shown on the plans or based on the Engineer’s recommendation.
   C. Abut all edges of pavers tightly to adjacent pavement.
   D. The pavers should be laid hand tight.
   E. Maintain straight pattern lines and adjust as necessary.
   F. Make all cuts where pavers do not fit at joints or pavement with masonry saw to leave a clean edge and clean joint. Ragged cuts will not be accepted.
   G. Fill gaps at the edges of the paved area with cut pavers. Cut pavers to be placed along the edge using a masonry saw in such a manner that no segment is smaller than one quarter of a full paver.
   H. Joints between the pavers shall be between 1/16 inch and 1/8 inch wide.
   I. Make a minimum of three phases of a plate vibrator (minimum 5,000 pounds compaction force) to set pavers in mortared setting bed prior to filling joints. Protect pavers from damage from plate vibrator as required. Sweep dry joint filler material into joints until they are completely filled. Lightly fog the joints with water.
   J. Where lateral displacement of the pavers has occurred adjacent to pavement, the cut pavers shall be replaced with new pavers of the correct size to comply with the specified joint widths and the surface shall be re-established.
   K. Protect newly laid pavers at all times.
   L. Repair or replace any damaged work to the original specified condition based on Engineers recommendations.
5. All materials generated by construction work in this section shall be removed at the end of each section of work and the site shall be left in a clean and safe condition under the guidance or Resident Engineer.

627.04 Method of Measurement
Brick Pavers on Mortared Setting Bed will be measured by the square yard.

627.05 Measurement and Payment
All work specified in this section will be paid under

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRICK PAVERS ON MORTARED SETTING BED</td>
<td>SQUARE YARD</td>
</tr>
</tbody>
</table>
DIVISION 700 - ELECTRICAL

SECTION 701 – COMMON PROVISIONS

701.01 Description
THE FIRST SENTENCE IS CHANGED TO:

These provisions are common to all work specified in Division 700.

701.02 Materials and Equipment.
THE WEBSITE IN THE LAST PARAGRAPH IS CHANGED TO:
http://www.state.nj.us/transportation/eng/

701.03 Existing Systems.
THE LAST PARAGRAPH IS CHANGED TO:

Before starting work on existing electrical facilities, the Contractor shall provide notification as specified in Subsection 105.09 and arrange a meeting with the Department if requested to verify the proper operation of the existing facilities. The Contractor shall document the resolutions of any meetings and forward a written summary to the Resident Engineer and all attendees.

701.04 Working Drawings.
THE ENTIRE SUBSECTION TEXT IS CHANGED TO:

Furnish, as specified in Subsection 105.04, certified working drawings for all non pre-approved electrical materials and equipment. Pre-approved materials are available on the web site specified in Subsection 701.02 and the Contractor shall submit a list of pre-approved materials to be used on the Project as specified in Subsection 106.01. Other certified or approval working drawings shall be submitted where specified.

Send at least seven copies of working drawings directly to the Department's Bureau of ITS Engineering. Send one additional copy for each outside testing agency or outside authority involved in the Project and one copy to the Resident Engineer.

701.07 Conduits
THE FOLLOWING IS ADDED TO THE SECOND PARAGRAPH:

Rigid Metallic Conduit, Type CDD, furnished and installed under the existing roadways, shall be installed by the directional boring or drilling method that shall be approved by the Engineer.

The contractor shall be responsible for the protection against surface subsidence, damage or disturbance to existing roadway, adjacent properties and utility facilities from this construction method. Subsurface investigations shall be the responsibility of the contractor. This work, in addition to any soils stabilization that may be required, shall be considered as incidental to the conduit installation. All conduit to be utilized for the installation of fiber optic trunk shall be installed so that the maximum bending angle at any bend location is 45 degrees and the total number of bends in any run between junction boxes does not exceed 180 degrees.

All proposed 2"RNMC shall follow the construction details for 2-2"RNMC for installation in grass areas and also in roadway areas but only install one conduit in the trench. A smooth transition without adding any conduit bends shall be made when changing conduit depth in the grass area to the conduit depth beneath the roadway surface and vise versa.

THE FOLLOWING IS ADDED AFTER THE SEVENTH PARAGRAPH OF THIS SECTION:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Conduit installed under existing sidewalk, concrete driveway, or curb shall be jacked and any concrete damaged shall be replaced (joint to joint). The conduit will be paid under the various CUG conduit items. The open cut method shall not be used. When multiple conduit runs are installed in a common trench under an existing roadway, one conduit shall be classified as type CUR or CDD, and all others shall be classified as type CUG.

THE EIGHTH PARAGRAPH OF THIS SECTION IS CHANGED TO:

Rigid metallic conduit installations mounted on bridges and other structures shall be classified as type CUG expansion joint fittings at all bridge expansion joints and all necessary mounting hardware.

THE FOLLOWING IS ADDED TO THE ELEVENTH PARAGRAPH:

Each conduit and duct entering a junction box in which work is done by the contractor, existing or newly installed by the Contractor, shall be sealed with a properly sized duct plug or conduit rodent proof seal of a one inch layer of "Nixalite" copper rodent repellant mesh shall be packed tightly into the end of the conduit, and around the cables, to a depth of no more than 2". The copper mesh shall be thoroughly wetted with an application of "Ropel" rodent repellant agent. The end of the conduit shall then be sealed, flush with the edge of the conduit or bushing, with standard duct seal. Duct plugs and split plugs, shall be manufactured by Calam, Carlon, or other approved equal manufacturer. All conduit and ducts found in junction boxes in which the contractor performs work, whether occupied or empty, shall have their ends sealed with plugs or sealant as described above.

THE FOLLOWING IS ADDED:

Proposed Conduit Verification

Conduit installation details provided in the plans are only conceptual. The Contractor shall investigate and verify the required installation of the proposed conduit and junction boxes based on conditions in the field and the requirements specified. Test Pits shall be as specified in Subsection 207.04. The Contractor shall notify the Resident Engineer at least 10 days in advance of doing any test pits or other subsurface investigations. Approved 22” X 36” working drawings shall be submitted showing the Contractor's proposed layout, including resolution of any conflicts.

701.09 Junction Boxes

THE FOLLOWING IS ADDED:

At any location, existing or proposed, where communication cables and electrical cables and wire are installed in a common junction box, a physical divider of various types secured with "u" channels shall be installed to separate the communication cables from the electrical power.

701.12 Bonding and Grounding

THE FOLLOWING IS ADDED TO THIS SECTION:

All ITS components shall be grounded in accordance with the requirements of National Electrical Code (NEC). Ground rods shall be one standard size and shall be installed in accordance with the requirements of national electrical code and by methods approved by the Engineer. Ground rods shall include a No. 6 AWG bare copper conductor and ground clamps. Where space is available, multiple shorter ground rods may be installed rather than attempt to install one long rod. The installation of two or more ground rods shall be connected in parallel to reduce the grounding system resistance. When two or more vertical-driven ground rods are installed, they should be separated by not less than 6 feet, in accordance with NEC, and at least twice the rod length, to minimize mutual resistance. Ground rods shall only be driven into undisturbed earth or thoroughly compacted fill areas. The ground system resistance-lo-ground shall be measured as the installation is completed, and shall not be higher than 25 Ohms. The ground resistance shall be measured, using a ground tester approved by the Engineer. The measured ground resistance shall be recorded and reported to the Engineer.

701.19 Method of Measurement
THE FOLLOWING IS ADDED:

Junction Box Dividers of various types will be measured by the number of units.

701.20 Basis of Payment

THE FOLLOWING IS ADDED:

<table>
<thead>
<tr>
<th>Pay Items</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>JUNCTION BOX DIVIDERS, TYPE A</td>
<td>UNIT</td>
</tr>
<tr>
<td>JUNCTION BOX DIVIDERS, TYPE C</td>
<td>UNIT</td>
</tr>
<tr>
<td>FOUNDATION, TYPE DMS</td>
<td>UNIT</td>
</tr>
<tr>
<td>¾” RIGID METALLIC CONDUIT, TYPE EXPOSED</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>2” RIGID METALLIC CONDUIT, TYPE EXPOSED</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>3” RIGID METALLIC CONDUIT, TYPE EXPOSED</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>GROUND WIRE, NO. 10 AWG</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>24”X16”X8” STAINLESS STEEL JUNCTION BOX</td>
<td>UNIT</td>
</tr>
<tr>
<td>DUPLEX STANDARD RECEPTACLE</td>
<td>UNIT</td>
</tr>
<tr>
<td>GENERAL PURPOSE 10KVA TRANSFORMER</td>
<td>UNIT</td>
</tr>
<tr>
<td>PANELBOARD</td>
<td>UNIT</td>
</tr>
<tr>
<td>ELECTROMECHANICAL TIME SWITCH</td>
<td>UNIT</td>
</tr>
<tr>
<td>60 AMP CIRCUIT BREAKER</td>
<td>UNIT</td>
</tr>
<tr>
<td>3” RIGID METALLIC CONDUIT, TYPE CDD</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>1 ½” RIGID METALLIC CONDUIT, TYPE CUG</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>2” RIGID METALLIC CONDUIT, TYPE CUG</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>3” RIGID METALLIC CONDUIT, TYPE CUG</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>4” RIGID METALLIC CONDUIT, TYPE CUG</td>
<td>LINEAR FOOT</td>
</tr>
</tbody>
</table>

As specified in Subsection 109.02 all payment to complete the work specified is included in the items in the Proposal covered by this Section, unless payment is specified otherwise.

SECTION 703 – HIGHWAY LIGHTING

703.02 Materials and Equipment

2. Lighting Standard Assemblies.

THE FOLLOWING IS ADDED TO THIS SECTION:

Lighting Standard Bollard Assemblies, Type L-R-B shall consist of a bollard with the following details:

Bollard: CANDB1-70HPS-RR3LD-240-COLTX-LMS 48913M

Description of Components:

Hood: Shall be made from cast aluminum 356, mechanically assembled.
Guard: Shall be made from cast aluminum 356, composed of four .840” (21mm) outside diameter rods mechanically assembled to the housing.
Optical System: (RR3MD), I.E.S. type III (asymmetrical) with deflector covering 165 deg. Round prismatic borosilicate glass thermo-resistant refractor. The optical system shall be mechanically assembled on the luminaire.
Ballast: High power factor of 90%. 240 volts. Lamp starting capacity -40F(-40C) degrees. Assembled on a unitized removable tray with quick disconnect plug.
Access-Mechanism: Two screws integrated on the housing offers access to the inside of the luminaire and to the lamp.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY

Page 295
Hardware: All exposed screws will be in stainless steel type 316L. All seals and sealing devices are made and/or lined with EPDM and/or silicone.

Finish: Textured color to be advised NJDOT approved (COLTX). Application of a polyester powder coat paint. (4 mils/100 microns). The chemical composition provides a highly durable UV and salt spray resistant finish in accordance to the ASTM-B117-73 standard and humidity proof in accordance to the ASTM-D2247-68 standard.

Series: CANDB1-BCL Bollard candela 1 head only (L)
Lamp: 70HPS 70 Watt High Pressure Sodium (ANSI Code S62)
Optical System: RR3LD, I.E.S. type III (asymmetrical) with deflector covering 165 degrees.
Ballast: 240 Volts
Color: COLTX Textured Standard Color.

Construction Details: As shown on Contract Drawings.

**703.03 Method of Measurement.**

THE FOLLOWING IS ADDED TO THIS SECTION:

“Bollard” Assembly will be measured by number each.

**703.04 Basis of Payment.**

THE FOLLOWING PAY ITEMS ARE ADDED:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIGHTING ASSEMBLIES, TYPE L-R-B</td>
<td>UNIT</td>
</tr>
<tr>
<td>MAINTENANCE LIGHTING ASSEMBLIES</td>
<td>UNIT</td>
</tr>
<tr>
<td>NAVIGATIONAL LIGHTING ASSEMBLIES</td>
<td>UNIT</td>
</tr>
</tbody>
</table>

**SECTION 705 – SIGN LIGHTING**

**705.01 Description**

THE LAST PARAGRAPH IS CHANGED TO:

The above ground installation consists of sign luminaries with lamp, Lumi Trak lighting maintenance system, meter cabinets, flexible and rigid conduit, fittings, wire, sign service cabinet with control equipment, conduit, and wire to nearest junction box.

**705.02 Materials and Equipment**

THE FIRST SENTENCE IS CHANGED TO:

Sign lighting assemblies shall consist of fixtures, conduits, fittings, wire and wiring, sign service cabinet, Lumi Trak lighting maintenance system, hardware, bonding and grounding, painting, testing, sign tag indicating sign structure number and all other equipment and material necessary for sign illumination.

THE FOLLOWING IS ADDED:

Lumi Trak lighting maintenance system is available from manufacturer’s representative Metro Tech Sales at (201) 529-0909 or from the manufacturer at the following web site: [http://www.lumitrak.com/](http://www.lumitrak.com/). No substitutions are acceptable.

**705.04 Method of Measurement**

THE FIRST SENTENCE IS CHANGED TO:

Sign lighting assembly at each sign support will be measured, and payment will be made per sign lighting assembly per structure on a lump sum basis.

**705.05 Basis of Payment**

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIGN LIGHTING ASSEMBLY, STRUCTURE NO. 1</td>
<td>LUMP SUM</td>
</tr>
<tr>
<td>SIGN LIGHTING ASSEMBLY, STRUCTURE NO. 2</td>
<td>LUMP SUM</td>
</tr>
</tbody>
</table>

**ROUTE 36 OVER THE SHERWSBURY RIVER**
**HIGHLANDS BRIDGE**
**MONMOUTH COUNTY**
SECTION 706 - INTELLIGENT TRANSPORTATION SERVICES FACILITIES

706.01 Description

1. **General**

THE FOLLOWING IS ADDED

The purpose of these specifications is to describe minimum acceptable design and operating requirements.

In general, the work in this project includes but is not limited to:

- Furnishing and installing underground conduits and coaxial cables
- Furnishing and installing CCTV Assemblies with pan, tilt, and zoom (PTZ) camera controls.
- Furnishing and installing one ground-mounted DMS Assemblies with DMS controls, also referred-to as Ground Mount Dynamic Message Sign
- Furnishing and Installing two walk-in type, cantilevered DMS Assemblies with DMS controls, also referred-to as Walk-In Dynamic Message Sign
- Furnishing and installing communication cabinets, communications and electrical equipment
- Installing and furnishing conduits, power, ground wires, coaxial cables, fiber optic cables, jumper cables, communication cables and modems, junction boxers, meter cabinets, and foundations and all other equipment as required.,
- Installing and furnishing Center Control Equipment at the TOCS-Traffic Operations Center, South.
- The contractor shall apply for all electric and communications services on Department furnished forms in order to make the system operational. The contractor shall pay all costs for the services until the project has reached Substantial Completion. The NJDOT contact for communication service accounts in New Jersey is (609)-530-3659; 1035 Parkway Ave. CN600, Trenton, NJ 08625.
- Assuring all installed components can communicate with TOCS’s “On-Time” system using Cable TV communications.

ITS Contact:

The corporation controlling Cable TV and its local representative for ITS are as listed below:
Lino Goncalves
Technical Field Operation Supervisor
403 South Street
Eatontown, NJ 07724
Desk: 732-935-5483
Fax: 732-542-7753
Cell: 732 299 2980

Contact for Electric, JCP&L, may be found in Section 105.09

For all ITS devices installed under this project, the contractor shall collect and determine the required information and shall provide the State with an electronic file, Excel or Access based, of an As-Built Inventory Report listing the following: all make/model/serial number/manufacturer details, GPS coordinates, name of installer, date installed, type of connection (Cable), Internet address, Size Dimension (Height, Length, Depth), support structure type, and Milepost. For DMS’s, the contractor shall also provide direction of traffic served.

2. **Manufacturer qualifications:**
• Must have been in the business of manufacturing State Highway or Interstate Highway, permanently mounted, overhead, walk-in LED DMS, that are used to manage vehicular roadway traffic, for minimum of five (5) continuous years preceding the contract bid date.
• Final inspection and acceptance of equipment shall be made after installation at the designated location as shown on the plans, unless otherwise specified herein.

706.02 Material and Equipment

THE FOLLOWING IS ADDED:

Material and Equipment supplied for this project shall confirm to applicable NTCIP requirements and shall be compatible with operations for the existing material and equipment, control and software located at the Traffic Operations Centers. In order to verify compatibility with the control systems now in place at the Traffic Operations Center, South the contractor shall contact Mr. Wayne Wayland of Control Technologies, Inc. (CTI) AT 540 899 7666. Systems will not be accepted by the Department that do not function with the “ON-TIME” control system or require any software modifications to those systems in order to be compatible.

The equipment furnished by the contractor shall consist of new hardware and licensed copies of original equipment manufacturer software.

1. All Dynamic Message (DMS) Sign Assemblies, including Ground Mount and Walk-In types

A. System Components
These specifications describe major DMS system components, including:
• DMS
• DMS sign controller
• Sign controller enclosures
• DMS control software
• NTCIP communications protocol

B. System Requirements
The Specifications also address other key DMS requirements:
• DMS manufacturer qualifications
• Product testing
• Product documentation

C. General Specifications
Dynamic Message Signs (DMS’s) shall be full matrix, capable of displaying multiple lines of amber text with multiple characters per line. All materials furnished, assembled, fabricated or installed under this item shall be new, corrosion resistant and in strict accordance with the details shown in the plans and as detailed in this specification. All major components shall be identified with a metal plate containing the serial number. The Walk-In Dynamic Message Sign (Walk-In DMS shall be a walk-in access dynamic message sign (DMS). The Ground Mount Dynamic Message Sign (Ground Mount DMS) shall be a Ground Mount dynamic message sign (DMS).

D. Standards
Dynamic Message Signs shall comply with the following standards. If no revision date is specified, the most recent revision of the standard applies.

i. Environmental Resistance – The DMS housing shall be designed to comply with type 3R enclosure criteria as described in NEMA Standards Publication 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum)

ii. Radio Frequency Emissions – All equipment shall be designed in accordance with Federal Communications Commission (FCC) Part 15, Subpart B as a “Class A” digital device.

iii. Maintenance Access and Safety – The DMS equipment provided shall be compliant with all relevant OSHA requirements.

v. Structural Integrity – The DMS housing shall be designed and constructed to comply with all applicable sections of AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals, Fourth Draft, 2001, as well as the fatigue resistance requirements of NCHRP Report 412, Fatigue-Resistant Design of Cantilevered Signal, Sign, and Light Supports.

2. Dynamic Message Sign Controller

A. Materials and Construction
This section describes the minimum specifications for the Dynamic Message Sign (Walk-In and Ground Mount) controllers and auxiliary control panels to be provided with this contract. Each DMS shall include a sign controller, auxiliary control panel, and associated equipment.

1. General Requirements:
This section describes the minimum specifications for the dynamic message sign (DMS) controllers and auxiliary control panels to be provided with this contract. Each DMS shall include a sign controller, auxiliary control panel, and associated equipment. The vendor shall provide all the materials, software, and services necessary to install DMS controllers, auxiliary control panels, and associated equipment that fully comply with the functional requirements specified herein, including incidental items that may have been inadvertently omitted.

Each DMS shall be controlled and monitored by its own sign controller. The sign controller shall be a stand-alone microprocessor-based system, which does not require continuous communication with DMS Central software in order to perform DMS control functions.

The sign controller shall meet the following operational requirements:

(a) Communicate using the NTCIP protocol
(b) Contain memory for storing changeable and permanent messages, schedules (which may alternatively be stored and managed in the Central controller), and other necessary files for controller operation
(c) Include a front panel user interface with LCD or equivalent and keypad for direct operation and diagnostics as described herein
(d) Contain a minimum of three (3) RS232 communication port
(e) Contain a minimum of one (1) Ethernet port
(f) Contain a built-in or external Hayes-compatible dial up modem
(g) Contain DMS-specific control firmware (embedded software) that shall monitor all external and internal sensors and communication inputs and control the display modules as directed by external control software and the front panel interface. NTCIP shall be natively supported in the DMS controller. External protocol converter or translator devices are not allowed.

2. Controller Location:
The sign controller and associated communication equipment shall be installed in one of the following locations as specified in Contract Documents:
(a) Inside a ground-mounted control equipment cabinet located near the sign
(b) Inside the DMS housing
(c) Inside a pole-mounted control equipment cabinet attached to the DMS support structure

3. Environmental:
The sign controller shall meet the environmental requirements defined in NEMA Standards Publication TS 4, Hardware Standards for Dynamic Message Signs (DMS), with NTCIP Requirements.
4. Mechanical and Electrical:
The sign controller shall meet the following electrical and mechanical requirements:
(a) Mount in a standard EIA 19-inch (480 mm) equipment rack or shelf with a maximum 4U space requirement
(b) Weigh no more than 10 pounds, including its enclosure
(c) Consume no more than 30 watts of power
(d) Powered by an internal regulated DC power supply capable of operating on 120VAC 60Hz

5. Operational Requirements;
Front Panel User Interface:
The sign controller’s front panel shall include a keypad and LCD. These devices shall be used to perform the following functions with the sign controller and DMS:
(a) Monitor the current status of the sign controller, including the status of all sensors and a monochromatic WYSIWYG representation of the message visible on the display face
(b) Perform diagnostics testing of various system components, including pixels, power systems, sensors.
(c) Activate messages stored in memory
(d) Configure display parameters, including display size and colors
(e) Configure communications port settings and NTCIP options

Memory:
The sign controller shall have non-volatile electronically changeable memory. This memory shall be formed by flash or battery-backed static RAM integrated circuits that retain the data in memory for a minimum of 30 days following a power loss. This changeable memory shall be used to store messages and schedules (which may alternatively be stored and managed in the Central controller). The controller memory shall be capable of storing a minimum of 100 changeable messages in non-volatile RAM.

Internal Clock:
The DMS sign controller shall contain a computer-readable clock with solid state non-volatile memory or that has a battery backup circuit. The battery shall keep the clock operating properly for at least 30 days without external power, and the clock shall automatically adjust for daylight savings time and leap year using hardware, software, or a combination of both. The clock shall be set electronically by the sign controller microprocessor and shall be accurate to within one (1) minute per month.

6. Communication Modes:
All remote communication ports shall be NTCIP-compatible as defined in the “Requirements for NTCIP Compatibility” section of these specifications. The DMS sign controller shall be able to receive instructions from and provide information to a computer containing DMS control software using the following communication modes:
(a) Remotely via direct, dial-up, cable, DSL, and wireless communications with a remotely located computer. The system communications backbone, as well as all field modems or signal converters, shall provide the DMS sign controller with both an RS232 signal and Ethernet signal.
(b) Locally via direct connection with a laptop computer that is connected directly to the sign controller using any of the following connections: an RS232 null modem connection and an Ethernet connection.

Serial Communication Ports:
The DMS sign controller shall contain a minimum of three (3) RS232 communication ports. These ports shall support multiple communication interfaces, including, but not limited to, direct null-modem (for local laptop control), dial-up, cable, DS, wireless and leased-line modems, radio systems, cellular modems, and fiber optic modems. The RS232 ports shall all have standard DB9M connectors.

The baud rate, connection type, and NTCIP communication protocol shall be configurable. Each port must support all typical serial baud ranging from 1200 to 115,200 baud. All three ports shall be capable of supporting the following sub network profiles: NTCIP 2101 (PMPP) or NTCIP 2103 (PPP). They shall also be capable of supporting NTCIP 2201 (Null) and NTCIP 2202 (Internet) transport profiles. Only one each of the transport and sub network profiles shall be active at any time on each port.
Ethernet Port:
The DMS sign controller shall contain a minimum of one (1) 10/100Base-T Ethernet communication port. This port shall be available for optional use for communicating from the central control system to the DMS sign controller when an Ethernet network is available. The Ethernet port shall have a standard RJ45 connector.

Communications on the Ethernet port shall be NTCIP-compatible using the NTCIP 2202 Internet transport profile and the NTCIP 2104 Ethernet sub network profile. This shall permit the controller to be operated on any typical Ethernet network using the TCP/IP and UDP/IP protocols.

Dial-Up Modem Communication Port:
The DMS sign controller shall include one (1) built-in Hayes-compatible dial-up modem. The modem port shall have a standard RJ11 connector.

This modem shall be configured to support either the NTCIP 2101 (PMPP) or the NTCIP 2103 (PPP) sub network profile. The following transport profiles shall also be available for configuration: NTCIP 2201 (Null) and NTCIP 2202 (Internet). Only one each of the transport and sub network profiles shall be active at any time on the port.

The modem shall be configurable to support both incoming and outgoing calls as supported by NTCIP. The modem shall support a minimum communication speed range from 1200 baud to 5600 bauds. The modem shall support the following protocols at a minimum: Hayes-compatible “AT” command set, MNP5, MNP10, and V.42bis.

CDMA Wireless Modem:
One rugged CDMA wireless modem shall be provided in NEMA 4X enclosure as approved by the sign manufacturer, CDMA network provide, the Engineer for wireless communications between sign in the field and remote monitoring location. The wireless modem shall be located inside the controller enclosure if approved by the Engineer. The wireless modem shall be fully supported by all applicable NTCIP standards.

Controller Addressing:
The DMS sign controller shall use whatever addressing scheme is appropriate for the NTCIP network types used for communications. The controller addressing shall be configurable through the front panel user interface.

NTCIP 2101 (PMPP) networks shall be configured with an address in the range 1 to 255 with a default address of 1. NTCIP 2104 (Ethernet) networks shall use a static IP address. Both the IP address and subnet shall be configurable. NTCIP 2103 (PPP) networks shall not require network addressing.

Transient Protection:
The RS232 and Ethernet communication ports in the DMS sign controller shall be protected with surge protection between each signal line and ground. This surge protection shall be integrated internally within the controller.

A series/parallel two-stage suppression device shall protect the modem communication port from over-voltage and over-current conditions. This surge protection shall be integrated internally within the controller.

7. DMS Control Outputs:
The DMS sign controller shall transmit and receive data packets to and from the DMS via dedicated fiber optic cables. Copper cables may be used if the controller is located within the sign housing. This network shall communicate with all sensors, drivers, and other devices utilizing a CAN (controller area network) bus network running throughout the DMS.

Data transferred shall include pixel states, sensor values, and I/O readings from various devices, such as door sensors and power supply monitors. Pixel data shall include the states to be displayed on the sign face as well as diagnostic data retrieved from the LED drivers.

Message Presentation on the DMS Display Matrix:
The DMS controller shall have the ability to display messages on the DMS display face. The sign controller shall control the LED drivers in a manner that causes the desired message to display on the DMS sign. At a minimum, the sign controller shall support the following features as described in the DMS specification:
(a) Display of alpha numeric characters, including letters, numbers, and punctuation
(b) Selection of particular character font’s style
(c) Horizontal alignment of text on the display, including left, center, and right justification
(d) Vertical alignment of text on the display, including top, middle, and bottom justification
(e) Adjusting the spacing horizontally between characters or vertically between lines of text
(f) Alternating between pages of a multiple-page message
(g) Display of graphic bitmaps of various sizes ranging to very small to the size of the entire DMS matrix

Message Effects:
The DMS shall be able to display messages using the following types of effects:
(a) Static Message – The selected message is displayed continuously on the face until the sign controller blanks the sign or causes the display of another message.
(b) Flashing Message – All or part of a message is displayed and blanked alternately at rates between 0.1 seconds and 9.9 seconds. The flash rate is user programmable in increments of 0.1 seconds.
(c) Scrolling Message – The message moves across the display face from one side to the other. The direction of travel is user selectable as either left-to-right or right-to-left.
(d) Multiple-Page Message – A message contains up to six different pages of information, with each page filling the entire pixel matrix. Each page’s display time is user programmable from 0.1 seconds to 25.5 seconds, and adjustable in increments of 0.1 seconds.

Message Activation:
Messages shall be activated on a DMS in three ways:
(a) Manual – An operator using the front panel LCD/keypad interface or NTCIP-compatible control software manually instructs a particular message to be activated.
(b) Schedule – The internal time-based scheduler in the DMS may be configured to activate messages at programmable times and dates. Prior to activation, these messages and their activation times and dates shall be configured using the control software. (Alternatively, schedules be stored and managed in the Central controller).
(c) Events – Certain events, like a power loss, may trigger the activation of pre-configured messages when they occur. These events must be configured using the control software.

A displayed message shall remain on the sign until one of the following occurs:
(a) The message’s duration timeout expires.
(b) The controller receives a command to change the message.
(c) The controller receives a command to blank the sign.
(d) The schedule stored in the controller’s memory (or stored and managed in the Central controller) indicates that it is time to activate a different message.
(e) A special event, such as a loss of communication, occurs that is linked to message activation.

It shall be possible to confer a “priority” status onto any message, and a command to display a priority message shall cause any non-priority message to be overridden.

Schedule Activation:
The DMS sign controller shall support the activation of messages based on a time/date-based schedule, stored either in the sign controller, or in the Central controller). The format and operation of the message scheduler shall be per the NTCIP 1201 and NTCIP 1203 standards.

Display of Alphanumeric Text:
The DMS sign controller shall support the storage and use of a minimum of twelve (12) font sets with which messages can be formatted and displayed. Each font shall support up to 255 characters. All text font files shall include the following characters:

The letters “A” through “Z”, in both upper and lower case
(a) Decimal digits “0” through “9”
(b) A blank space
(c) Eight (8) directional arrows

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
The DMS supplier shall provide the DMS controller with the following fonts preinstalled. The controller shall support changing or replacing these fonts from the central software using NTCIP.

<table>
<thead>
<tr>
<th>Font Name</th>
<th>Character Height</th>
<th>Character Width</th>
<th>Variable or Fixed</th>
<th>Stroke Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>7x4</td>
<td>7</td>
<td>4</td>
<td>Variable</td>
<td>Single (1)</td>
</tr>
<tr>
<td>7x5</td>
<td>7</td>
<td>5</td>
<td>Fixed</td>
<td>Single (1)</td>
</tr>
<tr>
<td>7x6</td>
<td>7</td>
<td>6</td>
<td>Variable</td>
<td>Double (2)</td>
</tr>
<tr>
<td>Graphic 7</td>
<td>7</td>
<td>N/A</td>
<td>Variable</td>
<td>N/A</td>
</tr>
<tr>
<td>8x4</td>
<td>8</td>
<td>4</td>
<td>Variable</td>
<td>Single (1)</td>
</tr>
<tr>
<td>8x6</td>
<td>8</td>
<td>6</td>
<td>Variable</td>
<td>Double (2)</td>
</tr>
<tr>
<td>9x6</td>
<td>9</td>
<td>6</td>
<td>Variable</td>
<td>Double (2)</td>
</tr>
<tr>
<td>11x7</td>
<td>11</td>
<td>7</td>
<td>Fixed</td>
<td>Double (2)</td>
</tr>
<tr>
<td>14x8</td>
<td>14</td>
<td>8</td>
<td>Fixed</td>
<td>Double (2)</td>
</tr>
<tr>
<td>14x10</td>
<td>14</td>
<td>10</td>
<td>Variable</td>
<td>Triple (3)</td>
</tr>
<tr>
<td>16x8</td>
<td>16</td>
<td>8</td>
<td>Variable</td>
<td>Double (2)</td>
</tr>
<tr>
<td>16x10</td>
<td>16</td>
<td>10</td>
<td>Variable</td>
<td>Triple (3)</td>
</tr>
</tbody>
</table>

Display of Graphic Images:
The DMS control software shall support the inclusion of graphics in messages. If the NTCIP 1203 v2 standard has not reached a “recommended” or “approved” state by the time of contract award, the vendor shall support graphics using manufacturer-specific objects and MULTI tags.

If a vendor-specific means of supporting graphics is used, the vendor shall commit to provide NTCIP 1203 v2 firmware updates at no cost to the Department. These updates shall include all current requirements of these specifications and also standard graphics support. The vendor shall install the updates no later than six months after the NTCIP 1203 v2 standard reaches the “approved” state.

8. DMS Intensity Control:
The DMS controller shall provide means to change the brightness of the display matrix manually or automatically. The manual control will allow the user to select one of at least 100 intensity levels, which will be communicated to the LED drivers in the DMS. The brightness shall remain at that level until the user changes the level or sets the controller to automatic mode.

The automatic intensity control mode will monitor the ambient light sensors of the DMS and will use a mathematical algorithm to automatically select one of the 100 or more intensity levels. The intensity level will then be transmitted to the LED drivers in the DMS. The algorithm used to calculate the intensity level shall be determined by the manufacturer and tested under real-world lighting conditions.

The intensity control mode, manual or automatic, shall be settable via NTCIP using the control software or via the front panel interface. The manual brightness level shall be settable via the software or front panel. The mode and brightness level shall be monitored from both the software or front panel interfaces.

9. System Status Monitoring and Diagnostic Testing:
The DMS controller shall be capable of monitoring the status of many of the DMS components and subsystems in real-time and/or manual modes, depending on the component or system. The following sections detail the status and diagnostic information that shall be provided by the controller. All of this status and diagnostic data shall be available via the front panel LCD screen and shall be transmitted via NTCIP to control software upon request.

Message Display Status:
The DMS controller shall be capable of monitoring and displaying the currently active message (if any) on the controller’s front panel LCD display. This display shall be in a WYSIWYG format.
True Message Display Verification (TMDV):
The TMDV shall be performed during both message downloads and sign poll from a central controller or laptop computer. The TMDV shall perform a real-time read of the displayed message and shall return the state of each pixel to the central controller as it is currently displayed to the motorist, including any errors. This shall allow the central controller operator to see what is visibly displayed to the motorist on an individual pixel basis. During a TMDV, the state of each pixel (full-on, half-on or off) in the sign shall be read by the sign controller to allow the central controller or laptop computer to show the actual message, including static, flashing and alternating messages, that is visibly displayed on the sign in a WYSIWYG format. This pixel reading shall take place while a message is displayed on the sign without disturbing the message in any way. Any flashing, flickering, blinking, dimming, or other disturbance of the message during this pixel read shall be cause for rejection of the sign. The TMDV shall be an actual real time read of the current flowing through each string of LED’s at the time of the associated sign poll or message download and shall not be accomplished by simulating errors based on the last pixel test.

LED Pixel Testing:
Upon command from either the front panel control interface or via NTCIP from remote control software, the sign controller shall direct all of the LED modules to perform diagnostic tests of all their pixels. The controller shall then collect and report the results of the pixel testing. Each pixel test shall not take more than five (5) seconds to complete either locally or remotely.

The controller shall also be capable of automatically detecting in real-time the status of each of the display’s pixels and reporting their on/off status. This monitoring shall take place without interfering with the display of data on the DMS face.

Power Supply Operation:
The sign controller shall monitor and report the functional status of regulated DC power supplies located in the DMS by monitoring diagnostic outputs located on the supplies. The controller shall monitor the output voltage of each power supply and the status of each output fuse. The power supply voltages shall be measured to the nearest tenth of a volt and the fuse status shall be indicated as pass or fail.

Door Status:
If the DMS or control equipment cabinet is equipped with access doors and sensors to monitor their open status, the controller shall monitor the status of those doors.

Sign Enclosure Air Flow:
The controller shall monitor and report the sign enclosure air flow status.

Environmental Conditions:
The DMS controller shall monitor the readings of all light, temperature, and humidity sensors installed in the DMS housing.

10. Error Notification:
The DMS sign controller shall be capable of automatically informing a maintenance operator (via the local LCD panel) and a central control system (via NTCIP communication) of the occurrence of important events and subsystem failures.

All major component and subsystem errors shall be indicated on the controller’s LCD front panel.

The controller shall be capable of sending event notifications to the central control system via SNMP “traps” as allowed by NTCIP. When one of these events occurs, the sign controller shall create a data packet for transmission to the central controller that shall contain details about the event. The transmission of traps shall be governed by the NTCIP standards. The controller shall be configurable to enable or disable the transmission of traps for each event or error type. This configuration shall include the automatic initiation of these traps, including establishing telephone modem connections if appropriate, when the NTCIP network permits transmission initiation by the sign controller.

The following sections list errors and events that the controller shall report as defined above.
Over Temperature Shutdown:
The DMS controller shall continuously monitor the DMS housing’s temperature sensors and shall automatically shut down the DMS if the internal cabinet temperature exceeds a safety threshold. This threshold shall have a default value of +140°F (60°C) and shall be configurable at the controller.

If the temperature approaches the threshold the controller shall reduce the brightness of the sign face. If the temperature continues to increase and exceeds that threshold, the controller shall trigger a warning notification event and blank the face of the sign. The sign face shall remain blank until the temperature begins to drop. As the temperature drops, the controller shall gradually increase the brightness of the display face, eventually returning to full brightness.

The sign controller shall employ an algorithm to control the above brightness reductions and increases utilizing hysteresis to ensure that the display face does not visibly flicker as the temperature changes.

The event notifications sent for over temperature situations shall include visual indication on the controller’s front panel LCD, as well as a trap notification sent to the central control system.

Controller Restart:
When the DMS controller detects that it has been restarted due to a manual reset or error condition, it shall send a trap notification to the central system. It shall also automatically activate the NTCIP reset message. The controller shall be equipped with a manually resettable counter to track the number of controller resets since the last time counter was reset.

Power Loss:
When the DMS controller detects that it has lost power, it shall automatically indicate that on the front panel LCD. It shall also send a trap notification to the central system and activate the NTCIP power loss message.

Power System Failure:
The DMS controller shall automatically monitor the major power systems in the sign and detect when one of them has failed. These failures shall be reported on the front panel LCD and transmitted to the central system.

Door Opened:
When the sign controller detects that one of the sign cabinet or control cabinet doors has been opened, it shall transmit a trap to the central system indicating which door has opened.

Communication Loss:
The DMS controller shall monitor the frequency of communication packets from the central system. If the controller detects that communication has not occurred between the controller and central system for longer than a configurable timeout, then the controller shall automatically activate a communication loss message as defined by NTCIP. This communication loss message shall be configurable as allowed by NTCIP.

11. Auxiliary Control Panel:
The DMS shall include an auxiliary control panel that shall provide a secondary user interface panel for DMS control, configuration, and maintenance. The auxiliary control panel shall be housed inside the DMS enclosure and shall be equipped with one NTCIP compatible RS232 communication port from controller with USB converter for remote communications, through a laptop computer, to the DMS controller.

One hinged shelf which folds from inside the cabinet and is suitable for a laptop computer to rest on shall be provided.

The auxiliary control panel shall include a vendor recommended communications cable, to interface to the DMS controller, capable of operating up to 1000 feet from the DMS controller.

B. Control Equipment Cabinet
This section describes the requirements of the metal cabinet used to house the sign controller and associated equipment separately from the sign cabinet. The controller cabinet shall be provided with the manufacturer recommended
communications cabled for communications between DMS controller and DMS. The controller shall be mounted inside a separate ground controller cabinet as specified in the Contract Documents.

1. Ground-Mounted Controller Cabinet:
The ground-mounted control equipment cabinet shall be an NJDOT P-type cabinet. It shall be designed to mount on a concrete pad near the DMS. The cabinet shall enclose the sign controller, panel board, 120 VAC electrical outlets, and remote communication devices, such as a modem.

General Specifications:
The controller cabinet weight shall not exceed 200 pounds (45.5 kg) when the cabinet is empty.

Cabinet Construction:
The cabinet shall protect all internal components from rain, ice, dust and corrosion in accordance with NEMA enclosure Type 3R standards, as described in NEMA Standards Publication 250-1997, Enclosures for Electrical Equipment (1000 Volts Maximum).

Internal component hardware (nuts, bolts, screws, standoffs, rivets, fasteners, etc.) shall be fabricated from stainless steel, aluminum, nylon or other durable corrosion-resistant materials suitable for roadway signage applications.

The DMS controller cabinet shall be constructed using 0.125-inch thick aluminum alloy 5052-H32. The exterior of the controller cabinet shall be natural mill-finish aluminum.

Serviceability:
The controller cabinet shall provide safe and convenient access to all modular assemblies, components, wiring and other materials located within the cabinet. All internal components shall be removable and replaceable by a single technician.

The door shall be attached to the cabinet by a full-length stainless steel hinge and mounting hardware. Both doors shall open outward. In the closed position, each door shall latch to a double-flanged door opening with a three-point draw-roller mechanism. The door handle shall be stainless steel. Each door shall have a doorstop to hold the door in the open position. The doors shall each be equipped with a Corbin #2 lock. The #2 Corbin lock shall have a spring loaded dust cover.

A fluorescent lamp shall be located at the top of the controller cabinet to illuminate the cabinet interior. A switch mounted near the front door shall automatically turn on the light when the door is opened.

Electrical Systems:
The cabinet shall contain a power panel board and circuit breakers that meet the following minimum requirements:

(a) Service entrance-rated
(b) Minimum of 12 circuit breaker mounting positions
(c) Short circuit ratings of 22,000 amps and 10,000 amps for the main and branch circuits, respectively
(d) UL listed

The panel board shall be mounted in the equipment rack.
The cabinet shall contain a utility outlet circuit consisting of a minimum of two (2) 15-A NEMA 15-R, 120 VAC duplex outlets, with ground-fault circuit interrupters. The outlets shall be mounted inside the cabinet and located near the load center.

The cabinet shall include one (1) earth ground lug that is electrically bonded to the cabinet. The lug shall be installed near the power entrance.

2. Uninterruptible Power Supply (UPS):

A UPS shall be provided to allow the sign controller to notify the central controller when an improper power condition at the DMS persists for longer than a user selectable “short power loss time”.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
The UPS shall meet the following minimum specifications:

(a) Line Transient Protection: Passes ANSI/IEEE C.62.41/C.62.45 Cat A&B
(b) Safety Compliance: Satisfies US / CSA En50091-1 regulations.
(c) Capacity: Must be able to operate controller & modem for 10 minutes
(d) Voltage Nominal: 120VAC
(e) Voltage Range: 92-135 VAC
(f) Transfer time: <150 ms typical
(g) Battery: Sealed, maintenance-free lead acid
(h) Battery recharge time: 2-8 hours; must be temperature-compensated
(i) Over current protection: UPS automatically shutdown if overload exceed
   i. 10% of nominal for 3 minutes.
(j) Communications: RS-232 Interface (monitor, control and calibrate), DB-9 connection
(k) Front panel display indicators: Fault, Test, Low Battery, On Battery, On Line
(l) Operating temperature range: -34° F to +165°F (-37°C to +74°C)

(NOTE: The UPS shall be mounted in a manner to meet the temperature range requirements of the DMS as outlined in this specification [-34°F to 165°F (-37°C to 74°C)] with a relative humidity of up to 100% condensing).

Environmental Systems:
One (1) thermostatically controlled 100 cfm exhaust fan shall be mounted near the top of the control cabinet.

Filtered air intake ports shall be located on the bottom third of each access door. The fan and air filters shall be removable and replaceable from inside the cabinet.

3. Pole-Mounted Controller Cabinet:
All specifications of Section 5.1 DMS controller cabinet shall apply to pole mounted controller cabinet unless otherwise noted in this sub section.

The pole-mounted control equipment cabinet shall be a 336S-type cabinet. It shall be provided with two (2) mounting brackets suitable for use with pole-mount straps.

The cabinet shall enclose the sign controller, panel board, 120 VAC electrical outlets, and remote communication devices, such as a modem.

General Specifications:
The pole-mounted controller cabinet shall be approximately 46” (1,168 mm) high by 24” (610 mm) wide by 20.25” (514 mm) deep. The front-to-back cabinet dimensions shall not exceed 26” (660 mm) at its widest point, including the door handles, louvers and roof overhang.

The controller cabinet weight shall not exceed 200 pounds (45.5 kg) when the cabinet is empty.

Serviceability:
One (1) vertically hinged door shall be mounted on the cabinet for interior access. The door shall be located on the front face of the cabinet. The door opening shall not be less than 36” (914 mm) high by 21” (533 mm) wide. The door opening shall be sealed with a 0.5” x 2” closed cell foam gasket.

C. DMS Control Software
This section describes the minimum specifications for the DMS sign control software. The contractor shall provide all software, software media, licenses, and documentation necessary to install and operate a Dynamic Message Sign (DMS) control system that fully complies with the functional requirements herein, including incidental items that may have been inadvertently omitted.

1. General Specifications:
DMS control software shall:
(a) Operate on desktop and laptop computers with Intel® Pentium® III or better processors and Microsoft® Windows XP Professional™ installed
(b) Provide a user-friendly multi-color graphical user interface
(c) Be written as a native 32-bit Windows® program using Microsoft-certified software development tools (compilers, etc.)
(d) Control a network of at least 250 Dynamic Message Signs
(e) Utilize a client-server architecture with the server handling sign communications and the clients connecting to the server via local and wide area networks (LAN and WAN)
(f) Support DMS communications via any combination of dedicated hardwired serial network, fiber-optic network, dial-up telephone lines, leased phone lines, cellular telephone, CDMA, GPRS, spread spectrum radio, Ethernet, or other as specified herein
(g) Support DMS control, monitoring, and diagnostic functions as specified herein
(h) Control DMS both remotely from a central location, and locally at the DMS site using a laptop computer
(i) Be accompanied by an easy-to-use software installation utility
(j) Include an operation manual that includes detailed instructions for configuring and using all parts of the software
(k) Contain an on-line help system that includes documentation for every screen or dialog box present in the software. It shall also be context sensitive such that pressing the help button or [F1] key on any screen will launch the help page for that particular screen
(l) Be fully compliant with the communications protocol requirements of the NTCIP standards.

2. Software Security:
DMS control software shall support the creation of user IDs and passwords for up to 100 system users. Only a “System Administrator” shall assign user creation, as well as individual user access rights.

Before a system operator can use the DMS control software, the software shall request a “user name” and user “password.” If the correct user name and password are not provided, access to the software shall be declined.

3. Client-Server Architecture:
The software shall be of a modular design including a server and multiple client modules. The server shall handle all DMS communication and shall store all configuration data, messages, and other data. The client software modules shall send requests to and receive responses from the server over any TCP/IP-based network, including LANs and WANs. Separate clients shall be provided for each of the following software functions:
(a) Shell client that handles user login and logout, as well as launching the other clients
(b) Display control client for controlling DMS messaging, monitoring system status, and performing DMS diagnostics
(c) Message editor client for creating DMS messages
(d) Message scheduler client for creating time and date schedules for activating messages
(e) Administration client for DMS system configuration and administration

4. DMS Control:
The DMS control software shall provide a user interface that presents the system’s DMS in both list and graphical formats. The software shall allow the DMS to be grouped as needed by the administrator.

List and Map Interfaces:
(a) The DMS list shall clearly display the following information about each DMS:
(b) DMS ID number, as “1” through “250”
(c) DMS IP address as required by Department
(d) DMS name, in a descriptive text format
(e) Iconic representation of the type of communication network used for the DMS (i.e. direct or dial-up)
(f) Name and priority level of message file being displayed
(g) Date and time of last communication between the control software and the DMS sign controller
(h) Error and warning status, including pixel errors, power failures, communication error, etc.

The graphical interface shall include the following:
(a) Configurable bitmaps that may be used to show all or parts of the system geographically
(b) Icons for each sign that may be placed anywhere on the map
(c) Visual indicators or Icon color changes to indicate the status of the DMS (i.e., yellow for warnings or red for errors)
(d) Message displayed
(e) Visual indicators or Icon flashes if a message is running on the DMS
(f) Icon View with sign location and message displayed or Sign name is visible if mouse is placed over a DMS icon

Direct Control Operations:
(a) The user interface shall provide a means for users to directly perform the following tasks for each sign:
(b) Send and activate stored messages from the libraries
(c) Libraries to include validation against an “allowed” and “disallowed” list of individual words
(d) Spell check capability of messages
(e) Blank the display
(f) Activate an ad-hoc quick message that is created immediately, not loaded from a library
(g) Send and activate schedules
(h) Retrieve both messages, schedules (if stored in the sign controller), and active libraries from the sign
(i) Perform diagnostics of DMS subsystems, such as power supplies, sensors, etc.
(j) Perform tests of pixels
(k) Monitor the sign’s event log

Polling:
The software shall have a feature to poll all or a set of DMS at predefined intervals or at a specific time-of-day. During this poll, the software shall retrieve the most recent status information from the sign and present it to the user as appropriate in the list and map interfaces.

Scenarios:
The administrator shall have the ability to create scenarios that act like macros or scripts to automate a series of often repeated tasks. These scenarios shall have the ability to perform the following actions:
(a) Send and activate stored messages from the libraries
(b) Blank the display
(c) Send and activate schedules
(d) Perform diagnostics of DMS subsystems, such as power supplies, sensors, etc.
(e) Perform tests of pixels

The scenarios shall be saved to libraries where system operators may activate them through the graphical user interface. The scenarios shall also be scheduled to automatically run at predetermined times and dates.

System Monitoring:
The software shall be capable of monitoring and displaying to the operator the contents of any communications in progress with DMS. The status of all outgoing and incoming data packets shall be visible.

5. Message Creation and Editing:
A DMS system operator shall be able to use the DMS control software to create, edit, name, and store message files.

The message editor GUI shall present a scaled image of the DMS display matrix, including a complete and accurate representation of the display matrix type (full or line) and the number of display pixels. The DMS editor image shall actively show message content in a WYSIWYG format, while a new message is being created or an existing message is being edited.

The message editor shall provide the operator with the ability to program:
(a) The number of pages that the message is to contain (shall be a maximum of six)
(b) Message text
(c) Message graphics, including pixel-by-pixel editing, lines, area fill, block move, etc.
(d) Character font type(s) used to construct the message
(e) The amount of inter-line spacing, measured in pixels
(f) Horizontal message justification on the DMS display matrix including left, center, and right
(g) Vertical message justification on the DMS display matrix including top, middle, and bottom
(h) The type of entry effect, as “static” or “scrolling”
(i) Message page on time and off time
(j) Message scroll rate, if a scrolling message
(k) The flash rate of all or part of a message page
(l) Message priority status

The message editor shall provide a method of incorporating data fields into a DMS message. The following data fields shall be provided:
(a) Time, in 12-hour format
(b) Time, in 24-hour format
(c) Temperature, in degrees Fahrenheit and Celsius
(d) Speed, kilometers per hour and miles per hour (vehicle speed, for DMS sites that contain speed measurement equipment)
(e) Day of week (Monday, Tuesday, etc)
(f) Day of the month (1, 2, …31)
(g) Month of the year (1, 2, …12)
(h) Calendar year, in both two-digit and four-digit formats

The message editor shall provide a user friendly means for the operator to:
(a) Insert, add, or delete, message text
(b) Paste graphics from other programs using the Windows clipboard
(c) Clear the content of the editing page
(d) Save the message file under its existing name or a new name
(e) Delete a message file
(f) Save all new changes

It shall be possible to store message files in both the DMS control computer memory and the DMS sign controller memory.
The system operators shall have the ability to print any message or library of messages.

6. Message Libraries:
DMS control software shall support the creation and storage of message libraries (file directories), which allow the system operator to categorize message files by:
(a) DMS matrix size
(b) Message subject matter
(c) User defined

The library editor shall allow a system operator to:
(a) Create a new library
(b) Store the same message in multiple libraries
(c) Select a message from an existing library and edit the message contents
(d) Search message libraries for messages with specified text in message name or contents
(e) Copy/Paste a message from one library to another
(f) Delete a message file from a library
(g) Rename a library
(h) Delete a library
(i) Save all new changes
(j) Create/delete/rename library subdirectory
(k) Copy/cut/paste messages between subdirectories

The number of messages stored in the control computer shall only be limited by the available disk space. The system shall allow for downloading messages from the control computer for storage in the sign controller.

7. Schedule Creation and Editing:
DMS control software shall support the creation of message schedules, which instruct the DMS sign controller to run specific messages at pre-determined times and dates. Software shall contain an editor, which allows messages to be scheduled via:
(a) Month of the year (January, February, etc.)
(b) Day of the week (Monday, Tuesday, etc)
(c) Day of the month (1, 2, …, 31)
(d) Time of day

The schedule editor shall provide a convenient means for the operator to:
(a) Create a new schedule
(b) Rename an existing schedule
(c) Delete a schedule
(d) Save all new changes

It shall be possible to store schedule files in both the DMS control computer memory and the DMS sign controller memory. (Alternatively, schedules be stored and managed in the Central controller.)

8. Display Fonts:
The software shall support a minimum of twelve (12) fonts. These fonts shall be configurable by the system administrator. The software shall automatically adjust the available fonts in the message editor based on the DMS model configuration.

The software shall include a font editor to allow the operator to create custom fonts. The font editor shall allow the DMS system operator to create new fonts or modify existing fonts. The operator shall have the capabilities to graphically edit each character within a font in a pixel-by-pixel manner.

Any of the fonts provided by the software vendor or created/modified by the administrator shall be downloadable to the DMS.

9. Event Logging:
The software shall include an event logging system that logs all significant system events. Each logged events shall include the following fields at a minimum:
(a) Event ID number
(b) Operator that initiated the event
(c) Time and date that the event occurred
(d) Description of the event (i.e., “Diagnostic Test Performed”)
(e) Source of the event (i.e., DMS sign name)
(f) Additional data relevant to the event (i.e., “Failed pixel: (4, 73)”)  
(g) Text of the message sent

The events logged shall include, but not be limited to, the following:
(a) User login/logout
(b) Failed login attempts
(c) Communication failures
(d) Message and schedule activation or display blanking
(e) Diagnostics test results
(f) Warning events sent from the sign
(g) Other system errors

The system operators shall have the ability to view, sort by category, and print the log file at any time.

10. System Configurations:
The DMS control software shall allow system administrators, and other users with correct security access right, to configure many system parameters and functions. The basic sets of configurable settings include the following:
(a) Sign models and individual signs
(b) Communication networks
(c) System error/warning alarms
(d) User security rights
(e) System maps and sign icon placement
(f) Default system option settings
(g) Default message parameters
(h) Message priority settings

Sign Configuration:
The control software shall be configured with the following parameters:
(a) Sign viewing area height and width (for full-matrix signs)
(b) Number of lines and each line’s height and width (for line-matrix signs)
(c) Color capabilities (i.e., amber, tricolor, full-color, etc.)
(d) Site name
(e) DMS ID number
(f) Network address
(g) Communication parameters
(h) IP address (static)

Communication Settings:
Communication network configuration shall include the ability to configure and modify sign communication networks
with the following parameters:
(a) Network type (i.e., direct serial, dial-up)
(b) Communication port (i.e., COM4)
(c) Baud rate (ranging from 1200 to 115,200)
(d) Hardware handshaking
(e) NTCIP subnet-work and transport protocols
(f) Communication retries and timeouts
(g) IP address (static)

System Alarms:
Configurable settings shall allow the system administrator to determine which of the following events will trigger an
audio and visual (on-screen) alarm:
(a) Communication failure
(b) Priority status conflict
(c) Sign restart
(d) Power supply failure
(e) Door open
(f) Circuit board failure
(g) High temperature

User Administration:
The administrator shall have the ability to add, remove and modify users. The access rights of each user shall be
configurable to allow or deny access to each major software feature.

System Maps:
It shall be possible to configure a number of signs into a group and have them appear on a map within the software. The
administrator shall be able to use the software to select the map, identified as a bitmap file, which can then be imported
into the software. The sign shall have an icon that may be placed anywhere on the map.

Message Editor Defaults:
The message editor shall automatically utilize the following default settings during the creation of new message files:
(a) Pixel spacing between adjacent lines of text
(b) Pixel spacing between adjacent text characters
(c) Display duration of a given message page
(d) Color palette to be used for color-capable signs  
(e) Effect to be applied to text (i.e., static, scrolling, etc.)  
(f) Effect rate, which shall determine the speed of scrolling messages  
(g) Flash rate, which shall determine the speed of flashing messages  
(h) Message priority classification  
(i) Horizontal text justification supporting left, center, or right  
(j) Vertical text justification supporting top, middle, and bottom  
(k) Character fonts  
(l) Shall allow to edit and save changes to message editor default settings

Message Priorities:
User-definable defaults shall allow messages to be assigned a priority classification of:

(a) Emergency  
(b) High  
(c) Normal  
(d) Low  
(e) Minimal

A numeric priority range shall be assigned to each of these five priority classifications. The priority shall allow two different message files to be assigned the same classification, but within that classification, one message can be identified as having higher priority. It shall not be possible to post a lower priority message on a sign with higher priority message already posted and an error message should result from such an attempt. It shall be possible to blank a sign regardless of the posted message priority.

11. Software Used and Reproduction Rights:
The DMS manufacturer shall provide a DMS control software site license with the DMS supplied for this contract. Two (2) copies of the DMS control software shall be provided to the Department on CD-ROM. The engineer shall have the right to request or reproduce an unlimited number of software copies as per Department requirements. the site license shall cover unlimited concurrent client users.

D. NTCIP Conformance
This section describes the minimum specifications for the NTCIP communication capabilities of the DMS controller and DMS control software. The vendor shall provide all the software, firmware, and services necessary to operate a dynamic message sign (DMS) system that fully complies with the NTCIP functional requirements specified herein, including incidental items that may have been inadvertently omitted.

1. References:
These specifications reference standards through their NTCIP designated names. The following list provides the current versions of each of these standards.

Each NTCIP device covered by these project specifications shall implement the version of the standard that is specified in the following table. Refer to the NTCIP library at [www.ntcip.org](http://www.ntcip.org) for information on the current status of NTCIP standards.

<table>
<thead>
<tr>
<th>Document Number and Version</th>
<th>Document Title</th>
<th>Document Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>NTCIP 1101:1996 and Amendment 1</td>
<td>Simple Transportation Management Framework (STMF)</td>
<td>Jointly Approved</td>
</tr>
<tr>
<td>NTCIP 1102 v1.12</td>
<td>Octet Encoding Rules (OER) Base Protocol</td>
<td>Recommended Standard</td>
</tr>
<tr>
<td>NTCIP 1103 v1.15</td>
<td>Transportation Management Protocols</td>
<td>User Comment Draft</td>
</tr>
<tr>
<td>NTCIP 1201:1996 and Amendment 1</td>
<td>Global Object Definitions</td>
<td>Jointly Approved</td>
</tr>
<tr>
<td>NTCIP 1203:1997 and Amendment 1</td>
<td>Object Definitions for Dynamic Message Signs</td>
<td>Jointly Approved</td>
</tr>
</tbody>
</table>
2. Subnet Profiles:
Each serial or modem port on each NTCIP device shall be configurable to support both NTCIP 2101 and NTCIP 2103. Only one of these profiles shall be active at any given time. Serial ports shall support external dial-up, cable and DSL modems.

Each Ethernet port on the NTCIP device shall comply with NTCIP 2104.

The NTCIP device(s) may support additional Subnet Profiles at the manufacturer’s option. At any one time, only one subnet profile shall be active on a given port of the NTCIP device. All response datagram packets shall use the same transport profile used in the request. The NTCIP device shall be configurable to allow a field technician to activate the desired subnet profile and shall provide a visual indication of the currently selected subnet profile.

3. Transport Profiles:
Each serial or modem port on each NTCIP device shall be configurable to support both NTCIP 2201 and NTCIP 2202.

Each Ethernet port on the NTCIP device shall comply with NTCIP 2202.

The NTCIP device(s) shall support additional transport profiles at the manufacturer’s option. Response datagrams shall use the same transport profile used in the request. Each NTCIP device shall support the receipt of datagrams conforming to any of the supported transport profiles at any time.

4. Application Profiles:
Each NTCIP device shall comply with NTCIP 2301 and shall meet the requirements for Conformance Level 1.

An NTCIP device shall support additional application profiles at the manufacturer’s option. Responses shall use the same application profile used by the request. Each NTCIP device shall support the receipt of application data packets at any time allowed by the subject standards.

5. Object Support:
Each NTCIP device shall support all mandatory objects of all mandatory conformance groups as defined in NTCIP 1201 and NTCIP 1203.

Each NTCIP device shall support all mandatory objects in all optional conformance groups required herein. In addition, all optional objects listed in these specifications shall be supported.

The NTCIP device(s) shall support the following optional conformance groups unless otherwise noted in the Contract Documents:

<table>
<thead>
<tr>
<th>Conformance Group</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple Transportation Management Framework (STMF) Application Profile</td>
<td>Jointly Approved</td>
</tr>
</tbody>
</table>

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
The following table indicates objects that are considered optional in the NTCIP standards, but are required by this specification. It also indicates modified object value ranges for certain objects. Each NTCIP device shall provide the full, standardized object range support (FSORS) of all objects required by these specifications unless otherwise indicated below.

<table>
<thead>
<tr>
<th>Object</th>
<th>Reference</th>
<th>Project Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module Table</td>
<td>NTCIP 1201, Clause 2.2.3</td>
<td>Shall contain at least one row with module Type equal to 3 (software)</td>
</tr>
<tr>
<td>Max Time Base Schedule Entries</td>
<td>NTCIP 1201, Clause 2.4.3.1</td>
<td>Shall be at least 28</td>
</tr>
<tr>
<td>Max Day Plans</td>
<td>NTCIP 1201, Clause 2.4.4.1</td>
<td>Shall be at least 20</td>
</tr>
<tr>
<td>Max Day Plan Events</td>
<td>NTCIP 1201, Clause 2.4.4.2</td>
<td>Shall be at least 12</td>
</tr>
<tr>
<td>Max Event Log Config</td>
<td>NTCIP 1201, Clause 2.5.1</td>
<td>Shall be at least 50</td>
</tr>
<tr>
<td>Event Config Mode</td>
<td>NTCIP 1201, Clause 2.4.3.1</td>
<td>The NTCIP Component shall Support the following Event Configuration: on Change, greater Than Value, smaller Than Value</td>
</tr>
<tr>
<td>Event Config Log OID</td>
<td>NTCIP 1201, Clause 2.5.2.7</td>
<td>FSORS</td>
</tr>
<tr>
<td>Event Config Action</td>
<td>NTCIP 1201, Clause 2.5.2.8</td>
<td>FSORS</td>
</tr>
<tr>
<td>Max Event Log Size</td>
<td>NTCIP 1201, Clause 2.5.3</td>
<td>Shall be at least 200</td>
</tr>
<tr>
<td>Max Event Classes</td>
<td>NTCIP 1201, Clause 2.5.5</td>
<td>Shall be at least 16</td>
</tr>
<tr>
<td>Event Class Description</td>
<td>NTCIP 1201, Clause 2.5.6.4</td>
<td>FSORS</td>
</tr>
<tr>
<td>Max Group Addresses</td>
<td>NTCIP 1201, Clause 2.7.1</td>
<td>Shall be at least 1</td>
</tr>
<tr>
<td>Community Names Max</td>
<td>NTCIP 1201, Clause 2.8.2</td>
<td>Shall be at least 3</td>
</tr>
<tr>
<td>Num Fonts</td>
<td>NTCIP 1203, Clause 2.4.1.1.1</td>
<td>Shall be at least 12</td>
</tr>
<tr>
<td>Max Font Characters</td>
<td>NTCIP 1203</td>
<td>Shall be at least 255</td>
</tr>
<tr>
<td>Clause 2.4.1.1.3</td>
<td>The DMS shall support flash “on” times ranging from 0.1 to 9.9 seconds in 0.1 second increments</td>
<td></td>
</tr>
<tr>
<td>Default Flash Off</td>
<td>NTCIP 1203 Clause 2.5.1.1.1.4</td>
<td>The DMS shall support flash “off” times ranging from 0.1 to 9.9 seconds in 0.1 second increments</td>
</tr>
<tr>
<td>Default Background Color</td>
<td>NTCIP 1203 Clause 2.5.1.1.1</td>
<td>The DMS shall support the black background color</td>
</tr>
<tr>
<td>Default Foreground Color</td>
<td>NTCIP 1203 Clause 2.5.1.1.2</td>
<td>The DMS shall support the amber foreground color</td>
</tr>
<tr>
<td>Default Justification Line</td>
<td>NTCIP 1203 Clause 2.5.1.1.6</td>
<td>The DMS shall support the following forms of line justification: left, center, and right</td>
</tr>
<tr>
<td>Default Justification Page</td>
<td>NTCIP 1203 Clause 2.5.1.1.7</td>
<td>The DMS shall support the following forms of page justification: top, middle, and bottom</td>
</tr>
<tr>
<td>Default Page On Time</td>
<td>NTCIP 1203 Clause 2.5.1.1.8</td>
<td>The DMS shall support page “on” times ranging from 0.1 to 25.5 seconds in 0.1 second increments</td>
</tr>
<tr>
<td>Default Page Off Time</td>
<td>NTCIP 1203 Clause 2.5.1.1.9</td>
<td>The DMS shall support page “off” times ranging from 0.1 to 25.5 seconds in 0.1 second increments</td>
</tr>
<tr>
<td>Default Character Set</td>
<td>NTCIP 1203 Clause 2.5.1.1.10</td>
<td>The DMS shall support the eight bit character set</td>
</tr>
<tr>
<td>DMS Max Changeable Msg</td>
<td>NTCIP 1203 Clause 2.6.1.1.1.4</td>
<td>Shall be at least 100.</td>
</tr>
<tr>
<td>DMS Message Multi String</td>
<td>NTCIP 1203 Clause 2.6.1.1.1.8.3</td>
<td>The DMS shall support any valid MULTI string containing any subset of those MULTI tags listed in Table 3 (below)</td>
</tr>
<tr>
<td>DMS Control Mode</td>
<td>NTCIP 1203 Clause 2.7.1.1.1.1</td>
<td>Shall support at least the following modes: local, central and central Override</td>
</tr>
<tr>
<td>DMS SW Reset</td>
<td>NTCIP 1203 Clause 2.7.1.1.1.2</td>
<td>FSORS</td>
</tr>
<tr>
<td>DMS Message Time Remaining</td>
<td>NTCIP 1203 Clause 2.7.1.1.1.4</td>
<td>FSORS</td>
</tr>
<tr>
<td>DMS Short Power Recovery</td>
<td>NTCIP 1203 Clause 2.7.1.1.1.18</td>
<td>FSORS</td>
</tr>
<tr>
<td>DMS Long Power Recovery</td>
<td>NTCIP 1203 Clause 2.7.1.1.1.19</td>
<td>FSORS</td>
</tr>
<tr>
<td>DMS Short Power Loss Time</td>
<td>NTCIP 1203 Clause 2.7.1.1.1.10</td>
<td>FSORS</td>
</tr>
<tr>
<td>DMS Reset Message</td>
<td>NTCIP 1203 Clause 2.7.1.1.1.12</td>
<td>FSORS</td>
</tr>
<tr>
<td>DMS Communications Loss</td>
<td>NTCIP 1203 Clause 2.7.1.1.1.12</td>
<td>FSORS</td>
</tr>
<tr>
<td>DMS Time Comm Loss</td>
<td>NTCIP 1203 Clause 2.7.1.1.1.12</td>
<td>FSORS</td>
</tr>
<tr>
<td>DMS End Duration Message</td>
<td>NTCIP 1203 Clause 2.7.1.1.1.15</td>
<td>FSORS</td>
</tr>
<tr>
<td>DMS Memory Mgmt</td>
<td>NTCIP 1203 Clause 2.7.1.1.1.16</td>
<td>The DMS shall support the following Memory management Modes: normal and clear Changeable</td>
</tr>
<tr>
<td>DMS Multi Other Error Description</td>
<td>NTCIP 1203 Clause 2.4.1.1.1.20</td>
<td>Messages</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If the vendor implements any vendor-specific MULTI tags, the DMS shall provide meaningful error messages within this object whenever one of these tags generates an error.</td>
</tr>
<tr>
<td>DMS Illum Control</td>
<td>NTCIP 1203 Clause 2.8.1.1.1.1</td>
<td>The DMS shall support the following illumination control modes: Photocell, and Manual</td>
</tr>
<tr>
<td>DMS Illum Num Bright Levels</td>
<td>NTCIP 1203 Clause 2.8.1.1.1.4</td>
<td>Shall be at least 100</td>
</tr>
<tr>
<td>DMS Illum Light Output Status</td>
<td>NTCIP 1203 Clause 2.8.1.1.1.9</td>
<td>FSORS</td>
</tr>
<tr>
<td>Num Action Table Entries</td>
<td>NTCIP 1203 Clause 2.8.1.1.9</td>
<td>Shall be at least 200</td>
</tr>
<tr>
<td>Watchdog Failure Count</td>
<td>NTCIP 1203 Clause 2.11.1.1.1.5</td>
<td>FSORS</td>
</tr>
<tr>
<td>DMS Stat Door Open</td>
<td>NTCIP 1203 Clause 2.11.1.1.6</td>
<td>FSORS</td>
</tr>
<tr>
<td>Fan Failures</td>
<td>NTCIP 1203 Clause 2.11.2.1.1.8</td>
<td>FSORS</td>
</tr>
<tr>
<td>Fan Test Activation</td>
<td>NTCIP 1203 Clause 2.11.2.1.1.9</td>
<td>FSORS</td>
</tr>
<tr>
<td>Temp Min Ctrl Cabinet</td>
<td>NTCIP 1203 Clause 2.11.4.1.1.1</td>
<td>FSORS</td>
</tr>
<tr>
<td>Temp Max Ctrl Cabinet</td>
<td>NTCIP 1203 Clause 2.11.4.1.1.2</td>
<td>FSORS</td>
</tr>
<tr>
<td>Temp Min Sign Housing</td>
<td>NTCIP 1203 Clause 2.11.4.1.1.5</td>
<td>FSORS</td>
</tr>
<tr>
<td>Temp Max Sign Housing</td>
<td>NTCIP 1203 Clause 2.11.4.1.1.6</td>
<td>FSORS</td>
</tr>
</tbody>
</table>

6. Multi Tags:
Each NTCIP device shall support the following message formatting MULTI tags. The manufacturer may choose to support additional standard or manufacturer-specific MULTI tags.

<table>
<thead>
<tr>
<th>MULTI Tag</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>f1</td>
<td>Field 1-time (12 hr)</td>
</tr>
<tr>
<td>f2</td>
<td>Field 1-time (24 hr)</td>
</tr>
<tr>
<td>f8</td>
<td>Field 8- day of month</td>
</tr>
<tr>
<td>f9</td>
<td>Field 9-month</td>
</tr>
<tr>
<td>f10</td>
<td>Field 10-2 digit year</td>
</tr>
<tr>
<td>f11</td>
<td>Field 11-4 digit year</td>
</tr>
<tr>
<td>f1 (and /f1)</td>
<td>Flashing text on a line-by-line basis with flash rates controllable in 0.1-second increments.</td>
</tr>
<tr>
<td>fo</td>
<td>Font</td>
</tr>
<tr>
<td>j12</td>
<td>Justification- line-left</td>
</tr>
<tr>
<td>j13</td>
<td>Justification- line-center</td>
</tr>
<tr>
<td>j14</td>
<td>Justification- line-right</td>
</tr>
<tr>
<td>j1p2</td>
<td>Justification- page-top</td>
</tr>
<tr>
<td>j1p3</td>
<td>Justification- page-middle</td>
</tr>
</tbody>
</table>
7. Documentation:
NTCIP documentation shall be provided on a CD-ROM and will contain ASCII versions of the following Management Information Base (MIB) files in Abstract Syntax Notation 1 (ASN.1) format:
(a) The relevant version of each official standard MIB modules referenced by the device functionality.
(b) If the device does not support the full range of any given object within a standard MIB Module, a manufacturer specific version of the official standard MIB Module with the supported range indicated in ASN.1 format in the SYNTAX and/or DESCRIPTION fields of the associated OBJECT TYPE macro. The filename of this file shall be identical to the standard MIB Module except that it will have the extension “man”.
(c) A MIB module in ASN.1 format containing any and all manufacturer specific objects supported by the device with accurate and meaningful DESCRIPTION fields and supported ranges indicated in the SYNTAX field of the OBJECT-TYPE macros.
(d) A MIB containing any other objects supported by the device.

3. **Coaxial Cable** shall be a headend-grade or quad-shield coaxial cable with a minimum of 60% + 40% braid and double foil insulation. The center conductor must be straight and extend 1/8 inch (3.2 mm) beyond the end of the connector, and the connector should be securely crimped to the cable.

4. **CCTV Camera Standard Assembly** shall be constructed as a modified Traffic Signal Standard, Type C. in accordance with the contract details and the Standard Specifications.

A. **Materials and equipment** shall conform to Section 701 and to the following Subsections:
   - Cabinets ....................................................................................................................... 906.12
   - Panel Boards and Circuit Breakers ............................................................................. 906.14
   - Pedestals, Poles, and Transformer Bases ..................................................................... 906.15

B. **Material Certifications.** All materials and products shall be manufactured in the United States of America, and comply with ASTM or AASHTO specifications. Mill certifications shall be supplied as proof of compliance with the specifications.

C. **Performance Calculations.** The pole shall be designed to support the specified camera and accessories.

D. **Hand Holes.** The hand hole opening shall be reinforced with a minimum 2 inches wide hot rolled steel rim. The nominal outside dimension is ¼ inch x 1 inch.

E. **Cable Supports/Electrical Cable Guides and Parking Stand (Eyebolts).** Top and bottom electrical cable guides shall be located within the pole aligned with each other as referenced in the drawings.

F. **Base Plate.** Base plates shall conform to ASTM A36 or A572 Grade 42. Plates shall be integrally welded to the tubes with a telescopic welded joint or a full penetration butt weld with backup bar. Plates shall be hot dip galvanized per the requirements of the contract documents.

G. **Anchor Bolts.** Anchor bolts shall conform to the requirements of ASTM F1554 Grade 55. The upper 12 inches of the bolts shall be hot dip galvanized per ASTM A153. Each anchor bolt shall be supplied with two hex nuts and two flat washers. The strength of the nuts shall equal or exceed the proof load of the bolts.
5. **MPEG-4 VIDEO Encoders/Decoders** shall each be MPEG-4 Standalone devices and shall contain channels for Video and Data capable of bi-directional transmission of RS-232 signals and a SNMP for local connection to a management computer. Each MPEG-4 Video device shall support the SIMPLE NETWORK MANAGEMENT PROTOCOL (SNMP). Each MPEG-4 Video device shall have a default IP address and shall be IP addressable. The MPEG-4 Video device shall be supplied with a licensed copy of the management software to enable total configuration of all the options and features listed below. The encoded/decoded video/data output shall be available through a 10/100 BASE-TX Ethernet port. All data and management ports are to be RJ-45. All video and data wiring connections shall be included with each MPEG-4 device, including RS-232 cable for connection to a management computer for each chassis. Each MPEG-4 Video device shall conform to the following:

**ETHERNET PORTS:** 10/100 BASE-TX FULL DUPLEX, RJ-45 CONNECTORS

**PROTOCOLS:** TCP/IP (COMPLETE PROTOCOL STACK)

**VIDEO:**
- NTSC 30 fps
- 1VPP NOMINAL SIGNAL LEVEL
- ISO/IEC 14496 (MPEG-4), M-JPEG
- 720 HORIZONTAL/480 VERTICAL RESOLUTION
- BNC VIDEO INPUT CONNECTOR, 75 OHM INPUT IMPEDANCE

**DATA:** RJ-45

**OPERATING TEMPERATURE SHALL BE** -10°C TO 70°C, 95% NON-CONDENSING HUMIDITY

The encoding of NTSC video to MPEG-4 over Ethernet and establishment of an Internet Address may be combined into one unit as an alternate to providing separate units that encode and switch. The end result shall be an NTSC video that is encoded at the field local construction site to Mpeg4 over IP and transmitted via cable TV to the TOCS (south). For equipment that is manufactured with SC type connectors, ST type connector adapters shall be provided.

6. **CCTV Camera**

CCTV Camera unit shall be manufactured by Pelco or Cohu, color and black and white CCD, bi-directional RS232, 422 and 485 data formats for the control of the PTZ units. The video can be displayed in a traditional CCTV environment (i.e. on a monitor) and as part of the computer system by running viewing software on a PC. CCTV Camera Unit shall be a day/night type.

**Title generation:** Sector Programming for privacy zones and sector ID

**Multi-protocol:** Cohu, Pelco, American Dynamics, Javelin, NTCIP

**Signal Format:** NTSC 768 (H) X 494 (V)

**Image Capture:** 1/2” or 1/4” color and black and white, progressive scan

**Image Sizes:** 160 x 120 to 1288 x 968.

**Imaging Features:**
- AGC or selectable gain (0-20)
- Configurable color balance
- Text and graphics overlay

**Operating temperatures:** -30 C to 70 C

**Power:** 12 - 24VDC or 120VAC, 60Hz

**Signal to Noise:** 50 dB

**Zoom:** 23X optical, 10X electronic

**Automatic focus, iris**

**Lux** 0.3 lux at 1/60 sec shutter (B/W)

The motorized zoom lens shall meet or exceed the following design and performance-specifications:

1. The motorized zoom lens shall be 23X optical zoom with an additional 10X digital zoom, 4.1mm to 73.8mm, F1.6.
2. The lens shall provide a mean time between failures (MTBF) of >500,000 cycles nominal for zoom, focus, and iris functions.

The variable speed/high speed pan and tilt drive unit shall meet or exceed the following design and performance specifications:

1. Pan Speed: Variable between 360° per second continuous
2. Vertical Tilt: Unobstructed tilt of +10° to -90°
3. Manual Control Speed: 0.1° to 80° per second, and pan at 150° per second in turbo mode. Tilt operation shall range from 0.1° to 40° per second
4. Automatic Preset Speed Pan speed of 360° and a tilt speed of 200° per second
5. Presets: 64 preset positions with a 20-character label available for each position; programmable camera settings, including selectable auto-focus modes, for each preset; command to copy camera settings from one preset to another; preset programming through control keyboard or through dome system on-screen menu
6. Preset Accuracy: +/- 0.1°
7. Proportional Pan/Tilt Speed: Speed decreases in proportion to the increasing depth of zoom
8. Automatic Power-Up: User-selectable to the mode of operation the dome will assume when power is cycled, including automatically returning to position or function occurring before power outage
9. Zones: Eight zones with up to 20-character labeling for each, with ability to blank the video in the zone
10. Motor Drive: Cogged belt with 0.9° stepper motor
11. Motor Operating Mode: Microstep to .015° steps
12. Motor: Continuous duty, variable speed, operating at 18 to 30 VAC, 24 VAC nominal
13. Limit Stops: Programmable for manual panning, auto/random scanning, and frame scanning
14. Inner Liner: Rotating black ABS liner inside sealed lower dome
15. Alarm Inputs: Seven N.O./N.C. dry contacts
16. Alarm Outputs: One auxiliary Form C relay output and one open collector auxiliary output
17. Alarm Output Programming: Alarm outputs can be alternately programmed to operate on alarm
18. Alarm Action: Individually programmed for three priority levels, initiating a stored pattern or going to a pre-assigned preset position
19. Resume after Alarm: After completion of alarm, dome returns to previous programmed state or its previous position
20. Window Blanking: Eight four-sided, user-defined shapes, with each side being of different lengths; window blanking setting to turn off at user-defined zoom ratio; window blanking set to opaque gray or translucent smear; blank all video above user-defined tilt angle; blank all video below user-defined tilt angle
21. Patterns: Four user-defined programmable patterns including pan, tilt, zoom, and preset functions; pattern programming through control keyboard or through dome system on-screen menu
22. Pattern Length: Four patterns of user-defined length, based on dome memory
23. Auto-Sensing: Automatically sense and respond to protocol utilized for controlling unit whether Coaxitron or RS-422 P or D protocols; accept competitors’ control protocols with the use of optional translator cards
24. Menu System: Built-in for setup of programmable functions; multilingual, including English, Spanish
25. Auto Flip: Rotates dome 180° at bottom of tilt travel
26. Password Protection: Programmable settings with optional password protection
27. Clear: Clear individual, grouped, or all programmed settings
28. Diagnostics: On-screen diagnostic system information
29. Freeze Frame: Freeze current scene of video during preset movement
30. Display Setup: User-definable locations of all labels and displays; user-selectable time duration of each display
31. Azimuth/Elevation/Zoom: On-screen display of pan and tilt locations and zoom ratio
32. Compass Display: On-screen display of compass heading; user-definable compass setup
33. Video Output Level: User-selectable: normal, or high to compensate for long video wire runs
34. Compatibility: All dome drives are compatible with all back box configurations
35. Power Consumption: Maximum 70 VA
36. Weight: Not to exceed 1.09Kg

7. **NEMA Enclosure.**
The cabinet shall be an aluminum NEMA 3R enclosure approximately 26” high x 17” wide x 15” deep. It shall have louvers with replaceable air filters on each side, low on one side and high on the other. The cabinet shall have a
sunshield on the top and front, and shall be equipped with a lock equivalent to a CCL 2-NJVHS. One key shall be supplied with each lock. The key shall be removable in the locked position only.

8. **10/100/1000 Gigabit Ethernet Switch** shall contain the characteristics and capabilities listed below and include licensed copies of software, including the operating software for the switch itself is to be supplied and operational:

   1. 24 Gigabit Ethernet ports
   2. Multicast support
   3. Auto switching
   4. Security and policy enforcement
   5. Routing & multicast routing
   6. Routing switch with minimum 8 ports 10/100base-tx
   7. AC power supply
   8. Management software
   9. IEEE 802.3 gigabit Ethernet
   10. IEEE 802 networks
   11. 10/100BASETX AND 10/100/1000BASET
   12. CONNECTORS: RJ-45
   13. TRANSMISSION: FULL/HALF DUPLEX
   14. RANGE: 20 MILES
   15. Bridging spanning tree algorithm
   16. Flow control
   17. Monitoring: single/multi port mirroring
   18. POWER: 120-240 VAC, 50/60 HZ, 60W MAX.
   19. OPERATING TEMP.: 0ºC TO 45ºC
   20. HUMIDITY: UP TO 90%, NON-CONDENSING

9. **Real Time Work Zone Traffic System**

   A. **Description**

   The REAL-TIME WORK ZONE TRAFFIC SYSTEM (“SYSTEM”) includes furnishing, installing, relocating, operating and maintaining an automated, portable, real-time work zone SYSTEM meeting the requirements noted herein, and providing the maintenance of the complete SYSTEM for the duration of the project. All equipment and software provided with the SYSTEM shall be National Transportation Communications for ITS Protocol (NTCIP) compliant.

   The SYSTEM shall monitor traffic conditions through and leading to, the project’s work zone and disseminate real-time information to the traveling public. The SYSTEM will notify the Traffic Operations Center - South (TOCS) located at Cherry Hill and the Resident Engineer’s office once the delay through the work zone exceeds a time or queue to be set by TOCS. This duration shall be able to be changed throughout the project. An unlimited number of Department employees shall be notified via their existing mail. E-mail addresses will be furnished after execution of the Contract. The telephone number to contact at the TOCS is (856)486-6650.

   At least 20 days prior to beginning installation, submit to the Engineer for review and approval evidence that the Contractor or Subcontractor has successfully completed at least three SYSTEM deployments on projects similar in concept and scope to this Contract. Include names, addresses and telephone numbers of the owner's representatives for verification. Submittal shall include brochures on all components of the SYSTEM, with details of, but not limited to: how and which communication systems shall be used, proposed sensor and sign locations, coordination with existing ITS systems, and the website. Upon approval from the Engineer, the Contractor shall demonstrate the SYSTEM prior to turning on the message signs and web site to the viewing public. Training shall be provided to Department staff on the use and operation of both the physical field hardware and the electronic version (website) of the SYSTEM.

   The SYSTEM shall be fully operational prior to any construction operations that require lane or shoulder closures on the project. The deployment and use of the system is not expected for the entire duration of the project and shall be made available at the direction of the Engineer who will decide based on the construction schedule.
706.03 Construction Requirements.
The provisions of 701 and 702 shall apply as supplemented below.

1. General
   All ITS devices shall be scheduled to be installed & be operational before any lane closures, with the exception of the permanent CCTV installations.

   The contractor shall contact the Traffic Operations Center, South (TOCS), prior to start of any construction or testing activities, to arrange access to the sites and coordinate the work activities. The contractor shall schedule the work accordingly. It will be the contractor’s responsibility that operation of any existing system or equipment operation is not compromised in any way. This includes equipment in the field and systems located at the Traffic Operations Center, South. Any damage caused by the contractor to the existing systems or equipment shall be repaired at contractor’s expense. The Contractor shall submit a plan for approval describing the method for any work in the Traffic Operations center.

   Prior to construction /installation of the CCTV foundation, the Contractor shall be required to field verify the location at the CCTV height stated for maximum coverage and minimum obstructions. This is to be done in the presence of the Resident Engineer and a representative from Traffic Operations South.

   The Contractor shall provide a complete technical submittal within 60 days of contract award and the manufacturer shall not proceed with DMS manufacture until the Engineer has approved the submittal. The submittal shall include: all DMS manufacturer qualification information, as specified herein, DMS Shop Drawing, including an illustration of the recommended installation method, and DMS structural calculations and certification by a registered Professional Engineer.

   Prior to start of any above ground work to construct the device assemblies, the contractor shall prepare and submit for approval 22” X 36” working drawings of the subsystem block diagrams showing the devices, control and software components and their interconnections, typical connector pinouts, configurations of ports, channels, address device and connection. The contractor shall provide shop drawings to show the proposed equipment, cable and wiring connections and configurations, and include the transient and surge suppression protection devices. An electronic file of the working drawings shall also be submitted in Intergraph.dgn format with the submission.

   Working drawings, block diagrams and catalog cuts for each operational sub system shall be submitted as a package of information showing the interconnection of the assembly components. Additional working drawing submittal requirements shall be completed as specified under each subsystem.

   Working drawings, block diagrams and catalog cuts for each operational sub system shall be submitted as a package of information showing the interconnection of the assembly components. Additional working drawing submittal requirements shall be completed as specified under each subsystem.

   The control and communications equipment shall be installed in the field (communication cabinet and DMS enclosure, CCTV, NEMA enclosures) and in the NTOC/TOCS. All of the equipment shall be interconnected to transmit and receive information between the device in the field and the TOCS for remote control and monitoring of various field ITS facilities constructed as part of this project.

   Proposed equipment at the Traffic Operations Center, South shall also include installing and furnishing connectors, surge protection devices and cables to provide communications between the proposed field ITS facilities with the existing facilities located at the Traffic Operations Center, South through either telephone service from local telephone company or cable service from local cable television provider.

   All above ground ITS components shall be located outside the required clear zone, or behind guide rail and/or other structures.

   Included in the work for and Ground Mount DMS Assemblies are the exposed and flexible conduits and supports, all the grounding, power and communications cabling and connections necessary to make the DMS operational and the coordination with the utility companies. The contractor shall route grounding, power distribution and telephone cables through the DMS structures and make connection to the power distribution panel, Ethernet switch, and cable modem.

   The contractor shall provide all equipment and consumable supplies. All consumables shall be approved by the Engineer.

2. Ground Mount Dynamic Message (DMS) Signs

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
This section describes the minimum construction and operational functionality requirements for the Ground Mount Dynamic Message Sign (DMS). The contractor/vendor shall provide all the materials, software license, and services necessary for DMS and associated equipment that fully comply with the functional requirements specified herein, including incidental items that may have been inadvertently omitted.

A. General Specifications

The Ground Mount DMS housing shall provide lift-face service access for all LED display modules, electronics, environmental control equipment, air filters, wiring, and other internal DMS components.

The Ground Mount DMS size shall be as specified in the Contract Documents. The Ground Mount DMS shall contain a full display matrix measuring a minimum of [A] rows high by [B] pixel columns wide as shown in Ground Mount DMS DIMENSIONS table below. The matrix shall display amber messages and text that are continuous, uniform, and unbroken in appearance to motorists and travelers.

### MAXIMUM GROUND MOUNT DMS ENCLOSURE DIMENSIONS

<table>
<thead>
<tr>
<th>Pixel Rows [A]</th>
<th>Pixel Columns [B]</th>
<th>Cabinet Height (ft/m) [C]</th>
<th>Cabinet Width (ft/m) [D]</th>
<th>Cabinet Depth* (ft/m) [E]</th>
<th>Weight (lbs/kg) [F]</th>
<th>Max. Power (watts) [G]</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>70</td>
<td>8’-6”  (2.59m)</td>
<td>18’-0” (5.49m)</td>
<td>2’-4”</td>
<td>2400 lbs</td>
<td>2640</td>
</tr>
</tbody>
</table>

Each display pixel shall be composed of multiple monochrome amber LED’s. The pixel matrix shall be capable of displaying alphanumeric character fonts measuring a minimum of 9 inches (230 mm) high to a maximum of the display matrix height.

The DMS shall be able to display messages composed of any combination of alphanumeric text, punctuation symbols, and graphic images across multiple frames.

Dimensions:
The approximate DMS housing dimensions shall be as shown in DMS DIMENSIONS table for the type of DMS specified in the Contract Documents. The housing dimensions shall not exceed values shown under [D] wide by [C] high. The front-to-back housing depth shall not exceed the value shown under [E] at its widest point, including the ventilation hoods.

Ground Mount DMS weight shall not exceed the value shown under [F] for the type of sign specified in the Contract Documents.

Power Requirements:
Maximum AC power shall not exceed the value shown under [G] for the type of DMS specified in the Contract Documents when the following circuits are operational and fully loaded.

Ground Mount DMS shall operate from a 120/240 VAC, 60Hz, single-phase power source, including neutral and earth ground.

Legibility:
Ground Mount DMS messages shall be legible within a distance range of 150 ft (45.7 m) to 900 ft (274 m) from the DMS display face under the following conditions:

1. Whenever the Ground Mount DMS is displaying alphanumeric text that is 18-inches (460 mm) high by 12 inches wide
2. 24 hours per day and in most normally encountered weather conditions such as snow, rain, sun.
3. During dawn and dusk hours when sunlight is shining directly on the display face or when the sun is directly behind (silhouetting) the Ground-Mount DMS
B. Sign Construction:

1. The Ground Mount housing shall be constructed to have a neat, professional appearance. The housing shall protect internal components from rain, ice, dust and corrosion in accordance with NEMA enclosure Type 3R standards, as described in NEMA Standards Publication 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum). All internal and external components shall be manufactured from corrosion resistant material.

2. The Ground Mount housing bottom side shall contain small weep holes for draining any water that may accumulate due to condensation. Weep holes and ventilation/exhaust hoods shall be screened to prevent the entrance of insects and small animals.

3. The Ground Mount shall be capable of operating without any decrease in performance over a temperature range of -40°F to 165°F (-40°C to 74°C) with a relative humidity of up to 100% condensing, unless otherwise noted in this specification. Ground Mount and sign controller components shall not be damaged by storage at or temporary operational exposure to a temperature range of -40°F to +185°F (-40°C to +85°C).

4. External Ground Mount component hardware (nuts, bolts, screws, standoffs, rivets, fasteners, etc.) shall be fabricated from stainless steel, aluminum, nylon, or other durable corrosion-resistant materials suitable for the roadway signage application.

5. All external screws, nuts, and locking washers shall be stainless steel. No self-tapping external screws shall be used. All parts shall be made of corrosion resistant materials, such as plastic, stainless steel or aluminum. All materials used in construction shall be resistant to fungus growth and moisture deterioration. Dissimilar metals shall be separated by an inert dielectric material.

6. Ground Mount and sign controller components shall be 100% solid-state, except for the environmental control fans and thermostats. All high voltage electrical components (exceeding 24 VDC) used in the Ground Mount and the sign controller shall be UL (Underwriter’s Laboratory) listed and meet all applicable NEC code requirements.

7. The presence of ambient radio signals and magnetic or electromagnetic interference, including those from power lines, transformers, and motors, shall not impair the performance of the Ground Mount. The Ground Mount shall not radiate electromagnetic signals that adversely affect any other electronic device, including those located in vehicles passing underneath or otherwise near the Ground Mount and its sign controller.

C. Ground Mount Sign Housing:

The lift-face housing dimensions and total weight shall be as shown in this specification or in the plans. The lift-face housing shall be designed and manufactured to be rain and weather tight.

The sign housing skin shall be constructed of aluminum alloy 5052-H32 which shall not be less than 1/8" thick, unless otherwise specified in this document. Framing structural members shall be made of aluminum alloys 6061-T6 and 6063-T5.

The equipment within the sign housing shall be protected from moisture, dust, dirt and corrosion. The lift-face housing shall meet NEMA 3R enclosure criteria as defined in NEMA Standards Publication 250-1997, “Enclosures for Electrical Equipment (1000 Volts Maximum).”

The sign housing shall be engineered and Professional Engineer certified to 2001 AASHTO and NCHRP Report 411 specifications for AASHTO basic wind speeds. The sign housing shall also be engineered and Professional Engineer certified to withstand group loading combinations as outlined in 2001 AASHTO including: sign weight, repair personnel and equipment, ice and wind loads, and shall also meet strength requirements for truck-induced gusts as specified in NCHRP Report 412. The sign housing shall be engineered to withstand snow loading (40 PSF) for applicable geographical regions.

The front face of the sign housing shall be angled 3 degrees from vertical for the purposes of maximizing message visibility.

Ground Mount housings that do not utilize three (3) degree forward tilt faces shall incorporate adjustable mounting brackets on the rear vertical plane for optimizing the viewing angle. These brackets shall allow for adjustment of the angular alignment of the sign housing in the vertical direction from zero (0) degrees to ten...
(10) degrees down in one degree increments. The Adjustable mounting brackets shall be set prior to installation to give the best possible visibility setting in accordance to each Ground Mount site.

The housing shall be designed to accommodate mounting on the rear vertical plane.

The exterior mounting assemblies shall be 6061-T6 aluminum alloy extrusions, 3/16-inch minimum thickness.

Ground Mount structural assembly hardware (nuts, bolts, washers, and direct tension indicators) shall be stainless high-strength steel and shall be appropriately sized for the application.

Welding:
The aluminum skin shall be welded to the Ground Mount cabinet frame. All exterior sheet seams shall be continuously seam welded to the Ground Mount frame to form a single structure. Stitch welding shall be used on the interior of the cabinet to attach the aluminum skin sheets to the aluminum extrusion frame.


D. Mounting Brackets:
Multiple mounting brackets in the form of I-beam or Z-bar extrusions shall be bolted to the Ground Mount housing exterior rear wall to facilitate attachment of the Ground Mount to the support structure. Mounting brackets shall be:
1. Extruded from aluminum alloy number 6061-T6
2. Attached to the Ground Mount structural frame members, not just the exterior sheet metal
3. Installed at the Ground Mount manufacturer’s factory
4. Attached to the Ground Mount using stainless steel bolts
5. Attached to the Ground Mount using direct tension indicators to verify that mounting hardware is tightened with the proper amount of force
6. Installed such that all bracket-to-Ground Mount attachment points are sealed and water-tight
7. Designed and fabricated such that the installing contractor can drill into them without penetrating the Ground Mount housing and compromising the housing’s ability to shed water
8. The hardware used to attach the mounting brackets (nuts, bolts, washers, and direct tension indicators) to the Ground Mount cabinet shall be stainless steel and shall be appropriately sized for the application.

E. Lifting Hardware:
For moving and installation purposes, permanently mounted eye bolts or sealed pick angles shall be attached to the top of the Ground Mount housing. Eye bolts or pick angles hardware shall attach directly to the Ground Mount housing structural frame and be installed at the Ground Mount factory. All mounting points for eye bolts or pick angles shall be sealed to prevent water from entering the Ground Mount housing. Lifting hardware, as well as the housing frame, shall be designed such that the Ground Mount can be shipped and handled without damage or excessive stress being applied to the housing prior to or during Ground Mount installation on its support structure.

F. Front Face Construction:
The housing face shall be a two piece construction, consisting of internal structural members and lens panel assemblies. The border from the display area to the edges of the sign shall be a minimum of 12 inches.

There shall be no exposed fasteners or welds on the housing face.

The Ground Mount front face shall be constructed with multiple rigid panels, each of which supports and protects a full-height section of the LED display matrix. The panels shall be fabricated using aluminum sheeting on the exterior and polycarbonate sheeting on the interior of the panel.
Front face panels shall provide a high-contrast background for the Ground Mount display matrix. The aluminum mask of each panel shall be treated with Kynar 500 and shall contain an opening for each pixel. Openings shall be large enough to not block any portion of the viewing cones of the LED’s.

Face panels shall be attached to each other using stainless steel hardware. Seams that separate adjacent panels shall be sealed. Panels shall not be welded or otherwise permanently mounted to the Ground Mount housing. Panels shall be mounted in such a way that they are removable from the interior of the Ground Mount housing.

Capture hardware for mounting the display module to the Ground Mount shall be provided to allow for the removal and replacement of the display modules without using the tools.

The face panels shall include a lens panel aluminum mask, which shall be:

1. 0.090 inch minimum thickness.
2. Finished with a matte-black, licensed-factory-applied, Kynar 500 Resin, fluoropolymer-based coating system.
3. Perforated, providing an aperture for each pixel on the display modules. Each aperture shall be as small as possible, without blocking the LED light output at the required viewing angle.

The lens panel shall consist of a Kynar 500 coated aluminum mask over a clear glazing. The aluminum mask shall be laminated and sealed to the surface of the glazing using the 3M Scotch VHB joining system or pre-approved equivalent.

The lens panel shall be:

1. Modular in design
2. Interchangeable with no misalignment with the LED pixels.
3. Removable from within the main sign housing.

Each panel shall have a single polycarbonate sheet attached securely to the inside of the aluminum panel. The polycarbonate sheet shall cover all of the pixel openings. The polycarbonate shall be sealed to prevent water and other elements from entering the Ground Mount. The polycarbonate shall contain UV inhibitors that protect the LED display matrix from the effects of ultraviolet light exposure and prevent premature aging of the polycarbonate itself.

The lens panel glazing shall be 90% UV opaque polycarbonate – GE LEXAN® XL10 or pre-approved equivalent. The minimum required glazing properties include:

1. 1/4-inch thick minimum
2. Clear in color
3. Guaranteed for 10 years against yellowing, loss of light transmission and breakage
4. Tensile Strength, Ultimate: 9,500 psi
5. Tensile Strain at Yield: 6%
6. Tensile Modulus: 340,000 psi
7. Flexural Modulus: 340,000 psi
8. Impact Strength, Izod (up to 125 mils, notched): 12-16 ft-lbs/inch
9. Rockwell Hardness: M70, R118
10. Heat Deflection Temperature Under Load: 270°F (264 psi); 288°F (66 psi)
11. Coefficient of Thermal Expansion: 3.75x10-5 in/in/°F
12. Initial Light Transmittance: 88% (average)
13. Change in Light Transmittance, 5 years exposure: less than 5%
14. Change in Yellowness Index, 5 years exposure: less than 5%
LED display modules shall be mounted to the inside of the Ground Mount front face panels. Common hand tools shall be used for removal and replacement.

Ground Mount front face borders (top, bottom, left side, and right side), which surround the front face panels and LED display matrix, shall be treated with Kynar 500, to maximize display contrast and legibility.

The face shall include external panels that shall:
1. Be manufactured from extruded aluminum.
2. Be designed and attached so to minimize heat conduction between the exterior surfaces and the interior components.
3. Be finished with a matte-black, licensed-factory-applied Kynar 500 Resin, fluoropolymer-based coating system.
4. Be removable from within the sign housing.

The border, and therefore the panels, shall be a minimum of 12 inches wide. The panels shall be thermally isolated from the rest of the sign housing.

**G. Exterior Finish:**
Ground Mount front face panels and front face border pieces shall be coated with semi-gloss black Kynar 500 resin or an equivalent brand of oven-fired fluoropolymer coating, which has an expected outdoor service life of 20 years.

All other Ground Mount housing surfaces, including the access doors and Ground Mount mounting brackets, shall be natural mill-finish aluminum.

**H. Service Access:**
The sign housing shall be front access. The sign housing shall be provided with a lift-face for accessibility to all internal components of the sign.

The VMS front face shall be constructed with a single or multiple vertically hinged rigid door panels, each of which contains a full-height section of the LED display matrix. The door panels shall be fabricated using aluminum sheeting on the exterior and polycarbonate sheeting on the interior of the panel.

The sign shall have a set of two geared screw jacks, one at each end of the sign door, that easily open the lift face and hold it open at any position from closed to 60 degrees open. The face shall be easily opened from a bucket truck at either end of the sign by a single person, using either manual or electrical tools.

Regular opening and closing of the lift face shall not cause warping or misaligned fit/closure. A stainless steel hinge shall connect the sign housing and the lift face. All components shall be readily accessible for maintenance when the lift face is open. Gaskets shall provide a weather-tight seal when the lift face is closed.

A minimum of two closure devices shall be used to secure the lift face to the sign housing. A hasp that is lockable with a padlock shall be provided near one of the closure devices.

One (1) access door shall be provided for each 10 or 15 pixel wide section of the sign housing. These doors shall be vertically hinged and shall contain a section of the sign’s front face. The doors shall swing out from the face to provide access to the cabinet interior. Each door shall extend the full height of the display matrix.

To prevent open doors from blowing in wind, they shall each have a retaining latch mechanism to hold the door open at a 90-degree angle.

Each door shall form the face panel for a section of the sign. The LED modules shall be mounted to the door and be removable from the door when in the open position. Other sign components, such as power supplies, wiring, etc. shall be located inside the sign cabinet and be accessible through the door opening.
Each door shall contain a minimum of two (2) screw-type latches to lock them in the closed position. These latches shall be captive to prevent them from falling off. They shall pull the door tight and compress a gasket located around the perimeter of each door. They shall also be capable of providing leverage to easily release the gasket seal when opening the doors. The gasket shall prevent water from entering the cabinet around the doors.

I. Internal Lighting:
The sign housing shall be furnished with a minimum of three incandescent lamps positioned for optimum lighting. Optionally, fluorescent lamps may be specified, and these shall be 150 Watts equivalent light (42 Watts actual power), medium screw base, instant start, helix fluorescent lamps and shall be spaced evenly across the length of the housing interior.

The lights shall be enclosed in heavy-duty fixtures. Each fixture shall have a die-cast aluminum housing, a die-cast twist-on guard secured by a set screw and a porcelain socket.

There shall be a door switch for the lights.

The sign housing shall be furnished with a minimum of two (2) GFI duplex outlets spaced for optimum access and convenience.

J. LED Display Modules and Driver Boards:
Each display module consists of a display board with a matrix of LED pixels. The pixels are mounted on the front side of the display module.

Each driver shall have the capability to control one or more display modules. The driver board connects to the sign interface circuits and passes information to the associated display modules, which control the character pixels or Each LED display module shall consist of one (1) LED pixel board and one (1) LED driver circuit board. The LED driver circuit board shall be mounted physically to the back of the LED pixel board using durable non-corrosive hardware. They shall be electrically connected via one or more header-type connectors. The header connectors shall be keyed such that the boards cannot be connected incorrectly.

The driver board shall receive control signals and display data from the sign controller. The display module shall contain the control and memory elements and provide the signals to switch and read the LED pixels.

The driver boards shall connect to a single control cable common to each line of display modules.

The LED display board shall contain all LED’s required to form a matrix of pixels. Pixels shall be arranged uniformly to display a dot-matrix 18-inch high by 12-inch wide character in five columns wide and seven pixels high. The height of a standard character shall be defined as the distance from the lowest point of the lowermost pixel of the character to the highest point of the uppermost pixel of the character. Smaller characters are not acceptable.

The display modules shall be rectangular, and shall have an identical horizontal and vertical pitch between pixels containing 45 LED pixels arrayed 9 high by 5 wide. The pitch shall be measured from the center of one pixel to the center of all adjacent pixels. This distance shall be 2.60 to 2.75-inches.

The separation between the last column of one module and the first column of the next shall be equal to the horizontal distance between the columns of a single display module. The separation between the last row of one module and the first row of the next shall be equal to the horizontal distance between the rows of a single display module.

All LED’s shall be individually and directly mounted to the LED circuit board to form the LED display board. The LED circuit board shall be a manufactured using a laminated fiberglass printed circuit board. The LED display board shall support the driver board. All LED pixel boards shall be identical and interchangeable throughout the Ground Mount.
All LED’s shall be mounted so that their mechanical axis is normal +/- 1.00 degree to the face of the sign to ensure brightness uniformity over the face of the sign.

K. LED Pixel Boards:
Each LED pixel board shall be composed of a printed circuit board to which LED pixels are soldered. The LED pixel boards shall conform to the following specifications:

1. LED pixel boards shall be manufactured using a printed circuit board.
2. The distance from the center of one pixel to the center of all adjacent pixels, both horizontally and vertically, shall be 2.60 to 2.75 inches.
3. All pixels shall contain an equal quantity of discrete LED’s and LED strings. Each pixel shall contain a minimum of two (2) independent and parallel strings of LED’s. The minimum number of LED’s per pixel shall be not less than four (4).
4. The failure of an LED string or pixel shall not cause the failure of any other LED string or pixel in the Ground Mount.
5. Each LED pixel shall not consume more than 1.5 watts.
6. The circular base of the discrete LED’s shall be soldered so that they are flush and parallel to the surface of the printed circuit board. The longitudinal axis of the LED’s shall be perpendicular to the circuit board.
7. All exposed metal on both sides of the LED pixel board, except connector contacts, shall be protected from water and humidity exposure by a thorough application of conformal coating.
8. All LED pixel boards shall be identical and interchangeable throughout the Ground Mount.

Epoxy encapsulation of the LED’s will not be permitted. Hoods or visors shall not be used.

The LED’s shall be protected from the outside environmental conditions, including moisture, snow, ice, wind, dust, dirt and UV rays.

L. Discrete LED’s:
Ground Mount pixels shall be amber color and shall be constructed with discrete LED’s manufactured by Avago Technologies (formerly Agilent Technologies), or by Toshiba Corporation, or by Nichia Corporation, or approved equivalent. Discrete LED’s shall conform to the following specifications:

1. All LED’s shall have a nominal viewing cone of 30 degrees with a half-power angle of 15 degrees measured from the longitudinal axis of the LED. Viewing cone tolerances shall be as specified in the LED manufacturer’s product specifications and shall not exceed +/- 3 degrees.
2. Amber LED’s shall utilize AlInGaP semiconductor technology and shall emit amber light that has a peak wavelength of 590 ± 5 nm.
3. The LED lenses shall be fabricated from UV light resistant epoxy.
4. The LED intensity bins shall be distributed evenly throughout the sign and shall be consistent from pixel to pixel. Random distribution of the LED bins shall not be accepted.
5. LED package style shall be of the through-hole, stand-off type.
6. All LED’s used in all Ground Mount provided for this contract shall be from the same manufacturer and of the same part number, except for the variations in the part number due to the intensity and color bins.
7. Pixels shall contain the quantity of discrete LED’s needed to output a minimum intensity of 40 candelas at 20 mA. Pixel brightness shall be attained by the sum of the brightness of the individual LED’s in each pixel. The brightness of each LED shall be measured in accordance with the CIE Test Method A, as described in CIE 127-1997, Technical Report: Measurement of LED’s. The LED brightness and color bins that are used in each pixel shall be provided to the engineer for approval. Certification shall be provided, with the submittals, from the LED manufacturer that demonstrates that the LED’s were tested and binned in accordance with the CIE Test Method A.
8. shall yield an overall minimum luminous intensity for the sign face of 9,200 Cd/m² at 30 mA drive current stated below. Certification shall also be provided, with the submittals, from the LED manufacturer that the various LED color and intensity bins shall be distributed evenly throughout the
sign and shall be consistent from pixel to pixel. Random distribution of the LED bins shall not be accepted.

9. All pixels shall have equal color and on-axis intensity. All pixels included in each sign, as well as throughout the entire contract, including the spare parts, shall have equal color and on-axis intensity. The method used to provide the equal color and intensity, as stated above, shall be included in the submittals and approved by the Engineer.

10. The LED’s shall be rated by the LED manufacturer to have a minimum lifetime of 100,000 hours of continuous operation while maintaining a minimum of 70% of the original brightness.

M. Pixel Drive Circuitry:
Each driver board shall have the capability to one or more display modules or Each LED display module shall consist of one (1) LED pixel board and one (1) LED driver circuit board. The LED driver circuit board shall be mounted physically to the back of the LED pixel board using durable non-corrosive hardware. They shall be electrically connected via one or more header-type connectors. The header connectors shall be keyed such that the boards cannot be connected incorrectly.

The driver board connects to the sign interface circuits and passes information to the associated display modules, which control the character pixels. The driver board shall receive control signals and display data from the sign controller. The display module shall contain the control and memory elements and provide the signals to switch and read the LED pixels. The driver circuit boards shall conform to the following specifications:

1. LED driver boards shall be manufactured using a printed circuit board.
2. All exposed metal on both sides of the LED driver board, except connector contacts, shall be protected from water and humidity exposure by a thorough application of silicone conformal coating.
3. Constant current LED driver ICs or another method that provides at least the same level of control (such as PWM) shall be used to prevent LED forward current from exceeding the LED manufacturer’s recommended forward current whenever a forward voltage is applied.
4. The LED pixels shall be directly driven using pulse width modulation (PWM) of the drive current to control the display intensity. This LED driver circuitry shall vary the current pulse width to achieve the proper display intensity levels for all ambient light conditions. The drive current pulse shall be modulated at a frequency high enough to provide flicker-free operation and a minimum of 200 brightness levels.
5. The LED driver boards shall receive updated display data at a minimum rate of ten (10) frames per second from the sign controller.
6. Each LED driver board shall be powered by 24 VDC from external regulated DC power supplies. Each driver board shall receive power from a minimum of two (2) independent power supplies.
7. The voltage of each power input shall be measured to the nearest tenth of a volt and reported to the sign controller upon request. Each driver board shall also contain one status LED for each power source that indicates if the power source is present or not.
8. The LED driver circuitry shall be able to detect that individual LED strings or pixels are stuck off and shall report the pixel status to the sign controller upon request. The circuit shall also be able to detect problems with individual LEDs.
9. The LED driver board shall contain a seven segment numeric LED display that indicates the functional status of the driver and pixel boards. At a minimum, it shall indicate error states of the LED pixels and communication network. The indicator shall be positioned such that a maintenance technician can easily view the status code for diagnostic purposes. The status codes shall also be reported to the sign controller upon request. Alternatively, this information may be displayed by the sign controller.
10. All driver circuit boards shall be identical and interchangeable throughout the Ground Mount.
11. Removal or failure of a single driver circuit board shall not affect the performance of any other LED display module in the Ground Mount.
12. Individual addressing of the each driver circuit shall be configured via the communication wiring harness and connector. No on-board addressing jumpers or switches shall be allowed.

N. Brightness Control:
The Ground Mount shall be capable of automatically adjusting LED brightness to account for changing ambient light conditions. The system required for this function consists of three primary component groups: Photocells, an adjustable brightness table and the overall brightness capability of the Ground Mount.

Three (3) photocells shall be installed in the sign. These devices shall permit automatic light intensity measurement of light conditions at each sign location. These photocells shall be mounted in a manner to measure front, rear and ambient light conditions.

Brightness shall be manually settable from the front panel of the controller and remotely from the central computer in 1% increments from one to 99 percent. Brightness control shall be able to be returned to automatic from the sign controller front panel and the central computer.

1. Automatic adjustment of the LED brightness shall occur in small enough increments so that the brightness of the sign changes smoothly, with no perceivable brightness change between adjacent levels.
2. Provision shall be made to prevent perceivable brightening of the sign due to stray headlights shining upon the photo sensors at night.
3. Pixel brightness shall be controlled by pulse width modulation of the DC current.
4. The pixel current waveform shall have a frequency of 100 +/- 5 Hz at night time brightness levels and a minimum of 2400 Hz at daytime brightness levels with an adjustable duty cycle of 0.1% to 99.9% in 0.5% or finer increments.
5. There shall be a means to adjust how rapidly the sign responds to changes in ambient light as measured by the photocells. This can be used, for example, to prevent the sign from changing its brightness due to a vehicle’s headlight momentarily shining on the sign. The adjustment shall be made from the central controller or laptop computer and shall have two different settings, one for day-time control and one for night-time control, with the day/night ambient light threshold also being an adjustable value. In addition, there shall be a means to specify different weighting factors for each photocell, to specify how prominently each photocell figures in the calculation of night-time ambient light.

Brightness Table:

1. The sign controller shall monitor the photo cell circuits in the sign and convert the measured light intensity into the desired pixel brightness.
2. The photo circuit readings shall be correlated with a brightness table in the sign controller.
3. The brightness table shall have a minimum of 256 brightness levels.
4. The brightness table shall be downloadable, both locally and from the central controller, and can be customized according to the requirements of the installation site.

O. Regulated DC Power Supplies:
The LED pixel display modules shall be powered with auto-ranging regulated switching power supplies that convert the incoming AC to DC at a nominal voltage of 24 volts DC. Power supplies shall be wired in a redundant parallel configuration that uses multiple supplies for the Ground Mount display matrix.

Power supplies shall be arranged in redundant, diode OR configuration, such that one supply may completely fail and the sign will still be supplied with enough power to run 30% of all pixels at 100% duty cycle at 65 degrees C (149 degrees F). Functioning supplies must current-share to within 10%.

The power supplies shall be sufficient to maintain the appropriate LED display intensity throughout the entire operating input voltage range.

Each power supply within each pair shall receive 120VAC power from separate circuits on separate circuit breakers, such that a single tripped breaker will not disconnect power from both supplies. It shall be acceptable for a single circuit breaker to power multiple DC power supplies provided that none of those power supplies are in the same power supply pair.
The power supplies shall be sufficient to maintain the appropriate LED display intensity throughout the entire operating input voltage range.

Each group of power supplies shall be monitored by a microprocessor-controlled circuit. This circuit shall monitor the voltage of each power supply and the status of each output circuit’s fuse. The power supply voltages and fuse states shall be reported via a CAN (controller area network) communication network to the sign controller upon request. Alternatively, the power supplies’ outputs may be monitored directly, and reported to Central by the sign controller.

The power supplies used to power the LED pixel modules shall be identical and interchangeable throughout the Ground Mount.

Regulated DC power supplies shall conform to the following specifications:

1. Nominal output voltage of 24 VDC +/- 10% unless otherwise approved
2. Nominal maximum output power rating of 1500 watts
3. Operating input voltage range shall be a minimum of 90 to 260 VAC
4. Operating temperature range shall be a minimum of –30°F to +165°F (-34ºC to +74ºC)
5. Maximum output power rating shall be maintained over a minimum temperature range of –30°F to +140°F (-34ºC to +60ºC)
6. Power supply efficiency shall be a minimum of 80%
7. Power factor rating shall be a minimum of 0.95
8. Power supply input circuit shall be fused
9. Automatic output shut down if the power supply overheats or one of the following output faults occurs: over-voltage, short circuit, or over-current
10. Power supplies shall be UL listed
11. Printed circuit boards shall be protected by an silicone conformal coating

P. Control Systems:
The Ground Mount shall include a Ground Mount controller and auxiliary control panel as specified in the Requirements for Ground Mount Controllers section herein.

Q. Environmental Monitoring Systems:
The Ground Mount shall include sensors that monitor and report ambient (external) light level and temperature, as well as the internal temperature and humidity.

Ambient Light Measurement:
Sensors that measure the outdoor ambient light level and the outdoor ambient temperature at the Ground Mount site shall be mounted in-line with the Ground Mount housing walls. This ambient light and temperature measurement system shall consist of three (3) electronic light sensors.

Two of the light sensors shall be placed such that they measure the ambient light levels striking the front and rear of the Ground Mount. The third light sensor shall be mounted to the floor of the Ground Mount housing and shall face the ground. The Ground Mount sign controller shall continuously monitor the light sensors and adjust the LED display matrix intensity to a level that creates a legible message on the Ground Mount face.

Ambient Temperature Measurement:
An ambient outdoor temperature sensor shall be mounted such that it is never in direct contact with sunlight. This external temperature sensor reading shall be continuously monitored by the Ground Mount sign controller and shall be reported to the Ground Mount control software upon request.

Internal Temperature Measurement:
The ventilation system shall be activated by multiple temperature sensors. There shall be a minimum of one sensor located near the middle of each module line, at the top of the display module in the exhaust stream from the cavity between the display module and the lens panel. There shall be an additional temperature sensor
located to accurately measure the ambient temperature outside the sign housing. The temperature sensors shall have an accuracy of +/- 1.5 degrees C and a range from -40° to +74°C. The temperatures from the sensors shall be continuously measured and monitored by the sign controller. A temperature reading greater than a user selectable critical temperature shall cause the sign to go to blank and the sign controller shall report this action to the central controller. This user selectable critical temperature shall be capable of being changed by the central controller or laptop computer. The central controller and laptop computers shall have the ability to read temperature measurements from the sign controller. The internal temperature sensor’s outputs shall be continuously monitored by the Ground Mount sign controller and shall be reported to the Ground Mount control software upon request.

Internal Humidity Measurement:
The Ground Mount shall contain one (1) sensor that measures the relative humidity of the air inside the Ground Mount cabinet. The sensor shall monitor the humidity from 0 to 100%. The humidity sensor output shall be continuously monitored by the Ground Mount sign controller and shall be reported to the Ground Mount control software upon request.

R. **Interior Ground Mount Environmental Control:**
The Ground Mount shall contain systems for cabinet ventilation, face panel fog and frost prevention, and safe over-temperature shutdown.

**Housing Ventilation System:**
The ventilation system shall be a positive-pressure, filtered, forced-air, fully ducted system which cools both the display modules and the sign housing interior. Negative pressure systems that use exhaust fans are not acceptable.

The ventilation system shall provide a minimum of four (4) sign housing volume air changes per minute at the pressure drop developed throughout the entire ventilation system.

The ventilation system shall duct positive pressure outside ambient air directly to the LED display modules. The ventilation system shall evenly duct air into the cavity between each display module and the lens panel at the bottom of the sign.

The air shall then be exhausted out of the top the display modules to the sign housing interior. Outside ambient air shall also be directed uniformly to the back of the display modules at the bottom of the sign. Fans placed between the intake fans and the display modules, in lieu of a fully ducted system, are not acceptable.

Air flow shall be sufficient to exchange a minimum of one volume of air every two (2) seconds in the void between each display module and the lens panel.

All duct work that impedes access to any sign components shall be easily removable, without tools, for servicing of these components.
All ductwork shall be 0.040-inch thickness minimum aluminum and shall be designed to be extremely efficient with minimal pressure drop throughout the system.

S. **Ventilation System Intake:**
The ventilation system fans shall be located on the intake side to produce a positive pressure ventilation system. Air shall be drawn into the sign housing through hoods, and then filtered before reaching the fan units. There shall be an aluminum air plenum that contains the intake fans and filter.

The intake port shall be filtered and protected by an aluminum hood assembly.

The fans shall have ball or roller bearings, shall be permanently lubricated and shall require no periodic maintenance. The fans are to be positioned in such a manner so as to provide a balanced air flow to the ventilation system in the event of failure of any fan.
The sign housing shall have two exhaust ports located near the top rear of the housing. Each exhaust port shall be protected by an aluminum hood assembly.

The intake and exhaust plenum shall be sealed and designed to keep any water that gets through the hoods from getting into the sign housing interior. All water that builds up between the hoods and the filters shall drain to the exterior of the sign housing.

Ventilation System – Inlet Ventilation System Inlet Filters:
The inlet and exhaust filters shall be electrostatic and shall be sized to properly accommodate the air flow and pressure drop requirements of the ventilation system. The filters shall have an Initial Minimum Efficiency Rating Value (MERV) of 7 in accordance with ASHRAE 52.2p. Filters shall be easily removable from within the sign housing without the use of tools. The filter shall be environment-friendly, washable, reusable electrostatic filters.

Ventilation System Air Flow Sensors:
The sign shall have a minimum of two 100% solid state air flow sensors. Adequate air flow shall be automatically tested and tested on command from the central controller or laptop computer. Inadequate airflow, indicative of a fan or filter failure, shall cause an error message to be sent to the central controller or laptop computer when the sign controller is polled by the central controller or laptop computer. Airflow testing shall be performed within a pre-set ambient temperature range.

Ventilation System Back-up Control:
The housing shall be equipped with a thermally-controlled back-up system that will activate the ventilation system automatically in the event that the temperature inside the housing exceeds a pre-set limit.

Over Temperature Safety Shutdown:
The Ground Mount shall automatically shut down the LED modules to prevent damaging the LED’s if the measured internal cabinet air temperature exceeds a maximum threshold temperature. The threshold temperature shall be configurable and shall have a default factory setting of 140°F (+60°C).

T. Wiring and Power Distribution:
Power and Signal Entrances:
Two threaded conduit hubs shall be located on the rear wall of the Ground Mount housing. One hub shall be for incoming AC power and the other shall be for incoming Ground Mount signal cabling or a communications line.

Load Center:
The Ground Mount shall contain a power load center and circuit breakers that meet the following minimum requirements:

1. Service entrance-rated
2. Minimum of 20 circuit breaker mounting positions
3. Short circuit ratings of 22,000 amps and 10,000 amps for the main and branch circuits, respectively
4. UL listed load center and circuit breakers

Earth Grounding:
Shall be provided with one earth ground lug that is electrically bonded to the Ground Mount housing. The lug shall be installed near the power entrance location on the Ground Mount housing’s rear wall.

U. Convenience Outlets
The Ground Mount housing shall contain a utility outlet circuit consisting of a minimum of two (2) 15-A NEMA 15-R, 120 VAC duplex outlets, with ground-fault circuit interrupters spaced for optimum access and convenience.

V. Transient Protection:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
The Ground Mount and sign controller signal and power inputs shall be protected from electrical spikes and transients as follows:

**Site AC Power:**
The AC power feed for all equipment shall be protected at the load center by a parallel-connection surge suppresser rated for a minimum surge of 10 KA.

**Control Equipment AC Power:**
A series-connected surge suppressor capable of passing 15 amps of current shall protect the sign controller and other control and communication equipment. This device shall conform to the following requirements:

1. Withstand a peak 50,000 ampere surge current for an 8x20 microsecond waveform
2. Maximum continuous operating current of 15 amps at 120 VAC, 60 Hz
3. Series inductance of 200 micro henrys (nominal)
4. Temperature range of −40°F to +158°F (−40°C to +70°C)
5. Approximate dimensions of 3-inches wide by 5-inches long by 2-inches high (76 mm by 127 mm by 50 mm)
6. The device shall be UL-1449 recognized
7. UL 1449 surge rating of 400 V or less

**Communication Signals:**
Transient voltage surge suppressors shall protect all communication signals connecting the control equipment from off-site sources using copper cables. Transient voltage surge suppressors shall protect all copper communication lines used to pass data between the sign controller and sign.

### 3. Walk-In Dynamic Message (DMS) Sign

**A. General Specifications:**
- The Walk-In housing shall provide walk-in service access for all LED display modules, electronics, environmental control equipment, air filters, wiring, and other internal DMS components.
- The Walk-In size shall be as specified in the Contract Documents. The DMS shall contain a full display matrix measuring a minimum of \[A\] rows high by \[B\] pixel columns wide as shown in DMS DIMENSIONS table below. The matrix shall display amber messages and text that are continuous, uniform, and unbroken in appearance to the motorists and travelers.

<table>
<thead>
<tr>
<th>Pixel Rows [A]</th>
<th>Pixel Columns [B]</th>
<th>Cabinet Height [(\text{ft/m})] [C]</th>
<th>Cabinet Width [(\text{ft/m})] [D]</th>
<th>Cabinet Depth* [(\text{ft/m})] [E]</th>
<th>Weight [(\text{lbs/kg})] [F]</th>
<th>Max. Power [(\text{watts})] [G]</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>90</td>
<td>8' -6” (2.59m)</td>
<td>26' -1” (6.94m)</td>
<td>4’ -0” (1.22m)</td>
<td>3500 lbs (1587kg)</td>
<td>5400</td>
</tr>
</tbody>
</table>

Each display pixel shall be composed of multiple monochrome amber LED’s. The pixel matrix shall be capable of displaying alphanumeric character fonts measuring a minimum of 18 inches (460 mm) high to a maximum of the display matrix height.

The DMS shall be able to display messages composed of any combination of alphanumeric text, punctuation symbols, and graphic images across multiple frames.

**Dimensions:**
The approximate DMS housing dimensions shall be as shown in DMS DIMENSIONS table for the type of DMS specified in the Contract Documents. The housing dimensions shall not exceed values shown under \[D\].

**ROUTE 36 OVER THE SHREWSBURY RIVER**
**HIGHLANDS BRIDGE**
**MONMOUTH COUNTY**

Page 335
wide by [C] high. The front-to-back housing depth shall not exceed the value shown under [E] at its widest point, including the ventilation hoods.

DMS weight shall not exceed the value shown under [F] for the type of sign specified in the Contract Documents.

Legibility:
DMS messages shall be legible within a distance range of 150 ft (45.7 m) to 900 ft (274 m) from the DMS display face under the following conditions:
1. When the DMS is mounted so its bottom side is positioned between five feet (1,524 mm) and 20 feet (6,096 mm) above a level roadway surface
2. Whenever the DMS is displaying alphanumeric text that is 18-inches (460 mm) high
3. 24 hours per day and in most normally encountered weather conditions
4. During dawn and dusk hours when sunlight is shining directly on the display face or when the sun is directly behind (silhouetting) the DMS
5. When viewed by motorists and travelers that have 20-20 corrected vision
6. When the motorist eye level is 3 feet (914 mm) to 12 feet (3,658 mm) above the roadway surface.

B. Power Requirements:
Maximum AC power shall not exceed the value shown under [G] for the type of DMS specified in the Contract Documents when the following circuits are operational and fully loaded:
1. LED display pixel matrix, with 100% of the pixels operating at their maximum possible drive current
2. DMS environmental control system
3. Utility outlet circuit
4. DMS sign controller

DMS shall operate from a 120/240 VAC, 60Hz, single-phase power source, including neutral and earth ground.

C. Sign Construction:
1. The DMS housing shall be constructed to have a neat, professional appearance. The housing shall protect internal components from rain, ice, dust, and corrosion in accordance with NEMA enclosure Type 3R standards, as described in NEMA Standards Publication 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).
2. The DMS housing bottom side shall contain small weep holes for draining any water that may accumulate due to condensation. Weep holes and ventilation/exhaust hoods shall be screened to prevent the entrance of insects and small animals.
3. DMS and sign controller components shall operate in a minimum temperature range of –30°F to +165°F (-34°C to +74°C) and a relative humidity range of 0 to 95%, non-condensing. DMS and sign controller components shall not be damaged by storage at or temporary operational exposure to a temperature range of –40°F to +185°F (-40°C to +85°C).
4. External DMS component hardware (nuts, bolts, screws, standoffs, rivets, fasteners, etc.) shall be fabricated from hot dipped or mechanically galvanized steel, stainless steel, aluminum, nylon, or other durable corrosion-resistant materials suitable for the roadway signage application.
5. All external screws, nuts, and locking washers shall be stainless steel. No self-tapping external screws shall be used. All parts shall be made of corrosion resistant materials, such as plastic, stainless steel or aluminum. All materials used in construction shall be resistant to
fungus growth and moisture deterioration. Dissimilar metals shall be separated by an inert dielectric material.

6. DMS and sign controller components shall be 100% solid-state, except for the environmental control fans and thermostats. All high voltage electrical components (exceeding 24VDC) used on DMS and sign controller shall be UL (Underwriter’s Laboratory) listed and meet all applicable NEC code requirements.

7. The presence of ambient radio signals and magnetic or electromagnetic interference, including those from power lines, transformers, and motors, shall not impair the performance of the DMS. The DMS shall not radiate electromagnetic signals that adversely affect any other electronic device, including those located in vehicles passing underneath or otherwise near the DMS and its sign controller.

D. DMS Sign Housing:

1. The DMS housing structural frame shall consist of aluminum extrusions made from 6061-T6 and/or 6063-T6 or 6063-T5 aluminum alloy. All sides of the DMS housing exterior, except the front, shall be covered with 0.125-inch (3.17 mm) thick aluminum sheets made from 5052-H32 aluminum alloy. This external aluminum skin shall be attached to the structural framework using a proven method of attachment.

2. An aluminum fold-up work space for the laptop computer and an aluminum document holder shall be mounted on the back inside wall of the sign housing.

3. DMS housing right, left, and rear walls shall be vertical. The top and bottom sides shall be horizontal. The front DMS wall shall be built with a permanent forward tilt angle of three (3) degrees, so that the top of the DMS housing is deeper than its bottom. LED display modules shall be mounted parallel to the front wall, so they are tilted three (3) degrees forward toward the viewing motorists and use of the legible LED viewing area is optimized.

4. DMS housings that do not utilize three (3) degree forward tilt faces shall incorporate adjustable mounting brackets on the rear vertical plane for optimizing the viewing angle. These brackets allow for adjustment of the angular alignment of the sign housing in the vertical direction from zero (0) degree to ten (10) degrees down in one degree increments. The Adjustable mounting brackets shall be set prior to installation to give the best possible visibility setting in accordance to each DMS site.

5. The housing shall be designed to accommodate mounting on the rear vertical plane.

6. The exterior mounting assemblies shall be 6061-T6 aluminum alloy extrusions, 3/16-inch minimum thickness.

7. DMS structural assembly hardware (nuts, bolts, washers, and direct tension indicators) shall be stainless steel or galvanized A325 high-strength steel and shall be appropriately sized for the application.

E. Welding:

1. The aluminum skin shall be welded to the DMS cabinet frame. All exterior sheet seams shall be continuously seam welded to the DMS frame to form a single structure. Stitch welding shall be used on the interior of the cabinet to attach the aluminum skin sheets to the aluminum extrusion frame.


3. Proof of certification of all the LED DMS manufacturer’s welders and applicable welding procedures shall be supplied with the submittals. The name, phone number and address of the ANSI/AWS Certified Welding Inspector that certified the LED DMS manufacturer’s welders
and procedures shall also be provided with the submittals. Compliance with this standard shall include, but shall not be limited to, the following:

(a) Welding shall be performed according to documented in-house welding procedures
(b) A Certified Welding Inspector (CWI) shall inspect DMS welding on a daily basis and shall complete written reports that document welding progress, weld integrity, and any corrective action taken. The DMS manufacturer shall archive these reports and make them available for review, upon request of the Engineer.

F. Mounting Brackets:
Multiple mounting brackets in the form of I-beam or Z-bar extrusions shall be bolted to the DMS housing exterior rear wall to facilitate attachment of the DMS to the support structure.

Mounting brackets shall be:
1. Extruded from aluminum alloy number 6061-T6
2. Attached to the DMS structural frame members, not just the exterior sheet metal
3. Installed at the DMS manufacturer’s factory
4. Attached to the DMS using stainless steel or mechanically galvanized A325 high-strength steel bolts
5. Attached to the DMS using direct tension indicators to verify that mounting hardware is tightened with the proper amount of force
6. Installed such that all bracket-to-DMS attachment points are sealed and water-tight
7. Designed and fabricated such that the installing contractor can drill into them with out penetrating the DMS housing and compromising the housing’s ability to shed water

The hardware used to attach the mounting brackets (nuts, bolts, washers, and direct tension indicators) to the DMS cabinet shall be stainless steel or galvanized A325 high-strength steel and shall be appropriately sized for the application.

G. Lifting Hardware:
For moving and installation purposes, multiple galvanized steel lifting eyebolts or permanently mounted and sealed pick angles shall be attached to the top of the DMS housing. Eye bolts or picks angles hardware shall attach directly to the DMS housing structural frame and be installed at the DMS factory. All mounting points for eye bolts or pick angles shall be sealed to prevent water from entering the DMS housing. Lifting hardware, as well as the housing frame, shall be designed such that the DMS can be shipped and handled without damage or excessive stress being applied to the housing prior to or during DMS installation on its support structure.

H. Front Face Construction:
1. The DMS front face shall be constructed with multiple rigid panels, each of which supports and protects a full-height section of the LED display matrix. The panels shall be fabricated using aluminum sheeting on the exterior and polycarbonate sheeting on the interior of the panel.
2. Front face panels shall provide a high-contrast background for the DMS display matrix. The aluminum mask of each panel shall be treated with Kynar 500 and shall contain an opening for each pixel. Openings shall be large enough to not block any portion of the viewing cones of the LED’s.
3. Face panels shall be attached to each other using stainless steel hardware. Seams that separate adjacent panels shall be sealed. Panels shall not be welded or otherwise permanently mounted to the DMS housing. Panels shall be mounted in such a way that they are removable from the interior of the DMS housing.

I. The face panels shall include a Lens Panel Aluminum Mask, which shall be:
1. 0.090 inch minimum thickness
2. Finished with a matte-black, licensed-factory-applied, Kynar 500 Resin, fluoropolymer-based coating system.
3. Perforated, providing an aperture for each pixel on the display modules. Each aperture shall be as small as possible, without blocking the LED light output at the required viewing angle.
4. The Lens Panel Assembly shall consist of a Kynar 500 coated aluminum mask over a clear glazing. The aluminum mask shall be laminated and sealed to the surface of the glazing using the 3M Scotch VHB joining system or pre-approved equivalent.

J. **The Lens Panel Assembly shall be:**
   1. Modular in design
   2. Interchangeable with no misalignment with the LED pixels.
   3. Removable from within the main sign housing.
   4. Each panel shall have a single polycarbonate sheet attached securely to the inside of the aluminum panel. The polycarbonate sheet shall cover all of the pixel openings. The polycarbonate shall be sealed to prevent water and other elements from entering the DMS. The polycarbonate shall contain UV inhibitors that protect the LED display matrix from the effects of ultraviolet light exposure and prevent premature aging of the polycarbonate itself.
   5. The Lens Panel Clear Glazing shall be 90% UV opaque polycarbonate – GE LEXAN® XL10 or pre-approved equivalent.

K. **The minimum required glazing properties include:**
   1. 1/4-inch thick minimum
   2. Clear in color
   3. Guaranteed for 10 years against yellowing, loss of light transmission and breakage
   4. Tensile Strength, Ultimate: 9,500 psi
   5. Tensile Strain at Yield: 6%
   6. Tensile Modulus: 340,000 psi
   7. Flexural Modulus: 340,000 psi
   8. Impact Strength, Izod (up to 125 mils, notched): 12-16 ft-lbs/inch
   9. Rockwell Hardness: M70, R118
   10. Heat Deflection Temperature Under Load: 270°F (264 psi); 288°F (66 psi)
   11. Coefficient of Thermal Expansion: 3.75x10-5 in/in/°F
   12. Initial Light Transmittance: 88% (average)
   13. Change in Light Transmittance, 5 years exposure: less than 5%
   14. Change in Yellowness Index, 5 years exposure: less than 5%

LED display modules shall be mounted to the inside of the DMS front face panels. Common hand tools shall be used for removal and replacement.

DMS front face borders (top, bottom, left side, and right side), which surround the front face panels and LED display matrix, shall be treated with Kynar 500, to maximize display contrast and legibility.

L. **The face shall include External Fascia Perimeter Panels, that shall:**
   1. Be manufactured from extruded aluminum.
   2. Be designed and attached so to minimize heat conduction between the exterior surfaces and the interior components.
   3. Be finished with a matte-black, licensed-factory-applied Kynar 500 Resin, fluoropolymer-based coating system.
   4. Be removable from within the sign housing.

The border, and therefore the external fascia perimeter panels, shall be a minimum of 12 inches (.0305 m) wide. The external fascia panels shall be thermally isolated from the rest of the sign housing. The design and materials used to accomplish this shall be approved by the engineer.
In the presence of wind, the DMS front face shall not distort in a manner that adversely affects LED message legibility.

M. Exterior Finish:
DMS front face panels and front face border pieces shall be coated with semi-gloss black Kynar 500 resin or an equivalent brand of oven-fired fluoropolymer coating, which has an expected outdoor service life of 20 years.

All other DMS housing surfaces, including the access doors and DMS mounting brackets, shall be natural mill-finish aluminum.

N. Service Access
1. The DMS housing shall provide safe and convenient access to all modular assemblies, components, wiring, and subsystems located within the DMS housing.
2. All of those internal components shall be removable and replaceable by a single technician. The DMS front face panels shall also be removable and replaceable from inside the DMS cabinet.
3. One (1) vertically hinged door shall be located on each end (left and right side) of the DMS housing. Each access door shall be mounted to an integral doorframe, which bolts to the DMS housing using stainless steel hardware. A continuous vertical stainless steel hinge shall support each door, and all doors shall open outward. In the closed position, each door shall latch to its frame with a three-point draw-roller mechanism. The latching mechanism shall include an internal handle and release lever. Door release levers shall be located so that a person with no key and no tools cannot become trapped inside the housing.
4. Access doors, when open at a 90-degree angle from the DMS housing end wall, shall not extend more than 38-inches (965 mm) from the housing. The bottom edge of each door shall be at least 3.5-inches (89 mm) from the bottom edge of the DMS housing.
5. This access door shall be 92” X 34” (2337 mm X 864 mm) minimum. The door will be fitted with a handle operated locking mechanism, closed cell neoprene gasket and a stainless steel hinge. The door shall incorporate an integral frame made of 6061-T6 and 6063-T5 aluminum alloy extrusions, 3/16-inch minimum thickness.
6. A three-point lockable aluminum, framed, heavy-duty access door shall be provided at the end of the housing as shown in the plans to enable easy access to the walk-in housing. This shall make it possible for a single maintenance person to easily access the display modules.
7. Included in the door assembly shall be a device to hold the door open at 90 degrees.
8. Each door shall be furnished with a lock that is keyed to the engineer’s requirements.
9. The DMS shall be equipped with an OSHA compliant safety rail assembly, which prevents service personnel from falling out of the DMS when closed across an open access door. A rail assembly shall be provided for each door in the display. The safety rail shall consist of a top rail that extends 42-inches (1067 mm) above the interior walkway, and a mid rail that extends 21-inches (533 mm) above the interior walkway. The rail assembly shall require no tools to open and close.
10. The DMS cabinet shall be equipped with an OSHA compliant anchor point at each entrance location for the connection of a personal fall arrest system. These anchorages must be strong enough to withstand a force of 5,000 pounds (2268 kilograms) as required by OSHA. The anchorages must be located just inside access door within easy reach from the outside.

O. Interior Work Area:
1. Minimum headroom of 70 to 72-inches (1,829 mm) shall be provided. This free space shall be maintained across the entire width of the DMS housing, with the exception of structural
frame members. Structural members shall be designed not to obstruct the free movement of maintenance personnel throughout the DMS interior.

2. A level walkway shall be installed in the bottom of the DMS housing. The walkway shall be a minimum of 24-inches (610 mm) wide, and it shall run the entire length of the housing. The walkway’s top surface shall be non-slip and shall be free of obstructions that couldtrip service personnel. The walkway shall support a load of 300 pounds (136 kg) per linear foot, and it shall be constructed of multiple, removable panels.

P. Internal Lighting:

1. The DMS housing shall contain a minimum of one (1) 4-foot (1,200 mm), 60-watt fluorescent lamp fixture for every eight (8) feet (2,438 mm) of DMS housing width. Lamps shall be evenly spaced across the housing ceiling, so they provide uniform light distribution for maintenance purposes. Wire cages shall protect lamps. Lamp ballasts shall be rated for cold weather operation down to 0°F (-17ºC). One light switch shall be located within easy reach of each access door.

2. The sign housing shall be furnished with a minimum of three (3) GFI duplex outlets spaced for optimum access and convenience; and four (4) compact fluorescent, located above the walkway for optimum lighting. The fluorescent lamps shall be 150 Watts equivalent (42 Watts actual power), medium screw base, instant start, helix fluorescent lamps.

3. A 12-hour timer for the lights shall be located near the door. The light timer shall not incorporate a hold feature.

Q. LED Display Modules and Driver Boards:

1. Each display module consists of a display board with a matrix of LED pixels
2. The pixels are mounted on the front side of the display module.
3. Each driver board shall have the capability to control a minimum of nine display modules. The driver board connects to the sign interface circuits and passes information to the associated display modules, which control the character pixels. The driver board shall receive control signals and display data from the sign controller. The display module shall contain the control and memory elements and provide the signals to switch and read the LED pixels.
4. The driver boards shall connect to a single control cable common to each of display modules. The LED display board shall contain all LED’s required to form a matrix of pixels. Pixels shall be arranged uniformly to display a dot-matrix 18-inch (457 mm) high character in five columns wide and seven pixels high. The height of a standard character shall be defined as the distance from the lowest point of the lowermost pixel of the character to the highest point of the uppermost pixel of the character.
5. The display modules shall be rectangular, and shall have an identical horizontal and vertical pitch between pixels containing 45 LED pixels arrayed 9 high by 5 wide. The pitch shall be measured from the center of one pixel to the center of all adjacent pixels. This distance shall be 2.75-inches (70 mm).
6. The separation between the last column of one module and the first column of the next shall be equal to the horizontal distance between the columns of a single display module. The separation between the last row of one module and the first row of the next shall be equal to the horizontal distance between the rows of a single display module.
7. All LED’s shall be individually and directly mounted to the LED circuit board to form the LED display board. The LED circuit board shall be a manufactured using a laminated fiberglass printed circuit board. The LED display board shall support the driver board. All LED pixel boards shall be identical and interchangeable throughout the DMS.
8. All LED’s shall be mounted so that their mechanical axis is normal +/- 1.00 degree to the face of the sign to ensure brightness uniformity over the face of the sign.

R. LED Pixel Boards:
1. Each LED pixel board shall be composed of a printed circuit board to which LED pixels are soldered. The LED pixel boards shall conform to the following specifications:
2. LED pixel boards shall be manufactured using a laminated fiberglass printed circuit board.
3. The distance from the center of one pixel to the center of all adjacent pixels, both horizontally and vertically, shall be 2.75 inches (69.85mm).
4. All pixels shall contain an equal quantity of discrete LED’s and LED strings. Each pixel shall contain a minimum of two (2) independent and parallel strings of LED’s. The minimum number of LED’s per pixel shall be not less than four (4).
5. The failure of an LED string or pixel shall not cause the failure of any other LED string or pixel in the DMS.
6. Each pixel shall contain the quantity of discrete amber LED’s needed to output a minimum luminous intensity of 9,200 candelas per square meter when operated within the forward current limits defined in these specifications.
7. Each LED pixel shall not consume more than 1.5 watts.
8. The circular base of the discrete LED’s shall be soldered so that they are flush and parallel to the surface of the printed circuit board. The longitudinal axis of the LED’s shall be perpendicular to the circuit board.
9. All exposed metal on both sides of the LED pixel board, except connector contacts, shall be protected from water and humidity exposure by a thorough application of conformal coating.
10. All LED pixel boards shall be identical and interchangeable throughout the DMS.
11. Pixel Protection Device:
    Each pixel shall have a device attached to the printed circuit board (PCB) to hold and protect the LED’s

S. These devices shall:

1. Hold the LED’s perpendicular to the display modules within 0.5 degree,
2. Prevent the LED’s from being crushed or bent during handling,
3. Protect the LED’s from damage when the display module is laid on the front surface (the side that the LED lamps are located),
4. Be easily removable from the display module PCB without any tools,
5. Not put any stress on the LED’s due to differentials of expansion and contraction between the device and the LED’s over the herein specified temperature range,
6. Not become loose or fall off during handling or due to vibrations,
7. Not block airflow over the leads of the LED’s,
8. Securely hold each LED while allowing a gap between the device and a minimum of 95% of the body of each LED for airflow,
9. Not block the light output of the LED’s at the required viewing angle,
10. Be black in color to maximize contrast.
11. Epoxy encapsulation of the LED’s will not be permitted. Hoods or visors shall not be used.
12. The LED’s shall be protected from the outside environmental conditions, including moisture, snow, ice, wind, dust, dirt and UV rays.

T. Discrete LED’s:

DMS pixels shall be amber color and shall be constructed with discrete LED’s manufactured by Avago Technologies (formerly Agilent Technologies), or by Toshiba Corporation, or by Nichia Corporation, or approved equivalent.

Discrete LED’s shall conform to the following specifications:

1. All LED’s shall have a nominal viewing cone of 30 degrees with a half-power angle of 15 degrees measured from the longitudinal axis of the LED. Viewing cone tolerances shall be as
specified in the LED manufacturer’s product specifications and shall not exceed +/- 3 degrees.

2. Amber LED’s shall utilize AlInGaP semiconductor technology and shall emit amber light that has a peak wavelength of 590 ± 5 nm.

3. The LED lenses shall be fabricated from UV light resistant epoxy.

4. The LED intensity bins shall be distributed evenly throughout the sign and shall be consistent from pixel to pixel. Random distribution of the LED bins shall not be approved.

5. LED package style shall be of the through-hole, stand-off type.

6. All LED’s used in all DMS provided for this contract shall be from the same manufacturer and of the same part number, except for the variations in the part number due to the intensity and color bins.

7. Pixels shall contain the quantity of discrete LED’s needed to output a minimum intensity of 40 candelas at 20 mA. Pixel brightness shall be attained by the sum of the brightness of the individual LED’s in each pixel. The brightness of each LED shall be measured in accordance with the CIE Test Method A, as described in CIE 127-1997, Technical Report: Measurement of LED’s. The LED brightness and color bins that are used in each pixel shall be provided to the engineer for approval. Certification shall be provided, with the submittals, from the LED manufacturer that demonstrates that the LED’s were tested and binned in accordance with the CIE Test Method A.

8. This shall yield an overall minimum luminous intensity for the sign face of 9,200 Cd/m² at 30 mA drive current stated below. Certification shall also be provided, with the submittals, from the LED manufacturer that the various LED color and intensity bins shall be distributed evenly throughout the sign and shall be consistent from pixel to pixel. Random distribution of the LED bins shall not be approved.

9. The LED’s in each pixel shall be clustered to maximize long range visibility. All pixels shall have equal color and on-axis intensity. All pixels included in each sign, as well as throughout the entire contract, including the spare parts, shall have equal color and on-axis intensity. The method used to provide the equal color and intensity, as stated above, shall be included in the submittals and approved by the Engineer.

10. The LED’s shall be rated by the LED manufacturer to have a minimum lifetime of 100,000 hours of continuous operation while maintaining a minimum of 70% of the original brightness.

U. Pixel Drive Circuitry:

Each driver board shall have the capability to control a minimum of nine display modules. The driver board connects to the sign interface circuits and passes information to the associated display modules, which control the character pixels. The driver board shall receive control signals and display data from the sign controller. The display module shall contain the control and memory elements and provide the signals to switch and read the LED pixels.

The driver circuit boards shall conform to the following specifications:

1. LED driver boards shall be manufactured using a laminated fiberglass printed circuit board.

2. All exposed metal on both sides of the LED driver board, except connector contacts, shall be protected from water and humidity exposure by a thorough application of silicone conformal coating.

3. Constant current LED driver ICs or another method that provides at least the same level of control (such as PWM) shall be used to prevent LED forward current from exceeding the LED manufacturer’s recommended forward current whenever a forward voltage is applied. To maximize LED service life, LED drive currents shall not be allowed to exceed the manufacturer’s recommendations for the 100,000-hour lifetime requirement.
5. The LED pixels shall be directly driven using pulse width modulation (PWM) of the drive current to control the display intensity. This LED driver circuitry shall vary the current pulse width to achieve the proper display intensity levels for all ambient light conditions. The drive current pulse shall be modulated at a frequency high enough to provide flicker-free operation and a minimum of 200 brightness levels.

6. The LED driver boards shall receive updated display data at a minimum rate of ten (10) frames per second from the sign controller.

7. Each LED driver board shall be powered by 24 VDC from external regulated DC power supplies. Each driver board shall receive power from a minimum of two (2) independent power supplies.

8. The voltage of each power input shall be measured to the nearest tenth of a volt and reported to the sign controller upon request. Each driver board shall also contain one status LED for each power source that indicates if the power source is present or not.

9. The LED driver circuitry shall be able to detect that individual LED strings or pixels are stuck off and shall report the pixel status to the sign controller upon request.

10. The LED driver board shall contain a seven segment numeric LED display that indicates the functional status of the driver and pixel boards. At a minimum, it shall indicate error states of the LED pixels and communication network. The indicator shall be positioned such that a maintenance technician can easily view the status code for diagnostic purposes. The status codes shall also be reported to the sign controller upon request. Alternatively, this information may be displayed by the sign controller.

11. All driver circuit boards shall be identical and interchangeable throughout the DMS.

12. Removal or failure of a single driver circuit board shall not affect the performance of any other LED display module in the DMS.

13. Individual addressing of each driver circuit shall be configured via the communication wiring harness and connector. No on-board addressing jumpers or switches shall be allowed.

14. Brightness Control:

15. Automatic adjustment of the LED brightness shall occur in small enough increments so that the brightness of the sign changes smoothly, with no perceivable brightness change between adjacent levels. Provision shall be made to prevent perceivable brightening of the sign due to stray headlights shining upon the photo sensors at night. Pixel brightness shall be controlled by pulse width modulation of the DC current. The pixel current waveform shall have a frequency of 100 ± 5 Hz at night time brightness levels and a minimum of 2400 Hz at daytime brightness levels with an adjustable duty cycle of 0.1% to 99.9% in 0.5% or finer increments.

16. There shall be a means to adjust how rapidly the sign responds to changes in ambient light as measured by the photocells. This can be used, for example, to prevent the sign from changing its brightness due to a vehicle’s headlight momentarily shining on the sign. The adjustment shall be made from the central controller or laptop computer and shall have two different settings, one for daytime control and one for nighttime control, with the day/night ambient light threshold also being an adjustable value. In addition, there shall be a means to specify different weighting factors for each photocell, to specify how prominently each photocell figures in the calculation of night time ambient light.

17. Brightness Table:

18. The sign controller shall monitor the photo cell circuits in the sign and convert the measured light intensity into the desired pixel brightness. The photo circuit readings shall be correlated with a brightness table in the sign controller. The brightness table shall have a minimum of 256 brightness levels. Each sign shall have its own, independent brightness table.

19. The brightness table in each individual sign controller shall be downloadable, both locally and from the central controller, and can be customized according to the requirements of the installation site.

20. Automatic Brightness Control:
22. The DMS shall be capable of automatically adjusting LED brightness to account for changing ambient light conditions. The system required for this function consists of three primary component groups: Photocells, an adjustable brightness table and the overall brightness capability of the DMS.

23. Photocell Devices:
24. Three (3) photocells shall be installed in the sign. These devices shall permit automatic light intensity measurement of light conditions at each sign location. These photocells shall be mounted in a manner to measure front, rear and ambient light conditions.

25. Manual Brightness Control:
26. Brightness shall be manually settable from the front panel of the controller and remotely from the central computer in 1% increments from one to 99 percent. Brightness control shall be able to be returned to automatic from the sign controller front panel and the central computer.

V. Regulated DC Power Supplies:
The LED pixel display modules shall be powered with auto-ranging regulated switching power supplies that convert the incoming AC, to DC at a nominal voltage of 24 volts DC. Power supplies shall be wired in a redundant parallel configuration that uses multiple supplies for the DMS display matrix.

Power supplies shall be arranged in redundant, diode OR configuration, such that one supply may completely fail and the sign will still be supplied with enough power to run 30% of all pixels at 100% duty cycle at 65 degrees C (149 degrees F). Functioning supplies must current-share to within 10%.

The power supplies shall be sufficient to maintain the appropriate LED display intensity throughout the entire operating input voltage range.

Each power supply within each pair shall receive 120VAC power from separate circuits on separate circuit breakers, such that a single tripped breaker will not disconnect power from both supplies. It shall be acceptable for a single circuit breaker to power multiple DC power supplies provided that none of those power supplies are in the same power supply pair.

The power supplies shall be sufficient to maintain the appropriate LED display intensity throughout the entire operating input voltage range.

Each group of power supplies shall be monitored by a microprocessor-controlled circuit. This circuit shall monitor the voltage of each power supply and the status of each output circuit’s fuse. The power supply voltages and fuse states shall be reported via a CAN (controller area network) communication network to the sign controller upon request. Alternatively, the power supplies’ outputs may be monitored directly, and reported to Central by the sign controller.

The power supplies used to power the LED pixel modules shall be identical and interchangeable throughout the DMS.

Regulated DC power supplies shall conform to the following specifications:

1. Nominal output voltage of 24 VDC +/- 10% unless otherwise approved
2. Nominal maximum output power rating of 1500 watts
3. Operating input voltage range shall be a minimum of 90 to 260 VAC
4. Operating temperature range shall be a minimum of –30°F to +165°F (-34°C to +74°C)
5. Maximum output power rating shall be maintained over a minimum temperature range of –30°F to +140°F (-34°C to +60°C)
6. Power supply efficiency shall be a minimum of 80%
7. Power factor rating shall be a minimum of 0.95
8. Power supply input circuit shall be fused
9. Automatic output shut down if the power supply overheats or one of the following output faults occurs: over-voltage, short circuit, or over-current
10. Power supplies shall be UL listed
11. Printed circuit boards shall be protected by an silicone conformal coating

a. Control Systems:
The Walk-In DMS shall include a DMS controller and auxiliary control panel as specified in the Requirements for DMS Controllers section herein.

W. Environmental Monitoring Systems:
The Walk-In DMS shall include sensors that monitor and report ambient (external) light level and temperature, as well as the internal temperature and humidity.

1. Ambient Light Measurement:
   Sensors that measure the outdoor ambient light level and the outdoor ambient temperature at the DMS site shall be mounted in-line with the DMS housing walls. This ambient light and temperature measurement system shall consist of three (3) electronic light sensors.

   Two of the light sensors shall be placed such that they measure the ambient light levels striking the front and rear of the DMS. The third light sensor shall be mounted to the floor of the DMS housing and shall face the ground. The DMS sign controller shall continuously monitor the light sensors and adjust the LED display matrix intensity to a level that creates a legible message on the DMS face.

2. Ambient Temperature Measurement:
   A minimum of one (1) ambient temperature sensor shall be mounted to either the rear wall or bottom side of the DMS housing. The sensor shall be placed such that it is never in direct contact with sunlight. The external temperature sensor reading shall be continuously monitored by the DMS sign controller and shall be reported to the DMS control software upon request.

3. Internal Temperature Measurement:
   The ventilation system shall be activated by multiple temperature sensors. There shall be a minimum of one sensor located near the middle of each module , at the top of the display module in the exhaust stream from the cavity between the display module and the lens panel. There shall be an additional temperature sensor located to accurately measure the ambient temperature outside the sign housing. The temperature sensors shall have an accuracy of +/- 1.5 degrees C and a range from -40° to +74°C.

   The temperatures from the sensors shall be continuously measured and monitored by the sign controller. A temperature reading greater than a user selectable critical temperature shall cause the sign to go to blank and the sign controller shall report this action to the central controller. This user selectable critical temperature shall be capable of being changed by the central controller or laptop computer. The central controller and laptop computers shall have the ability to read temperature measurements from the sign controller.

   The internal temperature sensor’s outputs shall be continuously monitored by the DMS sign controller and shall be reported to the DMS control software upon request.
4. Internal Humidity Measurement:
The DMS shall contain one (1) sensor that measures the relative humidity of the air inside the DMS cabinet. The sensor shall monitor the humidity from 0 to 100%. The humidity sensor output shall be continuously monitored by the DMS sign controller and shall be reported to the DMS control software upon request.

X. Interior Walk-In DMS Environmental Control:
The DMS shall contain systems for cabinet ventilation, face panel fog and frost prevention, and safe over-temperature shutdown.

1. Housing Ventilation System:
The ventilation system shall be a positive-pressure, filtered, forced-air, fully ducted system which cools both the display modules and the sign housing interior. Negative pressure systems that use exhaust fans are not acceptable.

The ventilation system shall provide a minimum of four (4) sign housing volume air changes per minute at the pressure drop developed throughout the entire ventilation system. Outside ambient air shall be ducted directly from the fans to ducts at the bottom the sign. The duct at the bottom of the sign shall evenly duct air into the cavity between each display module and the lens panel. The air shall then be exhausted out of the top of each display module. Outside ambient air shall also be directed uniformly to the back of the display modules. Fans placed between the intake fans and the display modules, in lieu of a fully ducted system, are not acceptable.

Air flow shall be sufficient to exchange a minimum of one volume of air every two (2) seconds in the void between each display module and the lens panel.

All duct work that impedes access to any sign components shall be easily removable, without tools, for servicing of these components.

All ductwork shall be 0.040-inch thickness minimum aluminum and shall be designed to be extremely efficient with minimal pressure drop throughout the system.

A manual override timer switch shall be located just inside the access door to manually activate the ventilation system. The switch shall be adjustable from zero (0) to four (4) hours. If doors are located at both ends of the cabinet, one override switch shall be located at each door.

2. Ventilation System Intake:
The ventilation system shall have four (4) fans. The fans shall be located on the intake side to produce a positive pressure ventilation system. Air shall be drawn into the sign housing through hoods, and then filtered before reaching the fan units.

The fans shall have ball or roller bearings, shall be permanently lubricated and shall require no periodic maintenance. The fans are to be positioned in such a manner so as to provide a balanced air flow to the ventilation system in the event of failure of any fan.

The sign housing shall have two (2) intake ports, each with an associated air plenum. Each intake port shall be filtered and protected by an aluminum hood assembly.

The sign housing shall have two exhaust ports located near the top rear of the housing. Each exhaust port shall be protected by an aluminum hood assembly.
The air plenums will be sealed and designed to keep any water that gets through the hoods from getting into the sign housing interior. All water that builds up between the hoods and the filters shall drain to the exterior of the sign housing.

The bottom of each hood assembly shall be protected by an aluminum grate that folds up to allow the bottom of the grate to be cleaned from within the sign housing.

3. Ventilation System – Exhaust Ventilation System Exhaust Filters:
The exhaust filters shall be electrostatic and shall be sized to properly accommodate the air flow and pressure drop requirements of the ventilation system. The filters shall have an Initial Minimum Efficiency Rating Value (MERV) of 7 in accordance with ASHRAE 52.2p. Filters shall be easily removable from within the sign housing without the use of tools and shall be environment-friendly, washable, reusable electrostatic filters.

4. Ventilation System – Inlet Ventilation System Inlet Filters:
The sign shall have one filter system for each air intake plenum. Each filter system shall utilize reusable and commercially available filter media. The inlet and exhaust filters shall be electrostatic and shall be sized to properly accommodate the air flow and pressure drop requirements of the ventilation system. The filters shall have an Initial Minimum Efficiency Rating Value (MERV) of 7 in accordance with ASHRAE 52.2p. Filters shall be easily removable from within the sign housing without the use of tools. Both inlet and exhaust shall use environment-friendly, washable, reusable electrostatic filters.

5. Ventilation System – Automatic Filter System:
The sign shall have two filter cartridges – one (1) for each air intake plenum. Each filter cartridge shall contain a minimum of 60 filter media changes that shall be automatically changed (advanced) when commanded by the sign controller. The filter media shall be replaceable and commercially available. The filter shall have an Initial Atmospheric Dust Spot Efficiency of 64 at 20 cm/s in accordance with ASHRAE 52.1. For each filter cartridge, the effective filtration area of each filter media change shall be a minimum of four square feet of filter media. Changing (advancing) the filter media shall be fully automatic and shall not require manual assistance. The sign controller shall read the solid state air flow sensors, the internal temperature sensors and the outside (ambient) temperature sensor and use this information in an algorithm to automatically change (advance) the filter when appropriate. Each time the filter is changed, the sign controller shall notify the central controller at the next poll. The sign and central controllers shall track the number of remaining changes. When a filter fails to change, the sign controller shall notify the central controller of this failure at the next poll. Each filter cartridge shall be easily removable from within the sign housing without the use of tools.

6. Ventilation System Air Flow Sensors:
The sign shall have a minimum of two 100% solid state air flow sensors. Adequate air flow shall be automatically tested once a day and tested on command from the central controller or laptop computer. Inadequate airflow, indicative of a fan or filter failure, shall cause an error message to be sent to the central controller or laptop computer when the sign controller is polled by the central controller or laptop computer. To protect the display modules and other electronic circuitry, airflow testing shall only be performed within a pre-set ambient temperature range.

Y. Wiring and Power Distribution:
1. Power and Signal Entrances:
Two threaded conduit hubs shall be located on the rear wall of the DMS housing. One hub shall be for incoming AC power and the other shall be for incoming DMS signal cabling or a communications line.

2. Load Center:
   The DMS shall contain a power load center and circuit breakers that meet the following minimum requirements:
   a. Service entrance-rated
   b. Minimum of 20 circuit breaker mounting positions
   c. Short circuit ratings of 22,000 amps and 10,000 amps for the main and branch circuits, respectively
   d. UL listed load center and circuit breakers
   e. Earth Grounding:
      Walk-In DMS shall be provided with one earth ground lug that is electrically bonded to the DMS housing. The lug shall be installed near the power entrance location on the DMS housing’s rear wall.

Z. Convenience Outlets:
   The Walk-In DMS housing shall contain a utility outlet circuit consisting of a minimum of three (3) 15-A NEMA 15-R, 120 VAC duplex outlets, with ground-fault circuit interrupters. One outlet shall be located near each end of DMS housing interior, and the third outlet shall be located near the housing’s center.

1. Transient Protection:
   The DMS and sign controller signal and power inputs shall be protected from electrical spikes and transients as follows:
   a. Site AC Power:
      The AC power feed for all equipment shall be protected at the load center by a parallel-connection surge suppressor rated for a minimum surge of 10 KA.
   b. Control Equipment AC Power:
      A series-connected surge suppressor capable of passing 15 amps of current shall protect the sign controller and other control and communication equipment.

2. This device shall conform to the following requirements:
   a. 1. Withstand a peak 50,000 ampere surge current for an 8x20 microsecond waveform
   b. 2. Maximum continuous operating current of 15 amps at 120 VAC, 60 Hz
   c. Series inductance of 200 micro henrys (nominal)
   d. Temperature range of –40°F to +158°F (-40°C to +70°C)
   e. Approximate dimensions of 3-inches wide by 5-inches long by 2-inches high (76 mm by 127 mm by 50 mm)
   f. The device shall be UL-1449 recognized, UL 1449 surge rating of 400 V or less
   g. Communication Signals:
      Transient voltage surge suppressors shall protect all communication signals connecting the control equipment from off-site sources using copper cables.
      Transient voltage surge suppressors shall protect all copper communication lines used to pass data between the sign controller and sign.

4. CCTV Camera Standard Assembly
   CCTV Camera Standard Assembly includes installing and furnishing a modified Traffic Signal Standard, Type C, hand holes, air terminal, anchor bolt assembly, cap and mountings for camera assembly and NEMA enclosure as shown in the plans or specified in the specifications. It shall also include all necessary incidental material and hardware.
Camera standards shall be securely bolted in a vertical position. Shims of 6 millimeters maximum thickness shall be installed, if necessary. Camera assemblies and cabinets shall be securely attached to poles as shown in the plans and as approved by the Engineer. The Contractor shall install a NEMA 3R enclosure to the camera standard with a cabinet and shall be mounted at such a position that a service technician faces oncoming traffic when opening the cabinet.

5. CCTV Camera and Controller Assemblies

CCTV Camera and Controller Assemblies shall consist of furnishing and installing a complete CCTV System with equipment at location shown on the plans and listed in these specifications and contract documents. The CCTV System shall include but is not limited to CCTV Camera, controller/receiver driver, NEMA Enclosure, Camera Drive System, MPEG4 encoder, Ethernet Switch (if not functionally included in the MPEG4 encoder), miscellaneous cables, electric power equipment, surge suppression, patch panel, connectors, pan-tilt drive, video/data transceiver, all labor, testing, warranty and documentation and other incidental material for a complete operational, integrated and configured assembly.

Video signals transmitted from the CCTV camera shall be encoded to IP and transmitted over cable television service with the use of MPEG-4 encoders and Ethernet switch, into a cable modem. At the Traffic Operations Center, South, the IP signals shall then be received by a gigabit Ethernet switch, decoded and connected to the traffic operation center operators to view traffic conditions. Each CCTV site shall include the necessary communications equipment to encode the camera video and control signals for transmission via Fast 100 Ethernet IP Protocol, establish an Internet address, and transmit the signals to the traffic operations centers. The decoding and receiving equipment shall be included in the pay item Center Control Equipment to be furnished and installed at the TOCS. Cable connections at those sites shall include a PelcoNET 4001A series transmitter/receiver combination with each assembly in lieu of fiber optic modems and IP encoding equipment.

All CCTV cables at the local sites shall enter the control cabinet through the back. All cables shall enter the cabinet via a 2” threaded conduit passing through the back of the cabinet and through the wall of the camera pole as shown on the plans. The fittings used to make these connections are all part of the camber assembly and shall not be paid separately.

6. Central Control Equipment

Central Control Equipment shall consist of furnishing and installing video servers, gigabit Ethernet switches, cables and other related equipment needed to be installed at the Traffic Operations Center, South for complete operation of the CCTV and VMS systems. Central Control Equipment shall also include software integration at the TOCS. Software integration at the TOCS is the responsibility of the Contractor. The TOCS shall be equipped with the equipment necessary to receive Fast Ethernet encoded video over IP and control data signals, individually decode the Ethernet encoded signals to NTSC, connect each video picture to the existing monitor switches in the existing TOC equipment rooms, and connect DMS information and instruction sets to the existing DMS management system in the existing TOC equipment rooms. One 24 port 10/100 Mbps Ethernet Switch featuring 2 uplink Ethernet ports shall be installed on Rack 3 of the TOCS, as well as five encoder/decoders for the field equipment being installed. Any equipment not specifically mentioned in these specifications that may be necessary to build a fully operational system of video encoders, gigabit switches and decoders shall be furnished and installed at the TOCS.

7. System Integration

System Integration shall consist of furnishing and installing any additional equipment at each field installation location for complete operation of that system with the TOCS. Any equipment not specifically mentioned in these specifications that may be necessary to build a fully operational system at the field location shall be furnished and installed at the field location.

8. Real Time Work Zone Traffic System

A. System Requirements

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
The SYSTEM shall consist of the following (as a minimum):

1. Installing two dedicated portable Dynamic Message Signs (DMS) remotely controlled via central computer base station at locations preferred and approved by TOCS.

2. Displaying the automatically generated SYSTEM messages on the proposed two Walk-In DMS’s in the Contract; and on any of the portable Variable Message Signs provided for in the Contract. Until the permanent DMS are operational, temporary DMS shall be deployed at the specified locations.

3. Providing the automatically generated SYSTEM messages through the Highway Advisory Radio (HAR) system operated by TOCS.

4. Use of the Department signs or other existing ITS systems shall not restrict or adversely impact the operation of those facilities.

5. Installing portable traffic sensors linked to central computer base station that are located to address traffic conditions through the work zone and a minimum queue length of 1 mile beyond the limits of the work zone. The sensors shall be redeployed or provided as required to ensure the traffic conditions though the actual queues, the work zone, and to provide for the sign messages specified are accurately depicted.

6. 1 central base station equipped with appropriate software and either wireless or dedicated phone line communications to “link” with the SYSTEM.

7. The SYSTEM shall be capable of providing current operational and location status (i.e. current traffic data and messages, communications system, signs and sensors) via the central base station computer and via the Internet on a dedicated project web-site established for the purpose of monitoring the corridor and the SYSTEM equipment. Critical system operator control functions shall be password protected.

8. Through the password-protected web-site or at the field sites, SYSTEM shall allow the TOCS operators to manually override the automated messaging in order to display a message at any time. The operator shall be able to send a pre-programmed or custom message to one sign or multiple signs without sending the identical message to individual signs. The operator shall be able to cancel this manual override and initiate any and all of the systems automated messaging features at any time. The SYSTEM shall record in the database the time frame and message content of any message overrides.

9. The web-site shall have the capability of providing a password protected “link” for approved personnel to have access to retrieve the volume and speed data the system is collecting.

10. The web-site for the SYSTEM shall be capable of verifying and validating the real-time messages on the signs for password approved personnel.

11. The software shall be configured to assess any type of malfunction that has occurred. This assessment includes communication disruption between any device in the system configuration, sign malfunctioning, speed sensor malfunction, etc. The SYSTEM shall be capable of notifying the Resident Engineer’s office, the Contractor, and the TOCS about any system malfunction. The SYSTEM software shall be configured so that appropriate personnel are immediately notified by e-mail once a malfunction has occurred in the system. The SYSTEM shall record these notices in the database.

12. The web-site address shall be open to the public for viewing only of the speed/travel times and the sign messages and be linked to a Department web site, and other regional agency traffic web sites as directed. The web site shall be in the format as required by the Department’s Webmaster. The information shall be presented on zoom-able map to allow the user to view from the specific device level up to the State level.

13. The dedicated project web-site shall provide a full color map depicting the project area with current locations of traffic sensors and signs, and include installing icons and links to traffic cameras in the region.

14. Using color-coding, the map shall reflect the current traffic conditions at each traffic sensor and display the entire information message being shown by each sign.

15. The exact locations of all devices shall be determined as part of an on-site analysis with TOCS and the Resident Engineer, and must meet the Department’s safety requirements and be coordinated with the other construction operations. The final locations shall be approved.
by the Engineer, and shall be relocated or repositioned during the deployment if directed by
the Engineer. If directed by the Engineer, the devices will be removed from the Project site
for any winter shutdown and redeployed within a two week notice by the Engineer.

16. The SYSTEM shall provide Traffic Control or safety protection for the installation and
maintenance of any equipment within the clear zone or not covered by existing structures or
safety devices.

17. The SYSTEM shall operate continuously (24 hours, 7 days a week) when deployed on the
project.

18. The SYSTEM shall be capable of acquiring traffic volume and speed data; developing travel
times, queue lengths, and delay times; and selecting motorist information messages
automatically without operator intervention after system initialization.

B. System Data Acquisition

1. Each traffic sensor shall communicate with the computer base station to provide the
appropriate signs with the specified traffic message.

2. The SYSTEM shall be capable of obtaining and using traffic data from existing ITS systems.

3. The SYSTEM shall be set to display continuous travel times between the locations as
specified and as directed by the TOCS. The SYSTEM shall be capable of calculating and
having travel time information displayed on the signs within specific points within the project
limits, for the entire project limits, and from the designated signs. Initial message location
requirements are specified in the Real Time Traffic Table below and shall be finalized with
TOCS prior to setting up.

4. The SYSTEM shall be capable of calculating and having “real time” delay information
displayed on the signs. This “real time” delay shall be calculated and displayed on the signs
to the parameters as directed by TOCS, i.e: to the nearest minute for delays up to 15 minutes
after the initial 5 minute delay. For delays exceeding 15 minutes, the delay information
displayed on the signs shall be rounded to the nearest 5 minute increment. Each traffic
sensors shall communicate with the computer base station to activate the appropriate signs
whenever the prevailing traffic speed slows to specified speed or delay time as directed by
TOCS. Once activated, the preprogrammed messages shall be automatically displayed on the
appropriate signs until the delay drops below a specified time or as directed by TOCS.

5. To allow for motorist information messages of high specificity, the SYSTEM shall acquire
quantitative traffic data using an accurate speed measurement technique that includes the
capability of detecting stopped traffic, counting traffic volume and lane occupancy, and
measuring queue lengths.

6. The SYSTEM’S traffic sensors shall be of a type to cover all lanes in at least one direction
and whose accuracy is not degraded by inclement weather of degraded visibility conditions
including precipitation, fog, darkness, excessive dust, and road debris.

7. All traffic data acquired and developed by the SYSTEM shall be archived in log file with
time and date stamps. This information shall be retrievable by the Engineer at any time and
the records during full deployment shall be provided to the Engineer on CD-ROM or DVD in
Microsoft Excel 2002 at Completion.

C. System Motorist Information Messages

1. The SYSTEM shall be capable of providing speed, delay, length of traffic queue, travel time,
and lane closure advisories to motorists.

2. The traffic condition information displayed on the signs is to be updated every 1 minute.

3. The web-site delay information is to be updated simultaneously with the traffic condition
information displayed on the signs. The web-site shall be capable of displaying more than
one type traffic condition information simultaneously.

4. Records of all motorist information messages displayed by the SYSTEM shall be recorded in
log files with time and date stamps. This information shall be retrievable by the Engineer at
any time and the records during all deployment shall be provided to the Engineer on CD-ROM or DVD in Microsoft Excel 2002 at Completion.

5. System must have capacity to preset at least 25 different default or automatic advisory messages for each sign

6. Default and advisory message content shall be programmable from the central base station.

7. Initial traffic conditions and messages for signs shall be as specified in the Real Time Message Table, with other message content as directed by the TOCS. Travel times will be from the point of the respective sign to the specified location(s) in the message.

<table>
<thead>
<tr>
<th>ROUTE</th>
<th>DIRECTION</th>
<th>GENERAL LOCATION</th>
<th>EXIST/NEW SIGN</th>
<th>PROPOSED MESSAGE TO BE DISPLAYED</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>NB</td>
<td>Prior to Rt 520</td>
<td>NEW</td>
<td>TRVL TIME TO MIDDLETOWN XX MINS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.P. 6.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>SB</td>
<td>At Valley Road fork, M.P. 14.5</td>
<td>NEW</td>
<td>TRVL TIME TO SEA BRIGHT XX MINS</td>
</tr>
</tbody>
</table>

**D. System Communications**

1. Communications between central computer base station and any individual sign and sensor shall be independent through the full range of deployed locations and shall not rely upon communications with any other sign or sensor.

2. The SYSTEM communication system shall incorporate an error detection/correction mechanism to insure the integrity of all traffic conditions data and motorist information messages.

3. Any required configuration of the SYSTEM communications system shall be performed automatically during SYSTEM initialization.

4. The communications, including access and control by the TOCS, shall be provided over a stable and secure system that is not impacted by weather or other users. Included in the operational responsibilities are all communication costs such as FCC licensing, cellular telephone, satellite and internet subscription charges.

**E. Signs**

1. The DMS provided with the SYSTEM shall be trailer mounted. The message panel shall be at least 7 ft above the pavement, present a level appearance, and be capable of displaying up to ten characters in each of three lines at a time at a minimum character height of 18 in. It shall be capable of displaying variable size characters to provide for any message as directed by TOCS.

2. The message panel shall be visible from 1/4 mile under both day and night conditions. The letters shall be legible from 750 feet.

3. The sign shall include automatic dimming for nighttime operation and a power supply capable of providing 24 hours of uninterrupted service.

4. When the signs are displaying messages, they shall be considered a traffic control device. At all times when no message is displayed, they shall be considered equipment.

5. All messages are to be center-justified.

6. Messages to be displayed shall have the capability to be timed to changes at various times of the day and days of the week.

7. The sign shall be capable of displaying hybrid message, where the first panel with the automated SYSTEM message as described and the second panel displaying another TOCS generated message.

8. Any request to change the messages on the signs shall be approved by the TOCS.

**ROUTE 36 OVER THE SHREWSBURY RIVER**

**HIGHLANDS BRIDGE**

**MONMOUTH COUNTY**
F. System Performance

1. An "on site" specialist, who is skilled in the operation of all the SYSTEM equipment and software shall be locally available 24 hours a day, 7 days a week to maintain the system components, move portable devices as necessary and to respond to emergency situations within 8 hours. Ensure that this specialist is equipped with sufficient resources to respond to needed corrections of deficiencies within 8 hours of notification.

2. The speed and travel time displayed on the signs and web site shall be within 3 mph and 3 minutes of actual conditions.

3. The Contractor shall make all necessary corrections or adjustment to the SYSTEM within 24 hours of notification by the Engineer. For each 24-hour timeframe period that components of the SYSTEM are not fully restored to proper working order, payment reductions from the monthly estimate will be made as follows:
   (a) 1 day = 5% pay reduction
   (b) 2 days = 10% pay reduction
   (c) 3 days = 15% pay reduction
   (d) 4 days = 20% pay reduction
   (e) 5 days = 25% pay reduction
   (f) 6 days = 30% pay reduction
   (g) 7 days = 40% pay reduction
   (h) 8 days = 50% pay reduction
   (i) 9 days = 60% pay reduction
   (j) 10 days = 75% pay reduction

4. If any components of the SYSTEM are down for more than 10 total days in a month whether they are consecutive or cumulative, then no payment will be made for that month.

5. The Department reserves the right to have SYSTEM components removed at any time, or the complete SYSTEM terminated and removed, if it determines the SYSTEM is not performing as specified, in which case no further payment shall be made.

9. Testing

A. General
Each subsystem shall be tested by the contractor in the presence of the Engineer to verify proper operation of the individual components at three levels:

Level A: at each individual device location field site.
Level B: from the Traffic Operations Centers to the field site with the original equipment manufacturer's software. Minimum 10-day observation period.
Level C: from the respective Traffic Operations Centers to the device field site locations after integration by others into the ON-TIME control software system. The Contractor shall conduct a system performance test to verify that each overall device and communications path meets the requirements of these Special Provisions. A 30-Consecutive Day Operational Test shall be conducted following the successful completion of the system performance test. Only equipment compatible with those control software systems shall be provided and the Contractor shall provide support during this testing, including adjustments or replacements to any equipment and materials installed until a full 30 day observation period is successfully completed.

The required wiring system testing as specified in Subsection 701.16 shall be completed and approved prior to the start of Level A.

The contractor shall submit test procedures for each individual subsystem for review and approval. The contractor shall outline the tests to be performed and methods to be utilized for each level mentioned above. Each test shall be prepared in order to verify operation of the requirements of the material specifications for each assembly and component installed at the local field sites and shall include verification of the operation of the equipment as controlled from the TOCS facility. These test procedures shall be submitted individually for each subsystem but may be contained in one all-inclusive binder.

The contractor shall test each installed device and subsystem component to verify functionality. All subsystems must test for communication of video, audio and data.
The Contractor shall develop a test plan for all furnished and installed equipment that shall include a list of test procedures to be performed, test schedule and the equipment to be tested. The tests shall include demonstration of the control of the devices by way of On-Time control system. The test plan shall be submitted to the Engineer for review and approval at least 30 days prior to the scheduled date of the start of the tests. This test plan shall, as a minimum, contain the following elements: requirements for test initiation, the test objective, success criteria, test description, test conditions, test data requirements, test equipment/facilities, methodology, data collection/analysis, test schedule, action(s) taken to correct discrepancies, re-test data and criteria for successful exit from the test. The test plan shall contain samples of all data sheets and performance records to be used during the test. The tests shall be performed at each individual local site and from the TOCS for all systems and subsystems fully installed and operational together. The successful demonstration of the equipment functionality via these tests shall be used to determine payment for the work.

The Engineer will approve or request modifications to the test plan and all test forms to be used within 15 days of the Contractor's submittal. The installation test will not be authorized to start without the approval of the test plan and forms. The Engineer, or designee, shall be invited to monitor all tests. Any failures shall be documented and repairs made.

If the Engineer determines that the equipment provides consistent operation that is in conformance with the installation test plan and the Contract Documents, the Engineer will issue written test approval. If in the Engineer's determination, the installation test is not successful, the Contractor shall not continue with the work nor invoice for payment until testing is completed and the performance meets the requirements of the Contract plans and specifications.

B. DMS Systems (Walk-In and Ground Mount)

a. Stand Alone Tests:
The Contractor shall conduct an approved stand-alone test of the equipment installation at the field site. The test shall, as a minimum, exercise all stand-alone (non-network) functional operations of the field equipment with all of the equipment installed as per the plans, or as directed by the Engineer.

Approved data forms shall be completed and turned over to the Engineer as the basis for review and rejection or approval. At least two (2) working days' notice shall be given prior to all tests to permit the Engineer or his representative to observe each test.

b. Consequences of Stand Alone Test Failure:
If any unit fails to pass its stand-alone test, the unit shall be corrected or another unit substituted in its place and the test successfully repeated. If a unit has been modified as a result of a stand-alone test failure, a report shall be prepared and delivered to the Engineer prior to the re-testing of the unit. The report shall describe the nature of the failure and the corrective action taken.

If a failure pattern develops, the Engineer may direct that design and construction modifications be made to all units without additional cost to the Department or extension of the contract period.

c. System Test:
The Contractor shall conduct approved DMS system tests on the field equipment with the central equipment. The tests shall, as a minimum, exercise all remote control functions and display the return status codes from the controller. Approved data forms shall be completed and turned over to the Engineer as the basis for review and for rejection or approval.

d. Consequence of System Test Failure:
If system tests fail because of any components(s) in the subsystem, the particular component(s) shall be corrected or substituted with other component(s) and the tests shall be repeated. If a component has been
modified as a result of the system test failure, a report shall be prepared and delivered to the Engineer prior to retest.

e. 72 Hours & 30 Days Test Failure:
72-hour and 30-days tests shall be performed if DMS construction is required. After the installation of the DMS system is completed and the successful completion of the System Test, the DMS system shall be subjected to one continuous 72-hour full operating test prior to a 30 day test period. The test shall consist primarily of exercising all control, monitor and communications functions of the field equipment by the central equipment.

The 30 days test period shall commence on the first day after the successful completion of the approved 72-hour continuous full operating test period.

During the 30 days test period, downtime, due to mechanical, electrical and/or other malfunctions, shall not exceed five (5) working days. The Engineer may extend the 30 days test period by a number of days equal to the downtime in excess of five (5) working days.

The Engineer will furnish the DMS vendor with a letter of approval stating the first day of the 30 days test period.

f. Final System Acceptance:
Final system acceptance shall be defined as when all work and materials provided for in this item have been furnished and completely installed, and all parts of the work have been approved by the Engineer and the Dynamic Message Sign System has been operated continuously and successfully for thirty (30) calendar days with no more than five (5) working days downtime due to mechanical, electrical and/or other malfunctions.

C. CCTV System
Local site camera operation; remote camera operation from Central to field; video quality at the local site; CCTV IP communication system and diagnostics; CABLE modem service, picture quality and control system from central.

D. Dynamic Message Signs
Testing of all DMS signs and work shall include all local message display and control of DMS, cable TV communication and remote control tests. In addition to testing each individual DMS the contractor is required to prepare and perform a test on one (1) DMS sign that verifies the sign’s communication protocol ability to conform to the mandatory NTCIP standards for DMS’s listed as follows:

NTCIP 1201 - Global Object Definitions (w/Amendment 1)
NTCIP 1203 - Object Definitions for Dynamic Message Signs (w/Amendment 1)
NTCIP 2101 - Point-to-Multi-Point Protocol (PMPP) Using RS-232 Subnet Profile
NTCIP 2103 - Point-to-Point Protocol (PPP) Using RS-232 Subnet Profile
NTCIP 2201 - Transportation (Null) Transport Profile
NTCIP 2202 - Internet (TCP/IP and UDP/IP) Transport Profile
NTCIP 2301 - Simple Transportation Management Framework (STMF)

10. Warranties and Guarantees
All equipment furnished and installed by the contractor shall carry a two-year warranty against any imperfections in workmanship or materials, from the date of Substantial Completion. The contractor shall submit a warranty certificate to the Resident Engineer for each equipment manufacturer and device component. Each certificate shall name the NJDOT as holder of the certificate, not the contractor. Any repairs made by a manufacturer or representative to any equipment shall be documented and returned with units when warranty repaired. This documentation shall include an explanation of the exact repairs made and identification of parts replaced by part number and circuit number. All warranty repairs must be made within the warranty period.
The Contractor shall provide the Department with a complete record of all repairs made to each unit.

11. Final Documentation
All documentation shall be submitted to the Resident Engineer before Substantial Completion of the contract can be considered as accomplished.

Two sets of complete schematics and maintenance manuals of the equipment shall be supplied with each type of equipment furnished. The maintenance manual shall include a complete sub-component parts listing.

System Documentation working drawings and as-built drawings shall be supplied by the Contractor in Intergraph CADD.dgn format in accordance with the file structure and standards of the NJDOT. System Documentation reports shall be forwarded in MS Word. Complete As-Built documentation showing the function and detail of each individual communication cable and jumper connection installed by the Contractor. The contractor shall furnish as-built drawings for each subsystem, including wiring and configurations, as well. The drawings shall illustrate the local site device connections and configurations and show all equipment interconnections and configurations with the central control system from which it operates. The contractor shall prepare the as-builts in CADD.dgn format.

706.04 Method of Measurement.
The general provisions of Section 701 and 702 shall apply as supplemented below:

8 Port Ethernet Switch shall not be measured separately. The cost of 8 Port Ethernet Switches shall be included in the cost of CCTV Camera Assemblies and Dynamic Message Sign Assemblies.
24 Port Ethernet Switch shall not be measured separately. The cost of the 24 Port Ethernet Switch shall be included in the cost of Central Control Equipment
Encoder/Decoders shall not be measured separately. The cost of encoders/decoders shall be included in the cost of CCTV Controller Assemblies, Dynamic Message Sign Assemblies, and Central Control Equipment.
CCTV Camera Assemblies shall be measured by the number of each.
CCTV Controller Assemblies shall be measured by the number of each
Dynamic Message Sign Assembly shall be measured by the number of each, including procurement and installation
Dynamic Message Sign Controllers shall not be measured separately. The cost of DMS Controllers shall be included in the cost of Dynamic Message Sign Assembly.
Ground-Mount Dynamic Message Sign Assembly shall be measured by the number of each.
Walk-In Dynamic Message Sign Assembly shall be measured by the number of each.
Central Control Equipment shall be measured by lump sum
System Integration shall be measured by the number of each, one for each field location.
Coaxial Cable shall be measured by the linear foot
Real-Time Work Zone Traffic System will be measure by the month.

706.05 Basis of Payment.
Payment will made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCTV CAMERA STANDARD ASSEMBLY</td>
<td>UNIT</td>
</tr>
<tr>
<td>CCTV CONTROLLER ASSEMBLY</td>
<td>UNIT</td>
</tr>
<tr>
<td>GROUND MOUNT DYNAMIC MESSAGE SIGN ASSEMBLY</td>
<td>UNIT</td>
</tr>
<tr>
<td>WALK-IN DYNAMIC MESSAGE SIGN ASSEMBLY</td>
<td>UNIT</td>
</tr>
<tr>
<td>CENTRAL CONTROL EQUIPMENT</td>
<td>LUMP SUM</td>
</tr>
<tr>
<td>SYSTEM INTEGRATION</td>
<td>UNIT</td>
</tr>
<tr>
<td>COAXIAL CABLE</td>
<td>LINEAR FOOT</td>
</tr>
<tr>
<td>REAL-TIME WORK ZONE TRAFFIC SYSTEM</td>
<td>MONTH</td>
</tr>
</tbody>
</table>
AS SPECIFIED IN SUBSECTION 109.02, ALL PAYMENT TO COMPLETE THE WORK SPECIFIED IS INCLUDED IN THE ITEMS IN THE PROPOSAL COVERED BY THIS SECTION, UNLESS PAYMENT IS SPECIFIED OTHERWISE.
DIVISION 800 – LANDSCAPING

SECTION 808 - FERTILIZING AND SEEDING

808.05 Basis of Payment.
THE SECOND PARAGRAPH IS CHANGED TO:

Payment will not be made for areas of fertilizing and seeding disturbed by Construction Operations, beyond the prescribed grading limits in islands and medians, and between prescribed grading limits and the right-of-way line, except as follows: all areas within the Right-of-way limits approved for storage of topsoil.

SECTION 811 – MULCHING

811.03 Construction Requirements.
THE FOLLOWING IS ADDED TO THE FIFTH PARAGRAPH:

In areas designated as Narcissus in Turf, bulbs shall be planted in turf areas and shall not receive wood mulching.

813.02 Materials
THE FOLLOWING IS ADDED:

All of the plant material for the project shall be inspected to ensure the necessary quality and conformity with the specifications. The plant material inspection guidelines in the Standard Specifications are superseded by these requirements except where pertaining to any reference sources, State and Federal Agricultural inspection and certification requirements, etc. All of the certifications that are required for all aspects of the plant material shall be supplied to the Engineer at, or before the delivery of the plant material to the holding area of the project. Plant material that arrives without the necessary documentation may be watered and unloaded but will not be inspected until the required documentation is received and accepted. The inspection of the plant material shall take place in the plant holding area as specified below.

Within 30 days after the Pre-construction conference, the contractor will provide to the Engineer and to the representatives of the Landscape and Urban Design Unit, the sources of all of the plant material. The information regarding the source of the plant material shall be organized in such a manner that each item is listed individually and includes the name, address and telephone number of the nursery where the plant was grown. In order to assist with the inspection process the contractor has the option to propose any number of methods to pre-screen the plant material at the nursery. This may include the use of digital images or digital video of the trees at the nursery prior to the digging of the trees. Viewing of the images of the plant material does not in any way constitute approval or acceptance of the plant material.

The branches of all trees should be arranged uniformly around the trunk in order to create a symmetrical, uniform and dense crown. The main trunk of all trees shall be straight with only a single leader. All shrubs shall have a dense and uniform branching habit with the appropriate number of canes as specified in the American Standard for Nursery Stock, ANSI Z60.1 – 2004. Substitutions of plant material will only be permitted in accordance with the requirements as indicated in the Standard Specifications, Section 909.05 Plant Materials.

813.03 Construction Requirements.
THE FOLLOWING IS ADDED AFTER THE SECOND PARAGRAPH:

In order to ensure that all of the plant material conforms to the specifications, the contractor shall establish an off-site holding area for the inspection and temporary storage of all of the plant material utilized on the project. The holding area shall be located and constructed in order to provide the necessary security and shall have an overhead irrigation system capable of providing sufficient water to the plant material as needed. The Contractor shall provide the Engineer a minimum of 48 hours notice prior to the delivery of the plant material to the holding area. All of the plant material shall be delivered to this holding area for inspection prior to being transported to the project site for planting.

Immediately upon arrival to the holding area, the plant material shall be watered thoroughly. The plant material shall then be unloaded utilizing a front-end loader or other mechanical means. Offloading of the trees utilizing planks or other non-mechanical means is not acceptable. Once the trees have been unloaded, the branches shall be untied and spread open. The trees shall then be spaced sufficiently apart from one another that the branches do not touch. All plant material that meets the specifications and is found acceptable, shall be sealed with standard NJDOT inspection seals, by representatives from the Landscape and Urban Design Unit. The seals shall remain on all plant material until all of the planting on the project has been completed. All rejected plant material shall immediately be removed from the holding area.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Accepted and sealed plant material shall then be healed in with mulch or soil and maintained in such conditions that will protect the trees from being damaged while in the holding area. As indicated above, an overhead irrigation system shall be utilized to provide adequate water for the accepted plant material while in the holding area. The Engineer and Landscape and Urban Design personnel shall have unlimited access to the plant material while in the holding area. Any plant material that is damaged while in the holding area shall be rejected and immediately removed from the site. Additional plants shall be supplied and inspected as described above. The acceptable plant material shall then be re-tied as needed and protected for and during shipment to the project site. Any damage to the plant material during the handling and transporting to the project site that renders the plant material unacceptable will require additional plant material be supplied.

3. Planting Beds.

THE FOLLOWING IS ADDED TO THE FOURTH PARAGRAPH:

In areas designated as Narcissus in Turf, bulbs may be planted in established turf or may be set in the bed area at the required depth prior to Fertilizing and Seeding operations at the direction of the Engineer. Once the bulbs have been set, machinery or other heavy equipment shall not be permitted on these areas and care shall be taken to maintain the desired grade.


THE FOLLOWING IS ADDED BEFORE THE FIRST PARAGRAPH:

A water truck must be available on the project site during all planting operations. Water truck components such as tanks, hoses, etc. or watering systems which have previously contained or were used to apply herbicides or pesticides are not acceptable for use in watering any of the plant material.

8. Pruning.

THE FIRST PARAGRAPH IS DELETED.

THE FIRST SENTENCE OF THE SECOND PARAGRAPH IS CHANGED TO:

Pruning of newly planted trees and shrubs shall be limited to the removal of diseased, weak, broken and interfering branches.

813.05 Plant Establishment Period and Replacements.

THIS SUBSECTION IS DELETE.

813.07 Basis of Payment

THE FOLLOWING IS ADDED AFTER THE LAST SENTENCE:

Separate payment will not be made for any additional plant material that may be required as a result of plants that are rejected for whatever reason. Separate payment will not be made for the construction and maintenance of the holding area, irrigation systems, water or any additional materials or any labor associated with the holding area or associated with the handling of plant material during the inspection, transportation and planting of the plant material, etc. Plant material that is incorrect in genus, species or variety will be removed from the project and the correctly specified plant material shall be supplied and inspected. No additional payment or compensation will be made for any materials or labor that may be associated with this work.

THE FOLLOWING IS ADDED TO THE END OF SECTION 813.

EXTENDED PLANT ESTABLISHMENT

Description.

This work shall consist of the replacement of all plants that have been identified as not being alive and healthy at the beginning of each prescribed interval after the plantings have been accepted. This work shall also include
weeding, spraying with herbicide, insecticide or fungicides, pruning, repairing and adjusting of guy stakes, the restoration of all areas that are disturbed or damaged during the replacement period and the securing of a Prepaid Maintenance Bond and an approved Highway Occupancy Permit for the entire “Establishment” period. Additionally, insurance requirements listed under Subsection 107.23, parts 1, 2 and 4 shall remain in effect for the duration of the “Establishment” period.

The dates for plant acceptance are June 1 for spring planting and December 1 for fall planting. No split acceptance will be allowed. Once a date for Plant acceptance has been established by the Engineer, the interval for the replacement periods shall be as follows:

June 1 Plant Acceptance:
1. August 15 to December 1 – replacement period
2. March 1 to May 1 – replacement period
3. August 15 to December 1 – replacement period
4. March 1 to May 1 – replacement period

December 1 Plant Acceptance:
1. March 1 to May 1 – replacement period
2. August 15 to December 1 – replacement period
3. March 1 to May 1 – replacement period
4. August 15 to December 1 – replacement period

Plantings will be determined as “Established” two years from the date of substantial completion of the project.

Materials.
Reference: Subsection 813.02

Construction Requirements.
Ten (10) working days prior to the commencement of each replacement period a listing of all plantings that shall require replacing will be submitted to the contractor by the Landscape and Urban Design Unit (Phone: 609-530-5670).

During the plant establishment period at the aforementioned intervals, all planting beds, hedges and individual plants shall have all weeds sprayed with an herbicide and treated with a pre-emergence herbicide. All plantings shall be provided with sufficient water during the entire establishment period.

All plants that are not alive and healthy at the beginning of each interval period as determined by Landscape and Urban Design Unit, shall be replaced in kind, quantity and size with acceptable live, healthy plants installed as originally specified. Replacements shall include any plantings that were replaced in a previous interval that have become other than alive and healthy. The Landscape and Urban Design Unit reserves the right to allow substitute varieties of plants to be used in its sole discretion.

At each interval, all weeds, debris and damaged plant materials shall be removed and disposed of in accordance with Subsection 201.10. Holes resulting from the theft of plants shall be filled during each replacement interval.

Replacement planting shall conform to the requirements for initial planting except as follows:

1. Existing wood chips shall be removed and may be reused if salvageable and conforming to Subsection 909.04.
2. Backfilling may be made with excavated materials which does not contain wood chips or other objectionable materials.

Replacement of evergreen materials shall be made from March 1 to May 1 and from August 15 to December 1. Replacement of deciduous material shall be made from March 1 to May 1 and from October 15 to December 1. All stakes, guys and guy wires shall be removed two weeks prior to the conclusion of the 2 year plant establishment period.

When lane or shoulder closures are required during the extended establishment period, these closures shall conform to all the traffic control requirements set forth in the Highway Occupancy Permit.

Method of Measurement.
Extended Plant Establishment will not be measured, and payment will be made on a Lump Sum basis

**Basis of Payment.**
Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXTENDED PLANT ESTABLISHMENT</td>
<td>LUMP SUM</td>
</tr>
</tbody>
</table>

Separate payment will not be made for Replacement Plantings but all costs thereof shall be included in the Lump Sum price bid for the item Extended Plant Establishment.

Separate payment will not be made for Watering
Separate payment will not be made for Traffic Control Items.
Separate payment will not be made for the application of herbicides, insecticides or fungicides.
Separate payment will not be made for insurance; all costs of procuring and maintaining required insurance policies and making the State an additional insured as specified, shall be at the Contractor’s own expense.
Separate payment for the maintenance bond will not be made. All costs of procuring a maintenance bond as specified shall be at the contractor’s own expense.
Separate payment will not be made for overhead and profit or any other costs incurred by the contractor so as to perform this item; payment for all associated work and costs under this item will be limited to the lump sum payment and will not be adjusted for any reason.

Payment for this item will not be made to the Contractor until such time that the project has reached Substantial Completion (See Subsection 108.10), and the Prepaid Maintenance Bond is in place and the Highway Occupancy Permit has been approved by the Department. Said Bond and Permit will remain in effect for the entire Establishment Period or until it is determined by the NJDOT Landscape and Urban Design Unit that they are no longer required. The maintenance bond to be procured by the contractor prior to payment for this item shall be furnished by only those sureties listed in the US Treasury Department Circular 570 and authorized to do business in this State. The bond shall be accompanied by a certification as to authorization of the attorney-in-fact to commit the surety company and a true and correct statement of the financial condition of said surety company. The bond shall be the sum of not less than $100,000.00 and shall be maintained for a period of at least two years from the date of the acceptance of the initial plantings as established by the Engineer. In the event of insolvency of the surety or if the maintenance bond has not been properly authorized or issued by the surety company, the Contractor shall furnish and maintain, as above provided, other surety satisfactory to the Commissioner. All work required under this item may be made without the consent of the surety company. The bond shall be furnished on forms supplied by the Department.

**Permit Description**

This work shall consist of the replacement of all plants that have been identified by the Landscape and Urban Design Unit as not being alive and healthy at the beginning of each prescribed interval after the plantings have been accepted. This work shall also include weeding, spraying with herbicide, insecticide or fungicides, pruning, repairing and adjusting of guy stakes and the restoration of all areas that are disturbed or damaged during the replacement period.

Once a date for Plant Acceptance has been established by the New Jersey Department of Transportation (NJDOT) Project entitled ROUTE 36 Section 3K, CONTRACT NO. 012961654, and the interval for the replacement periods shall be designated by the NJDOT Landscape and Urban Design Unit as follows:

**June 1 Plant Acceptance:**
1. August 15 to December 1 - replacement period
2. March 1 to May 1 – replacement period
3. August 15 to December 1 – replacement period
4. March 1 to May 1 – replacement period

**December 1 Plant Acceptance:**
1. March 1 to May 1 – replacement period
2. August 15 to December 1 – replacement period
3. March 1 to May 1 – replacement period
4. August 15 to December 1 – replacement period
Plantings will be determined as “Established” two years from the date of acceptance of the initial plantings. Ten (10) working days prior to the commencement of each replacement period a listing of all plantings that shall require replacing will be submitted to the contractor by the NJDOT Landscape and Urban Design Unit (Phone: 609-530-5670).

During the plant establishment period at the aforementioned intervals, all planting beds, hedges and individual plants shall have all weeds sprayed with an herbicide and treated with a pre-emergence herbicide. All plantings shall be provided with sufficient water during the entire establishment period.

All plants that are not alive and healthy at the beginning of each interval period, as determined by the Landscape and Urban Design Unit, shall be replaced in kind, quantity and size with acceptable live, healthy plants installed as originally specified. Replacements shall include any plantings that were replaced in a previous interval that have become other than alive and healthy. The Landscape and Urban Design Unit reserves the right to allow substitute varieties of plants to be used in its sole discretion.

At each interval, all weeds, debris and damaged plant materials shall be removed and disposed of in accordance with Subsection 201.10*. Holes resulting from the theft of plants shall be filled during each replacement interval.

Replacement planting shall conform to the requirements for initial planting except as follows:

1. Existing wood chips shall be removed and may be reused if salvageable and conforming to Subsection 909.04*.

2. Backfilling may be made with excavated materials which does not contain wood chips or other objectionable materials.

Replacement of Evergreen materials shall be made from March 1 to May 1 and from August 15 to December 1. Replacement of Deciduous material shall be made from March 1 to May 1 and from October 15 to December 1.

All stakes, guys and guy wires shall be removed two weeks prior to the conclusion of the 2 year plant establishment period.

When lane or shoulder closures are required during the extended establishment period, these closures shall conform to all the traffic control requirements set forth in the Highway Occupancy Permit, these traffic control requirements are further described as contained in the NJDOT Construction Project Plans entitled ROUTE 36 Section 3K, CONTRACT NO. 012961654.

The Permittee has been previously compensated for all work described above.

*Refers to the New Jersey Department of Transportation (NJDOT) 2001 Standard Specifications for Road and Bridge.

SECTION 815 – WEED BARRIER

815.01 Description
This work shall consist of the furnishing and installing of a landscape weed barrier on prepared soil surfaces of all shrub beds and also in all mulched areas of tree planting as designated on the plans.

815.02 Materials
Landscape weed barrier shall be a manufacturer’s product specifically designated for this purpose. Materials shall be 100% polypropylene woven fabric and black in color. The minimum weight shall be 2.5 ounces per square yard.

Staples ................................................................. 909.11

815.03 Construction Requirements
Prior to the installation of the landscape weed barrier, all plant material shall be completely installed. The soil shall be smooth and free of depressions, clods, mounds, large stones or other debris. A pre-emergent herbicide shall be applied to the area prior to the installation of the landscape weed barrier. The landscape weed barrier shall be installed according to the Manufacturer’s recommendations. Where the landscape weed barrier is installed end to end, the upper end of each down-hill strip shall be buried 6 inches deep in a vertical position with the uphill strip overlapping for a distance of 6 inches to form a smooth, shingle-like effect. When laid parallel, the landscape weed barrier shall overlap 6 inches. The landscape weed barrier shall be neatly trimmed to conform to the edge of the planting area. If the landscape

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
weeds. If the weed barrier becomes dislodged and exposed at any time during the plant establishment or replacement period, the landscape weed barrier shall be re-installed at no cost to the State.

815.04 Method of Measurement.
Weed barrier will be measured by the square yard.

815.05 Basis of Payment.
Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEED BARRIER</td>
<td>SQUARE YARD</td>
</tr>
</tbody>
</table>

SECTION 816 - CONCRETE CURBSTONE EDGING

816.01 Description
Concrete curbstone edging shall include the excavation and removal of existing material, furnishing and placement of a concrete footing and the furnishing and placement of concrete curbstones edging between concrete pavers and mulched planting beds as shown on the plans.

816.02 Materials
Concrete curbstone edging shall be provided by the same manufacturer of the concrete pavers being used on the job.

Concrete curbstone edging shall be placed in secure holding area approved by the resident engineer.
Concrete curbstone shall be laid according to plan and be manufactured by one of the following companies or approved equal:

- **EP Henry Corporation**
  201 Park Avenue
  Woodbury, NJ
  (856) 845-6200
  [http://www.ephenry.com](http://www.ephenry.com)
  Style: Coventry Curbstone
  Color: Autumn Blend

- **Cambridge Pavers, Inc.**
  Jerome Avenue, PO Box 157
  Lyndhurst, NJ  07071-0157
  (201) 933-5000
  [http://www.cambridgepavers.com](http://www.cambridgepavers.com)
  Style: Cambridge Curbstone
  Color: Ruby/Onyx Blend

- **Ideal Concrete Block Co.**
  45-55 Power Road
  Westford, MA  01886
  (800) 444-7287
  [http://www.idealconcreteblock.com](http://www.idealconcreteblock.com)
  Style: CurbStone
  Color: Autumn Blend

816.03 Construction Requirements.
Concrete Curbstone Edging will be installed in accordance with the manufacturer’s recommendations.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
816.04 Method of Measurement.
Concrete Curbsone Edging will be measured by the Linear Foot.

816.05 Basis of Payment
Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONCRETE CURBSTONE EDGING</td>
<td>LINEAR FEET</td>
</tr>
</tbody>
</table>

THE FOLLOWING SECTION IS ADDED:

SECTION 817 - CONCRETE PAVERS

817.01 Description
Concrete pavers and brick surfaces shall include the excavation and removal of existing material, compaction of subsoil, furnishing, placement and compaction of an aggregate base, furnishing and placement of a 4 inch concrete base, a ¾ inch bituminous setting bed and neoprene tack coat, the furnishing and installation of an invisible plastic paver edge restraint system, and the furnishing, placement and compaction of concrete pavers.

817.02 Materials
Concrete pavers to be used shall meet the requirements set forth in ASTM C936, Standard Specification for Solid Interlocking Concrete Paving Units. Requirements include an average compressive strength of 55Mpa, average absorption no greater than 5% when tested in accordance with ASTM C140, resistance to at least 50 freeze-thaw cycles with average material loss not exceeding 1% when tested in accordance with ASTM C67 and conformance to abrasion resistance test. The paver sizes used on this job shall consist of a combination of the following: 3 inches x 6 inches x 2 3/8 inches, 4 ½ inches x 6 inches x 2 3/8 inches, 6 inches x 6 inches x 2 3/8 inches, 6 inches x 9 inches x 2 3/8 inches.

Concrete pavers shall be laid in a random pattern and be manufactured by one of the following companies or approved equal:

EP Henry Corporation
201 Park Avenue
Woodbury, NJ
(856) 845-6200
http://www.ephenry.com
Style: Old Towne Cobble
Color: Autumn Blend

Cambridge Pavers, Inc.
Jerome Avenue, PO Box 157
Lyndhurst, NJ 07071-0157
(201) 933-5000
http://www.cambridgepavers.com
Style: RoundTable Collection
Color: Ruby/Onyx Blend

Ideal Concrete Block Co.
45-55 Power Road
Westford, MA 01886
(800) 444-7287
http://www.idealconcreteblock.com
Style: Yankee Cobble
Color: Autumn Blend

The contractor shall deliver and stack on the project all the concrete pavers required to complete the project. Upon delivery, the pavers shall be placed in secure holding area approved by the resident engineer.
The plastic paver edge restraint system shall be a commercially available PVC edging product specifically made to contain pavers with pre-drilled holes for spiking with a minimum 10 inches x 3/8 inch diameter steel spikes. Straight sections of pavement shall receive rigid PVC edging and radius areas shall receive flexible PVC edging. Areas where pavers abut concrete curbstone edging shall not receive the plastic edge restraint system.

Other materials shall conform to the following subsections:

- Sand…………………………………………………901.13
- Dense-Graded Aggregate…………………………….901.08
- Concrete……………………………………………..901.12
- Bituminous…………………………………………...904.01
- Brick………………………………………………...910.04

817.03 Construction

Existing pavement, subbase and soil shall be excavated and removed from the project in accordance with Section 201 and the subsurface shall be compacted to the prescribed grade by machine. An aggregate subbase course shall be placed and compacted to the prescribed thickness a minimum of 6 inches beyond the limits of the concrete pavers on both sides as indicated on the plan. A concrete base shall be placed on top of the aggregate subbase. A bituminous setting bed will be placed on the concrete base.

Prior to purchase by the contractor, a representative sample of 20 pavers (for each type) shall be submitted to the Engineer’s office for approval by the Engineer and the Landscape and Urban Design Unit. Pavers shall be free of chips, cracks, voids, discolorations or other defects which might be visible or cause staining in finished work.

The plastic paver edge restraint system shall be installed according to the manufacturer’s directions. The concrete pavers and brick surface shall be placed on top of a neoprene tack coat in a random pattern as provided by the manufacturer and shall have butted joints. The area receiving concrete pavers and brick surface shall be outlined with a soldier course of the 6 inches x 6 inches x 2 3/8 inches blocks. Full units shall be used to the maximum extent possible in order to achieve the desired pattern. Gaps along the edge of the pavement or between the two types of pavers shall be filled with edge units or saw-cut pavers. Pavers shall be cut with a motor-driven saw to provide clean, sharp, unchipped edges. The joints shall be broom filled with sand and the entire area tamped with a ‘plate-type’ sliding compactor. This process will be repeated until the joints are full. Any excess sand shall be broom swept off the paver and brick surface.

Unit to unit offset from flush shall not exceed 1/16 inch. Finished surface of paving shall have a tolerance of 1/8 inch in 2 feet and 4 inches in 10 feet from level, or slope as indicated.

817.04 Mockups.

The contractor shall schedule a meeting through the Engineer with the Project Designer to review the expectations and requirements of the unit paving mockup and the final installation. Before installing any unit paving in its final location, the Contractor shall build a mockup to illustrate the form and pattern of the unit paving to verify selection made under this Subsection and to demonstrate the ability of the Contractor to provide quality workmanship, the desired aesthetic effect and qualities of the materials. Mockups for the various unit paving items shall be constructed in accordance with the following:

The Contractor shall notify the Engineer seven days in advance prior to the construction of the mockup and shall construct the mockup in the location as directed by the Engineer. The mockup shall consist of a full depth section pavement and shall exhibit all patterns of the unit paving design. The size shall be six (6) feet in length and four (4) feet in width or as directed. The Contractor shall obtain written approval of the mockups from the Engineer prior to starting the unit paving installation and shall maintain the mockup in an undisturbed condition as a standard for judging the completed work. If the mockup is not acceptable, an additional mockup shall be constructed until all requirements have been met. After completion of the work, the mockup shall either be accepted as complete work or demolished and removed by the Contractor.

817.05 Method of Measurement

Concrete pavers will be measured by the Square Yard.

817.06 Basis of Payment

Payment will be made under:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Separate payment will not be made for the excavation and removal of existing material, compaction of subsoil, furnishing, placement and compaction of an aggregate base, furnishing and placement of a 4 inch concrete base, a 4/5 inch bituminous setting bed and neoprene tack coat, the furnishing and installation of an invisible plastic paver edge restraint system, sawcutting of the pavers and any waste pavers. Payment will be made for the actual area of concrete pavers and brick surface installed.

THE FOLLOWING SECTION IS ADDED:

SECTION 818 - FLAGPOLE

818.01 Description
This work shall consist of the furnishing and installation of a 15 foot high (above ground) aluminum external halyard flagpole.

818.02 Materials
Flagpole shall be constructed from 6063-T6 aluminum meeting ASTM B 241 specifications with a uniform conical taper. Finish shall be directional sanded satin. Accessories shall include a gold anodized aluminum ball finial, a cast aluminum revolving truck with pulley, a solid braided polypropylene halyard with two bronze swivel snap hooks with vinyl covers, a cast aluminum cleat with mounting screws, a spun aluminum flash collar to match the pole and a galvanized steel foundation sleeve.

Flagpoles shall be as manufactured or distributed by the following companies or approved equal:
American Eagle Flag, LLC
442 Lacey Road
Forked River, NJ 08731-3626
1-888-776-1776

East Coast Flag & Flagpole, Inc.
101 Pennant Ave. & Route 9 South
Beachwood, NJ 08722
1-800-823-3524

Kempton Flag & Flag Pole Co.
State Highway 34 North
Wall, NJ 07719
(732) 449-0880

818.03 Construction Requirements.
Flagpole shall be installed in accordance with the manufacturer’s recommendations.

818.04 Method of Measurement.
Flagpole will be measured by the unit.

818.05 Basis of Payment.
Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLAGPOLE</td>
<td>UNIT</td>
</tr>
</tbody>
</table>

Payment for the concrete, wood shims and all hardware and appurtenances for construction of the flagpole shall be included in the cost for the pay item Flagpole.
THE FOLLOWING SECTION IS ADDED:

SECTION 819 -GAZEBO

819.01 Description
This work shall consist of the excavation and removal of existing material, compaction of subsoil, furnishing, placement and compaction of an aggregate base, furnishing and placement of a 4 inch concrete base and the furnishing and installing of an octagonal 12 foot gazebo in the location shown on the plans.

819.02 Materials
The gazebo shall be constructed of vinyl-coated #1, hand-selected, kiln dried, pressure treated lumber throughout. Flooring shall be of composite decking and shall match the pier in texture and color. Roof shall be a single tier roof with a tongue and groove underlayment. Composite roofing material replicating weathered wood shake shingles shall be attached.

819.03 Construction Requirements.
Submittals
The contractor shall submit manufacturer’s product data, shop drawings, standard color samples and warranty to the Engineer for review.

Installation
Prior to the construction of the foundation for the gazebo, the Contractor shall mark out the area with stakes and string for the Engineer’s review and approval. The gazebo shall be pre-assembled before being placed in its final location and anchored to the foundation in accordance with the manufacturer’s recommendations.

819.04 Method of Measurement
The quantity to be paid for under this item will be the number of gazebos furnished and installed in accordance with the plans, specifications and directions of the Engineer.

819.05 Basis of Payment
Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAZEBO</td>
<td>UNIT</td>
</tr>
</tbody>
</table>

The price bid shall be a unit price per gazebo furnished and installed and shall include the cost of all labor, materials, equipment and incidentals, including hardware and anchors required to complete the work and shall also include the cost of all labor, materials, equipment and incidentals to construct the foundation and anchor the gazebo to the foundation.

THE FOLLOWING SECTION IS ADDED:

SECTION 820 - STEEL BENCH

820.01 Description
This work shall consist of furnishing and installing all Type 1 (with back) and Type 2 (backless) Steel Benches in accordance with the plans and specifications.

820.02 Materials
Benches shall be constructed of steel with flat bar seating surface and cast iron supports, with a black polyester powder coated finish, matching Federal Standard 595-B – 17038. Benches shall be pre-assembled as manufactured by the following companies or approved equal:

DuMor Site Furnishings
P.O. Box 142
Mifflintown, PA 17059
820.03 Construction Requirements.

Submittals
The contractor shall submit manufacturer’s product data, shop drawings, standard color samples, warranty and foundry certificates to the Engineer for review.

Installation
Bench shall be pre-assembled before being placed in its final location. Final location will be determined prior to installation.

820.04 Method of Measurement
The quantity to be paid for under this item will be the number of benches furnished and installed in accordance with the plans, specifications and directions of the Engineer.

820.05 Basis of Payment
Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEEL BENCH, TYPE 1</td>
<td>UNIT</td>
</tr>
<tr>
<td>STEEL BENCH, TYPE 2</td>
<td>UNIT</td>
</tr>
</tbody>
</table>

The price bid shall be a unit price per bench furnished and installed and shall include the cost of all labor, materials, equipment and incidentals, including hardware and anchors required to complete the work in accordance with the plans and specifications to the satisfaction of the Engineer. The price bid for Type 1 shall also include the cost of all labor, materials, equipment and incidentals to construct a concrete pad, if deemed appropriate, for surface mounting.

THE FOLLOWING SECTION IS ADDED:

SECTION 821 - WELCOME SIGN

821.01 DESCRIPTION
This work shall consist of fabricating, furnishing and installing a welcome sign in the location shown on the plans and all labor, materials, equipment and incidentals required to construct concrete footings for the posts.

821.02 MATERIALS
ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Welcome sign shall be made from high density urethane (HDU) or clear grade redwood or red cedar and shall be sandblasted to create a three dimensional effect. Colors, font styles and logo shall match existing signs used in the Borough of Sea Bright where directed by the Engineer.

CONSTRUCTION

821.03  Construction Requirements
     The contractor shall submit manufacturer’s product data, shop drawings, color and material samples and warranty to the Engineer’s office for review and approval by the Landscape and Urban Design unit. The sign manufacturer shall have at least five years of experience in the design and fabrication of outdoor custom designed signs using the materials and techniques specified.
     The welcome sign shall be installed in accordance with the sign manufacturer’s recommendations.

821.04  Method of Measurement
     The quantity to be paid for under this item will be the number of Welcome Signs furnished and installed in accordance with the plans, specifications and directions of the Engineer.

821.05  Basis of Payment
     Payment will be made under:

     | Pay Item       | Pay Unit |
     |----------------|----------|
     | WELCOME SIGN   | UNIT     |

     The price bid shall be a unit price per Welcome Sign furnished and installed and shall include the cost of all labor, materials, equipment and incidentals, including hardware and anchors required to complete the work.
DIVISION 900 - MATERIALS

SECTION 901 - AGGREGATES

901.04 Broken Stone.
The fifth through seventh lines in the table in the first paragraph are changed to:

Absorption in cold water
No. 8 and larger ......................................................................................................................... 1.8
No. 89 and 9 ............................................................................................................................. 1.8

901.05 Washed Gravel.
The third through fifth lines in the table following the first paragraph are changed to:

Absorption in cold water
No. 8 and larger ......................................................................................................................... 1.8 maximum
No. 89 and 9 ............................................................................................................................. 1.8 maximum

901.08 Dense-Graded Aggregate.
   C. Production from Mixture with RAP.

The second sentence is changed to:

When AASHTO T 310 (Direct Transmission Method, nuclear gauge method for measuring density and moisture content) is used to perform Compaction Acceptance Testing (Subsection 301.05, Subpart 2), a representative sample of five tests for each 5,000 square yards lot will be taken.

901.12 Aggregates for Portland Cement Concrete, Mortar, and Grout.
   A. Coarse Aggregate.
The first sentence of the first paragraph is changed to:

Coarse aggregate shall be broken stone or washed gravel conforming to Subsection 901.04 or 901.05 respectively except that carbonate rock shall not be used for concrete surface courses or bridge decks.

   B. Fine Aggregate.
The sixth line in the table following the first paragraph is changed to:

No. 30 ................................................................................................................................ 25 - 65

SECTION 902 - BEAM GUIDE RAIL

902.02 Posts and Spacers.
The entire subsection text is changed to:

Suppliers for obtaining recycled/synthetic routed spacers will be identified in the Standard Input. According to the provisions of 105.04, the Working Drawing submission shall provide evidence that the spacers that are to be used do satisfy the above criteria. Steel spacers shall conform to AASHTO M 270 Grade 36 and shall be galvanized according to AASHTO M 111. Steel pipe spacers shall be schedule 40 galvanized pipe.

Wood timber spacers and posts shall conform to Subsection 918.01.
Steel posts shall be structural steel that conforms to AASHTO M 270 Grade 36 and shall be galvanized according to AASHTO M 111.

To verify suppliers for obtaining recycled/synthetic routed spacers (Polymer & Composite Blockouts), the Contractor is advised to study the “Bureau of Material’s Approved List” on the following NJDOT website:

http://www.state.nj.us/transportation/eng/technology/materials

SECTION 903 – HOT MIX ASPHALT

903.01 Composition of Mixtures.
For this Project, the 25 percent or less RAP requirements shall govern.

SECTION 904 – BITUMINOUS MATERIALS

904.01 Asphalt Binder.
THE FIRST SENTENCE OF THE FIRST PARAGRAPH IS CHANGED TO:

Asphalt binder shall conform to AASHTO M320, “Performance-Graded Asphalt Binder”.

904.06 Temperature-Volume Correction Factors.
SUBSECTION IS CHANGED TO:

Temperature-volume correction factors that shall be used to convert the volume of bituminous materials, measured at the temperature at the point of use, to the volume at 60 °F are found in the following tables:

Table 904-1 Temperature-Volume Correction Factors for Bituminous Materials

Asphalt Binder, All Grades.
Cut-Back Asphalt, Grades RC-800, RC-3000, MC-800, and MC-3000.
Inverted Emulsified Asphalt, Grade IEMC-800.

http://www.state.nj.us/transportation/cpm/BaselineDocuments/

SECTION 905 - CONCRETE ADMIXTURES AND CURING MATERIALS

905.02 Chemical Admixtures.
THE FOLLOWING IS ADDED:

Corrosion inhibitor products that are to be used in the fabrication of concrete items shall be as follows:

Calcium Nitrite Based as produced by
W.R. Grace & Company
2133 85th Street
North Bergen, NJ 07047
Telephone: 201-869-5220

Calcium Nitrite Based as produced by
The Euclid Chemical Company
5 Joanna Court
East Brunswick, NJ 08816
Telephone: 732-390-9770

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Calcium Nitrite Based as produced by Master Builders Inc.
798 Welsh Road
Huntingdon Valley, PA 19006
Telephone: 215-938-7501

Calcium Nitrite Based as produced by SIKA Corporation
201 Polito Avenue
Lyndhurst, NJ 07071
Telephone: 800 - 933 - SIKA (7452)

Calcium Nitrite Based as produced by Great Eastern Technologies, LLC
“Chem Strong CI”
515 Route 528
P. O. Box 3015
Lakewood, NJ 08701
Telephone: 888 - 452 – 9348

SECTION 908 – JOINT MATERIALS

908.02 Joint Sealers.
THE FIRST PARAGRAPH IS CHANGED TO:

Hot-poured joint sealer for joints and cracks in both HMA and portland cement concrete surface course shall be sealant conforming to Subsections 908.06, 908.07, and ASTM D 6690 as follows:
1. Type II Sealant shall be used when sealing cracks in HMA.
2. Type IV Sealant shall be used when sealing joints and cracks in Portland cement concrete pavements and HMA saw and seal applications.

908.03 Preformed Elastomeric Joint Sealer (Compression Type)
A. Requirements.
THE SECOND SENTENCE IS CHANGED TO:

The material shall conform to the physical properties specified in Table 1 of ASTM D 3542 and as modified herein. The Compression-Deflection properties specified in Table 1 of ASTM 3542 shall be replaced with NJDOT Test Method J-2 as provided within these Specifications. The requirement for Pressure Deflection shall be 3.5 psi.

THE FIRST SENTENCE OF THE FIFTH PARAGRAPH IS CHANGED TO:

The width to height ratio of the compression sealer shall never be less than 90%.

908.05 Strip Seal Expansion Dam.
B. Glandular Type Strip Seal.
1. Scope.
THE FIRST SENTENCE IS CHANGED TO:

This specification covers the material requirements for glandular type strip seal deck joint systems consisting of an extruded neoprene rubber gland seal mechanically locked in the cavities of two parallel steel rail sections.

3. Metal Components and Adhesive.
THE FIRST AND SECOND SENTENCES ARE CHANGED TO:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Steel rail sections shall conform to AASHTO M 270 Grade 36 or 50. Steel for plates, shapes and other structural steel used in the deck joint system shall conform to AASHTO M 270 Grade 36 or 50.

THE FOLLOWING NEW SUBSECTION IS ADDED:
908.08 Polymerized Joint Adhesive.

Polymerized joint adhesive shall be hot-applied asphaltic joint adhesive/sealer and shall conform to the physical properties in Table 908-6 below.

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Test Procedure</th>
<th>Physical Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cone Penetration, 77°F</td>
<td>D 5329</td>
<td>60-100</td>
</tr>
<tr>
<td>Flow, 140°F</td>
<td>D 5329</td>
<td>5 mm maximum</td>
</tr>
<tr>
<td>Resilience, 77°F</td>
<td>D 5329</td>
<td>30% minimum</td>
</tr>
<tr>
<td>Ductility, 77°F</td>
<td>D 113</td>
<td>30 cm minimum</td>
</tr>
<tr>
<td>Ductility, 39.2°F</td>
<td>D 113</td>
<td>30 cm minimum</td>
</tr>
<tr>
<td>Tensile Adhesion, 77°F</td>
<td>D 5329</td>
<td>500% minimum</td>
</tr>
<tr>
<td>Softening Point</td>
<td>D 36</td>
<td>77°C minimum</td>
</tr>
<tr>
<td>Asphalt Compatibility</td>
<td>D 5329</td>
<td>Pass</td>
</tr>
</tbody>
</table>

The polymerized joint adhesive shall have a viscosity at the recommended pour temperature to allow for proper application of the material. The manufacturer of the joint adhesive shall provide documentation of recommended pour temperature and safe heating temperature for the material and shall submit certifications of compliance according to Subsection 106.04. Test results shall be attached to the certification.

SECTION 909 – LANDSCAPING MATERIALS

909.05 Plant Materials.

THE FOLLOWING IS ADDED TO THE END OF THIS SECTION:

Hemerocallis shall be chosen, according to availability, from the following color groups. Only one variety per bed shall be used, but more than one variety may be chosen from each group in order to fulfill the total quantity required in the contract.

<table>
<thead>
<tr>
<th>NEAR WHITE, ORANGE &amp; RED</th>
<th>GOLD</th>
<th>YELLOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>May May</td>
<td>Stella de Oro</td>
<td>Happy Returns</td>
</tr>
<tr>
<td>So Lovely</td>
<td>Prester John</td>
<td>North Field</td>
</tr>
<tr>
<td>Paprica Velvet</td>
<td>Chicago Gold Coast</td>
<td>Mary Todd</td>
</tr>
<tr>
<td>Tamara June</td>
<td>Isaiah</td>
<td>Good Impression</td>
</tr>
<tr>
<td>Celebrity Elite</td>
<td>Northbrook Gold</td>
<td>Butterpat</td>
</tr>
<tr>
<td>Open Hearth</td>
<td>Jen Melon</td>
<td>Pizza</td>
</tr>
<tr>
<td>Pardon Me</td>
<td>Condilla</td>
<td>Gala Bells</td>
</tr>
<tr>
<td>Chicago Apache</td>
<td>Black Eyed Stella</td>
<td>Hyperion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beauty to Behold</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Erin Prairie</td>
</tr>
</tbody>
</table>

Narcissus shall be chosen, according to availability, from the following Narcissus groups. Only one variety per bed shall be used, but more than one variety may be chosen from each group in order to fulfill the total quantity required in the contract.
Narcissus in turf shall be chosen, according to availability, from the following list of early bloomers. Only one variety per bed shall be used, but more than one variety may be chosen from each group in order to fulfill the total quantity required in the contract.

TRUMPET NARCISSUS-YELLOW
Golden Harvest
King Alfred
Rembrandt
Hunter’s Moon
Unsurpassable

LARGE CUPPED-YELLOW
Armada
Binkie
Butterscotch
Carlton
Fortune
Galway

TRUMPET NARCISSUS-WHITE
Beersheba
Cantatrice
Empress of Ireland
Mount Hood
Vigil

LARGE CUPPED-BICOLOR
Amor
Duke of Windsor
Fortissimo
Ice Follies
Juanita
Kilworth

909.10 Topsoil.
A. Unacceptable Topsoil Sources.
ITEM 1. IS CHANGED TO:

1. Soils having less than 4.1 pH value, or greater than 8.0 pH value.

SECTION 910 - MASONRY UNITS

910.07 Granite Facing for Pier Shafts.
THE LAST SENTENCE OF THE LAST PARAGRAPH IS CHANGED TO:

The number of cores to be furnished for such tests shall be six.

THE FOLLOWING IS ADDED TO THIS SECTION:

Color of Granite:
Provide granite in color approximating color of coated architectural precast concrete or of color subsequently identified by the Engineer together with the Architect.

Inscriptions and Decorative Surfaces:
Carve and cut inscriptions and decorative surfaces according to requirements shown on the Contract Drawings. Use skilled stone carvers experienced in the successful performance of work similar to that indicated.

SECTION 912 - PAINTS, COATINGS, AND MARKINGS

912.06 Epoxy Bonding Coat.
THE ENTIRE SUBSECTION TEXT IS CHANGED TO:

Epoxy bonding coat shall be a two-component, epoxy resin, bonding system for application to concrete that meets the requirements of ASTM C 881, Type II, Grade 1 or 2, Class B or C. Certifications of compliance shall be furnished according to Subsection 106.04.
Epoxy waterproofing seal coat shall meet the requirements of ASTM C 881, Type VII; Grade 1, 2, or 3; Class D, E, or F. The seal coat shall be gray in color to match the adjacent concrete. Certifications of compliance shall be furnished according to Subsection 106.04.

912.10 Pavements Stripes or Markings.
C. Thermoplastic.
THE SECOND AND THIRD SUBPARTS ARE CHANGED TO:

2. For white, the composition of the mixture shall be as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percent by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resin/Binder</td>
<td>22-26 percent</td>
</tr>
<tr>
<td>Glass Beads (pre-mix)</td>
<td>30 percent minimum</td>
</tr>
<tr>
<td>White Pigment</td>
<td>10 percent minimum</td>
</tr>
<tr>
<td>Calcium Carbonate and Inert Fillers</td>
<td></td>
</tr>
<tr>
<td>(shall not contain silica other than as glass beads)</td>
<td>34-38 percent</td>
</tr>
</tbody>
</table>

3. Only yellow non-lead formulas shall be used, the composition of the mixture shall be as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percent by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resin/Binder</td>
<td>22-26 percent</td>
</tr>
<tr>
<td>Glass Beads (pre-mix)</td>
<td>30 percent minimum</td>
</tr>
<tr>
<td>Yellow Pigment</td>
<td>2 percent minimum</td>
</tr>
<tr>
<td>Calcium Carbonate and Inert Fillers</td>
<td></td>
</tr>
<tr>
<td>(shall not contain silica other than as glass beads)</td>
<td>42-46 percent</td>
</tr>
</tbody>
</table>

The yellow material’s combined totals of lead, cadmium, mercury, and hexavalent chromium shall not exceed 100 parts per million.

The thermoplastic manufacturer shall certify, according to Subsection 106.04, that the material will meet the requirements specified.

THE FOLLOWING IS ADDED TO THE END OF LIST:

D. Preformed Traffic Tape. Preformed traffic tape for permanent and temporary applications shall be from the NJDOT approved products list maintained by the Bureau of Materials Engineering and Testing.

912.12 Removable Pavement Marking Tape and Removable Black Line Masking Tape.
THE SUBSECTION HEADING AND SUBPART A IS CHANGED TO:

912.12 Removable Wet Weather Pavement Marking Tape and Removable Black Line Masking Tape.
A. Removable Wet Weather Pavement Marking Tape. The removable wet weather pavement marking tape shall consist of polymeric, conformable backing materials with a retroreflective surface designed to provide retroreflectivity in wet conditions. The underside of the tape shall be precoated with a pressure sensitive adhesive which bonds the tape to the roadway surface so as to be able to withstand traffic immediately after installation. Primers shall be used to promote tape adhesion to the pavement only in accordance with the tape manufacturer’s recommendations.

Daylight color of the white tape shall be no darker than color No. 37778 of FED-STD-595B. Daylight color of the yellow tape shall conform to the FHWA color tolerance chart for highway yellow.

THE THIRD PARAGRAPH IS CHANGED TO:

When measured with a LTL-2000 Retrometer, the tape shall have initial, minimum retroreflectance values conforming to:

**Dry Condition – ASTM E 1710**

**Entrance Angle = 88.76°**
<table>
<thead>
<tr>
<th>Observation Angle</th>
<th>Specific Luminance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White (Millicandelas per square foot per footcandle)</td>
<td>Yellow (Millicandelas per square foot per footcandle)</td>
</tr>
<tr>
<td>(Degrees)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.05</td>
<td>750</td>
<td>450</td>
</tr>
</tbody>
</table>

Note: The angular aperture of both the photoreceptor and the light projector shall be six minutes of arc. The reference axis shall be taken perpendicular to the test sample.

Continuous Wet Condition – ASTM E 2176
Entrance Angle = 88.76°

<table>
<thead>
<tr>
<th>Observation Angle</th>
<th>Specific Luminance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White (Millicandelas per square foot per footcandle)</td>
<td>Yellow (Millicandelas per square foot per footcandle)</td>
</tr>
<tr>
<td>(Degrees)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.05</td>
<td>750</td>
<td>350</td>
</tr>
</tbody>
</table>

The removable tape shall be capable of being removed manually, intact or in large pieces, at temperatures above 40 °F without the use of solvents, burning, grinding, or blasting. Only tape that has previously received the approval of the Department Bureau of Materials shall be used. Certification of Compliance shall be furnished according to Subsection 106.04.

912.13 Inorganic Zinc Coating System.
THE FOLLOWING IS ADDED:

A complete coating system of an inorganic zinc rich primer, a high build epoxy intermediate coat and a urethane finish coat shall be selected from one of the approved coating systems listed on the following website:

http://www.state.nj.us/transportation/eng/technology/materials

All products for the complete system, including thinners and solvents, shall be from the same manufacturer and shall be from the Qualified Paint List.

Drying time between coats shall be per the manufacturer’s recommendations.

The following information shall be submitted for the system selected at least one month before painting is anticipated:

1. A 1-gallon sample for each coat of paint in the system.
2. Infrared curves (0.1 to 0.6 mils) for each coat. Curves for the dry film of the vehicle (binder) of each component and for the mixed paint shall be included.
3. Weight per gallon, at 77 °F, for each coat. Variance shall be within plus or minus 1.8 ounces of the normal weight per gallon of the sample that was approved and placed on the QPL.
4. Viscosity in Krebs Units, at 77 °F, for each coat. Variance shall be within plus or minus 5 Krebs Units, or equivalent units of another viscometer, of the viscosity of the sample that was approved and placed on the QPL.
5. Percent of solids by weight of each coat.
6. Percent of metallic zinc by weight in the dry film of the cured zinc primer coat. This percentage shall be greater than or equal to that of the sample that was approved and placed on the QPL.
7. Percent of metallic zinc by weight in the zinc pigment component.
8. Finish coat color chips for selection of color by the Engineer.
9. The required curing time and dry film thickness for the qualification of the zinc primer for slip-critical connections in conformance with the requirements of AASHTO, Division I, Table 10.32.3C for Class of

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY

Page 377
Surface B. A certified test report with the slip coefficient tested according to AASHTO Division 1, Article 10.32.3.2.3.

10. Technical data sheets, MSDS, and specific application instructions for all coats. In the event of a conflict between the data/instruction sheets and these Specifications, with the approval of the Engineer, the manufacturer’s requirements shall govern. Work shall not be allowed to proceed until the information is received and approved.

11. Mixing and thinning directions.

12. Recommended spray nozzles and pressures.

The Contractor shall submit the manufacturer’s recommended repair procedures to correct damage such as that caused in handling and shipping, deficient or excessive coating thickness, removal of zinc salts and other contaminants that would be detrimental to succeeding coats, and procedures for surface preparation and painting of rust spots.

The Contractor shall provide the services of a paint or a painting technical representative from the paint manufacturer at the beginning of operations and whenever required during operations.

Each container of paint shall be labeled to show the name of the manufacturer, the trade name designation of the contents, the lot or batch number, the date of manufacture, and the volumetric contents in gallons or the weight of zinc powder in pounds. Each container shall be labeled according to the Code of Federal Regulations for flammables and shall contain all information necessary to comply with NJSA 34:5A-1 New Jersey Worker and Community Right To Know Act.

912.14 Epoxy Mastic Coating System.
THE FOLLOWING IS ADDED:

A complete coating system of an aluminum epoxy mastic primer and a urethane finish coat shall be selected from one of the approved coating systems listed on the following website:

http://www.state.nj.us/transportation/eng/technology/materials

All products for the complete system, including thinners and solvents, shall be from the same manufacturer and shall be from the Qualified Paint List.

Drying time between coats shall be per the manufacturer’s recommendations.

The following information shall be submitted for the system selected at least one month before painting is anticipated:

1. A 1-gallon sample for each coat of paint in the system.
2. Infrared curves (0.1 to 0.6 mils) for each coat. Curves for the dry film of the vehicle (binder) of each component and for the mixed paint shall be included.
3. Weight per gallon, at 77 °F, for each coat. Variance shall be within plus or minus 1.8 ounces of the nominal weight per gallon of the sample that was approved and placed on the QPL.
4. Viscosity in Krebs Units, at 77 °F, for each coat. Variance shall be within plus or minus 5 Krebs Units, or equivalent units of another viscometer, of the viscosity of the sample that was approved and placed on the QPL.
5. Percent of solids by weight of each coat.
6. Finish coat color chips for selection of color by the Engineer.
7. Technical data sheets, MSDS, and specific application instructions for all coats. In the event of a conflict between the data/instruction sheets and these Specifications, with the approval of the Engineer, the manufacturer’s requirements shall govern. Work shall not be allowed to proceed until the information is received and approved.
8. Mixing and thinning directions.
9. Recommended spray nozzles and pressures.

The Contractor shall submit the manufacturer’s recommended repair procedures to correct damage such as that caused in handling and shipping, deficient or excessive coating thickness, removal of zinc salts and other contaminants that would be detrimental to succeeding coats, and procedures for surface preparation and painting of rust spots.

The Contractor shall provide the services of a paint or a painting technical representative from the paint manufacturer at the beginning of operations and whenever required during operations.
Each container of paint shall be labeled to show the name of the manufacturer, the trade name designation of the contents, the lot or batch number, the date of manufacture, and the volumetric contents in gallons or the weight of zinc powder in pounds. Each container shall be labeled according to the Code of Federal Regulations for flammables and shall contain all information necessary to comply with NJSA 34:5A-1 New Jersey Worker and Community Right To Know Act.

912.15 Organic Zinc Coating System.
THE FOLLOWING IS ADDED:

A complete coating system of an organic zinc rich primer, a high build epoxy intermediate coat and a urethane finish coat shall be selected from one of the approved coating systems listed on the following website:

http://www.state.nj.us/transportation/eng/technology/materials

All products for the complete system, including thinners and solvents, shall be from the same manufacturer and shall be from the Qualified Paint List (QPL).

Drying time between coats shall be per the manufacturer’s recommendations.

The following information shall be submitted for the system selected at least one month before painting is anticipated:

1. A 1-gallon sample for each coat of paint in the system.
2. Infrared curves (0.1 to 0.6 mils) for the zinc primer, intermediate, and finish coats to include curves for the dry film of the vehicle (binder) of each component and for the mixed paint.
3. Weight per gallon, at 77 °F, for the zinc primer, intermediate, and finish coats. Variance shall be within plus or minus 1.8 ounces of the nominal weight per gallon of the sample that was approved and placed on the QPL.
4. Viscosity in Krebs Units, at 77 °F, for the zinc primer vehicle and the intermediate and finish coat paints. Variance shall be within plus or minus 5 Krebs Units, or equivalent units of another viscometer, of the viscosity of the sample that was approved and placed on the QPL.
5. Percent of solids by weight of the zinc primer vehicle and the intermediate and finish coat paints.
6. Percent of metallic zinc by weight in the dry film of the cured zinc primer coat. This percentage shall be greater than or equal to that of the sample that was approved and placed on the QPL.
7. Percent of metallic zinc by weight in the zinc pigment component.
8. Finish coat color chips for selection of color by the Engineer.
9. The required curing time and dry film thickness for the qualification of the zinc primer for slip-critical connections in conformance with the requirements of AASHTO, Division I, Table 10.32.3C for Class of Surface A. A certified test report with the slip coefficient tested according to AASHTO Division 1 Article 10.32.3.2.2.
10. Technical data sheets, MSDS, and specific application instructions for all coats. In the event of a conflict between the data/instruction sheets and these Specifications, with the approval of the Engineer, the manufacturer’s requirements shall govern. Work shall not be allowed to proceed until the information is received and approved.
11. Mixing and thinning directions.
12. Recommended spray nozzles and pressures.

The Contractor shall submit the manufacturer’s recommended repair procedures to correct damage such as that caused in handling and shipping, deficient or excessive coating thickness, removal of zinc salts and other contaminants that would be detrimental to succeeding coats, and procedures for surface preparation and painting of rust spots.

The Contractor shall provide the services of a paint or a painting technical representative from the paint manufacturer at the beginning of operations and whenever required during operations.

Each container of paint shall be labeled to show the name of the manufacturer, the trade name designation of the contents, the lot or batch number, the date of manufacture, and the volumetric contents in gallons or the weight of zinc powder in pounds. Each container shall be labeled according to the Code of Federal Regulations for flammables and shall contain all information necessary to comply with NJSA 34:5A-1 New Jersey Worker and Community Right To Know Act.

ROUTE 36 OVER THE SHERWESBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
912.17 Pavement Reflectors and Castings.
The following is added:

6. **Alternate pavement reflectors and castings.** Alternate pavement reflectors and castings shall be from the NJDOT approved products list maintained by the bureau of materials engineering and testing.

SECTION 913 - PIPE

913.03 Ductile Iron Water Pipe.
The first sentence of the first paragraph is changed to:

Ductile iron water pipe shall conform to ANSI/AWWA C151/A21.51.

913.04 Concrete Pipe
The entire subsection text is changed to:

In the manufacture of concrete pipe, concrete shall be composed of cement, coarse aggregate, fine aggregate, and water. Concrete may include admixtures, fly ash, or GGBFS. The materials shall conform to the following:

- Aggregates .................................................................................................................................................. 901.12
- Air-Entraining Admixture ..................................................................................................................... 905.01
- Chemical Admixture ............................................................................................................................... 905.02
- Fly Ash ..................................................................................................................................................... ASTM C 618, Class C or F
- GGBFS .................................................................................................................................................. 919.18
- Portland Cement or Blended Hydraulic Cement .................................................................................. 919.11
- Water ...................................................................................................................................................... 919.15

If fly ash is used to control alkali-silica reactivity, Class F fly ash shall be used.
Reinforced concrete culvert pipe, storm drain, and sewer pipe shall conform to AASHTO M 170, Class III, Wall B, unless otherwise designated. For jacked pipe, reinforced concrete culvert pipe shall conform to AASHTO M 170, Class V, Wall B. Reinforced concrete elliptical culvert, storm drain, and sewer pipe shall conform to AASHTO M 207, Class HE-III, unless otherwise designated.

If required for watertight flexible joints, preformed flexible joint sealants conforming to AASHTO M 198 shall be used.

The manufacturer of the pipe shall notify the Bureau of Materials at least 2 days before shipping pipe to the Project. Pipe will be inspected and approved in the manufacturer’s yard. For approval of the concrete pipe, three-point loading shall be performed in the manufacturer’s yard at a frequency directed by the Engineer.

913.11 Plastic Drainage Pipe.
The subsection heading and entire text are changed to:

913.11 High Density Polyethylene (HDPE), PVC Drainage Pipe.
Corrugated HDPE drainage pipe shall conform to AASHTO M 252 or AASHTO M 294M. PVC drainage pipe shall conform to ASTM D 2729.

SECTION 914 – PORTLAND CEMENT CONCRETE, MORTAR, AND GROUT

The title of this section is changed to:

SECTION 914 – PORTLAND OR BLENDED HYDRAULIC CEMENT CONCRETE, MORTAR, AND GROUT

914.01 Composition of Portland Cement Concrete.
The title and subsection are changed to:
914.01 Composition of Portland or Blended Hydraulic Cement Concrete.
Portland cement concrete shall be composed of portland cement or blended hydraulic cement, coarse aggregate, fine aggregate, admixtures, and water. Portland cement concrete except white concrete may include fly ash, Ground Granulated Blast Furnace Slag or Silica Fume. Materials shall conform to the following Subsections:

Aggregates ........................................................................................................................................ 901.12
Admixtures:
  Air-Entraining .............................................................................................................................. 905.01
  Chemical ......................................................................................................................................... 905.02
Mineral:
  Fly Ash ......................................................................................................................................... 919.07
  Silica Fume .................................................................................................................................. 919.10(b)
  Ground Granulated Blast Furnace Slag ..................................................................................... .... 919.18
  Portland Cement ................................................................................................................ ................. 919.11
  Water ........................................................................................................................................... 919.15

Chemical admixtures conforming to the requirements of Subsection 905.02 may be used in the mix design of structural concrete items.

914.02 Portland Cement Concrete Design, Control, and Acceptance Testing Requirements.
THE TITLE OF THIS SUBSECTION IS CHANGED TO:

914.02 Portland or Blended Hydraulic Cement Concrete Design, Control, and Acceptance Testing Requirements.
THE LIST FOR THE SELECTED STRUCTURAL CONCRETE PAY ITEM ADJUSTMENT HAS BEEN CHANGED TO:

E. Acceptance Testing for Strength for Pay Adjustment Items. Concrete Pay Items which are subject to pay adjustment and the base prices are as follows:

<table>
<thead>
<tr>
<th>STANDARD ITEM</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>BASE PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5A13C</td>
<td>CONCRETE IN SUPERSTRUCTURES, DECK SLAB</td>
<td>CY</td>
<td>$460.00</td>
</tr>
<tr>
<td>N5A05</td>
<td>CONCRETE IN SUPERSTRUCTURE, PARAPETS, 2'-8&quot; HIGH (HPC)</td>
<td>LF</td>
<td>$305.00</td>
</tr>
<tr>
<td>N5A06</td>
<td>CONCRETE IN SUPERSTRUCTURE, PARAPETS, 2-10&quot; HIGH (HPC)</td>
<td>LF</td>
<td>$305.00</td>
</tr>
<tr>
<td>5B63C</td>
<td>PRETENSIONED PRESTRESSED CONCRETE BEAMS, 63&quot;</td>
<td>LF</td>
<td>$185.00</td>
</tr>
<tr>
<td>5B63D</td>
<td>PRESTRESSED CONCRETE BOX BEAMS, (TYPE BI-48), 48&quot; X 27&quot;</td>
<td>LF</td>
<td>$215.00</td>
</tr>
<tr>
<td>N5E08</td>
<td>PRESTRESSED CONCRETE PILES, DRIVEN 14&quot; X 14&quot; (HPC)</td>
<td>LF</td>
<td>$90.00</td>
</tr>
<tr>
<td>N5E10</td>
<td>PRESTRESSED CONCRETE PILES, DRIVEN 24&quot; X 24&quot; (HPC)</td>
<td>LF</td>
<td>$90.00</td>
</tr>
<tr>
<td>N5E12</td>
<td>PRESTRESSED CONCRETE PILES, DRIVEN 54&quot; DIA (HPC)</td>
<td>LF</td>
<td>$90.00</td>
</tr>
</tbody>
</table>

B. Proportioning and Verification.
THE SECOND SENTENCE OF THE THIRD PARAGRAPH IS CHANGED TO:

At least six 4 by 8 inch test cylinders shall be prepared from each batch and cured according to AASHTO T 23 or AASHTO T 126.

THE FIRST SENTENCE OF THE TENTH PARAGRAPH IS CHANGED TO:

Classes A and B concrete may be designed to achieve early strength requirements by increasing the Cement content.

C. Acceptance Testing Procedures for Slump and Air Entrainment.
THE FIRST SENTENCE OF THE FOURTH PARAGRAPH IS CHANGED TO:

Following any permitted additions, the drum shall be rotated at the recommended mixing speed for a minimum of 30 revolutions without exceeding 300 total revolutions, the original test results shall be disregarded, and a single test for both slump and air entrainment performed.
D. General Acceptance Testing Requirements for Strength.
THE FOLLOWING IS ADDED AFTER THE SECOND PARAGRAPH:

Concrete test specimens which are to be used for determination of early strengths for form removal, opening to traffic, or otherwise placing the concrete into service shall be cured according to the field curing provisions in AASHTO T 23.

E. Acceptance Testing for Strength for Pay-Adjustment Items.
THE ENTIRE TEXT OF THIS SUBPART AFTER THE FIRST PARAGRAPH IS CHANGED TO:

The amount of pay-adjustment in dollars is the product of the Pay Item base price times the lot quantity times the percent pay-adjustment (expressed as a decimal) given by Equation 1 or Equation 2.

**Equation 1 and Equation 2:**

<table>
<thead>
<tr>
<th>Quality</th>
<th>Pay-adjustment (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD &lt; 50</td>
<td>PPA = 3.0 - 0.3 PD</td>
</tr>
<tr>
<td>PD ≥ 50</td>
<td>PPA = 26.0 - 0.76 PD</td>
</tr>
</tbody>
</table>

Where:  
PPA = Percent Pay-adjustment  
PD = Percent Defective (Estimate of percent of lot below the class design strength by the use of Equation 3 and Subsection 914.05, Table 914-5)

**Equation 3:**

Q = (ALS - CDS) / S

Where:  
Q = Quality index for pay-adjustment computations  
ALS = Average lot strength in psi  
CDS = Class design strength in psi  
S = Standard deviation of the strength test results in psi for the lot as computed by Equation 4

**Equation 4:**

S = \sqrt{\frac{\sum(Xi-ALS)^2}{N-1}}

Where:  
\sum = Summation  
Xi = Individual test result (average strength of a test cylinder pair)  
N = Number of test results for the lot

Note: When only a single test result is available, the standard deviation "S" is assumed to equal 200 psi.

For lots having percent defective (PD) levels less than 10 percent, Equation 1 provides positive adjustments to the contract price. For lots having exactly 10 percent defective, there is no adjustment to the contract price. For lots having greater than 10 percent defective, Equations 1 or 2, as appropriate, subtract progressively larger amounts from the contract price.

If, based on the initial series of tests, the lot quality of a pay-adjustment item is estimated to be PD = 50 or greater, or if any individual test value (average of a cylinder pair) falls below the retest limit for non-pay-adjustment concrete in Subsection 914.05, Table 914-4, the Engineer has the option to reevaluate by coring or other suitable means. When this provision is applied to Class P concrete, each beam or pile in the steam bed will be evaluated separately.
If the Department elects not to core, the Contractor may accept the pay-adjustment of (PPA) calculated by Equation 2 or, when approved by the Engineer, may take cores according to Subsection 914.05, Table 914-4 at no cost to the Department. The Contractor must take the cores within 60 days from notification of the option to core. As an aid in making this decision, the Contractor will be permitted to perform nondestructive testing using a method or device approved by the Engineer.

When re-evaluation is accomplished by a method other than coring, the results will be used only to determine what further action is to be taken. If any of the non-core tests results are below the class design strength, the Engineer has the option to core. If this option is waived, the Contractor may elect to core, at no cost to the State and within 60 days after being presented with this option, or to accept the pay-adjustment computed from the initial test cylinder results. If the Contractor elects to core, the coring shall be performed as directed and the Department will test the cores. If none of the non-core test results is below the class design strength, the Engineer may elect either to core or to accept the lot at 100 percent payment.

If, based on the core results, the lot is determined to be at a quality level of PD < 75, the pay-adjustment shall be computed by Equation 1 or Equation 2, as appropriate. If the lot is confirmed to be at a quality level of PD = 75 or greater, the lot is considered to be rejectable and the Engineer may:

1. Require the Contractor to remove and replace the defective lot at no cost to the State,
2. Allow the Contractor to leave the defective lot in place and receive a percent pay-adjustment (PPA) computed by Equation 2, or
3. Allow the Contractor to submit a plan, for approval, for corrective action to be performed at no cost to the State. If the plan for corrective action is not approved, either option 1 or 2 above may be applied.

F. Acceptance Testing for Strength for Non-Pay-Adjustment Items.
THE ENTIRE TEXT OF THIS SUBPART IS CHANGED TO:

All concrete items not specifically designated as pay-adjustment items as described in Subsection 914.02, Subpart E are considered to be non-pay-adjustment items, but may be accepted by pay-adjustment under certain circumstances. Such an item is eligible for 100 percent payment (PA = 0) provided the retest limit of Subsection 914.05, Table 914-4 is met. If this requirement is not met, the item will be treated as a pay-adjustment item according to Subsection 914.02, Subpart E, and all pay-adjustment provisions shall apply except that the item bid price will be used instead of an item base price in the computation of the pay-adjustment.

When a pay-adjustment is computed for any of the following items, which are only partially composed of concrete, the amount of pay-adjustment, if any, will be multiplied by the Estimated Percentage of Concrete (expressed as a decimal) as indicated below:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Estimate Percentage of Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>INLETS, TYPE</td>
<td>30</td>
</tr>
<tr>
<td>INLETS, TYPE __*, USING EXISTING CASTING</td>
<td>30</td>
</tr>
<tr>
<td>INLETS, TYPE B____*, USING EXISTING CASTING</td>
<td>40</td>
</tr>
<tr>
<td>INLETS, TYPE B____*, MODIFYING</td>
<td>40</td>
</tr>
<tr>
<td>INLETS, TYPE B____*, MODIFIED, USING EXISTING CASTING</td>
<td>40</td>
</tr>
<tr>
<td>INLETS, TYPE ES</td>
<td>50</td>
</tr>
<tr>
<td>INLET CASTINGS, TYPE ES</td>
<td>40</td>
</tr>
<tr>
<td>MANHOLES</td>
<td>30</td>
</tr>
<tr>
<td>MANHOLES, ____ * DIAMETER</td>
<td>30</td>
</tr>
<tr>
<td>MANHOLES, USING EXISTING CASTING</td>
<td>30</td>
</tr>
<tr>
<td>MANHOLES, SANITARY SEWER</td>
<td>30</td>
</tr>
<tr>
<td>MANHOLES, SANITARY SEWER, USING EXISTING CASTING</td>
<td>30</td>
</tr>
<tr>
<td>GRANITE CURB</td>
<td>25</td>
</tr>
<tr>
<td>RESET GRANITE CURB</td>
<td>25</td>
</tr>
<tr>
<td>BEAM GUIDE RAIL ANCHORAGES</td>
<td>25</td>
</tr>
<tr>
<td>CHAIN-LINK FENCE, ____ * HIGH</td>
<td>25</td>
</tr>
<tr>
<td>CHAIN-LINK FENCE, ALUMINUM-COATED STEEL, ____ * HIGH</td>
<td>25</td>
</tr>
<tr>
<td>CHAIN-LINK FENCE, PVC-COATED STEEL, ____ * HIGH</td>
<td>25</td>
</tr>
</tbody>
</table>
CHAIN-LINK FARM-TYPE FENCE 25
GATES, CHAIN-LINK FENCE, __‘ WIDE 25
GATES, CHAIN-LINK FENCE, ALUMINUM-COATED STEEL, __‘ WIDE 25
GATES, CHAIN-LINK FENCE, PVC-COATED STEEL, __‘ WIDE 25
GATES, CHAIN-LINK FARM-TYPE FENCE, __‘ WIDE 25
RESET FENCE 25
TEMPORARY CHAIN-LINK FENCE, __‘ HIGH 25
GUIDE SIGNS, TYPE GA, BREAKAWAY SUPPORTS 20
GUIDE SIGNS, TYPE GA, NON-BREAKAWAY SUPPORTS 20

The amount of pay-adjustment for pay items not listed above is the product of the unit bid price times the lot quantity times the percent pay-adjustment given by Equation 1.

THE FOLLOWING IS ADDED:

G. Mix Design, Fabrication and Furnishing of High Performance Concrete (HPC) for Parapets, Curbs, Sidewalks, and Substructure Members.

1. Fabrication Requirements. For the construction of parapets, curbs, sidewalks, and substructure concrete, the HPC shall be fabricated in accordance with the requirements of these specifications.

2. Mix Design Verification. In the development of the HPC mix design, the following performance requirements, in accordance with the indicated test method, shall be achieved. A report to document these results shall be provided to the NJDOT Regional Materials Office. The Contractor shall obtain the results of these standard tests from an AASHTO Accredited testing agency that is approved for Portland Cement concrete testing, at no cost to the Department.

Performance Requirements for Deck Slabs, Sidewalks, Concrete Railings

<table>
<thead>
<tr>
<th>Performance Characteristic</th>
<th>Standard Test Method</th>
<th>Performance Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scaling Resistance (x = visual rating of the surface after 50 cycles)</td>
<td>ASTM C 672</td>
<td>x = 3 max</td>
</tr>
<tr>
<td>Freeze-Thaw Durability (x = relative dynamic modulus of elasticity after 300 cycles)</td>
<td>AASHTO T 161 ASTM C 666 Proc. A</td>
<td>x = 80% minimum</td>
</tr>
<tr>
<td>Chloride Permeability 56 days (coulombs)</td>
<td>AASHTO T 277 ASTM C1202</td>
<td>1000 maximum</td>
</tr>
<tr>
<td>56 Day Compressive Strength (Verification Strength)</td>
<td>AASHTO T 22 ASTM C 39</td>
<td>5400 psi minimum</td>
</tr>
</tbody>
</table>

Performance Requirements for Substructure Protection Concrete

<table>
<thead>
<tr>
<th>Performance Characteristic</th>
<th>Standard Test Method</th>
<th>Performance Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion Resistance (x = average depth of wear)</td>
<td>ASTM C 944</td>
<td>x = 0.04 inches maximum</td>
</tr>
<tr>
<td>Freeze-Thaw Durability (x = relative dynamic modulus of elasticity after 300 cycles)</td>
<td>AASHTO T 161 ASTM C 666 Proc. A</td>
<td>x = 80% minimum</td>
</tr>
<tr>
<td>Chloride Permeability 56 days (coulombs)</td>
<td>AASHTO T 277 ASTM C1202</td>
<td>1000 maximum</td>
</tr>
<tr>
<td>56 Day Compressive Strength (Verification Strength)</td>
<td>AASHTO T 22 ASTM C 39</td>
<td>5400 psi minimum</td>
</tr>
</tbody>
</table>

Note: For the Scaling Resistance performance testing, as prescribed in the Standard Test Method, specimens shall be moist cured for 14 days and then air cured for 14 days.

a. If the compressive strength requirement has been achieved in 28 days, the strength requirement shall be considered acceptable. If the required compressive strength is not achieved in 28 days, the HPC sample shall be tested at 56 days.
b. If the chloride permeability requirement has been achieved in 28 days, the chloride permeability shall be considered acceptable. If the required chloride permeability is not achieved in 28 days, the HPC sample shall be tested at 56 days.

c. At least 90 calendar days prior to the planned start of the concrete placement, the mix design shall be submitted for approval and verification in accordance with Subsection 914.02. The submission shall include the results of the required Performance testing specified above.

d. In accordance with the above referenced AASHTO T277 test, at 28 and 56 day intervals, the Department will perform chloride permeability testing to document the quality of the HPC mix design and to verify the results submitted in the above referenced Report.

e. The Contractor shall submit four (4) additional cylindrical samples to the Department Laboratory, for performance of this testing. These samples shall be 4 inches in diameter and at least 8 inches in length. The test value shall be the result of the average value of tests on two (2) specimens for each mix design.

3. Production HPC.

a. As per the provisions of 501.12, Subpart 5., a plan of operation for placement of the HPC deck slab, shall be submitted for review and approval by the Engineer. Additionally, a pre-placement meeting shall be held at least seven days prior to the start of placement.

b. During production, the components of the mix design shall not be changed in any way from the approved mix design. If for some reason, the components must be changed, the mix design shall be re-verified according to the requirements stated herein.

4. HPC Acceptance Requirements.

a. With the exception that compression testing may be conducted at 56 days, the requirements specified in Subsection 914.02 for control and acceptance testing of Class A concrete shall be adhered to in the fabrication of the HPC elements.

b. Testing for the Chloride Permeability requirements stated below will not be performed for the sidewalk and parapet HPC.

c. Acceptance testing performance measures shall consists of the following parameters:

<table>
<thead>
<tr>
<th>Performance Characteristic</th>
<th>Standard Test Method</th>
<th>Performance Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Air Entrainment *</td>
<td>AASHTO T 152</td>
<td>6.0 ± 1.5 (#57 Aggregate)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.0 ± 1.5 (#67 Aggregate)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.0 ± 1.5 (#8 Aggregate)</td>
</tr>
<tr>
<td>Slump (inches) *</td>
<td></td>
<td>3 ± 1</td>
</tr>
<tr>
<td>Chloride Permeability **</td>
<td>AASHTO T 277</td>
<td>2000 maximum</td>
</tr>
<tr>
<td>56 days (coulombs)</td>
<td>ASTM C1202</td>
<td></td>
</tr>
<tr>
<td>56 Day Compressive Strength ***</td>
<td>AASHTO T 22</td>
<td>4400 psi</td>
</tr>
<tr>
<td>(Retest Limit)</td>
<td>ASTM C 39</td>
<td>minimum</td>
</tr>
</tbody>
</table>

Notes: * As per the guidance stated in Subsection 501.03, a Type F water-reducing, high range admixture will be permitted in accordance with Subsection 905.02 and Subsection 914.02, Subparts B and C. When a Type F admixture is used, the Slump and Air Content values for the HPC shall be as follows:

Slump: 6 ± 2 inches
Air Content: increase both the target value and tolerance percentages by 0.5

** For chloride permeability testing, 4 additional cylinders shall be provided to the Department Laboratory. Two cylinders each from two randomly selected delivery trucks shall be taken for testing at 28 day and 56 day intervals.

*** For compressive strength testing, the Initial Sampling Rate for the HPC shall be 6/Lot.
d. The HPC shall be a Non-Pay-Adjustment Item. In accordance with the provisions of Subsection 914.02 F., the HPC shall be accepted for strength according to the strength performance requirements stated herein.

e. A test for chloride permeability shall consist of two test specimens. The results of the two specimens shall be averaged to determine the test result. There will be two tests performed on each lot from samples taken from two randomly selected delivery trucks.

f. The lot is eligible for 100 percent payment provided that all test results are equal to or below 2000 coulombs.

g. Whenever one or more individual test results exceed 2000 coulombs at 28 days, the lot shall be re-evaluated at the same testing rate at 56 days. If, upon testing at 56 days, one or more individual test results exceed 2000 coulombs, the Engineer may:

1. Require the Contractor to remove and replace the defective lot at no cost to the State,

2. Permit the Contractor to submit a plan, for approval, for corrective action that is to be performed at no cost to the State.

5. Surface cracks

Surface cracks that may develop in deck slabs and do not exceed 3/8 inch in depth shall be sealed with a low viscosity epoxy sealer or a low viscosity methacrylate monomer penetrating sealer that is to be approved by the Engineer. Cracks exceeding 3/8 inch in depth shall be repaired by methods that are to be approved by the Engineer. All such corrective work shall be at the Contractor’s expense.

914.03 Mortar and Grout.
THE LAST PARAGRAPH IS CHANGED TO:

Epoxy grout conforming to the requirements of ASTM C 881, Type I; Grade 3; Class B or C may be used as a non-shrink grout.

914.04 Sampling and Testing Methods.
THE FOLLOWING AASHTO TEST METHOD IS ADDED:

T303 Standard Test Method for Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction.
### Table 914-1 Requirements for Roadway Concrete Items

<table>
<thead>
<tr>
<th>Concrete Item</th>
<th>Concrete Class</th>
<th>Slump (inch)</th>
<th>Percent Air Entrainment for Coarse Aggregate Size Numbers</th>
<th>357</th>
<th>467</th>
<th>57</th>
<th>67</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cast-in-Place Items</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Course, Bridge Approach Slabs, Bridge Approach Transition Slabs</td>
<td>B</td>
<td>2±1</td>
<td>5.0±1.5, 5.0±1.5, 6.0±1.5, 6.0±1.5, 7.0±1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Course</td>
<td>B</td>
<td>2±1</td>
<td>5.0±1.5, 5.0±1.5, 6.0±1.5, 6.0±1.5, 7.0±1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlet and Manhole Walls, Headwalls, Miscellaneous Concrete</td>
<td>B</td>
<td>3±1</td>
<td>----, ----, 6.0±1.5, 6.0±1.5, 7.0±1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlet and Manhole Top Slabs, Sidewalks, Driveways, Islands</td>
<td>B</td>
<td>3±1</td>
<td>----, ----, 6.0±1.5, 6.0±1.5, 7.0±1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slope Gutters, Vertical Curb, Sloping Curb, Barrier Curb and Base</td>
<td>B</td>
<td>4±1</td>
<td>----, ----, 6.0±1.5, 6.0±1.5, 7.0±1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concrete and White Concrete Vertical, Sloping and Barrier Curb, Concrete and White Concrete Islands</td>
<td>B</td>
<td>4±1</td>
<td>----, ----, 7.0±2.0, 7.0±2.0, 8.0±2.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Foundations for:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlets and Manholes</td>
<td>B</td>
<td>3±1</td>
<td>6.5 max, 6.5 max, 7.5 max, 7.5 max, 8.5 max</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical Items</td>
<td>B</td>
<td>3±1</td>
<td>----, ----, 7.5 max, 7.5 max, 8.5 max</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signs</td>
<td>B</td>
<td>3±1</td>
<td>----, ----, 6.0±1.5, 6.0±1.5, 7.0±1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junction Boxes</td>
<td>B</td>
<td>3±1</td>
<td>----, ----, 7.5 max, 7.5 max, 8.5 max</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 914-1 (Continued)

<table>
<thead>
<tr>
<th>Table 914-1 (Continued)</th>
<th>Concrete Class</th>
<th>Slump (inch)</th>
<th>Percent Air Entrainment for Coarse Aggregate Size Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>357</td>
<td>467</td>
</tr>
<tr>
<td><strong>Cast-in-Place Items (continued)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Footings for Fence Posts, Guide Rail End Treatment</td>
<td>B</td>
<td>3±1</td>
<td>----</td>
</tr>
<tr>
<td>Culverts</td>
<td>A</td>
<td>3±1</td>
<td>----</td>
</tr>
<tr>
<td>Monuments</td>
<td>A</td>
<td>3±1</td>
<td>----</td>
</tr>
<tr>
<td>Slope Protection</td>
<td>B</td>
<td>2±1</td>
<td>----</td>
</tr>
<tr>
<td><strong>Precast Items</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Culverts</td>
<td>A</td>
<td>3±1</td>
<td>----</td>
</tr>
<tr>
<td>Inlets and Manholes, Junction Boxes, Headwalls, Reinforced Concrete End Sections (See note 2)</td>
<td>B</td>
<td>3±1</td>
<td>----</td>
</tr>
<tr>
<td>Concrete and White Concrete Barrier Curb</td>
<td>B</td>
<td>3±1</td>
<td>----</td>
</tr>
</tbody>
</table>

Note 1: According to Subsection 501.03, a Type F water-reducing, high range admixture will be permitted according to Subsection 905.02 and Subsection 914.02, Subparts B and C. When a Type F admixture is used, the table Slump and Air Content values for the given concrete item shall be changed as follows:

- Slump: 6 ± 2 inches
- Air Content: Increase both the target value and tolerance percentages by 0.5.

Note 2: For the items in this category, the slump may be reduced to zero (dry cast) provided that adequate consolidation, acceptable to the Engineer, is achieved.
### Table 914-3  Mix Design Requirements

**Class of Concrete**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>S</th>
<th>P</th>
<th>P-1</th>
<th>P-2</th>
<th>P-3</th>
<th>P-4</th>
<th>P-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Design Strength (28 days, psi Note 3)</td>
<td>4600</td>
<td>3700</td>
<td>2000</td>
<td>5500</td>
<td>6000</td>
<td>6500</td>
<td>7500</td>
<td>7500</td>
</tr>
<tr>
<td>Verification Strength (28 days, psi Note 3)</td>
<td>5400</td>
<td>4500</td>
<td>--</td>
<td>6000</td>
<td>6500</td>
<td>7000</td>
<td>8000</td>
<td>8000</td>
</tr>
</tbody>
</table>

### Maximum Water/Cement Ratio (Note 2)

| lb/lb     | 0.443 | 0.488 | 0.577 | Note 1 | Note 1 | Note 1 | Note 1 | Note 1 | Note 1 |
| gals/bag  | 5.0    | 5.5    | 6.5    | Note 1 | Note 1 | Note 1 | Note 1 | Note 1 | Note 1 |

### Minimum Cement Content

| lb/cy     | 611    | 564    | 658    | Note 1 | Note 1 | Note 1 | Note 1 | Note 1 | Note 1 |
| Bags/cy   | 6.5    | 6.0    | 7.0    | Note 1 | Note 1 | Note 1 | Note 1 | Note 1 | Note 1 |

**Note 1:** According to PCI Manual, except as indicated in Note 2.

**Note 2:** The maximum water/cement ratio for all classes of concrete except for Classes P, P-1 and P-2, when a Type F water-reducing, high range admixture is used according to Tables 914-1 and 914-2, shall be reduced by 0.043 lb/lb (4.5 gals/bag).

**Note 3:** All concrete test results shall be recorded to the nearest 10 psi.

**Note 4:** To successfully meet the requirements of this specification, the target production strength must be higher than the Class Design Strength by an amount proportional to the Producer’s within-lot standard deviation.
<table>
<thead>
<tr>
<th>Class of Concrete</th>
<th>A</th>
<th>S</th>
<th>P</th>
<th>P-1</th>
<th>P-2</th>
<th>P-3</th>
<th>P-4</th>
<th>P-5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lot Size (maximum)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pay-Adjustment Items</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Sampling Rate</td>
<td>5/Lot</td>
<td>5/Lot</td>
<td>--</td>
<td>5/Lot</td>
<td>5/Lot</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Retest Sampling Rate (minimum)</td>
<td>5/Lot</td>
<td>5/Lot</td>
<td>--</td>
<td>5/Unit or Load Test</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Pay-Adjustment Items</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Sampling Rate</td>
<td>3/Lot</td>
<td>2/Lot</td>
<td>1/Lot</td>
<td>3/Lot</td>
<td>3/Lot</td>
<td>3/Lot</td>
<td>3/Lot</td>
<td>3/Lot</td>
</tr>
<tr>
<td>Retest Limit (psi)</td>
<td>4400</td>
<td>3600</td>
<td>2000</td>
<td>5400</td>
<td>5900</td>
<td>6400</td>
<td>7400</td>
<td>8400</td>
</tr>
<tr>
<td>Retest Sampling Rate</td>
<td>5/Lot</td>
<td>5/Lot</td>
<td>5/Lot</td>
<td>5/Lot</td>
<td>5/Lot</td>
<td>5/Lot</td>
<td>5/Lot</td>
<td>5/Lot</td>
</tr>
</tbody>
</table>

**Note 1:** The lot sizes are maximums and, at the option of the Engineer, any lot may be subdivided into two or more smaller lots. When such a subdivision is made, the specified sampling rate applies to each of the smaller lots.

**Note 2:** An initial strength test result is defined as the average strength of two 4 inch by 8 inch compression test cylinders, cured for 28 days, and tested in the Department Laboratory except for Classes P, P-1, and P-2 cylinders which may be tested at the fabricator's plant under the supervision of the Engineer.

**Note 3:** A retest result is defined as the strength of an individual test result obtained by coring or other suitable means. If retest is performed by coring, each retest result is defined as the corresponding nominal core strength divided by 0.85.

**Note 4:** The specified sampling rates shall apply except that no more than one test per truckload or batch of concrete will be required (except for air and slump tests when retempering). It is expected that each structural component will have a representative sample taken. At the option of the Engineer, nonstructural concrete lots consisting of 20 cubic yards or less may be accepted without strength tests.

**Note 5:** No lot shall include more than one class of concrete nor include concrete of the same class having different specified levels of slump or air entrainment.

**Note 6:** For prestressed concrete, if more than one bed is used or if more than 80 cubic yards of concrete are used, the production shall be subdivided as equally as possible into two or more lots.

**Note 7:** Retest limit for non-pay-adjustment roadway and structural items requiring the use of Class B, white concrete, shall be 3000 psi.
SECTION 915 – REINFORCEMENT STEEL

915.02 Prestressing Reinforcement.
C. Grit Impregnated Epoxy-Coated Prestressing Steel.
THE FIRST SENTENCE IS CHANGED TO:

Grit impregnated epoxy-coated prestressing steel strands shall conform to the requirements of ASTM A882 and to the criteria specified in 502.06.

915.03 Reinforcement Steel for Concrete Base and Concrete Surface Courses
SUBPART 5 TEXT IS CHANGED TO:

5. Dowels. Dowel bars in transverse joints shall be epoxy-coated, Grade 60, plain reinforcement steel conforming to ASTM A 615. If specified, dowel bars shall be fitted with end caps. The end caps shall be non-metallic and designed to prevent the entrance of grout or mortar into the expansion void. End caps shall have a maximum length of 2 1/2 inches and shall allow a minimum of 3/4 inch of movement.

SECTION 916 - SIGN MATERIALS

916.04 Retroreflective Sheeting.
THE ENTIRE SUBSECTION IS CHANGED TO:

As stated herein, the terms reflective sheeting and retroreflective sheeting are synonymous. Retroreflective sheeting shall conform to ASTM D 4956 based upon results obtained and reported through testing performed by the National Transportation Product Evaluation Program (NTPEP). Fluorescent retroreflective sheeting shall be selected from the approved products list as provided in the Special Provisions.

1. General Requirements.
   a. Retroreflectance. All retroreflective sheeting shall have the minimum coefficient of retroreflection (R coated) in conformance with ASTM D 4956.
   b. Color. The colors of the retroreflective sheeting, except for fluorescent colors shall conform to the color requirements of ASTM D 4956.
   c. Fluorescent Colors. The daytime fluorescent color of retroreflective sheeting shall be determined according to ASTM E 991.
      In addition, the color shall be equally distinguishable in daylight and at night under artificial headlight illumination. The color shall have a consistent chromaticity across all signs of the same color. Noticeable deviation from the shades that would affect the required performance shall be a cause for rejection of any sheeting or completed sign at any time before acceptance. For sheeting that is directional, the datum mark (arrow) imprinted on the face of the sheeting shall be the datum mark for test purposes.
   d. Product Performance Requirements. The retroreflective sheeting manufacturer shall meet the following requirements for their products.
      (1) Type III Sheeting – Sheetng shall be required to have a service life span of at least 12 years.
      (2) Types VI, VII, VIII AND IX Sheeting – Sheetng shall be required to have a service life span of at least 10 years.
      (3) The performance requirements shall be such that there is: no loss of retroreflectivity; no loss of colorfastness; no cracking; and no other conditions inherent to the sheeting including inks and overlay film that causes it to be incapable of performing as required.

2. Certification of Compliance. The manufacturer shall submit a certification of compliance according to Subsection 106.04 for each lot of sheeting supplied for use on the Project.

916.05 Legends, Borders, and Accessories.
THE FOLLOWING IS ADDED AFTER THE SECOND PARAGRAPH:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
All finished signs shall be clear and legible without smudging, blisters, delamination, loose edges or other blemishes.

1. **Type A Demountable.**
   
   THE FIRST AND SECOND PARAGRAPHS ARE CHANGED TO:
   
   The demountable sign letters, digits, arrows, borders, and alphabet accessories shall be reflectorized and shall consist of ASTM D 4956 Type VIII OR IX wide angle prismatic retroreflective sheeting applied to ⅜-inch cutout aluminum plates conforming to ASTM B 209, Alloy 6061-T6 or 5052.
   
   All shields and symbols to be mounted to sign types GO, GOX, and GA on breakaway tubular posts shall consist of ASTM D 4956 Type VIII OR IX wide angle prismatic retroreflective sheeting applied to 3/16-inch cutout aluminum plates conforming to ASTM B 209, Alloy 6061-T6.

2. **Type B Direct and Permanently Applied Retroreflective Sheeting Copy.**
   
   SUBPART D, E, & F ARE DELETED AND C IS CHANGED TO:
   
   c. When the background is ASTM D 4956 Type III sheeting, ASTM D 4956 Type III sheeting shall be used for copy.

916.08 Fabrication.

8. **Shop Painting and Reflectorization.**
   
   a. **Application.**
   
   THE LAST SENTENCE IN THE THIRD PARAGRAPH IS CHANGED TO:
   
   Sheeting applied to extruded sections shall extend over top edges and down side legs a minimum of 1/16 inch; except that where ASTM D 4956 Type VIII or IX sheeting is used, it shall be cut at the top edges according to the manufacturer’s recommendation.

   c. **Screen Process Printing.**
   
   THE THIRD SENTENCE IN THE FIRST PARAGRAPH IS CHANGED TO:
   
   Transparent screen process paint, after application to the retroreflective sheeting and thoroughly dry shall conform to the color requirements ASTM D 4956.

9. **Packaging, Storage, and Shipping.**
   
   THE FIRST SENTENCE IN THE FIRST PARAGRAPH IS CHANGED TO:
   
   Packaging, storage, and shipping of signs produced using retroreflective sheeting shall be according to the sheeting manufacturer’s recommendations.

916.10 **Breakaway Steel “U” Post Sign Supports.**
   
   THE HEADING AND ENTIRE SUBSECTION TEXT IS CHANGED TO:

   916.10 **Steel “U” Post Sign Supports.**
   
   The steel “U” post sign supports shall conform to ASTM A499. Signs shall be secured to the steel “U” post by means of 18-8 stainless steel 5/16 x 18 UNC hexagonal headed bolts and nuts conforming to ASTM A320, Grade B8, Class 1. Sign mounting bolts shall extend beyond the end of each nut but not more than ¼ inches when fully tightened.
   
   The steel “U” posts shall be straight and have a smooth finish, free of burrs.
   
   The list of the approved products will be provided by the Bureau of Materials Engineering and Testing.

916.14 **Flexible Delineators.**

2. **Composition.**

   THE FIRST PARAGRAPH IS CHANGED TO:

   For ground mounted flexible delineators, the portion of the delineator above ground shall be one component, or shall be bonded together if it consists of two or more components. The shape of the delineator post where
10. **Mowability.**

THE ENTIRE SUBPART IS DELETED.

11. **Sampling Rate**

THE SUBPART NUMBER IS CHANGED TO:

10. **Sampling Rate.**

916.17 **Tables.**

THE HEADING AND THE ENTIRE SUBSECTION IS CHANGED TO:

916.17 Cast Memorial Plaques.

General Requirements: Provide castings free from pits, scale, sand holes, and other defects. Comply with requirements specified for metal, border style, background texture, and finish and in required thickness, size, shape, and copy. Details for plaque are shown on Drawing Sheet A-10.

Historic Preservation Compliance Requirements: Conform to requirements for final plaque design and content set by local Historical Preservation Groups.

Submittals: Provide shop drawing of completed plaque. Provide sample of bronze casting showing letters, background, border, and coating.

Allowed Manufacturers:
- A.R.K. Ramos
- Advanced Corporation
- Spencer Industries; Philadelphia, PA
- Bunting Inc.; Pittsburgh, PA
- Lake Shore Industries; Erie, PA

Bronze Castings: ASTM B 584, allow UNS No. C83600 (No. 1 manganese bronze).

Border Style and Ornament: As shown on drawings.

Background Texture: Manufacturer’s standard pebble texture.

Mounting: Concealed studs for substrates encountered.

Anchors and Inserts: Provide tamper resistant nonferrous-metal or stainless steel anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use chemical type anchors or expansion sleeve devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

Finishes: Comply with NAAMM’s “Metal Finishes Manual for Architectural Metal Products” for recommendations for applying and designating finishes. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping. Variations in appearance are acceptable if they are within range of approved samples and are assembled or installed to minimize contrast.

Cast-Bronze Plaque finishes: Exposed surfaces free from porosity, burrs, and rough spots; with returns finished with fine-grain air blast.

Raised Areas: Hand-tool and buff borders and raised copy to produce manufacturer’s standard satin finish.

Background Finish: Dark oxidized potassium sulfide “liver of sulfur” coating applied in formulation capable of resulting in bronze of color approved in sample.

Polished Highlight Finish: Manufacturer’s standard bright metal, and buffed finish.

**ROUTE 36 OVER THE SHREWSBURY RIVER**

**HIGHLANDS BRIDGE**

**MONMOUTH COUNTY**
Acrylic Lacquer Protective Coating: Coat polished highlight surfaces with the following system. Clear, air drying, acrylic lacquer specifically developed for coating copper-alloy products, applied by air spray in to coats per manufacturer’s written instructions, with interim drying to a total thickness of 1 mil.

Provide: Subject to compliance with requirements, provide “Incralac” developed by International Copper Research Council.

SECTION 917 – STRUCTURAL STEEL AND OTHER FERROUS METALS

917.01 Bolts and Bolting Material.

2. Specifications.

THE FOLLOWING IS ADDED:

c. Direct Tension Indicators shall comply with ASTM F959 and shall be accepted and installed according to Test Method S-3, “Procedure for Identification and Installation of High Strength Bolts with Direct Tension Indicators (DTI’s)”.


a. Bolts.

THE FIRST SENTENCE IS CHANGED TO:

Hardness for bolt diameters ¼ inch to 1 ½ inches, inclusive, shall be as noted:

THE FOLLOWING IS ADDED:

When atmospheric corrosion resistant weathering steel is to be used, Type 3 bolts shall be used.

THE FOLLOWING IS ADDED:

d. Direct Tension Indicators (DTI’s). When galvanizing of the bolt assembly is required, DTI’s shall be mechanically galvanized in accordance with AASHTO M298, Class 50 (ASTM B695, Class 50). DTI’s to be used for Type 3 bolts shall be epoxy coated with a black color.

4. Testing.

THE FOLLOWING IS ADDED:

g. Direct Tension Indicators (DTI’s). DTI’s shall be tested according to ASTM F 959.

7. Installation.

THE SUBPART A. IS CHANGE TO:

a. Bolts shall be installed according to the appropriate AASHTO Specifications. Direct Tension Indicators (DTI’s) shall be used with high strength bolts to verify the required tension. The provisions of Article 11.5.6.4.7 of Division II of the AASHTO Standard Specifications or of Article 11.5.6.4.7 of the AASHTO LRFD Bridge Construction Specifications shall be followed. If warranted and as directed by the Engineer, the face of the nut shall be smeared with wax before it is installed. The Castral Stick Wax lubricant, beeswax or a water wax emulsion; such as, the MacDermid “Torque ’N Tension Control Fluid” may be used.

THE FOLLOWING IS ADDED AT THE END OF THE SUBSECTION:

Anchor bolts, rock anchors, and hardware shall conform to AASHTO M270 Grade 36 and shall be galvanized after fabrication, including threading, according to ASTM A153.

Dowels used to anchor prestressed concrete voided slabs and box beams to abutments and piers shall conform to AASHTO M270 Grade 36 and shall be galvanized to ASTM A153. Threading of dowels is not required.

Welded steel shear connectors shall conform to Division II, Section 11 of the AASHTO Standard Specifications for Highway Bridges or Section 11 of the AASHTO LRFD Bridge Construction Specifications.

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Stainless steel bolts, nuts, and washers shall conform to ASTM A320, Class 1, Grade B8 (AISI Type 304).

For overhead and cantilever sign support structures, bolts, nuts and washers for steel to steel chord splices shall conform to AASHTO M164 and be hot-dip galvanized as per ASTM A153.

As an alternate, bolts, nuts and washers conforming to AASHTO M 164 may be substituted for bolts, nuts, and washers of the same diameter, length, and thickness conforming to ASTM A307.

917.03 Castings, Materials and Components for Drainage Structures.
THE FIRST PARAGRAPH IS CHANGED TO:

All inlet and manhole castings, grates, extension rings, extension frames and covers shall be capable of withstanding the proof load testing requirements specified in AASHTO M306 when they are tested as a complete assembled unit and shall conform to the following:

SECTION 918 - TIMBER AND TIMBER PRESERVATIVES

918.01 Sawn Timber Posts, Timber Spacers, and Routed Timber Spacers.
THE FOLLOWING SUBSECTION TEXT IS CHANGED TO:

Sawn timber members, timber spacers, and routed timber spacers shall be of Southern pine or Douglas fir with extreme fiber stress in bending in excess of 1,600 pounds per square inch, as assigned according to Southern Pine Inspection Bureau or West Coast Lumber Inspection Bureau grading rules. The timber posts, timber spacers, and routed timber spacers may be rough sawn or dressed. Treatment shall be according to AASHTO M133 and AWPA Standards C2 and C14, as summarized in Subsection 918.06.

918.02 Round Timber Piling.
THIS SUBSECTION IS DELETED

918.03 Dimension Lumber for Sheet Piling
THIS SUBSECTION IS DELETED.

918.04 Timber Connectors and Hardware.
THE FOLLOWING SUBSECTION TEXT IS CHANGED TO:

Timber connectors and hardware shall be galvanized and shall conform to Division II, Section 16 of the AASHTO Specifications for Highway Bridges.

918.05 Dimension Lumber, Timber, Glued-Laminated Timber, and Decking for Structures.
THE FOLLOWING SUBSECTION TEXT IS CHANGED TO:

Dimension lumber, timber, glued-laminated timber, and roof decking for structures shall conform to AASHTO M 168 with the following modifications:

1. Dimension lumber and timber shall be southern pine or Douglas fir of structural grade and shall conform to the grading rules of the Southern Pine Inspection Bureau or the Western Lumber Inspection Bureau. Grading must be performed by an agency approved by the Board of Review of the American Lumber Standards Committee. Southern pine shall be designated and graded as No. 2 if 1½ to 3½ inches thick and as No. 1 if 4½ inches or thicker. Douglas fir shall be designated and graded as Dense No. 1.

   Pacific coast Douglas fir may be used instead of southern yellow pine. Pacific coast Douglas fir shall be stress graded, conforming to the Standard Grading Rules of the West Coast Lumber Inspection Bureau. Timber for decking shall be designated Commercial DEX, and all other Douglas fir shall be Dense No. 1. Timber shall be dressed square edged S4S.

   Pacific coast Douglas fir shall be treated with creosote, AWPA Standard No. P13, by the full-cell process to a retention of not less than 12 pounds of preservative per cubic foot of timber for timber 5 inches and thicker, and 20 pounds of preservative per cubic foot of timber or to refusal but not less than 12 pounds per cubic foot for timber less than 5 inches thick, according to AWPA Standard No. C2.

   Timber for decking subjected to vehicular traffic shall be graded as Dense Commercial if southern pine and Select if Douglas fir. Timber for bridge decking shall be dressed square edged S4S.

2. Timber for decking used exclusively by pedestrians shall be Commercial grade and shall be dressed square edged S4S.
4. Treatment shall be according to AASHTO M133 and AWPA Standards C2, C14 and C28 as summarized in Subsection 918.06, except that timber railing systems and decking used by pedestrians shall not be preserved with creosote. In addition, timber decking, which is covered with membrane waterproofing and asphalt cement overlay, shall not be preserved with creosote.

5. Solid sawn timber for noise barriers shall be of Douglas fir-larch (Western Wood Products Association) and be graded as No. 1 or better or shall be southern pine (The Southern Pine Inspection Bureau) and graded as No. 2 or better. Hardwood may be used for solid sawn timber if it is at least of the same strength as the softwood and is approved by the Engineer. Heartwood may be used, but no heartwood center (pith) will be allowed.

   Glulam shall be classified 22F-E5 DF/DF (Douglas fir) or 20F-E3 SP/SP (Southern pine) (AITC Table 1). The adhesive in glulam production shall comply with “wet condition” as specified in PS56. Lumber used in the production of glulam shall be within a range of seven to 16 percent moisture content at the time of laminating. The moisture gradient within a single glulam member shall be limited to a five percent range as specified by PS56.

   All timber materials shall receive a preservative treatment consisting of five percent pentachlorophenol AWPA P-9, Type A in oil, according to AWPA Standards C14 and C28, current at time of bid, to a minimum retention of 0.5 pounds per cubic foot before gluing. Where feasible, all cuts and holes shall be fabricated before preservative treatment. After treatment, the maximum moisture content shall not exceed 19 percent.

918.06 Timber Treatment.
THE FOLLOWING SUBSECTION TEXT IS CHANGED TO:

Timber preservative treatment for various wood species and usage requirements shall be according to AASHTO M 133 and AWPA Standards C1, C2, C14 and C28 as summarized in the following tables:

1. **Timber Members.** Timber members of southern pine shall be treated with creosote, CCA, or pentachlorophenol (penta) to the minimum retention levels listed below. Timber members of Douglas fir shall be treated with creosote or ACZA to the minimum retention levels listed below. Timber members of oak, maple, and black/red gum shall be treated with creosote to the minimum retention levels listed below.

<table>
<thead>
<tr>
<th>Timber Members/Usage</th>
<th>AWPA Standards</th>
<th>Wood Species/Treatment Process</th>
<th>Minimum Retention (lbs/cu. ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C14</td>
<td>Creosote</td>
<td>Southern Pine</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCA/Penta</td>
<td></td>
</tr>
</tbody>
</table>

2. **Glued-Laminated Timber (Above Ground and Soil Contact).** Glued-laminated structural timber of southern pine or Douglas fir for use above ground and in soil contact shall be treated with creosote or pentachlorophenol (penta) to the minimum retention levels shown. Glued-laminated timber shall be treated before gluing.

<table>
<thead>
<tr>
<th>Glued-Laminated Structural Timber/Usage</th>
<th>AWPA Standards</th>
<th>Wood Species/Treatment Process</th>
<th>Minimum Retention (lbs/cu. ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Creosote</td>
<td>Southern Pine</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Douglas Fir</td>
</tr>
</tbody>
</table>
Creosote Penta Creosote Penta
Above ground and soil contact
C14, C28 12 0.60 12 0.60
Glued-laminated timber shall not be used in marine environment or in salt water splash zones.

918.07 Sampling and Testing Methods.
THE FOLLOWING SUBSECTION TEXT IS CHANGED TO:
Sampling and testing will be performed according to the following:
Timber for structures ............................................. Subject to inspection and testing prior to shipment
Timber preservatives ................................................................. AASHTO M 133

SECTION 919 - MISCELLANEOUS

919.02 Bearing Pads.
THE FIRST PARAGRAPH IS CHANGED TO:
Elastomeric bearing pads for bridge beams shall conform to Division II, Section 18 of the AASHTO
Standard Specifications for Highway Bridges or Section 18 of the AASHTO LRFD Bridge Construction
Specifications.

919.07 Fly Ash.
THE FIRST PARAGRAPH IS CHANGED TO:
Fly ash for portland cement concrete shall conform to ASTM C 618, Class C or Class F except that the loss on
ignition shall not be more than three percent. Fly ash used to control alkali-silica reactivity shall be Class F. Before
each source of fly ash is approved, certified results of tests conducted by a testing agency shall be submitted to and
verified by the Department. Accompanying the certification shall be a statement from the supplier listing the source and
type of coal, the methods used to burn, collect, and store the fly ash, and the quality control measures employed.

919.11 Portland Cement.
THE TITLE AND SUBSECTION ARE CHANGED TO:

919.11 Portland or Blended Hydraulic Cement.
Portland cement shall conform to the following:
Masonry Cement .................................................................ASTM C 91
Portland Cement, Type I, II, and Type III (see Note 1).................................ASTM C 150
White Portland Cement, Type I and III (see Note 2)..............................ASTM C 150
Blended Hydraulic Cement (see Note 3)..................................................ASTM C 595
Note 1: Type III may be used only for prestressed or precast items.
Note 2: Shall not contain more than 0.55 percent by weight of ferric oxide (Fe₂O₃).
Note 3: Only types IS, I(PM), and I(SM) may be used. Portland cement, may be pre-blended with a
maximum of 15 percent fly ash, by weight, or a maximum of 10 % silica fume by weight, or with a
maximum of 50% GGBFS by weight. If more than 30% GGBFS is used, a scaling test conforming
to ASTM C672 must be completed on the mix design and the concrete must have a visual rating
less than 3 as based on ASTM C672 10.1.5 after 50 cycles.
When blended portland cement is used, no additional mineral admixtures shall be added.
Different brands of cement, the same brand of cement from different mills or different types of cement shall not be
mixed.
Suitable means shall be provided for storing and protecting the cement against dampness. Cement which for any
reason has become partially set or which contains lumps of caked cement will be rejected. The temperature of the
cement at the time of delivery to the mixer shall not exceed 160 °F.

919.17 Epoxy Bedding and Bonding Compound.
THE ENTIRE SUBSECTION TEXT IS CHANGED TO:

ROUTE 36 OVER THE SHREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
Epoxy bedding and bonding compound shall be a 2-part, non-sag gel, rapid-setting epoxy adhesive conforming to the requirements of ASTM C 881, Type IV, Grade 3, Class B or C. Certifications of compliance shall be furnished according to Subsection 106.04.

919.18 Ground, Granulated Blast Furnace Slag.
THE SECOND PARAGRAPH IS CHANGED TO:

Ground, granulated blast furnace slag may be used as a replacement for portland cement as specified in Subsection 919.11 up to a maximum replacement level of 50 percent by weight. Replacement of portland cement greater than 30 percent will require a scaling test on the mix design conforming to ASTM C 672 with a visual rating less than 3.

919.19 Sampling and Testing Methods
THE FOLLOWING ARE ADDED:

Mineral Admixtures........................................................................................................8 pounds from each source
Blended Hydraulic Cement..................................................................................................ASTM C 595

THE FOLLOWING NEW SUBSECTION IS ADDED:

919.22 Controlled Low Strength Material (CLSM).
CLSM shall conform to the following:

| Fine Aggregate.............................................................................................................901.12 |
| Chemical Admixtures....................................................................................................905.02 |
| Portland Cement, Type I, II, III ....................................................................................919.11 |
| Water...........................................................................................................................919.15 |

CLSM shall consist of a mixture of portland cement, water, fine aggregate and chemical admixtures. Fly ash shall not be permitted in mixes intended for trench backfilling. The CLSM mixture shall be proportioned to provide a backfill material that is self-compacting and capable of being excavated with hand tools at a later date. CLSM shall be proportioned to produce a 28-day compressive strength of 50 to 150 pounds per square inch. An accelerating admixture shall be used to produce a fast setting flowable mixture as required. The CLSM shall have a permeability of $1.7 \times 10^{-3} \pm 0.2 \times 10^{-3}$ centimeters per second according to ASTM D5084 for backfilling of conduits and piping.

At least 45 days prior to the start of any CLSM placement, trial batches of CLSM shall be prepared of the same materials and proportions proposed for use on the project. Each mix design shall be submitted on portland cement concrete mix design forms furnished by the Department, naming the sources of materials and test data.

At least 6 X 12 inch compression test cylinders shall be prepared for each batch according to ASTM 5971-96 for 28-day strengths except for fast setting mixes, which shall be tested at the specified cure time.

THE FOLLOWING SECTION IS ADDED:

SECTION 921 – FIBERGLASS REINFORCED AND UNREINFORCED PLASTIC LUMBER

The furnishing of Fiberglass Reinforced Plastic Lumber (FRPL) shall conform to the following material properties:

1. **Plastic.** The plastic for FRPL shall be a mixture of one or more of the following recycled post consumer or post industrial thermoplastics: high-density polyethylene, medium-density polyethylene or, low-density polyethylene. The plastic shall be mixed with appropriate colorants, UV inhibitors and antioxidants so that the resulting product meets the material property requirements specified in Table I below.

FRPL shall not absorb moisture, corrode, rot, warp, splinter or crack. The outer skin shall be smooth and black in color unless otherwise specified in the contract plans. It shall contain hindered amine light stabilizers to provide sufficient resistance to ultraviolet light degradation so as to meet the requirements in Table I below.

2. **Manufacturing.** Manufacture FRPL as one continuous piece with no joints or splices to the dimensions and tolerances in accordance with Table 2 and consisting of a dense outer skin surrounding a less dense core. Interior voids shall not exceed 0.75 inch in diameter. FRPL shall be free of twist and curvature.
3. **Reinforcement.** FRPL shall be reinforced by fiberglass reinforcing rods spaced inside the four corners of the timber. Reinforce 10”x10” FRPL with a minimum of four 1.75 inch diameter reinforcing rods placed in the corners of the section. Reinforce 12”x12” FRPL with a minimum of four 1.5 inch diameter reinforcing rods placed in the corners of the section. Reinforce 8”x12” FRPL with a minimum of four 1.0 inch diameter reinforcing rods placed in the corners of the section. Reinforcing rods must be continuous and offer a minimum flexural strength of 70 ksi when tested in accordance with ASTM D 4476 and a minimum compressive strength of 40 ksi when tested in accordance with ASTM D 695. Steel reinforcing rods shall not be permitted. All FRPL used for constructing platforms, blocking and wales shall have a minimum of 15% (by weight) chopped glass reinforcement added to the polyethylene. No fiberglass rebar will be required for the smaller dimensional FRPL.

4. **Structural Properties.** 8”x12”, 10”x10” and 12”x12” FRPL shall meet the minimum structural properties (+/- 10%) listed in Tables 3A and 3B. Smaller, dimensional FRPL for platforms and blocking shall meet the minimum structural properties listed in Table 4.

<table>
<thead>
<tr>
<th>TABLE 1: PLASTIC MATERIAL PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Property</strong></td>
</tr>
<tr>
<td>Density (ASTM D792)</td>
</tr>
<tr>
<td>Density (ASTM E1547)</td>
</tr>
<tr>
<td>Water Absorption (ASTM D570)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Brittleness (ASTM D746)</td>
</tr>
<tr>
<td>Impact Resistance (ASTM D746)</td>
</tr>
<tr>
<td>Hardness (ASTM D2240)</td>
</tr>
<tr>
<td>Abrasion (ASTM D4060)</td>
</tr>
<tr>
<td>Cycles = 10,000</td>
</tr>
<tr>
<td>Wheel = CS17</td>
</tr>
<tr>
<td>Load – 2.2 lbs</td>
</tr>
<tr>
<td>Chemical Resistance (ASTM D543)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Tensile Properties (ASTM D638)</td>
</tr>
<tr>
<td>Compressive Modulus (ASTM D695)</td>
</tr>
<tr>
<td>Coefficient of Friction (ASTM F489)</td>
</tr>
<tr>
<td>Nail Pull-Out (ASTM D1761)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 2: DIMENSIONS AND TOLERANCES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Property</strong></td>
</tr>
<tr>
<td>Length</td>
</tr>
<tr>
<td>Width</td>
</tr>
<tr>
<td>Height</td>
</tr>
<tr>
<td>Corner Radius</td>
</tr>
<tr>
<td>Outer Skin Thickness</td>
</tr>
<tr>
<td>Distance from outer surface to rebar elements</td>
</tr>
<tr>
<td>Straightness (gap, bend or bulge inside while lying on a flat surface)</td>
</tr>
</tbody>
</table>

**TABLES 3-A,3-B, 3 C AND 3 D: STRUCTURAL PROPERTIES**

**ROUTE 36 OVER THE SHREWSBURY RIVER**  
**HIGHLANDS BRIDGE**  
**MONMOUTH COUNTY**
Table 3-A

<table>
<thead>
<tr>
<th>Member Size</th>
<th>10 in x 10 in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulus of Elasticity as derived below</td>
<td>653 ksi</td>
</tr>
<tr>
<td>Stiffness, E.I.</td>
<td>5.07E+08 lb-in²</td>
</tr>
<tr>
<td>Yield Stress in Bending</td>
<td>7.3 ksi</td>
</tr>
<tr>
<td>Weight</td>
<td>31-38 lbs/ft</td>
</tr>
</tbody>
</table>

Table 3-B

<table>
<thead>
<tr>
<th>Member Size</th>
<th>12 in x 12 in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulus of Elasticity as derived below</td>
<td>405 ksi</td>
</tr>
<tr>
<td>Stiffness, E.I.</td>
<td>6.58E+08 lb-in²</td>
</tr>
<tr>
<td>Yield Stress in Bending</td>
<td>4.4 ksi</td>
</tr>
<tr>
<td>Weight</td>
<td>42-51 lbs/ft</td>
</tr>
</tbody>
</table>

Table 3-C

<table>
<thead>
<tr>
<th>Member Size</th>
<th>8 in x 12 in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulus of Elasticity as derived below</td>
<td>388 ksi</td>
</tr>
<tr>
<td>Stiffness, E.I.</td>
<td>1.74E+08 lb-in²</td>
</tr>
<tr>
<td>Yield Stress in Bending</td>
<td>5.6 ksi</td>
</tr>
<tr>
<td>Weight</td>
<td>28-35 lbs/ft</td>
</tr>
</tbody>
</table>

Table 3-D - UNREINFORCED

<table>
<thead>
<tr>
<th>Member Size</th>
<th>8 in x 12 in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulus of Elasticity as derived below</td>
<td>93 ksi</td>
</tr>
<tr>
<td>Stiffness, E.I.</td>
<td>1.51E+08 lb-in²</td>
</tr>
<tr>
<td>Yield Stress in Bending</td>
<td>0.86 ksi</td>
</tr>
<tr>
<td>Weight</td>
<td>39-47 lbs/ft</td>
</tr>
</tbody>
</table>

5. **Modulus of Elasticity.** Determine the Modulus of Elasticity of a full size specimen by conducting a three point bend test with a load applied in the center of a simply supported fourteen foot span at a deflection rate of 0.25 inches per minute. The Modulus is to be taken at a strain of 0.01 inches per inch, where strain equals \( (6 \times \text{depth of cross section}) \times \text{deflection} / \text{span length squared} \) and where Modulus of Elasticity equals \( \frac{\text{load} \times \text{span length cubed}}{48 \times \text{deflection} \times \text{moment of inertia}} \).

**TABLE 4: STRUCTURAL PROPERTIES**

<table>
<thead>
<tr>
<th>Table 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulus of Elasticity (ASTM D6109)</td>
</tr>
<tr>
<td>Flexural Strength (ASTM D6109)</td>
</tr>
<tr>
<td>Compressive Strength (ASTM D6108)</td>
</tr>
<tr>
<td>Compressive Strength Parallel to Grain (ASTM D6112)</td>
</tr>
<tr>
<td>Compressive Strength Perpendicular to Grain (ASTM D6112)</td>
</tr>
<tr>
<td>Screw Withdrawal (ASTM D6117)</td>
</tr>
</tbody>
</table>

The approved manufacturers of FRPL products are listed on the following website:

[http://www.state.nj.us/transportation/eng/technology/materials](http://www.state.nj.us/transportation/eng/technology/materials)

THE FOLLOWING SECTION IS ADDED:

ROUTE 36 OVER THE SHEREWSBURY RIVER
HIGHLANDS BRIDGE
MONMOUTH COUNTY
SECTION 922 – FIBERGLASS REINFORCED PLASTIC PILES

The furnishing of Fiberglass Reinforced Plastic Piles (FRPP) shall conform to the following material properties:

1. **Plastic.** The plastic for FRPP shall be a mixture of one or more of the following recycled post consumer or post industrial thermoplastics: high-density polyethylene, medium-density polyethylene or, low-density polyethylene. The plastic shall be mixed with appropriate colorants, UV inhibitors and antioxidants so that the resulting product meets the material property requirements specified in Table I below.

   FRPP shall not absorb moisture, corrode, rot, warp, splinter or crack. The outer skin shall be smooth and black in color unless otherwise specified in the contract plans. It shall contain hindered amine light stabilizers to provide sufficient resistance to ultraviolet light degradation so as to meet the requirements in Table I below.

2. **Manufacturing.** Manufacture FRPP as one continuous piece with no joints or splices to the dimensions and tolerances in accordance with Table 2 and consisting of a dense outer skin surrounding a less dense core. Interior voids shall not exceed 0.75 inch in diameter. FRPP shall be free of twist and curvature.

3. **Reinforcement.** FRPP shall be reinforced by fiberglass reinforcing rods spaced evenly around the inside perimeter of the pile. Reinforce 10” OD FRPP with a minimum of six 1.000 inch diameter fiberglass reinforcing rods. Reinforce 13” OD FRPP with a minimum of twelve 1.375 inch diameter fiberglass reinforcing rods. Reinforce 16” OD FRPP with a minimum of sixteen 1.75” diameter fiberglass reinforcing rods. Reinforcing rods must be continuous and offer a minimum flexural strength of 70 ksi when tested in accordance with ASTM D 4476 and a minimum compressive strength of 40 ksi when tested in accordance with ASTM D695. Steel reinforcing rods shall not be permitted. All FRPP shall have a minimum of 5% (by weight) chopped glass reinforcement added to the polyethylene.

4. **Structural Properties.** 10” OD, 13” OD and 16” OD FRPP shall meet the minimum structural properties (+/- 10%) listed in Tables 3A and 3B. The Modulus of Elasticity shall be determined by the test procedure found in Section 6.

5. **Recoverable Deflection.** FRPP shall exhibit recoverable deflection. FRPP shall not exhibit more than a 5% reduction in bending stiffness (EI) when cyclically load tested. The manufacturer of the FRPP shall provide cyclical, flexural load test results from an independent test laboratory. Cyclical load testing shall be conducted on either the specified 13”OD. or 16”OD. FRPP. The test shall be for a minimum of 200 load cycles. The test shall be a four point load condition with a minimum 30.5' clear span and a minimum 15' shear span. The applied load shall produce a minimum of 40% of the FRPP's bending moment at yield. The bending moment at yield shall be determined by the formula \( M = f (I / c) \) where:

   \[ M = \text{bending moment at yield (in-lbs)} \]
   \[ f = \text{yield stress in bending (lb/in}^2) \]
   \[ I = \text{moment of inertia of cross-section (in}^4) \]
   \[ c = \text{distance from neutral axis to point where stress is desired (inches)} \]

<table>
<thead>
<tr>
<th>TABLE 1: PLASTIC MATERIAL PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Density (ASTM D792)</strong></td>
</tr>
<tr>
<td><strong>Density (ASTM E1547)</strong></td>
</tr>
<tr>
<td><strong>Water Absorption (ASTM D570)</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Brittleness (ASTM D746)</strong></td>
</tr>
<tr>
<td><strong>Impact Resistance (ASTM D746)</strong></td>
</tr>
<tr>
<td><strong>Hardness (ASTM D2240)</strong></td>
</tr>
<tr>
<td><strong>Abrasion (ASTM D4060)</strong></td>
</tr>
<tr>
<td>Cycles = 10,000</td>
</tr>
<tr>
<td>Wheel = CS17</td>
</tr>
<tr>
<td>Load – 2.2 lbs</td>
</tr>
<tr>
<td><strong>Chemical Resistance (ASTM D543)</strong></td>
</tr>
<tr>
<td>Sea Water</td>
</tr>
<tr>
<td>Gasoline</td>
</tr>
<tr>
<td>No. 2 Diesel</td>
</tr>
</tbody>
</table>
Tensile Properties (ASTM D638)  | Skin/Core | Minimum 500 psi at break  
Compressive Modulus (ASTM D695)  | Skin/Core | Minimum 40 Ksi  
Coefficient of Friction (ASTM F489)  | Skin | Maximum 0.25, wet or dry  
Nail Pull-Out (ASTM D1761)  | Skin/Core | Minimum 60 lbs  

<table>
<thead>
<tr>
<th>TABLE 2: DIMENSIONS AND TOLERANCES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FRPP</strong></td>
</tr>
<tr>
<td>Length</td>
</tr>
<tr>
<td>Outside Diameter</td>
</tr>
<tr>
<td>Outer Skin Thickness</td>
</tr>
<tr>
<td>Distance from outer surface to rebar elements (SFRPP)</td>
</tr>
<tr>
<td>Straightness (gap, bend or inside while lying on a flat surface)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLES 3-A and 3-B: STRUCTURAL PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Table 3-A</strong></td>
</tr>
<tr>
<td>Member Size</td>
</tr>
<tr>
<td>Modulus of Elasticity as derived below</td>
</tr>
<tr>
<td>Stiffness, E.I.</td>
</tr>
<tr>
<td>Yield Stress in Bending</td>
</tr>
<tr>
<td>Bending Moment at Yield</td>
</tr>
<tr>
<td>Weight</td>
</tr>
</tbody>
</table>

| **Table 3-B** |
| Member Size | 13” OD |
| Modulus of Elasticity as derived below | 1,054 ksi |
| Stiffness, E.I. | 1.48E+09 lb-in² |
| Yield Stress in Bending | 8.6 ksi |
| Bending Moment at Yield | 1860 in-kips |
| Weight | 45-55 lbs/ft |

| **Table 3-C** |
| Member Size | 16” OD |
| Modulus of Elasticity as derived below | 1464 ksi |
| Stiffness, E.I. | 4.41E+09 lb-in² |
| Yield Stress in Bending | 11.6 ksi |
| Bending Moment at Yield | 4665 in-kips |
| Weight | 73-84 lbs/ft |

6. **Modulus of Elasticity.** The Modulus of Elasticity shall be determined by the following test procedure:

a. Place a 54 foot long standard commercial type FRPP in a clamping device so that 6 feet of the piling will be firmly fixed and unable to move.
b. The opposite end is to simply supported.
c. Gradually apply a vertical (downward) load at a point that is 12 feet from the simply-supported end.
d. Measure the deflection along the length of the piling at the load point, and 3 equidistant locations.
e. Use the load and deflection data to calculate the flexural modulus of elasticity, maximum outer fiber stress, stiffness (EI), and the bending stress.
f. The flexural modulus of elasticity is calculated by dividing EI by the moment of inertia of the cross section of the product.
Calculate the properties in Table 3A and 3B utilizing standard elastic beam flexure formulas (as found in references such as Machinery’s Handbook; and Formulas for Stress and Strain, by Roark and Young). Report the Stiffness (EI) as the average of the stiffness at all measurement locations, between zero load and half the load corresponding to the specification yield stress. The specified minimum yield stress in bending shall be reached before failure of the product. Calculate the stress at the load point, on the tension side of the plastic composite marine piling.

As stated, conduct the tests on a full-scale product of the specified size. The results of these tests may be extended through engineering calculations, to a product of another size only if the other size has the same or smaller cross section than the tested product. Do not use smaller cross sections to predict the performance of larger cross sections.

7. Wrapping. Wrapping for the FRPP that are to be placed in clusters shall be 0.5” diameter steel cable (5/8” OD covering) polypropylene impregnated wire rope.

The approved manufacturers of FRPP products are listed on the following website:

http://www.state.nj.us/transportation/eng/technology/materials

THE FOLLOWING SECTION IS ADDED:

SECTION 923 – FIBERGLASS-CONCRETE COMPOSITE PILES

The Fiberglass-Concrete Composite Piles (FCCP) shall consist of three components: a hollow composite tube, a concrete core and a durable coating. The furnishing of FCCP shall conform to the following material properties:

1. Composite Tubes. Composite tubes shall be produced of composite FRP (Fiber Reinforced Polymer) materials that have been formed by means of pultrusion, filament winding, scrim, or by other methods of production. E-Glass or other continuous fiber reinforcement shall be incorporated in the shell and shall be impregnated with vinyl ester, polyester, or epoxy resin. The content of the structural wall shall be 50 to 70 percent glass with a minimum of 25 percent resin (by weight). The manufactured tubes shall be capable of withstanding normal handling, shipment, and installation procedures.

The Tubes shall exhibit superior corrosion and ultraviolet resistance as demonstrated when exposed to an accelerated environmental test chamber for not less than 3,600 hours. The tube shall show no structural failure (i.e. <10% loss of strength) as a result of exposure to moisture and lamps required in one of the following: ASTM G152, G155, G154 or B-117.

The Tubes to be used in the fabrication of FCCP shall provide sufficient cross section and strength to withstand stresses incurred by fabrication, handling and driving of the piles to the required resistance.

a. Tolerances. Acceptable tolerances for the fiberglass tubes shall be as follows:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Length (inches)</td>
<td>plus one foot; minus 0 inches</td>
</tr>
<tr>
<td>Maximum Sweep (inches)*</td>
<td>0.08% of total length</td>
</tr>
<tr>
<td>Ends out of Square (inches)</td>
<td>1.0% of diameter</td>
</tr>
</tbody>
</table>

* Sweep – deviation from straightness, measured at several points about the pile circumference while the pile is not subjected to bending stresses.

b. Physical Properties. As defined in ASTM D 2310 or D 2996, fiberglass products designated as follows shall be used:

- Class: RTRP (Reinforced Thermosetting Resin Pipe)
- Type: Type I (filament wound)
- Grade: Grade 1 (Glass fiber reinforced epoxy resin pipe), Grade 2 (Glass fiber reinforced polyester resin pipe) or Vinylester resin.

In the manufacture of fiberglass tubes resins containing ultraviolet (UV) inhibitors shall be used. A UV resistant film coating of a minimum 3 mils thickness to portions of piles remaining
exposed after installation shall be applied. Fiberglass tubes that have the following minimum physical properties shall be used:

<table>
<thead>
<tr>
<th>Nominal Tube Diameter (inch)</th>
<th>12</th>
<th>14</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elastic Moduli (ksi)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>axial-tensile1</td>
<td>4000</td>
<td>3350</td>
<td>2800</td>
</tr>
<tr>
<td>axial-compressive2</td>
<td>2800</td>
<td>2350</td>
<td>1900</td>
</tr>
<tr>
<td>hoop-tensile3</td>
<td>4500</td>
<td>4500</td>
<td>4500</td>
</tr>
<tr>
<td>Strength (ksi)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>axial-tensile</td>
<td>70</td>
<td>58</td>
<td>49</td>
</tr>
<tr>
<td>axial-compressive</td>
<td>39</td>
<td>35</td>
<td>29</td>
</tr>
<tr>
<td>hoop-tensile</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Wall thickness</td>
<td>0.200”</td>
<td>0.210”</td>
<td>0.230”</td>
</tr>
</tbody>
</table>

1  ASTM D 2105  
2  ASTM D 695 (modified – see Allowable Degradation)  
3  ASTM D 1599

c. **Allowable Degradation.** After exposure to light and water spray or salt spray for a duration of 3600 hours the total UV resistance of resin inhibitors and color film shall be sufficient to limit the loss of their properties to the limits specified below. Certification of exposure testing that has been conducted in accordance with at least one of the following ASTM methods: G152, G155, G154 or B117 shall be provided to the Engineer.

<table>
<thead>
<tr>
<th>Property</th>
<th>Allowable loss/change</th>
<th>Test Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>axial tensile strength loss</td>
<td>≤ 10%</td>
<td>ASTM D 2105</td>
</tr>
<tr>
<td>axial compressive strength loss</td>
<td>≤ 10%</td>
<td>ASTM D 695 (modified)*</td>
</tr>
<tr>
<td>hoop tensile strength loss</td>
<td>≤ 10%</td>
<td>ASTM D 1599</td>
</tr>
<tr>
<td>color film adhesion loss</td>
<td>≤ 10%</td>
<td>ASTM D 4541</td>
</tr>
<tr>
<td>color change</td>
<td>ΔE 25</td>
<td>ASTM E 308 and D 2244</td>
</tr>
</tbody>
</table>

*  ASTM D695 may be modified as follows:  
  Test specimen dimensions:  
  diameter: full diameter of tube being tested  
  height: 1 inch  
  Note. The compression tool described in ASTM D695 is not to be used. Center the specimen in the compression test machine and place a steel plate on top of the specimen to evenly distribute the load from the test machine.

2. **Dimensional and Physical Stability.** Dimensional and physical stability of materials used in the manufacture of composite piles shall meet the evaluation criteria of ASTM D696.

3. **Color. Color shall be permanent.** Color to be provided shall be black or gray.

4. **Concrete.** As a minimum, concrete infill for FCCP shall conform to Class A concrete strength requirements. In addition, a positive connection such as either using a composite tube with a textured inside surface, or use of a chemical bonding agent, or by using shrinkage compensating concrete shall be established between the composite tube and concrete core to ensure composite action.

5. **Ultimate Flexural Strength.** Independent test lab results confirming that the FCCP meet or exceed a 1400 in-kips ultimate flexural strength value for a 12 inch nominal dimension FCCP shall be submitted to the Engineer. In practice, FCCP should not be designed to their ultimate flexural strength capacity. Due to the strain limitations of concrete in tension, a factor of safety should be applied. For cyclically loaded bridge pier protection applications, FCCP should not be loaded beyond 50% of their ultimate flexural strength or 700 in-kips.

6. **Wrapping.** Wrapping for the FCCP that are to be placed in clusters shall be 0.5” diameter steel cable (5/8” OD covering) polypropylene impregnated wire rope.

The approved manufacturers of FCCP products are listed on the following website:

[http://www.state.nj.us/transportation/eng/technology/materials](http://www.state.nj.us/transportation/eng/technology/materials)
SECTION 990 - METHODS OF TESTS

THE FOLLOWING TEST METHODS ARE ADDED:

**B-10 TEST METHOD TO DETERMINE ASPHALT CONTENT FOR MODIFIED OPEN GRADED FRICTION (MOGFC) COURSES BY AGGREGATE SURFACE AREA**

**A. Scope.**

This test method is used to determine the percentage of asphalt to be used in MOGFC mixes based on the surface area of the aggregate. This percentage is averaged with asphalt contents determined as per Section 990, NJDOT B-11 to arrive at a design asphalt content for a MOGFC mix design.

**B. Apparatus and Materials.**

1. Ovens capable of maintaining temperatures of 140 ± 5 °F (60 ± 3 °C) and 230 ± 9 °F (110 ± 5 °C).
2. Balance meeting the requirements of AASHTO M231, Class D.
3. Two metal funnels having minimum dimensions of 3 ½ in. (90 mm) top diameter, 4 ½ in. (115mm) high and ½ in. (13 mm) orifice. The funnels shall have a metal strainer soldered where the base of the cone connects to the top of the spout. The equivalent size of the strainer shall not be larger than No. 10 (2.00 mm) sieve.
4. A 3/8 in. (9.5 mm) sieve and a No. 4 (4.75 mm) sieve.
5. S.A.E. No. 10 lubricating oil.
6. Two rubber stoppers to fit the funnel outlets.
7. Ring stand to support the funnels during testing.

**C. Procedure.**

**OIL RETENTION**

1. Through quartering, obtain two samples weighing approximately 105 g representative of the material passing the 3/8 in. (9.5 mm) sieve and retained on the No. 4 (4.75 mm) sieve.
2. Dry the sample in the 230 °F (110 °C) oven to a constant weight and allow to cool to room temperature.
3. Weigh out 100.0 g of the material and place in the metal funnel.
4. Place a stopper in the funnel outlet and fill funnel with S.A.E. No. 10 oil, completely immersing the aggregate.
5. After 5 minutes, remove the stopper and allow the oil to drain for 2 minutes.
6. Place the funnel containing the aggregate in the oven maintained at 140 °F (60 °C) for 15 minutes of additional draining.
7. Remove the sample from the funnel, cool to room temperature, reweigh to the nearest 0.1 g and record.

**SPECIFIC GRAVITY**

1. Determine the Apparent Specific Gravity of the aggregate passing the 3/8 in. (9.5 mm) sieve and retained on the No. 4 (4.85 mm) sieve according to AASHTO T 85.

**D. Calculations.**

1. Calculate the percent oil retained for each sample as follows:

\[ R = \frac{B - A}{A} \times 100 \]

where:
- \( R \) = percent oil retained
- \( A \) = weight of sample before test
- \( B \) = weight of sample after test
2. Using the average percent oil retained of the two samples, calculate the corrected percent oil retained as follows:

\[ R_c = \frac{R \times G_a}{2.65} \]

where:

- \( R_c \) = corrected percent oil retained
- \( G_a \) = apparent specific gravity of aggregate
- 2.65 = constant

3. Using the corrected percent oil retained, determine the surface constant (\( K_c \)) from the attached chart.

4. Calculate the design asphalt content as follows:

\[ \text{Design Asphalt Content} = \frac{(2.0 K_c + 4.0) \times 2.65}{G_a} \]

### DETERMINATION OF SURFACE CONSTANT \( K_c \)

<table>
<thead>
<tr>
<th>CORR. %OIL</th>
<th>( K_c )</th>
<th>CORR. %OIL</th>
<th>( K_c )</th>
<th>CORR. %OIL</th>
<th>( K_c )</th>
<th>CORR. %OIL</th>
<th>( K_c )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>0.1</td>
<td>2.6</td>
<td>1.2</td>
<td>5.1</td>
<td>2.2</td>
<td>7.6</td>
<td>3.1</td>
</tr>
<tr>
<td>0.2</td>
<td>0.1</td>
<td>2.7</td>
<td>1.2</td>
<td>5.2</td>
<td>2.2</td>
<td>7.7</td>
<td>3.1</td>
</tr>
<tr>
<td>0.3</td>
<td>0.2</td>
<td>2.8</td>
<td>1.2</td>
<td>5.3</td>
<td>2.2</td>
<td>7.8</td>
<td>3.2</td>
</tr>
<tr>
<td>0.4</td>
<td>0.2</td>
<td>2.9</td>
<td>1.3</td>
<td>5.4</td>
<td>2.3</td>
<td>7.9</td>
<td>3.2</td>
</tr>
<tr>
<td>0.5</td>
<td>0.3</td>
<td>3.0</td>
<td>1.3</td>
<td>5.5</td>
<td>2.3</td>
<td>8.0</td>
<td>3.2</td>
</tr>
<tr>
<td>0.6</td>
<td>0.3</td>
<td>3.1</td>
<td>1.4</td>
<td>5.6</td>
<td>2.3</td>
<td>8.1</td>
<td>3.3</td>
</tr>
<tr>
<td>0.7</td>
<td>0.4</td>
<td>3.2</td>
<td>1.4</td>
<td>5.7</td>
<td>2.4</td>
<td>8.2</td>
<td>3.3</td>
</tr>
<tr>
<td>0.8</td>
<td>0.4</td>
<td>3.3</td>
<td>1.4</td>
<td>5.8</td>
<td>2.4</td>
<td>8.3</td>
<td>3.4</td>
</tr>
<tr>
<td>0.9</td>
<td>0.4</td>
<td>3.4</td>
<td>1.5</td>
<td>5.9</td>
<td>2.5</td>
<td>8.4</td>
<td>3.4</td>
</tr>
<tr>
<td>1.0</td>
<td>0.5</td>
<td>3.5</td>
<td>1.5</td>
<td>6.0</td>
<td>2.5</td>
<td>8.5</td>
<td>3.4</td>
</tr>
<tr>
<td>1.1</td>
<td>0.5</td>
<td>3.6</td>
<td>1.6</td>
<td>6.1</td>
<td>2.5</td>
<td>8.6</td>
<td>3.5</td>
</tr>
<tr>
<td>1.2</td>
<td>0.6</td>
<td>3.7</td>
<td>1.6</td>
<td>6.2</td>
<td>2.6</td>
<td>8.7</td>
<td>3.5</td>
</tr>
<tr>
<td>1.3</td>
<td>0.6</td>
<td>3.8</td>
<td>1.6</td>
<td>6.3</td>
<td>2.6</td>
<td>8.8</td>
<td>3.5</td>
</tr>
<tr>
<td>1.4</td>
<td>0.7</td>
<td>3.9</td>
<td>1.7</td>
<td>6.4</td>
<td>2.6</td>
<td>8.9</td>
<td>3.6</td>
</tr>
<tr>
<td>1.5</td>
<td>0.7</td>
<td>4.0</td>
<td>1.7</td>
<td>6.5</td>
<td>2.7</td>
<td>9.0</td>
<td>3.6</td>
</tr>
<tr>
<td>1.6</td>
<td>0.7</td>
<td>4.1</td>
<td>1.8</td>
<td>6.6</td>
<td>2.7</td>
<td>9.1</td>
<td>3.6</td>
</tr>
<tr>
<td>1.7</td>
<td>0.8</td>
<td>4.2</td>
<td>1.8</td>
<td>6.7</td>
<td>2.8</td>
<td>9.2</td>
<td>3.7</td>
</tr>
<tr>
<td>1.8</td>
<td>0.8</td>
<td>4.3</td>
<td>1.8</td>
<td>6.8</td>
<td>2.8</td>
<td>9.3</td>
<td>3.7</td>
</tr>
<tr>
<td>1.9</td>
<td>0.9</td>
<td>4.4</td>
<td>1.9</td>
<td>6.9</td>
<td>2.8</td>
<td>9.4</td>
<td>3.8</td>
</tr>
<tr>
<td>2.0</td>
<td>0.9</td>
<td>4.5</td>
<td>1.9</td>
<td>7.0</td>
<td>2.9</td>
<td>9.5</td>
<td>3.8</td>
</tr>
<tr>
<td>2.1</td>
<td>1.0</td>
<td>4.6</td>
<td>2.0</td>
<td>7.1</td>
<td>2.9</td>
<td>9.6</td>
<td>3.8</td>
</tr>
<tr>
<td>2.2</td>
<td>1.0</td>
<td>4.7</td>
<td>2.0</td>
<td>7.2</td>
<td>2.9</td>
<td>9.7</td>
<td>3.9</td>
</tr>
<tr>
<td>2.3</td>
<td>1.0</td>
<td>4.8</td>
<td>2.0</td>
<td>7.3</td>
<td>3.0</td>
<td>9.8</td>
<td>3.9</td>
</tr>
<tr>
<td>2.4</td>
<td>1.1</td>
<td>4.9</td>
<td>2.1</td>
<td>7.4</td>
<td>3.0</td>
<td>9.9</td>
<td>3.9</td>
</tr>
<tr>
<td>2.5</td>
<td>1.1</td>
<td>5.0</td>
<td>2.1</td>
<td>7.5</td>
<td>3.1</td>
<td>10.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

THE FOLLOWING TEST METHODS ARE ADDED:
B-11 TEST METHOD TO DETERMINE THE OPTIMUM ASPHALT CONTENT FOR MODIFIED OPEN GRADED FRICTION COURSE (MOGFC) MIXES.

A. Scope.

This test method is used to determine gradation and the percentage of asphalt in a MOGFC mixture using polymer modified binder and stabilizing fibers. The gradation is verified to ensure stone-on-stone contact, and the impact resistance of the final job mix formula (JMF) is verified. The optimum asphalt content (AC) is determined from: (1) aggregate surface area, (2) relative Voids in Mineral Aggregate (VMA), and (3) visual drain-down determination of asphalt content. A simple average of these three criteria is used to determine the JMF asphalt content.

B. Apparatus.

1. Equipment as needed for AASHTO T 19
2. Equipment as needed for Superpave mix design as specified in AASHTO R 35 and T 312.
3. Equipment as needed for Section 990, NJDOT B-10.
4. Ovens capable of maintaining temperatures as specified in this method.
5. Clear, glass (Pyrex) 9” diameter pie pans.

C. Procedure.

1. Verification of Stone-On-Stone Contact - The design gradation is chosen to meet minimum air void requirements and to ensure that the aggregate skeleton exhibits stone-on-stone contact.

   1.1 For the selected JMF gradation determine the unit weight \( G_{uwca} \) of the coarse aggregate fraction of the aggregate using the dry rodding technique according to AASHTO T 19. The coarse aggregate fraction is the aggregate from the final JMF retained on the No. 4 sieve. From \( G_{uwca} \) calculate voids in coarse aggregate fraction \( VCA_{drc} \).

   1.2 For the selected JMF determine the voids in the coarse aggregate of the mix, \( VCA_{mix} \).

   1.3 Calculations:

   \[ VCA_{drc} = 100 \times \left( \frac{G_{sbca} - G_{uwca}}{G_{sbca}} \right) \]

   Where:

   \( VCA_{drc} \) = the voids in the coarse aggregate fraction of the JMF aggregate skeleton.
   \( G_{sbca} \) = the bulk specific gravity of the coarse aggregate fraction as determined by AASHTO T 85.
   \( G_{uwca} \) = the unit weight of the coarse aggregate fraction (expressed in kilograms per cubic meter) as determined by AASHTO T 19.

   \[ VCA_{mix} = 100 - \left( \frac{P_{ca} \times G_{mb}}{G_{sbca}} \right) \]

   Where:

   \( VCA_{mix} \) = the voids in the coarse aggregate fraction of the mix. The coarse aggregate fraction of the aggregate is that portion of the JMF aggregate skeleton not passing the 4.75-millimeter sieve.
   \( P_{ca} \) = the percent of the coarse aggregate fraction by weight of total mix.
   \( G_{mb} \) = the bulk specific gravity of the mix at the design AC content as determined by Section 3.4.
   \( G_{sbca} \) = the bulk specific gravity of the coarse aggregate fraction as determined by AASHTO T 85.

   1.4 For stone-on-stone contact \( VCA_{mix} \) must be less than \( VCA_{drc} \).

2. Surface Area Asphalt Content

   2.1 Determine “surface area” asphalt content according to Section 990, NJDOT B-10.

3. Relative VMA Asphalt Content

   Note steps 3.1, 3.2 & 3.3 shall be done using a batch plant or mixing in the laboratory.
3.1 Heat aggregate to 25°F (14°C) above binder producer recommended compaction temperature. Heat molds to 50°F (28°C) above recommended compaction temperature. Heat binder to recommended mixing temperature.

3.2 Mix aggregate with asphalt and fiber at five asphalt contents (one at the estimated JMF asphalt content, one each at + and - 0.5% and one each at + and – 1.0% of the estimated JMF asphalt content). After mixing, return sample to the oven if necessary, and when at the recommended compaction temperature, compact the specimens. Three specimens will be compacted at each asphalt content using a Superpave Gyratory Compactor (50 gyrations).

3.3 When compacted, cool to room temperature before removing from mold.

3.4 Determine the bulk specific gravity, G_mb, from each specimen’s dry mass (grams) and volume in cubic centimeters. The volume is determined from the diameter of the plug and the height as determined from four equidistant measurements using a caliper accurate to 0.02 cm.

\[
G_{mb} = \frac{w}{(\pi r^2 h / 0.99707)}
\]

Where:
- \( w \) = dry mass (measured to a tenth of gram)
- \( \pi \) = 3.1416
- \( r \) = radius in cm (measure to 0.01” or 0.0254 CM)
- \( h \) = height in cm as determined from 4 equidistant measurements. 0.99707 = density of water @ 25°C (77°F)

3.5 Determine maximum specific gravity, G_mm, of each specimen at each asphalt content according to AASHTO T 209.

3.6 From G_mb, G_mm, and each known asphalt content; calculate volumetric information as follows.

- % AC by wt of Total mix = b
- Volume of air = % air voids = \( V_a = (1 - \frac{G_{mb}}{G_{mm}}) \times 100 \)
- % by Volume of asphalt cement = \( V_b = (b \times G_{mb}) \)

Relative VMA = \( V_a + V_b \)

Note: The volume of the fiber, absorbed asphalt, and Specific Gravity of asphalt binder are not accounted for in this procedure. This procedure measures “relative VMA”.

3.7 Plot asphalt content versus “relative VMA” and select the asphalt content at the lowest point on the curve.

4. Visual Draindown Asphalt Content

4.1 Prepare 1000 gram samples of the uncompacted mix for each of the asphalt contents as detailed in Sections 3.1 and 3.2 above.

4.2 Place each sample into a clean, clear glass (Pyrex) 9 inch pie pans.

4.3 Place samples in oven for one hour at the binder manufacturer’s recommended mixing temperature. Remove and let cool for one hour at room temperature.

4.4 Visually observe the amount of liquid asphalt on the bottom of each pan.

4.5 Select AC content where ample bonding is evident, without having excessive drainage as evidenced by an appearance of unconnected pools of asphalt binder around aggregate points of contact.

5. Select Asphalt content for job mix formula (JMF)

5.1 Determine the JMF asphalt content by averaging the results from the three methods (surface area, relative VMA, and draindown).

\[
AC_{jmf} = \frac{(AC_{sc} + AC_{vma} + AC_{dd})}{3}
\]

Where:
- \( AC_{jmf} \) = the design JMF
- \( AC_{sc} \) = the asphalt content determined by the surface area in Section 2 above.
- \( AC_{vma} \) = the asphalt content determined by relative VMA in Section 3 above.
- \( AC_{dd} \) = the asphalt content determined by draindown in Section 4 above.
6. **Verification of Abrasion and Impact Resistance of JMF**
   6.1 Age at least two JMF specimens (plugs compacted with the same effort used during the design process) for 7 days ± 8 hours in an oven capable of maintaining 140 ± 5°F.
   6.2 Utilizing a Los Angeles Machine conforming to AASHTO T 96, without the charge of steel balls, subject the aged samples of known weight (A) to 300 revolutions at 30 to 33 revolutions per minute. After the 300 revolutions reweigh the samples (B).
   6.3 Calculate the Percent Loss

   \[ P_{\text{loss}} = 100 \times \frac{(A-B)}{A} \]

   Where:
   - \( P_{\text{loss}} \) = the loss expressed as percent of aged sample before L.A. Abrasion Machine treatment.
   - \( A \) = the weight of the samples before modified L.A. Abrasion test.
   - \( B \) = the weight of the samples after modified L.A. Abrasion test.

THE FOLLOWING TEST METHODS ARE ADDED:

**B-12 TEST METHOD TO DETERMINE THE OPTIMUM ASPHALT CONTENT FOR OPEN GRADED FRICTION COURSE (OGFC).**

A. **Scope.**

   This test method is used to determine the optimum percentage of asphalt in a OGFC mixture. The test method uses a visual draindown analysis to determine optimum asphalt content.

B. **Apparatus.**

   1. Ovens capable of maintaining temperatures as specified in this method.
   2. Clear glass (Pyrex) 9" diameter pie pans.

C. **Procedure.**

   2. Using 1000 gram batches, mix aggregate with asphalt at a minimum of 3 asphalt contents (one at the estimated job mix formula (JMF) asphalt content and one each at + and - 0.5% of the estimated JMF asphalt content). After mixing, check the temperature to ensure that it is 250 ± 10°F. Cool or reheat as necessary to meet the temperature tolerance.
   3. Place each 1000 gram batch into a clean, clear glass (Pyrex) 9 inch pie pans.
   4. Place samples in an oven at 255 ± 5°F for one hour. Remove and let cool for one hour at room temperature.
   5. Visually observe the amount of liquid asphalt on the bottom of each pan.
   6. Select the asphalt content where ample bonding is evident, without having excessive drainage as evidenced by an appearance of unconnected pools of asphalt binder around aggregate points of contact.

Test Method S-2

**S-2 PROCEDURE FOR PERFORMING ROTATIONAL-CAPACITY TEST ON BOLTS TOO SHORT TO FIT TENSION CALIBRATOR.**

B. **Procedure.**

   7.

   THE LAST SIX PARAGRAPHS ARE REMOVED.

THE FOLLOWING IS ADDED:

Test Method S-3

**ROUTE 36 OVER THE SHREWSBURY RIVER**
**HIGHLANDS BRIDGE**
**MONMOUTH COUNTY**
I. Verification of DTI Performance

Verification of DTI performance is required prior to installation of bolts in the work. In bridge work the manufacturers are typically specifying smaller gaps in the spaces between the protrusions on the washer than normally used in other construction or in the gap specified for testing in the product specification ASTM F 959. The basic principle used in this verification test is to make sure that there is a DTI gap when the test tension is 1.05 times greater than the job installation tension requirement. The following verification procedure shall be used:

A. Equipment Required:

1. Calibrated bolt tension measuring device with a special flat insert in place of normal bolt head holding insert. Special insert required to allow access to measure DTI gap.

2. Tapered leaf thickness (feeler) gage 0.005 inch. Same gage as to be used to inspect the bolts after installation.

3. Bolts, nuts, and standard washers to be used in the work with the DTI’s.

4. Impact and manual wrench to tighten bolts. Equipment should be the same as to be used in the work.

B. Verification Test Procedure: (Test three seats for each RC lot and position of DTI)

1. Install bolt, nut, DTI and standard washer into bolt tension measuring device. Assembly should match that to be used the work.

2. Use another wrench on the bolt head to prevent rotation of the head against the DTI if the DTI is to be used under the unturned element.

3. Tighten bolt to tension listed below (1.05 times the minimum installation tension). Use another wrench on the bolt head to prevent rotation of the head against the DTI if the DTI is to be used under the unturned element. If an impact wrench is used, tighten to a load slightly below the required load and use a manual wrench to attain the required tension. The load indicating needle of the bolt calibrator cannot be read accurately when an impact wrench is used.

<table>
<thead>
<tr>
<th>Bolt Size (inches)</th>
<th>½</th>
<th>5/8</th>
<th>¾</th>
<th>7/8</th>
<th>1</th>
<th>1 1/8</th>
<th>1 ¼</th>
</tr>
</thead>
<tbody>
<tr>
<td>M164 (A325) Bolts</td>
<td>13</td>
<td>20</td>
<td>29</td>
<td>41</td>
<td>54</td>
<td>59</td>
<td>75</td>
</tr>
</tbody>
</table>

Bolt Tension equals 1.05 (Min. Installation Tension)

4. Determine and record the number of spaces between the protrusions on the DTI that a 0.005 inch thickness gage is refused. The total number of spaces in the various sizes and grade of DTI’s is shown below.

<table>
<thead>
<tr>
<th>Bolt Diameter Inches</th>
<th>½</th>
<th>5/8</th>
<th>¾</th>
<th>7/8</th>
<th>1</th>
<th>1 1/8</th>
<th>1 ¼</th>
</tr>
</thead>
<tbody>
<tr>
<td>M164 (A325) Bolts</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
5. The number of spaces which the 0.005 inch thickness gage is refused should not exceed the number given in the table below. If the number of spaces exceeds the number in the table, the DTI fails the verification test.

**Verification Criteria***

<table>
<thead>
<tr>
<th>Number of spaces in washer</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. number of spaces gage is refused</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

*b* If the test is a coated DTI under the turned element, the maximum number of spaces that the gage is refused is the number of spaces on the washer minus one.

6. The bolts should be further tightened to the smallest gap to be allowed in the work. Normally, this smallest gap condition is achieved when the gaps at all the spaces are less than 0.005 inch (or a gap size as approved by the Engineer) and not all gaps completely closed. When such a condition is achieved, the 0.005 inch thickness gage is refused at all spaces but a visible gap exists in at least one space. Note the load in the bolt at the smallest gap. The bolts in this installation verification test and in the actual installation should not be tightened to a non visible gap condition when all the gaps are completely closed. The load in the bolt becomes indeterminate when no gap exists. It is possible to cause failure by tightening beyond complete crushing of the washer. The bolt load at this smallest gap should not cause excessive permanent inelastic deformation of the fastener. The degree of inelastic deformation is judged by removing the fastener from the test apparatus and turning the nut by hand the full length of the threads on the bolt after the test.

7. Remove the bolt from the calibrator and turn the nut on the threads of the bolt by hand. The nut should be able to be turned on the complete length of the threads, excluding the thread runout. Alternatively, if the nut is unable to go the full length, but the load at the minimum DTI gap (measured in step 6 above) is less than 95% of the bolt tension recorded at the nut rotation required for the rotational-capacity test, the assembly, including the DTI, is deemed to have passed the test. If the nut cannot be run the full thread length, and if the load at the smallest gap condition is greater than 95% of the bolt tension recorded at the nut rotation required for the rotational-capacity test, the load required for the smallest gap in step 6 is too large and the DTI lot shall be rejected.

**Short Bolts**

Bolts from Rotational Capacity (RC) lots too short to fit in the tension measuring device shall be tested in accordance with Test Method S-2 of these Specifications by tightening to the minimum DTI gap (measured in step 6 above) and checked in accordance with step 7. The 95% alternative cannot be used since short bolts are not tested in the tension measuring device for rotational capacity. The DTI used with the short bolt should be checked in accordance with step 1 through 5 using a longer bolt in the tension measuring device.

**II. Installation**

1. The use of a DTI under the unturned bolt head requires that the element bearing against the DTI not turn. Two men are required: One to operate the wrench, and the other to prevent turning of the element with the DTI and to monitor the gap. If the DTI is used under the turned element, an additional hardened washer must be used between the turning element and the protrusion on the DTI.

2. Snug the connection to compact the joint. The DTI should be inspected after snugging and the gaps checked. If the number of spaces in which the 0.005 inch thickness gage is refused exceeds the value in the table shown above in step 5 of the verification test, the bolt must be removed and another DTI installed. The bolt should be resnugged.
3. Tighten the bolts systematically to the inspection gap. The number of spaces in which the 0.005 inch thickness gage is refused should be equal or greater than the number shown in the table below. Tightening beyond the smallest gap established above in steps 6 and 7 is not allowed. Bolts which have a DTI with a smaller gap or no gap shall be replaced and the bolts tightened with a new DTI.

**Inspection Criteria** *

<table>
<thead>
<tr>
<th>Number of spaces in washer</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum spaces gage is refused</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

* The gage shall be refused in all spaces when a coated DTI is used under the turned element.
The provisions of N.J.S.A. 10:2-1 through 10:2-4 and N.J.S.A. 10:5-31 et seq. (P.L. 1975, c. 127, as amended and supplemented) dealing with discrimination in employment on public contracts, and the rules and regulations promulgated pursuant thereunto, are hereby made a part of this contract and are binding upon the Contractor.

Noncompliance by the Contractor with the requirements of the Affirmative Action Program for Equal Employment Opportunity may be cause for delaying or withholding monthly and final payments pending corrective and appropriate measures by the Contractor to the satisfaction of the Department.

During the performance of this contract, the contractor agrees as follows:

a. The contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, sex, affectional or sexual orientation. The contractor will take affirmative action to ensure that such applicants are recruited and employed, and that employees are treated during employment, without regard to their age, race, creed, color, national origin, ancestry, marital status or sex. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Public Agency Compliance Officer setting forth provisions of this nondiscrimination clause;

b. The contractor or subcontractor, where applicable will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, sex, affectional or sexual orientation;

c. The contractor or subcontractor, where applicable, will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer advising the labor union or workers’ representative of the contractor’s commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

d. The contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the Treasurer pursuant to P.L. 1975, c.127, as amended and supplemented from time to time.

e. When hiring workers in each construction trade, the contractor or subcontractor agrees to attempt in good faith to employ minority and female workers in each construction trade consistent with the applicable employment goal prescribed by N.J.A.C. 17:27-7.3; provided,
however, that the Affirmative Action Office may, in its discretion, exempt a contractor or subcontractor from compliance with the good faith procedures prescribed by the following provisions, A, B, and C, as long as the Affirmative Action Office is satisfied that the contractor is employing workers provided by a union which provides evidence, according to standards prescribed by the Affirmative Action Office, that its percentage of active “card carrying” members who are minority and female workers is equal to or greater than the applicable employment goal prescribed by N.J.A.C. 17:27-7.3, promulgated by the Treasurer pursuant to P.L. 1975, c. 127, as amended and supplemented from time to time. The contractor or subcontractor agrees that a good faith effort shall include compliance with the following procedures:

(A) If the contractor or subcontractor has a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor shall, within three days of the contract award, seek assurances from the union that it will cooperate with the contractor or subcontractor as it fulfills its affirmative action obligations under this contract and according to the rules promulgated by the Treasurer pursuant to P.L. 1975, c. 127, as supplemented and amended from time to time. If the contractor or subcontractor is unable to obtain said assurances from the construction trade union at least five days prior to the commencement of construction work, the contractor or subcontractor agrees directly to attempt to hire minority and female workers consistent with the applicable employment goal. If the contractor’s or subcontractor’s prior experience with a construction trade union, regardless of whether the union has provided said assurances, indicates a significant possibility that the trade union will not refer sufficient minority and female workers consistent with the applicable employment goal, the contractor or subcontractor agrees to be prepared to hire minority and female workers directly, consistent with the applicable employment goal, by complying with the hiring procedures prescribed under (B) below; and the contractor or subcontractor further agrees to immediately take said action if it determines or is so notified by the Affirmative Action Office that the union is not referring minority and female workers consistent with the applicable employment goal.

(B) If the hiring of a workforce consistent with the employment goal has not or cannot be achieved for each construction trade by adhering to the procedures of (b) above, or if the contractor does not have a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor agrees to take the following actions consistent with the applicable county employment goals:

1. To notify the Public Agency Compliance Officer, Affirmative Action Office, and at least one approved minority referral organization of its manpower needs, and request referral of minority and female workers;

2. To notify any minority and female workers who have been listed with it as awaiting available vacancies;

3. Prior to commencement of work, to request the local construction trade union, if the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade, to refer minority and female workers to fill job openings;
(4) To leave standing requests for additional referral to minority and female workers with the local construction trade union, if the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade, the State Training and Employment Service and other approved referral sources in the area until such time as the workforce is consistent with the employment goal;

(5) If it is necessary to lay off some of the workers in a given trade on the construction site, to assure, consistent with the applicable State and Federal statutes and court decisions, that sufficient minority and female employees remain on the site consistent with the employment goal; and to employ any minority and female workers so laid off by the contractor on any other construction site in the area on which its workforce composition is not consistent with an employment goal established pursuant to rules implementing P.L. 1975, c. 127;

(6) To adhere to the following procedure when minority and female workers apply or are referred to the contractor or subcontractor:

(i) If said individuals have never previously received any document or certification signifying a level of qualification lower than that required, the contractor or subcontractor shall determine the qualifications of such individuals and if the contractor’s or subcontractor’s workforce in each construction trade is not consistent with the applicable employment goal, it shall employ such persons which satisfy appropriate qualification standards; provided however, that a contractor or subcontractor shall determine that the individual at least possesses the skills and experience recognized by any worker’s skills and experience classification determination which may have been made by a Public Agency Compliance Officer, union, apprentice program or a referral agency, provided the referral agency is acceptable to the Affirmative Action Office and provided further, that, if necessary, the contractor or subcontractor shall hire minority and female workers who qualify as trainees pursuant to these regulations. All of the requirements of this paragraph, however, are limited by the provisions of (C) below.

(ii) If the contractor’s or subcontractor’s workforce is consistent with the applicable employment goal, the name of said female or minority group individual shall be maintained on a waiting list for the first consideration, in the event the contractor’s or subcontractor’s workforce is no longer consistent with the applicable employment goal.

(iii) If, for any reason, said contractor or subcontractor determines that a minority individual or a female is not qualified or if the individual qualifies as an advanced trainee or apprentice, the contractor or subcontractor shall inform the individual in writing with the reasons for the determination, maintain a copy in its files, and send a copy to the Public Agency Compliance Officer and to the Affirmative Action Office.

(7) To keep a complete and accurate record of all requests made for the referral of
workers in any trade covered by the contract and on forms made available by the Affirmative Action Office and shall be submitted promptly to that office upon request.

(C) The contractor or subcontractor agrees that nothing contained in (B) preceding provision shall preclude the contractor or subcontractor from complying with the hiring hall or apprenticeship provisions in any applicable collective bargaining agreement or hiring hall arrangement, and, where required by custom or agreement, it shall send journeymen and trainees to the union for referral, or to the apprenticeship program for admission, pursuant to such agreement or arrangement: provided, however, that where the practices of a union or apprenticeship program will result in the exclusion of minorities and females or the failure to refer minorities and females consistent with the county employment goal, the contractor or subcontractor shall consider for employment persons referred pursuant to said provisions (B) without regard to such agreement or arrangement; provided further, however, that the contractor or subcontractor shall not be required to employ female and minority advanced trainees and trainees in numbers which result in the employment of advanced trainees and trainees as a percentage of the total workforce for the construction trade, which percentage significantly exceeds the apprentice to journey worker ratio specified in the applicable collective bargaining agreement, or in the absence of a collective bargaining agreement, exceeds the ratio established by practice in the area for said construction trade. Also, the contractor or subcontractor agrees that, in implementing the procedures of the preceding provisions (B) it shall, where applicable, employ minority and female workers residing within the geographical jurisdiction of the union.

(D) The contractor agrees to complete an Initial Project Manning Report on forms provided by the Affirmative Action Office or in the form prescribed by the public agency and submit a copy of said form no later than 3 days after signing a construction contract; provided, however, that the public agency may extend in a particular case the allowable time for submitting the form to no more than 14 days; and to submit a copy of the Monthly Project Manning Report once a month (by the seventh work day of each month) thereafter for the duration of this contract to the Affirmative Action Office and to the Public Agency Compliance Officer. The contractor agrees to cooperate with the public agency in the payment of budgeted funds, as is necessary, for on-the-job and off-the-job programs for outreach and training of minority and female trainees employed on the construction projects.

(E) The contractor and its subcontractors shall furnish such reports or other documents to the Affirmative Action Office as may be requested by the office from time to time in order to carry out the purposes of these regulations, and public agencies shall furnish such information as may be requested by the Affirmative Action Office for conducting a compliance investigation pursuant to Subchapter 10 of the Administrative Code (NJAC 17:27).
PAYROLL REQUIREMENTS FOR 100% STATE PROJECTS

1. Each contractor and subcontractor shall furnish the Resident Engineer with payroll reports for each week of contract work. Such reports shall be submitted within 7 days of the date of payment covered thereby and shall contain the following information:

A. Each employee’s full name, address, and social security number. The employee’s full name, and social security number need only appear on the first payroll on which his name appears. The employee’s address need only be shown on the first submitted payroll on which his name appears; unless a change of address necessitates a submittal to reflect the new address.

B. Each employee’s specific work classification(s).

C. Entries indicating each employee’s basis hourly wage rate(s) and, where applicable, the overtime hourly wage rate(s). Any fringe benefits paid to the employee in cash must be indicated.

D. Each employee’s daily and weekly hours worked in each classification, including actual overtime hours worked (not adjusted).

E. Each employee’s gross wage.

F. The itemized deductions made.

G. The net wages paid.

2. Each contractor or subcontractor shall furnish a statement each week to the Resident Engineer with respect to the wages paid each of its employees engaged in contract work covered by the New Jersey Prevailing Wage Act during the preceding weekly payroll period. The statement shall be executed by the contractor or subcontractor or by an authorized officer or employee of the contractor or subcontractors who supervises the payment of wages. Contractors and subcontractors must use the certification set forth on New Jersey Department of Transportation Form FA-7 “Statement of Compliance,” or the same certification set forth on (1) U.S. Department of Labor Form WH-348, (2) the reverse side of U. S. Department of Labor Form WH-347, or (3) any form with identical wording.
January 2007

AMERICANS WITH DISABILITIES ACT

100% STATE FUNDED CONTRACTS

Equal Opportunity For Individuals With Disabilities.

The CONTRACTOR and the STATE do hereby agree that the provisions of Title II of the American With Disabilities Act of 1990 (the “ACT”) (42 U.S.C. Section 12101 et seq.), which prohibits discrimination on the basis of disability by public entities in all services, programs, and activities provided or made available by public entities, and the rules and regulations promulgated pursuant thereunto, are made a part of this contract. In providing any aid, benefit, or service on behalf of the STATE pursuant to this contract, the CONTRACTOR, agrees that the performance shall be in strict compliance with the Act. In the event that the CONTRACTOR, its agents, servants, employees, or subcontractors violate or are alleged to have violated the Act during the performance of this contract, the CONTRACTOR shall defend the STATE in any action or administrative proceeding commenced pursuant to this Act. The CONTRACTOR shall indemnify, protect, and save harmless the STATE, its agents, servants, and employees from and against any and all suits, claims, losses, demands, or damages of whatever kind or nature arising out of or claimed to arise out of the alleged violation. The CONTRACTOR shall, at its own expense, appear, defend, and pay any and all charges for legal services and all costs and other expenses arising from such action or administrative proceeding or incurred in connection therewith. In any and all complaints brought pursuant to the STATE’S grievance procedure, the CONTRACTOR agrees to abide by any decision of the STATE which is rendered pursuant to said grievance procedure. If any action or administrative proceeding results in an award of damages against the STATE or if the STATE incurs any expense to cure a violation of the ADA which has been brought pursuant to its grievance procedure, the CONTRACTOR shall satisfy and discharge the same at its own expense.

The STATE shall, as soon as practicable after a claim has been made against it, give written notice thereof to the CONTRACTOR along with full and complete particulars of the claim. If any action or administrative proceeding is brought against the STATE or any of its agents, servants, and employees, the STATE shall expeditiously forward or have forwarded to the CONTRACTOR every demand, complaint, notice, summons, pleading, or other process received by the STATE or is representatives.

It is expressly agreed and understood that any approval by the STATE of the services provided by the CONTRACTOR pursuant to this contract will not relieve the CONTRACTOR of the obligation to comply with the Act and to defend, indemnify, protect, and save harmless the STATE pursuant to this paragraph.

It is further agreed and understood that the STATE assumes no obligation to indemnify or save harmless the CONTRACTOR, its agents, servants, employees and subcontractors for any claim which may arise out of their performance of this Agreement. Furthermore, the CONTRACTOR expressly understands and agrees that the provisions of this indemnification clause shall in no way limit the CONTRACTOR’S obligations assumed in this Agreement, nor shall they be construed to relieve the CONTRACTOR from any liability, nor preclude the STATE from taking any other actions available to it under any other provisions of this Agreement or otherwise at law.
EQUAL EMPLOYMENT OPPORTUNITY SPECIAL PROVISIONS
CONSTRUCTION CONTRACTS FUNDED BY WHOLLY STATE FUNDS

I. GENERAL


Noncompliance by the Contractor with the requirements of the Affirmative Action program for Equal Employment Opportunity may be cause for delaying or withholding monthly and final payments pending corrective and appropriate measures by the Contractor to the satisfaction of the Department.

The Contractor will cooperate with the state agencies in carrying out its Equal Employment Opportunity obligations and in their review of its activities under the contract.

The Contractor and all its subcontractors, not including material suppliers, holding subcontracts of $2,500 or more, will comply with the following minimum specific requirement activities of Equal Opportunity and Affirmative Action set forth in these special provisions. The Contractor will include these requirements in every subcontract of $2,500 or more with such modification of language in the provisions of such contracts as is necessary to make them binding on the subcontractor.

II. EQUAL EMPLOYMENT OPPORTUNITY POLICY

The Contractor agrees that it will accept and implement during the performance of this contract as its operating policy the following statement which is designed to further the provision of Equal Employment Opportunity to all persons without regard to their race, color, religion, sex, age, creed, ancestry, marital status, or national origin, and to promote the full realization of Equal Employment Opportunity through a positive continuing program:

It is the policy of this company that it will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, creed, ancestry, marital status or national origin and that it will take Affirmative Action to ensure that applicants are recruited and employed and that employees are treated during employment without regard to their race, color, religion, sex, age, creed, ancestry, marital status, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre apprenticeship, and/or on-the-job training.
III. EQUAL EMPLOYMENT OPPORTUNITY OFFICER

The Contractor will designate and make known to the Department contracting officers an Equal Employment Opportunity Officer (hereinafter referred to as the EEO Officer) who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of Equal Employment Opportunity and who must be assigned adequate authority and responsibility to do so.

IV. DISSEMINATION OF POLICY

A. All members of the Contractor’s staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, will be made fully cognizant of, and will implement, the Contractor’s Equal Employment Opportunity Policy and contractual responsibilities to provide Equal Employment Opportunity in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

1. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every 6 months, at which time the Contractor’s Equal Employment Opportunity Policy and its implementation will be reviewed and explained. The EEO Officer or other knowledgeable company official will conduct the meetings.

2. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer or other knowledgeable company official covering all major aspects of the Contractor’s Equal Employment Opportunity obligations within 30 days following their reporting for duty with the Contractor.

3. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer or appropriate company official in the Contractor’s Procedures for locating and hiring minority group employees.

B. In order to make the Contractor’s Equal Employment Opportunity Policy known to all employees, prospective employees and potential sources of employees, i.e., schools, employment agencies, labor unions (where appropriate), college placement officers, etc., the Contractor will take the following actions:

1. Notices and posters setting forth in the Contractor’s Equal Employment Opportunity policy, as set forth in Section 2 of these Equal Employment Opportunity Special Provisions will be placed in conspicuous places readily accessible to employees, applicants for employment and potential employees.
2. The Contractor’s Equal Employment Opportunity Policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

V. RECRUITMENT

A. In all solicitations and advertisements for employees placed by or on behalf of the Contractor, the Contractor will state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age, creed, ancestry, marital status or national origin. All such advertisements will be published in newspapers or other publications having a large circulation among minority groups in the area from which the project workforce would normally be derived.

B. The Contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants, including, but not limited to, state employment agencies, schools, colleges and minority group organizations. To meet this requirement, the Contractor will, through his EEO Officer, identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority group applicants may be referred to the Contractor for employment consideration.

C. In the event the Contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the Contractor’s compliance with Equal Employment Opportunity contract provisions. (The US Department of Labor has held that where implementations of such agreements have the effect of discriminating against minorities or women, or obligates the Contractor to do the same; such implementation violates Executive Order 11246, as amended).

D. In the event that the process of referrals established by such a bargaining agreement fails to provide the Contractor with a sufficient number of minority referrals within the time period set forth in such an agreement, the Contractor shall comply with the provisions of “Section 9 Unions” of the EEO Special Provisions.

VI. ESTABLISHMENT OF GOALS FOR CONSTRUCTION CONTRACTORS

A. The New Jersey Department of Transportation has established, pursuant to N.J.A.C. 17:27-7.3, the minority and female goals for each construction contractor and subcontractor based on availability statistics as reported by the New Jersey Department of Labor, Division of Planning and Research, in its report, EEO Tabulation - Detailed Occupations as follows:
### MINORITY AND FEMALE EMPLOYMENT GOAL OBLIGATIONS FOR CONSTRUCTION CONTRACTORS AND SUBCONTRACTORS

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>MINORITY %</th>
<th>FEMALE%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic</td>
<td>20</td>
<td>6.9</td>
</tr>
<tr>
<td>Bergen</td>
<td>10</td>
<td>6.9</td>
</tr>
<tr>
<td>Burlington</td>
<td>16</td>
<td>6.9</td>
</tr>
<tr>
<td>Camden</td>
<td>16</td>
<td>6.9</td>
</tr>
<tr>
<td>Cape May</td>
<td>8</td>
<td>6.9</td>
</tr>
<tr>
<td>Cumberland</td>
<td>21</td>
<td>6.9</td>
</tr>
<tr>
<td>Essex</td>
<td>42</td>
<td>6.9</td>
</tr>
<tr>
<td>Gloucester</td>
<td>10</td>
<td>6.9</td>
</tr>
<tr>
<td>Hudson</td>
<td>38</td>
<td>6.9</td>
</tr>
<tr>
<td>Hunterdon</td>
<td>5</td>
<td>6.9</td>
</tr>
<tr>
<td>Mercer</td>
<td>19</td>
<td>6.9</td>
</tr>
<tr>
<td>Middlesex</td>
<td>16</td>
<td>6.9</td>
</tr>
<tr>
<td>Monmouth</td>
<td>11</td>
<td>6.9</td>
</tr>
<tr>
<td>Morris</td>
<td>7</td>
<td>6.9</td>
</tr>
<tr>
<td>Ocean</td>
<td>6</td>
<td>6.9</td>
</tr>
<tr>
<td>Passaic</td>
<td>24</td>
<td>6.9</td>
</tr>
<tr>
<td>Salem</td>
<td>15</td>
<td>6.9</td>
</tr>
<tr>
<td>Somerset</td>
<td>8</td>
<td>6.9</td>
</tr>
<tr>
<td>Sussex</td>
<td>5</td>
<td>6.9</td>
</tr>
<tr>
<td>Union</td>
<td>24</td>
<td>6.9</td>
</tr>
<tr>
<td>Warren</td>
<td>5</td>
<td>6.9</td>
</tr>
</tbody>
</table>

The Affirmative Action Office has interpreted Section 7.3 of the State of New Jersey Affirmative Action Regulations as applicable to work hour goals for minority and female participation.

If a project is located in more than one county, the minority work hour goal will be determined by the county which serves as the primary source of hiring or, if workers are obtained equally from one or more counties, the single minority goal shall be the average of the individual goal for the affected counties.

**B.** The State Affirmative Action office may designate a regional goal for minority membership for a union that has regional jurisdiction. No regional goals shall apply to this project unless specifically designated elsewhere herein.

**C.** When hiring workers in the construction trade, the Contractor and/or subcontractor agree to attempt, in good faith, to employ minority workers in each construction trade, consistent with the applicable county or, in special cases, regional goals.

**D.** It is understood that the goals are not quotas. If the Contractor or subcontractor has attempted, in good faith, to satisfy the applicable goals, he will have
complied with his obligations under these EEO Special Provisions. It is further understood that if the Contractor shall fail to attain the goals applicable to this project, it will be the Contractor’s obligation to establish to the satisfaction of the Department of Transportation that it has made a good faith effort to satisfy such goals. The Contractor or subcontractor agrees that a good faith effort to achieve the goals set forth in these special provisions shall include compliance with the following procedures:

1. Requests shall be made by the Contractor or subcontractor to each union or collective bargaining unit with which the Contractor or subcontractor has a referral agreement or arrangement for the referral of minority workers to fill job openings. Requests shall also be made for assurances for the referral of minority workers to fill job openings. Requests shall also be made for assurances from such unions or collective bargaining units that they will cooperate with the Contractor or subcontractor in fulfilling the Affirmative Action obligations of the Contractor or subcontractor under this contract. Such requests shall be made prior to the commencement of construction under the contract.

2. The contractor and its subcontractors shall comply with Section 9, Unions of these EEO Special Provisions and, in particular, with Section 9, Paragraph D, if the referral process established in any collective bargaining arrangement is failing to provide the Contractor or subcontractor with a sufficient number of minority referrals.

3. The Contractor and its subcontractors shall notify the Department’s Compliance Officer, the Affirmative Action Office of the Department of Treasury and at least one approved minority referral organization of the Contractor’s or subcontractors manpower needs and of the Contractor’s or subcontractor’s desire for assistance in attaining the goals set forth herein. The notifications should include a request for referral of minority and female workers.

4. The Contractor and its subcontractors shall notify the Department’s Compliance Officer and the Affirmative Action Office of the Department of Treasury in the event that a union or collective bargaining unit is not making sufficient minority referrals to enable the Contractor or subcontractor to attain the work goals for the Project.

5. The Contractor and its subcontractors shall make standing requests to all local construction unions, the state training and employment service and other approved referral sources for additional referrals of minority and female workers until such time as the project work force is consistent with the work hour goals for the project.

6. The Contractor and its subcontractors shall make standing requests to all local construction unions, the state training and employment service and other approved referral sources for additional referrals of minority and
female workers until such time as the project work force is consistent with the work hour goals for the project.

7. In the event that it is necessary to lay off some of the workers in a given trade on the construction site, the Contractor and its subcontractors shall ensure that fair layoff practices are followed regarding minority, female and other workers.

8. The Contractor and its subcontractors shall comply with the other requirements of these EEO Special Provisions.

VII. PERSONNEL ACTIONS

Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, age, creed, ancestry, marital status or national origin.

The following procedures shall be followed:

A. The Contractor will conduct periodic inspections of project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

B. The Contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

C. The Contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the Contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

D. The Contractor will promptly investigate all complaints of alleged discrimination made to the Contractor in connection with his obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the Contractor will inform every complainant of all of his avenues of appeal.

VIII. TRAINING AND PROMOTION

The Contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.

Consistent with the Contractor’s work force requirements and as permissible under State regulations, the Contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs, for the geographical area of
contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

The Contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

The Contractor will periodically review the training and promotion potential of minority group and women employees and will encourage eligible employees to apply for such training and promotion.

IX. UNIONS

If the Contractor relies in whole or in part upon unions as a source of employees, the Contractor will use his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the Contractor either directly or through a Contractor’s association acting, as agent will include the procedures set forth below:

A. The Contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice advising the labor union or workers’ representative of the Contractor’s commitments under both the law against discrimination and this contract and shall post copies of the notice in conspicuous places readily accessible to employees and applicants for employment. Further, the notice will request assurance from the union or worker’s representative that such union or worker’s representative will cooperate with the Contractor in complying with the Contractor’s Equal Employment Opportunity and Affirmative Action obligations.

B. The Contractor will use their best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.

C. The Contractor will use their best efforts to incorporate an Equal Employment Opportunity clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, or national origin.

D. The Contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the Contractor, the Contractor shall so certify to the Department and shall set forth what efforts have been made to obtain such information.

E. In the event the union is unable to provide the Contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective
bargaining agreement, the Contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, or national origin, making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The US Department of Labor has held that it shall be no excuse that the union with which the Contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees). In the event the union referral practice prevents the Contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these Special Provisions, such Contractor shall immediately notify the Department.

X. SUBCONTRACTING

A. The Contractor will use his best efforts to solicit bids from and to utilize minority group and female subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors may use lists of minority owned and female owned construction firms as issued by the Department.

B. The Contractor will use his best efforts to ensure subcontractor compliance with their Equal Employment Opportunity obligations.

XI. RECORDS AND REPORTS

A. The Contractor will keep such records as are necessary to determine compliance with the Contractor’s Equal Employment Opportunity obligations. The records kept by the Contractor will be designed to indicate:

1. The work hours of minority and non-minority group members and women employed in each work classification on the project.

2. The progress and efforts being made in cooperation with unions to increase employment opportunities for minorities and women (applicable only to Contractors who rely in whole or in part on unions as a source of their work force).

3. The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees, and

4. The progress and efforts being made in securing the services of minority group and female subcontractors or subcontractors with meaningful minority and female representation among their employees.

B. All such records must be retained for a period of 3 years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the Department.

C. The Contractor shall submit monthly reports to the Department after construction
begins for the duration of the project, indicating the work hours of minority, women, and non minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on a form supplied by the Department.

XII. SPECIAL CONTRACT PROVISIONS FOR INVESTIGATING, REPORTING AND RESOLVING EMPLOYMENT DISCRIMINATION AND SEXUAL HARASSMENT COMPLAINTS

The Contractor hereby agrees to the following requirements in order to implement fully the nondiscrimination provisions of the Supplemental Specifications:

The Contractor agrees that in instances when it receives from any person working on the project site a verbal or written complaint of employment discrimination, prohibited under N.J.S.A. 10:5-1 et seq, 10:2-1 et seq., 42 U.S.C. 2000 (d) et seq., 42 U.S.C. 2000(e) et seq. And Executive Order 11246, it shall take the following actions:

1. Within one (1) working day commence an investigation of the complaint, which will include but not be limited to interviewing the complaint, the respondent, and all possible witnesses to the alleged act or acts of discrimination or sexual harassment.

2. Prepare and keep for its use and file a detailed written investigation report which includes the following information:
   a) Investigatory activities and findings.
   b) Dates and parties involved and activities involved in resolving the complaint.
   c) Resolution and corrective action taken if discrimination or sexual harassment is found to have taken place.
   d) A signed copy of resolution of complaint by complainant and contractor.

In addition to keeping in its files the above-noted detailed written investigative report, the contractor shall keep for possible future review by the Department all other records, including, but not limited to, interview memos and statements.

3. Upon the request of the Department provides to the Department within ten (10) calendar days a copy of its detailed written investigative report and all other records on the complaint investigation and resolution.

4. Take appropriate disciplinary actions against any contractor employee, official or agent who has committed acts of discrimination or sexual harassment against any contractor employee or person working on the project. If the person committing
the discrimination is a subcontractor employee, then the contractor is required to attempt to effectuate corrective and/or disciplinary action by the subcontractor in order to establish compliance with project’s contract requirements.

5. Take appropriate disciplinary action against any contractor employee, official or agent who retaliates, coerces or intimidates any complainant and/or person who provides information or assistance to any instigation of complaints of discrimination or sexual harassment. If the person retaliating, coercing or intimidating a complainant or other person assisting in an investigation is a subcontractor’s employee, then the contractor is required to attempt to effectuate corrective and/or disciplinary action taken by the subcontractor in order to establish compliance with the project’s contract requirements.

6. Ensure to the maximum extent possible that the privacy interests of all persons who give confidential information in aid of the contractor’s employment discrimination investigation are protected.

7. In conjunction with the above requirements, the contractor herein agrees to develop and post a written sexual harassment policy for its workforce.

The contractor also agrees that its failure to comply with the above requirements may be cause for the New Jersey Department of Transportation to institute against the contractor any and all enforcement proceedings and/or sanctions authorized by the contract or by state and/or federal law.
I. UTILIZATION OF SMALL BUSINESS ENTERPRISE (SBE) BUSINESSES AS CONTRACTORS, MATERIAL SUPPLIERS AND EQUIPMENT LESSORS.

The New Jersey Department of Transportation advises each contractor or subcontractor that failure to carry out the requirements set forth in this attachment shall constitute a breach of contract and, after notification to the applicable State agency, may result in termination of the agreement or contract by the Department or such remedy as the Department deems appropriate. Requirements set forth in this section shall also be included in all subcontract agreements in accordance with State of New Jersey requirements.

II. POLICY

It is the policy of the New Jersey Department of Transportation that Small Business Enterprises, as defined in N.J.A.C. 12A:10A-1.2 et seq., and N.J.A.C. 17:14-1.2 et seq., shall have the maximum opportunity to participate in the performance of contracts financed wholly with 100% state funds.

III. CONTRACTOR’S SMALL BUSINESS OBLIGATION

The New Jersey Department of Transportation and its Contractor agree to ensure that Small Business Enterprises (SBE), as defined in N.J.A.C. 12A:10A-1.2 et seq., and N.J.A.C. 17:14-1.2 et seq., have maximum opportunity to participate in the performance of contracts and subcontracts financed wholly with 100% state funds. In this regard, the New Jersey Department of Transportation and all Contractors shall take all necessary and reasonable steps to ensure that Small Business Enterprises are utilized on, compete for, and perform on NJDOT construction contracts. The New Jersey Department of Transportation and its Contractors shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of State-funded contracts.

IV. COMPLIANCE

To signify and affirm compliance with the provisions of this attachment, the bidder shall complete the Schedule of Small Business Participation "Form A" included in the Proposal and all forms and documents required in Sections VII and VIII of these provisions which will be made a part of the resulting contract.

V. SMALL BUSINESS GOALS FOR THIS PROJECT

NOTE: SUBCONTRACTING GOALS ARE NOT APPLICABLE IF THE PRIME CONTRACTOR IS A REGISTERED SMALL BUSINESS ENTERPRISE (SBE) FIRM.

A. This project includes a goal of awarding 12% percent of the total contract value to subcontractors qualifying as SMALL BUSINESSES in amounts as follows:

1. ___% to businesses registered in the category of gross revenues that do not exceed $1 million; and
2. _____% to businesses registered in the category of having gross revenues exceeding $1 million consistent with the applicable annual revenue standards established at 13 C.F.R. 121.201; and
3. 12% to businesses in either category
B. Only Small Business Enterprises registered prior to the date of bid, or prospective Small Business Enterprises that have submitted to the New Jersey Commerce and Economic Growth Commission on or before the day of bid, a completed “State of New Jersey Small Business Vendor Registration Form” and all the required support documentation, will be considered in determining whether the contractor has met the established goals for the project. Early submission of required documentation is encouraged.

C. If a prospective Small Business Enterprise fails to meet the eligibility standards for participation the department’s Small Business Program, the contractor shall, prior to the award, make reasonable outreach efforts to replace that ineligible subcontractor with a registered Small Business whose participation is sufficient to meet the goal for the contract.

D. Prospective Small Businesses whose registration applications are denied or rejected by the New Jersey Commerce and Growth Commission are ineligible for participation on the project to meet Small Business goals, regardless of any pending appeal action in progress.

E. A directory of registered Small Businesses Enterprise firms is available upon request to the New Jersey Commerce and Growth Commission or the New Jersey Department of Transportation, Division of Civil Rights/Affirmative Action. The directory is to be used as a source of information only and does not relieve the Contractor of their responsibility to seek out Small Businesses Enterprises not listed.

VI. COUNTING SMALL BUSINESS ENTERPRISE PARTICIPATION

A. Each Small Business Enterprise (SBE) is subject to a registration procedure to ensure their SBE eligibility prior to the award of contract. In order to facilitate this process, it is advisable for the bidder to furnish the names of proposed SBEs to the Department before bid opening. Once a firm is determined to be a bona fide SBE by the New Jersey Commerce and Growth Commission, the total dollar value of the contract awarded to the SBE is counted toward the applicable goal.

B. The Contractor may count toward its SBE goal only expenditures to SBEs that perform a commercially useful function in the work of a contract. A SBE is considered to perform a commercially useful function when it is responsible for execution of a distinct element of the work of a contract and carrying out its responsibility by actually performing, managing and supervising the work involved. To determine whether a SBE is performing a commercially useful function, the Contractor shall evaluate the amount of work subcontracted, industry practice and other relevant factors.

C. If an SBE does not perform or exercise responsibility for at least 30 percent of the total cost of its contract with its own work force, or the SBE subcontracts a greater portion of the work of a contract than would be expected on the basis of normal industry practice for the type of work involved, you must presume that it is not performing a commercially useful function.

D. If a Contractor is part of a Joint Venture and one or more of the Sole Proprietorships, Partnerships, Limited Liability companies or Corporations comprising the Joint Venture is a registered SBE, the actual payments made to the Joint Venture for work performed by the SBE member, will be applied toward the goal. Payments made to the Joint Venture for work performed by a non-small business firm will not be applied toward the applicable goal.

E. If the Contractor is a registered SBE, payments made to the Contractor for work performed by the Contractor will be applied toward the SBE goal. Payments made to the Contractor for work performed by non-SBE’s will not be applied toward the goal.
F. When a SBE subcontracts part of the work of its contract to another firm, the value of the subcontracted work may be counted towards the SBE goals only if the SBE’s subcontractor is also a SBE. Work that a SBE subcontracts to a non-SBE firm does not count toward the assigned goal.

VII. SUBMISSION OF CONTRACTOR’S AFFIRMATIVE ACTION PLANS

A. Contractors are required to submit annually on their due date, their firm’s Affirmative Action Program to the Division of Civil Rights/Affirmative Action. Contractors must have an approved Affirmative Action Program in the Division of Civil Rights/Affirmative Action no later than seven (7) State business days after receipt of bids. No recommendations to award will be made without an approved Affirmative Action Program on file in the Division of Civil Rights/Affirmative Action.

B. The Annual Affirmative Action Program will include, but is not limited to the following:

1. The name of the company’s Liaison Officer who will administer the Small Business Enterprise Program.

2. An explanation of the affirmative action methods used in seeking out and considering Small Business Enterprises as subcontractors, material suppliers or equipment lessors.

3. An explanation of affirmative action methods which will be used in seeking out future Small Business Enterprises as subcontractors, material suppliers or equipment lessors after the award of the contract and for the duration of said project.

C. The following shall be submitted either with the bid or to the Division of Civil Rights/Affirmative Action no later than seven (7) state business days after the receipt of bids.

1. SBE "FORM A" - Schedule of SBE Participation. The Contractor shall list all SBEs that will participate in the contract including scope of work, actual dollar amount and percent of total contract to be performed. This form should be submitted only if the goal level established for the contract have been met or exceeded;

   Note: If a change occurs to the Contractor’s original Form A submission which was previously approved by the Division of Civil Rights/Affirmative Action, a Revised Form A must be submitted naming the replacement Small Business Enterprise subcontractors. A written explanation should be included with the submission of the revised Form A.

2. Request for Exemption - In the event the Contractor is unable to meet the specified goal level, that Contractor must submit a written request for a partial or full exemption from the SBE goal. This request shall include the names of all SBE firms that the contractor will utilize on the contract and shall describe the specific work to be performed by each SBE together with the actual dollar amount of that work. Additionally, this request must address the Contractor's efforts to make Reasonable Outreach Efforts as enumerated in Section VIII.

3. SBE "FORM B" - Affidavit of Small Business Enterprise. Each proposed SBE not listed in the NJ Commerce and Economic Growth Commission Directory must submit “Form B” attesting to its validity as an SBE. (All firms must be registered by the Commission prior to award of the contract.)

4. Additional Information - The Department in its sole discretion may request additional information from the Contractor prior to award of the contract in order to evaluate the Contractor’s compliance with the SBE requirements of the bid proposal. Such information must be provided within the time limits established by the department. The
Contractor shall, prior to the award of the contract, submit a completed SBE “Form A”, even if it has been granted an exemption from the SBE goal.

VIII. REASONABLE OUTREACH EFFORTS

If a Contractor fails to meet the goal for Small Business Enterprise participation, the Contractor shall document its reasonable outreach efforts to meet the SBE goal. Reasonable outreach shall include, but not be limited to the following:

A. Attendance at a pre-bid meeting, if any, scheduled by the Department to inform SBE’s of subcontracting opportunities under a given solicitation.

B. Advertisement in general circulation media, trade association publications, and small business enterprise-focus media for at least 20 days before bids are due. If 20 days are not available, publication for a shorter reasonable time is acceptable.

C. Written notification to SBE’s that their interest in the contract is solicited;

D. Efforts made to select portions of the work proposed to be performed by SBEs in order to increase the likelihood of achieving the stated goal;

E. Efforts made to negotiate with SBE’s for specific sub-bids including at a minimum
   1. The names, addresses and telephone numbers of SBE’s that were contacted;
   2. A description of the information provided to SBE’s regarding the plans and specifications for portions of the work to be performed; and
   3. A statement of why additional agreements with SBE’s were not reached;

F. Information regarding each SBE the bidder contacted and rejected as unqualified and the reasons for the bidder’s conclusion;

G. Efforts made to assist the SBE in obtaining bonding or insurance required by the Bidder or the Department.

IX. ADMINISTRATIVE RECONSIDERATION

A. If the Division of Civil Rights/Affirmative Action determines that the apparent successful bidder has failed to make reasonable outreach efforts to meet the requirements of this section, the Department must, before awarding the contract, provide the bidder an opportunity for administrative reconsideration.

B. As part of this reconsideration, the bidder will have the opportunity to provide written documentation or argument concerning the issue of whether it met the goal or made adequate good faith efforts to do so. NJDOT will send the bidder a written decision on reconsideration, explaining the basis for finding that the bidder did or did not meet the SBE goal or make an adequate good faith effort to do so.

C. Within seven (7) State business days of being informed by the Division of Civil Rights/Affirmative Action that it is not a responsible bidder because it has not made or documented sufficient outreach efforts to SBEs, a bidder may make a request in writing to the Director, Division of Procurement, PO Box 605, Trenton, New Jersey, 08625-0605; Telephone (609) 530-6355. The Director, Division of Procurement, does not participate in the initial determination of whether reasonable outreach was performed by the Contractor.
X. \textbf{RESPONSIBILITY AFTER AWARD OF THE CONTRACT}

If at any time following the award of contract, the Contractor intends to sublet any portion(s) of the work under said contract, or intends to purchase material or lease equipment not contemplated during preparation of bids, said Contractor shall take affirmative action:

A. To notify the Resident Engineer, in writing, of the type and approximate value of the Contractor intends to accomplish by such subcontract, purchase order or lease.

B. To signify and affirm compliance with the provisions of this Section, the Contractor shall submit the Post-Award SBE Certification Form to the Regional Supervising Engineer with his application to sublet or prior to purchasing material or leasing equipment. Post Award SBE forms may be obtained from the Resident Engineer.

C. To give small business enterprise firms equal consideration with non-small business firms in negotiation for any subcontracts, purchase orders or leases.

XI. \textbf{CONSENT BY DEPARTMENT TO SUBLETTING}

A. The Department will not approve any subcontracts proposed by the Contractor unless and until said contractor has complied with the terms of this SBE Utilization Attachment.

B. The Contractor shall provide the Resident Engineer with a listing of firms, organizations or enterprises to be used as subcontractors on the proposed project. Such listing shall clearly delineate which firms are classified as SBEs.

C. Notification of a subcontractor’s termination shall be sent to the Department by the Contractor through the Resident Engineer.

XII. \textbf{CONCILIATION}

In cases of alleged discrimination regarding these and all equal employment opportunity provisions and guidelines, investigations and conciliation will be undertaken by the Division of Civil Rights/Affirmative Action, New Jersey Department of Transportation.

XIII. \textbf{DOCUMENTATION}

A. Records and Reports

The Contractor shall keep such records as are necessary to determine compliance with its Small Business Enterprise Utilization obligations. The records kept by the Contractor will be designed to indicate:

1. The names of the small business enterprise subcontractors, equipment lessors and material suppliers contacted for work on this project.

2. The type of work to be done, materials to be utilized or services to be performed other than by the prime contractor on the project.

3. The actual dollar amount of work awarded to SBE’s.

4. The progress and efforts being made in seeking out and utilizing Small Business Enterprise firms. This would include solicitations, quotes and bids regarding project work items, supplies, leases, etc.
5. Documentation of all correspondence, contacts, telephone calls, etc, to obtain the services of Small Business Enterprise firms on this project.

B. The contractor shall submit reports, as required by the Department, on those contracts and other business transactions executed with Small Business Enterprise firms in such form and manner as may be prescribed by the Department.

C. All such records must be maintained for a period of three (3) years following acceptance of final payment and will be available for inspection by the Department.

XIV. **PAYMENT TO SUBCONTRACTORS**

The Contractor agrees to pay its subcontractors in accordance with the Specifications.

XV. **SANCTIONS**

Failure of a Contractor to comply with these provisions may result in bid rejection, reduced classification, suspension, debarment, or the institution of other appropriate action by the New Jersey Department of Transportation.
MINORITY/FEMALE OUTREACH AND TRAINING PROGRAM FOR WHOLLY STATE FUNDED PROJECTS

I. A pay item entitled “Training Reimbursement” paid lump sum has been added to this contract in conformance with PL 1975, c. 127, and applicable regulations and policies. The pay item reflects the fact that one-half of one percent of the total project cost of each state-funded contract of $1,000,000 or more must be available for the provision of on-the-job/off-the-job training for eligible trainees.

The lump sum amount will be used to reimburse the contractor for on-the-job/off-the-job training costs incurred during the life of the contract, provided that:

A) The training is required because of the contractor’s failure to meet the contract’s minority and female hiring goals.

B) Only minority and/or female trainees actually employed on the project are provided with training.

C) Training funds are not used to pay the salary of any trainee.

D) Off-the-job training programs are designed to increase the skills of trainees in a particular trade or craft or skills relating to contracting work or related academic or remedial education programs.

E) Training is provided by the State, regional or local public or private training institutions, agencies or organizations that have been approved by the Department of Treasury’s Affirmative Action Office.

II. The contractor is responsible for arranging the training at a site or sites approved, in advance, by the Department. Payment for such training is contingent on the contractor’s satisfaction of each of the following conditions:

A) The contractor must establish, to the satisfaction of the Department, that it has made a good faith effort necessary to ensure compliance with the contract’s minority/female hiring goals.

B) The contractor must submit to the Department a list of minority and/or female employees to be included in the training.

C) The contractor must submit to the Department a written description of the training program it proposes to utilize during the course of the project and has received approval of this program. The proposed program must have received Department approval prior to the commencement of any training for which reimbursement will be sought.

D) The contractor must submit, on a monthly basis, documentation of the training provided and of the costs incurred. The documentation shall include applications, invoices, billings and other pertinent materials provided by an approved training agency.

E) The contractor must maintain all records of applications, invoices, billings, accounting and other documentation of costs incurred and shall make such records available at its offices for audit by the Department at all reasonable times during the contract period and for three years from the date of final payment.
BRIDGE MAINTENANCE

AND

OPERATIONS FORMS
The following were evaluated for proper operation, regular movement, focus, mounting, applied tension, vibration, overheating, wear, rust, noise, carbon deposits, loose terminations, dirt accumulation, insulation, grounding, bonding, weather tightness, safety, and signs of distress:

3 = Operational/Needs Minor Work  2 = Operational/Needs Major Work  
1 = Non-Operational  S = Satisfactory  N = Not Applicable

<table>
<thead>
<tr>
<th>CAMERAS</th>
<th>CAMERA ENCLOSURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENCLOSURE HEATING UNITS</td>
<td>MONITORS</td>
</tr>
<tr>
<td>QUAD UNITS</td>
<td>PAN TILT MECHANISMS</td>
</tr>
<tr>
<td>CONTROL STATIONS</td>
<td>PUBLIC ADDRESS SYSTEM</td>
</tr>
<tr>
<td>INTERCOMS</td>
<td>MOTION SENSORS</td>
</tr>
<tr>
<td>ALARMS</td>
<td></td>
</tr>
</tbody>
</table>

ATTACH DETAILED EXPLANATION OF WORK NEEDED
DRIVE CONTROL SYSTEM

The following were evaluated for smooth operation, uniform & regular movement, mounting, applied tension, vibration, overheating, wear, rust, noise, carbon deposits, loose terminations, dirt accumulation, insulation, grounding, bonding, current/voltage/kilowatt reading, interlocks, weather tightness, safety, and signs of distress:

3=Operational/Needs Minor Work  2=Operational/Needs Major Work  
1=Non Operational   S=Satisfactory   N=Not Applicable

<table>
<thead>
<tr>
<th>PRIMARY DRIVE SYSTEM</th>
<th>SECONDARY DRIVE SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTROL CONSOLE/INDICATOR LIGHTS</td>
<td>INSTRUMENTS(GAUGES/METERS/SELSYN)</td>
</tr>
<tr>
<td>DRIVE AMPERAGE/VOLTAGE READINGS</td>
<td>PROGRAMMABLE CONTROLLERS</td>
</tr>
<tr>
<td>RADIO TRANSMITTERS/RECEIVERS</td>
<td>BYPASSES/INTERLOCKS</td>
</tr>
<tr>
<td>OVER SPEED/UNDER SPEED SWITCH</td>
<td>TACHOMETER</td>
</tr>
<tr>
<td>GENERATOR FREQUENCY</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ATTACH DETAILED EXPLANATION OF WORK NEEDED
ELECTRICAL

The following were evaluated for smooth operation, uniform & regular movement, mounting, applied tension, vibration, overheating, wear, rust, noise, carbon deposits, loose terminations, dirt accumulation, insulation, grounding, bonding, current/voltage/kilowatt reading, interlocks, weather tightness, safety, and signs of distress:

3=Operational/Needs Minor Work  2=Operational/Needs Major Work
1=Non Operational   S=Satisfactory   N=Not Applicable

<table>
<thead>
<tr>
<th>TRAFFIC SIGNALS/GONGS</th>
<th>HORN</th>
</tr>
</thead>
<tbody>
<tr>
<td>WARNING/BARRIER GATES</td>
<td>SERVICE/EMERGENCY LIGHTING</td>
</tr>
<tr>
<td>SMOKE DETECTION/ROOM HEATING</td>
<td>SOUND POWERED PHONES</td>
</tr>
<tr>
<td>SWITCHES/PUSHBUTTONS</td>
<td>WIRING</td>
</tr>
<tr>
<td>NAVIGATION LIGHTING</td>
<td>CIRCUIT BREAKERS/FUSES</td>
</tr>
<tr>
<td>PANEL BOARDS/SAFETY SWITCHES</td>
<td>RELAYS/TIMERS</td>
</tr>
<tr>
<td>RACEWAYS/CONDUIT/FITTINGS/BOXES</td>
<td>INSULATORS</td>
</tr>
<tr>
<td>ENCLOSURES</td>
<td>TRANSFER SWITCHES</td>
</tr>
<tr>
<td>CONTACTORS/STARTERS/OVERLOADS</td>
<td>LIGHTNING PROTECTION</td>
</tr>
<tr>
<td>RESISTORS</td>
<td>ELEVATORS</td>
</tr>
<tr>
<td>TRANSFORMERS</td>
<td>BRAKE MOTOR(S)</td>
</tr>
<tr>
<td>LIMIT SWITCHES</td>
<td>GENERATOR</td>
</tr>
<tr>
<td>DRIVE MOTORS</td>
<td>BLOCK HEATERS</td>
</tr>
<tr>
<td>LOCK MOTOR(S)</td>
<td>LOUVER MOTOR(S)</td>
</tr>
<tr>
<td>BATTERIES/BATTERY CHARGER(S)</td>
<td></td>
</tr>
</tbody>
</table>

ATTACH DETAILED EXPLANATION OF WORK NEEDED
MECHANICAL
The following were evaluated for smooth operation, uniform & regular movement, synchronization, interlock, mounting, overheating, vibration, wear, rust, noise, slippage, engagement, applied tension, lubrication, oil levels, oil contamination, dirt accumulation, fluid pressure, leakage, alignment, clearances, chordal thickness, backlash, air pressure, weather tightness, safety, and signs of distress:

3=Operational/Needs Minor Work  2=Operational/Needs Major Work  
1=Non Operational  S=Satisfactory  N=Not Applicable

<table>
<thead>
<tr>
<th>OPEN GEARING</th>
<th>ENCLOSED GEARING</th>
</tr>
</thead>
<tbody>
<tr>
<td>MACHINERY SUPPORTS &amp; FRAME</td>
<td>BEARINGS</td>
</tr>
<tr>
<td>SHAFTS</td>
<td>KEYS, KEY WAYS, SPLINES, SHRINK FITS</td>
</tr>
<tr>
<td>COUPLINGS</td>
<td>FASTENERS/MOUNTINGS</td>
</tr>
<tr>
<td>AUXILIARY DRIVE</td>
<td>BRAKES</td>
</tr>
<tr>
<td>TRUNNION ASSEMBLIES</td>
<td>SPAN LOCKS</td>
</tr>
<tr>
<td>SHEAVE WHEEL ASSEMBLIES</td>
<td>CURVED RACKS</td>
</tr>
<tr>
<td>SPAN GUIDES</td>
<td>BUMPER BLOCKS</td>
</tr>
<tr>
<td>LIVE LOAD SHOES/STRIKE PLATES</td>
<td>BUFFERS</td>
</tr>
<tr>
<td>WIRE ROPE S AND SOCKETS</td>
<td>TENSION ADJUSTING DEVICES</td>
</tr>
<tr>
<td>COUNTERWEIGHT/BALANCE CHAINS</td>
<td>SPAN LEVELING DEVICES</td>
</tr>
<tr>
<td>CENTERING DEVICES</td>
<td>WEDGE MACHINERY</td>
</tr>
<tr>
<td>LATCH BAR MACHINERY</td>
<td>RING GEAR</td>
</tr>
<tr>
<td>CENTER BEARING</td>
<td>BALANCE WHEELS AND TRACK</td>
</tr>
<tr>
<td>SPAN BALANCE</td>
<td>ENGINE/GENERATOR</td>
</tr>
</tbody>
</table>

ATTACH EXPLANATION OF WORK NEEDED
Bridge Operator's Certification

Date of Certification: __________

Type of Certification: [ ] Initial [ ] Recertification

Title: [ ] Bridge Operator [ ] Bridge Operator Trainee

This will confirm that ____________________ has been cross-trained in the operation of the ____________________ effective ____________________.

He/She received instruction in the following modes of operation.

[ ] Normal Operation (Electric) [ ] Diesel Generator (Primary Backup)
[ ] Auxillary Diesel Engine (Direct Drive)

The following standards were attained/unattained during the course of training.

<table>
<thead>
<tr>
<th>ATAINED</th>
<th>UNATTAINED</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1. Has the ability to perform this operation without direct supervision.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Has demonstrated physical ability and sufficient Eye-Hand coordination necessary to open and seat this structure without causing damage to the bridge.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Has the ability to follow sequential directions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Demonstrates confidence in his/her ability to perform under normal and/or emergency auxiliary conditions.</td>
</tr>
</tbody>
</table>

INSTRUCTED BY: ____________________

Chief Bridge Operator

Date: __________

This is to verify that I have personally observed the above-captioned employee perform the operation of this structure on the modes of operation specified.

Accordingly, I hereby certify ____________________ as a qualified operator on this structure.