APPENDIX A

Tremley Point Connector Road Traffic Analysis

NEW JERSEY TURNPIKE AUTHORITY

OPS 1950

INTERCHANGE 12 IMPROVEMENTS

Tremley Point Connector Road

Traffic Report

March, 2003

PREPARED BY:

Edwards AND Kelcey

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Project Overview

The "Brown Fields" areas located on the north side of the Rahway River approximately 2 miles to the north of the Interchange 12-toll plaza is in the process of being redeveloped.. The anticipated land use in this redevelopment area will generate a significant amount of truck traffic, most of which will be destined to the New Jersey Turnpike. Use of the existing local road network to convey this new traffic to the Turnpike would require routing this increased traffic volume through the already congested and predominately residential areas of Linden. Union County has formally requested that the Turnpike Authority investigate a direct connection between the Turnpike and Tremley Point Road. In response to this request, the Turnpike Authority proposed to deliver the traffic from the Tremley Point area to the Turnpike via a new roadway between Tremley Point Road in Linden and Industrial Road in Carteret. This new road will allow traffic to conveniently enter the Turnpike via the proposed improved toll plaza at Interchange 12. The proposed roadway referred to as the "Connector Road" in this and other documents related to this project, includes the construction of a viaduct over the Rahway River and associated roadway approaches supported by walls and embankments.

On the Carteret side of the Rahway River, the former landfill area located between Industrial Road and the river is also in the process of being redeveloped. This area is referred to as the Slayton Development. This redevelopment combined with the existing Kinder Morgan site, located on the eastern side of the land between the river and Industrial Road, will add another traffic component to the Connector Road.

The proposed Connector Road will address the projected traffic volumes generated by both the proposed developments in Carteret and the anticipated traffic generated from the proposed development in the nearby Tremley Point "Brown Fields" areas of Linden. The analysis of the lane requirements and Level of Service evaluations at the intersections at the ends of theroadway are based on traffic data provided by the local governments within the project area and the developers of the proposed redevelopment areas.

Traffic Analysis

A traffic analysis was performed for the Connector Road in conjunction with the work that was performed for the Interchange 12 Improvements Alternatives Analysis. The following are the portions of that work that pertain to the Connector Road.

Existing Traffic Data

A TRANPLAN model was created for the project representing the existing conditions. To develop and calibrate the model, existing traffic volumes were collected for the study area. Data collection included six (6) Automatic Traffic Recorder (ATR) locations and five (5) manual traffic classification counts. ATR's were placed at the following locations.

A1. Roosevelt Ave just east of Industrial Ave
A2. Roosevelt Ave just west of the Holiday Inn driveway
A3. Interchange 12 on-ramp just north of Roosevelt Ave
A4. Interchange 12 off-ramp just north of Roosevelt Ave
A5. Industrial Rd just east of Salt Meadow Road
A6. Tremley Point Rd just east of the New Jersey Turnpike (NJTP)

The five manual traffic counts were performed at the following intersections:

M1. Roosevelt Ave and NJTP ramps/Wedgewood Dr
M2. Roosevelt Ave and Post Blvd
M3. Industrial Ave and Salt Meadow Rd
M4. Roosevelt Ave and Harrison Ave
M5. Roosevelt Ave and Holiday Inn driveway

This data was used to create four networks (autos and trucks for AM and PM peak periods). The raw volumes were then adjusted to obtain a balanced network (volumes exiting an intersection up stream match the volumes entering the downstream intersection).

Traffic Model and Calibration

The extent of the TRANPLAN model for the existing traffic is schematically shown in the appendix. Fifteen (15) centroids represent the loading points for the model. The turnpike is represented by four centroids. Vehicles originating from the toll plaza and destined to points north on the turnpike are split between the outer and inner roads (2 centroids) and vehicles originating from the toll plaza and destined to points south on the turnpike are split between the outer and inner roads (2 centroids). The splits for north and south as well as the splits between inner and outer roadways are based on data obtained from the NJTP. The centroids are described as follows:

1. Turnpike North – Outer
2. Turnpike North – Inner
3. Turnpike South – Inner
4. Turnpike South – Outer
5. Roosevelt Ave East
6. Salt Meadow Rd
7. Tremley Point Connection
8. Industrial Rd East
9. Post Blvd
10. Roosevelt Ave West
11. Minue St.
12. Access Drive (Warehouse)
13. Access Drive (Holiday Inn)
14. Wedgewood Dr
15. Harrison Ave

Turning movement percentages were derived from the balanced networks and then used to help facilitate the creation of the four trip tables to be assigned to the model. A comparison to the link volumes shown on the balanced network diagrams reveals that the model has been calibrated almost to 100%. The following table compares the balanced volumes to the results of the assignments at three locations.

Calibration		AM Autos		AM Trucks		PM Autos		PM Trucks	
		Counts	Model	Counts	Model	Counts	Model	Counts	Model
Roosevelt West	In	571	573	70	69	815	816	37	36
	Out	681	681	111	113	713	714	34	34
Industrial East	In	125	124	104	105	253	252	30	29
	Out	183	183	44	44	164	164	60	60
NJTP	In	823	823	262	265	919	923	163	163
	Out	1006	1005	273	273	909	909	104	105

Future Traffic

Future traffic in the study area will be made up of two components: background growth and traffic generated by new and planned developments. Background growth, was based on an estimate of the local users of the Roosevelt Avenue corridor and the population and employment projections for nearby areas as provided by the State Planning Office (SPO). Table 1 indicates the estimated users of the study corridor based on the information provided by SPO for the years 2002 and 2020 population and employment projections. For the communities listed, the resulting composite growth factor is 1.03 giving equal weight to population and employment. The population and employment projections are based on the 2000 census that indicated a moderate employment increase of 1,946 job positions for Carteret between 2002 and 2020 for a growth of 1.27. However, since the anticipated growth in employment due to the various developments considered for this study exceeds the SPO projections, the employment growth factor for Carteret in Table 1 was set to unity.

Table 1

Background Traffic Growth

Area	Part	2002 POP	2020 POP	POP GF	2002 EMP	2020 EMP	EMP GF
Cartaret	70%	19608	20523	1.05	7291	9237	1.00
Woodbridge	25%	98171	100596	1.02	58568	61157	1.04
Rahway	5%	25291	24744	0.98	17485	18614	1.06
Composite	1.03			1.04			1.01

The modest background growth in the immediate Interchange 12 area was further augmented by background growth in regional travel as determined by traffic studies conducted for the Turnpike Authority. This increase was applied to car and truck traffic entering and leaving the turnpike and distributed to local roadways based on observed travel patterns. Based on meetings with the Borough of Carteret, City of Linden, and Middlesex and Union Counties, a list of proposed developments was compiled. Table 2 lists these developments and indicates the numbers of car and truck trips each development is projected to generate during the morning and evening peak hour. Traffic impact studies and / or future traffic estimates were available for the Port Carteret Expansion and for the expansion of various Tremley Point properties. Future traffic estimates for the other developments were based on the Institute of Transportation Engineers (ITE) trip generation rates as well as traffic generation patterns from similar projects. Only traffic volumes that will use the New Jersey Turnpike or any part of the study corridor are included. As indicated in Table 2, slightly over 4,600 trips will be added during the morning peak hour. Of this volume, approximately 22 percent are trucks. During the evening peak hour, the volume will increase to 5,000 trips of which about 20 percent are truck trips.

In addition to the new trips generated by future developments and expansions, a substantial part of the existing traffic on Tremley Point Road is likely to be diverted to Interchange 12 once the Connector Road is constructed. Based on automatic traffic recorder (ATR) counts, vehicle classification data and perceived routing preferences, approximately 540 morning and 470

evening peak hour vehicles are likely to be diverted. Of these volumes, the truck percentages are 29 and 24 for AM and PM peak hours respectively.

Table 2

Full Build Development Trips

Category	AM Cars	AM Trucks	AM Total	PM Cars	PM Trucks	PM Total
OENJ Car Port	150	14	164	150	14	164
Lower Roosevelt RDA	260	7	267	584	18	602
Ferry Terminal	174	0	174	130	0	130
Port Cartaret	282	108	390	294	78	372
Bulk Carriers	140	226	366	152	228	380
Slayton	348	146	494	476	154	630
ISP	1436	131	1567	1430	141	1571
Tremley Expansions	847	365	1212	776	386	1162
SUB-TOTAL	3637	997	4634	3992	1019	5011
Exiting Tremley Traffic	383	159	542	356	114	470
TOTAL	4020	1156	5176	4348	1133	5481

Excluding Kinder-Morgan, a high percentage (74% AM and 70% PM) of the generated future traffic is oriented to the proposed Connector Road. Should all of these developments not be implemented as initially planned, or the development levels or land use downgraded, the intersection / interchange between the proposed Connector Road and Industrial Road would be over designed. To establish a reasonable estimate of the peak traffic volume that will be connected through the Connector Road for the design year of the study, a factor of 60% of the maximum peak hour traffic volume for all of the currently proposed developments was used. This factor accounts for the probability that some of the anticipated developments will take place after 2020 or that some of the proposed land uses may change. In addition, the operating hours of all the anticipated trucking and warehousing occupants of the new developments are not likely to coincide with peak roadway traffic. Table 3 indicates the new development traffic and diverted existing Tremley Point traffic with the new, Connector Road oriented developments (ISP, other Tremley Point industry expansions and the Slayton Development) at 60 percent of full build-out. During the morning peak hour, 3,328 trips will be added to the study area traffic while during the evening peak hour, the volume increases to 3,665 trips. Diverted existing Tremley Point traffic volumes do not change. These volumes, combined with future background traffic, were used for design purposes.

Table 3

Design Level Development Trips

Category	AM Cars	AM Trucks	AM Total	PM Cars	PM Trucks	PM Total
OENJ Car Port	150	14	164	150	14	164
Lower Roosevelt RDA	260	7	267	584	18	602
Ferry Terminal	174	0	174	130	0	130
Port Cartaret	282	108	390	294	78	372
Bulk Carriers	140	226	366	152	228	380
Slayton	209	88	297	285	93	378
ISP	861	79	940	858	85	943
Tremley Expansions	510	220	730	465	231	696
SUB-TOTAL	2586	742	3328	2918	747	3665
Exiting Tremley Traffic	383	159	542	356	114	470
TOTAL	2969	901	3870	3274	861	4135

Not all of the new generated and diverted traffic is New Jersey Turnpike oriented. Table 4 indicates the number of future cars and trucks entering and exiting the Turnpike during the peak hours. A comparison to the volumes listed on Table 3 indicates that 68 percent of the AM and 71 percent of the new PM peak hour volumes are Turnpike oriented. The TRANPLAN model with the projected traffic volumes and distributions for the full amount of the proposed developments is shown in the Appendix.

Table 4

Turnpike Oriented Traffic

DESIGN LEVEL

AM Peak	ENTRY Cars	ENTRY Trucks	ENTRY Total	EXIT Cars	EXIT Trucks	EXIT Total	Total In/Out
Background	1181	393	1574	1077	342	1419	2993
Generated*	284	405	689	1477	464	1941	2630
Total	1465	798	2263	2554	806	3360	5623

PM Peak	ENTRY Cars	ENTRY Trucks	ENTRY Total	EXIT Cars	EXIT Trucks	EXIT Total	Total In/Out
Background	738	245	983	1094	345	1439	2422
Generated*	1539	389	1928	507	443	950	2878
Total	2277	634	2911	1601	788	2389	5300

FULL BUILD-OUT

AM Peak	ENTRY Cars	ENTRY Trucks	ENTRY Total	EXIT Cars	EXIT Trucks	EXIT Total	Total In/Out
Background	1181	393	1574	1077	342	1419	2993
Generated*	366	537	903	2018	587	2605	3508
Total	1547	930	2477	3095	929	4024	6501

PM Peak	ENTRY Cars	ENTRY Trucks	ENTRY Total	EXIT Cars	EXIT Trucks	EXIT Total	Total In/Out
Background	738	245	983	1094	345	1439	2422
Generated*	2086	499	2585	623	605	1228	3813
Total	2824	744	3568	1717	950	2667	6235

* Includes Diverted Existing Tremley Point Traffic

Connector Road Lane Requirements

The proposed Connector Road will cross over the Rahway River and provide a link between Industrial Road in Carteret and Tremley Point Road in Linden. With respect to traffic characteristics this roadway link is made up of two segments with differing traffic volume levels. The southern segment extends from Industrial Road to a point where Kinder Morgan and the proposed Slayton Development will have access. The northern segment includes the bridge over the Rahway River and extends from the aforementioned access drives for Kinder Morgan and the Slayton Development in Carteret to Tremley Point Road.

Traffic lane requirements for these segments are based on two levels of development at Tremley Point. The Design Level includes the anticipated growth of existing industries and new facilities during the next 15 to 20 years. The Full Build Level includes the continued growth of existing industries and the full build-out of the Tremley Point Redevelopment area beyond the Design Level period. Estimated peak hour traffic volumes by segment, type and development level are listed in Table 5.

Table 5

Projected Traffic Volumes

Development Level	Period	Direction	Cars	Trucks	Total	% Trucks
(South Segment)						
Design Level	AM	NB	1858	300	2158	14
		SB	302	292	594	49
	PM	NB	382	317	699	45
		SB	1772	268	2040	13
Full Build	AM	NB	2774	423	3197	13
		SB	437	424	861	49
	PM	NB	550	479	1029	47
		SB	2678	378	3056	12
(North Segment)						
Design Level	AM	NB	1570	238	1808	13
		SB	239	220	459	48
	PM	NB	270	247	517	48
		SB	1474	186	1660	11
Full Build	AM	NB	2370	329	2699	12
		SB	351	326	677	48
	PM	NB	382	379	761	50
		SB	2245	265	2510	11

The morning northbound and afternoon southbound direction peak volumes contain a substantial number of commuter vehicles while the off-peak direction volumes contain a high percentage of trucks. A cursory evaluation of the full build volumes clearly indicates that a single lane capacity is exceeded in the peak direction both during the AM and PM peak hours.

The Connector Road was analyzed with the design level volumes as a two-lane highway using the Highway Capacity Software (HCS) release 4.1c and the following parameters for the roadway: one 12 foot lane and a three foot shoulder in each direction of travel; maximum grade of 3 percent for distance of 0.25 miles (HCS default minimum) for the north segment; free flow speed of 50 miles per hour (mph); and a peak hour factor (PHF) of 0.90. The analysis was conducted for the peak direction only. The results for the four scenarios analyzed (north segment – AM, north segment – PM, south segment – AM, south segment – PM), revealed levels of service (LOS) "F" with volume to capacity (v/c) ratios between 1.14 and 1.51. Printouts of the two-lane HCS analysis are included in the appendix. The analyses presented show that a two-lane roadway does not accommodate effective operations at design level volumes. A four-lane roadway will be required to accommodate the design level volumes.

Next, the operations of the roadway were tested as an undivided, four-lane highway with a 12-foot inner lane and a 15-foot shoulder lane in each direction of travel. (HCS analysis was conducted for two 12-foot lanes and a three-foot shoulder in each direction). In the northbound direction, there will be a grade of 3 percent for a distance of approximately 1,100 feet, while in the southbound direction a 3 percent grade extends for about 800 feet. A PHF of 0.90 and a free flow speed of 50 mph were also used for the multi-lane highway analysis. Since the multi-lane highway module of HCS limits truck percentages to 25 percent and the off-peak direction truck percents are in the 48-50 percent range, the truck percentage was set to 25 and the remaining trucks over 25 percent converted to cars at a truck equivalency factor (ET) of 1.5 which is consistent with the grades.

The results of the analysis are indicated in Table 6. Overall, the vehicular operations of the north segment, which includes the bridge crossing over the Rahway River, are more efficient than those of the south segment. Under design level conditions, the roadway operates at LOS "C" in the peak direction during both the AM and PM periods. The off-peak direction during both the AM and PM periods operates at LOS "A." The HCS printouts for the multi-lane highway capacity analysis are included in the appendix.

Table 6

Connector Road HCS Analysis Results

Period	Direction	LOS	Density*
	(South Segment)		
AM	NB	C	24.3
	SB	A	7.9
PM	NB	A	9.1
	SB	C	22.9
	(North Segment)		
AM	NB	C	20.3
	SB	A	6.1
PM	NB	A	6.8
	SB	C	18.4

* passenger cars / mile / lane

As shown in the first portion of Table 6, the south segment vehicle operations are slightly more dense than those of the north segment. Under design level conditions, the south segment operates at LOS "C" or better in the peak direction during the AM and PM periods. The off-peak direction operates at LOS "A" during the AM and PM peaks.

Connector Road Intersections

The orientation of the Connector Road for all of the alternates studied is basically north/south. Both Tremley Point Road at the northern terminus of the Connector Road and Industrial Road at the southern terminus are oriented in the east/west direction. The intersections at both ends of the Connector Road are essentially signalized "T" intersections with multiple turning lanes to address the projected traffic volumes.

The heaviest traffic moves at the proposed intersection of the Connector Road with Industrial Road are oriented from Interchange 12 to the Connector Road and the return movement. The configuration of this signalized intersection will require a double left turn lane from eastbound Industrial Road to the northbound Connector Road. (Figure 1) The return move will be addressed by a channelized right turn move. The westbound through and the southbound turning movements conflict with each other. This coupled with the weave section between Industrial Road north/south and east/west intersection reduces the capacity of the intersection considerably. However, the intersection controlled by a three phase semi-actuated signal with a90 second cycle length, would operate at a LOS C with the design level traffic volumes.

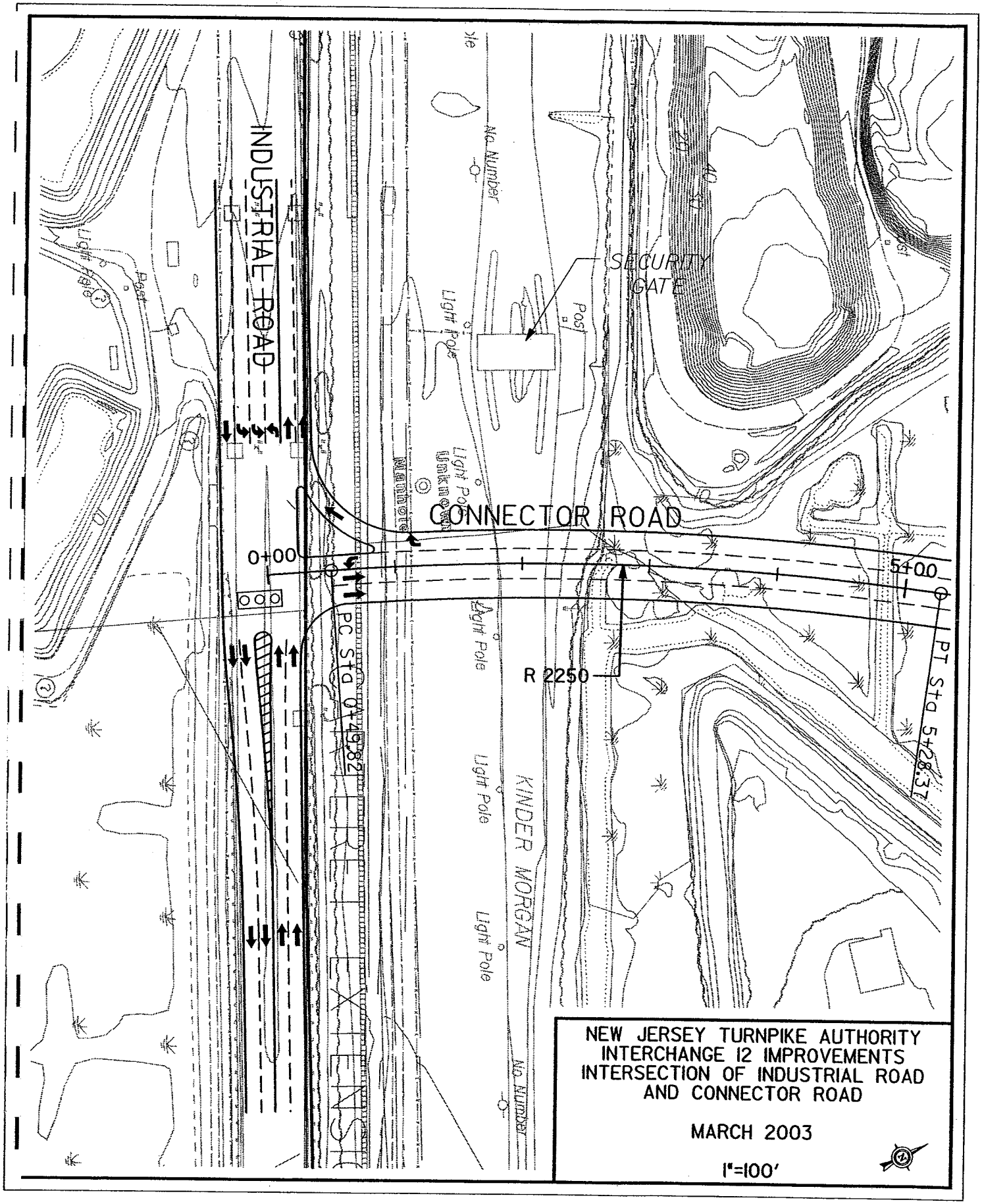
Potentially, if the ultimate development of the Tremley Point area generates the maximum peak hour traffic volumes that would be routed through this intersection, the heavy movements between the Turnpike and the Connector Road would require grade separation. The grade separation of these movements would allow the intersection to operate effectively for both the traffic related to the Connector Road and the significant opposing traffic volumes traversing the intersection from westbound Industrial Road.

All of the alignment alternative plans currently include an at-grade crossing of the Connector Road with the infrequently used Conrail tracks that parallel Industrial Road. Preliminary discussions with Conrail revealed that they may require the crossing to be grade separated. If grade separation at the railroad becomes necessary, the Connector Road and Industrial Road will be raised over the railroad and the same intersection configuration will be maintained to accommodate the Design Level traffic volumes. To minimize wetland and right-of-way impacts the elevated roadway will be constructed using retaining walls.

The location and lane configuration of the proposed roadway intersection that will convey traffic generated by the proposed Tremley Point redevelopment areas in Linden to Tremley Point Road has still not been determined by Union County. Preliminary indications are that the majority of traffic destined for the Connector Road will be from the new development(s), traveling eastbound on Tremley Point Road and will make a right turn to travel south on the Connector Road. Based on current land use along the eastern end of Tremley Point Road, it is not anticipated that a significant number of vehicles will travel westbound on Tremley Point Road and make a left turn onto the Connector Road.

With this distribution of traffic, the proposed configuration of the intersectionis shown in Figure 2. The intersection of Tremley Point Road and the Connector Road will be a two-phase signal controlled intersection, with a 90-second cycle length. The northbound approach will have double left-turn lanes and a one right-turn lane. The eastbound approach requires two right-turn lanes and one through lane. The westbound approach requires a signal shared through/ right turn lane. This intersection will have an overall LOS of C for the design year and full-build traffic volumes.

Although there is adequate capacity with the one lane westbound approach, the conflicting northbound approach under the full-build traffic volumes reduces the westbound approach to a LOS E. However, the overall intersection will operate at a LOS C. Revising the westbound approach to a two lane approach will improve this approach to a LOS C. However, since with a single lane westbound approach the intersection operates with a LOS C and the westbound volume capacity ratio is 0.69, it is recommended to maintain the single shared westbound lane.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CONNECTOR ROAD
SECURITY GATE
0+00
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PC Sta 0+49.82
PT Sta 5+28.37
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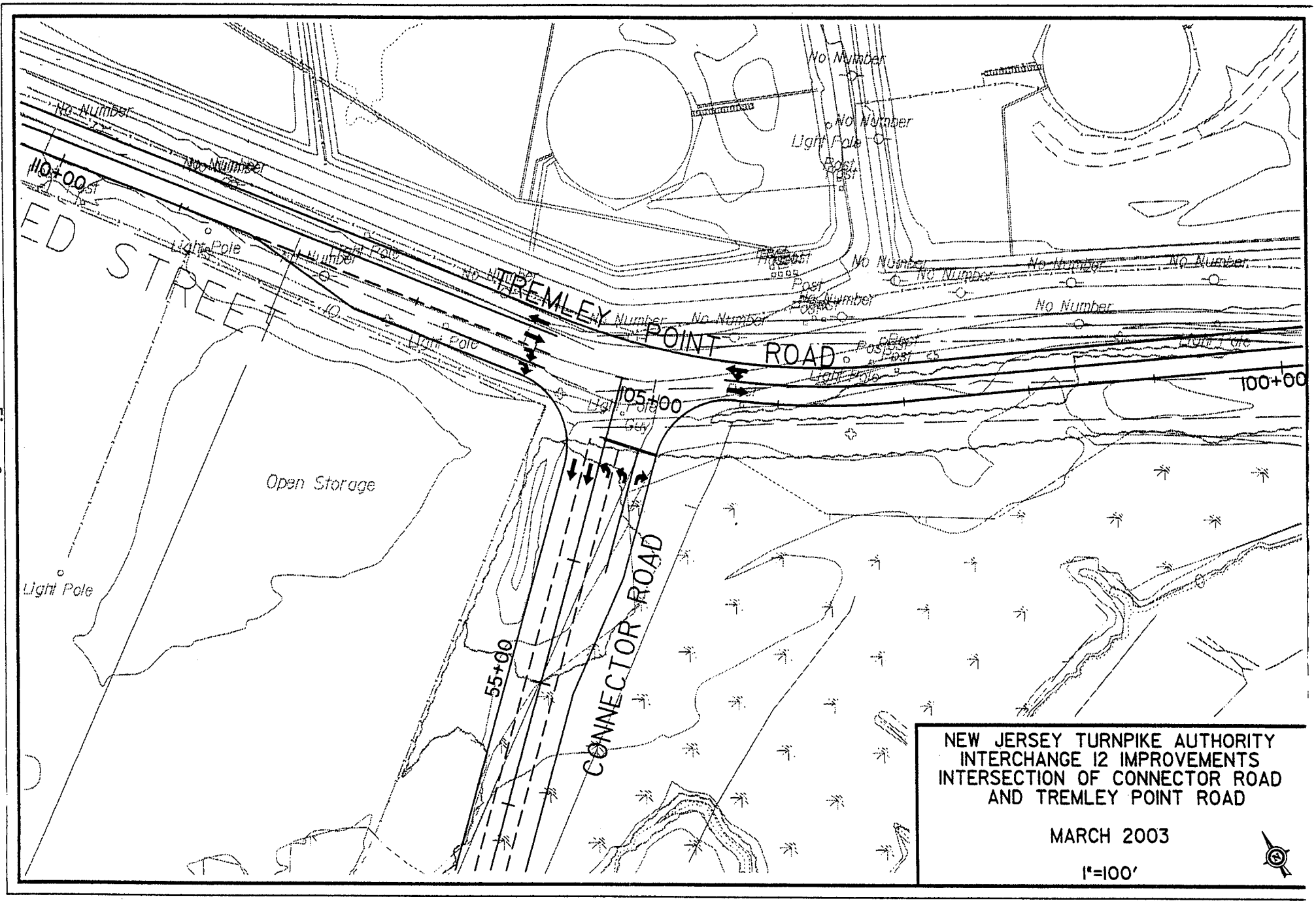
NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
INTERSECTION OF INDUSTRIAL ROAD
AND CONNECTOR ROAD
MARCH 2003
1"=100'

Figure 1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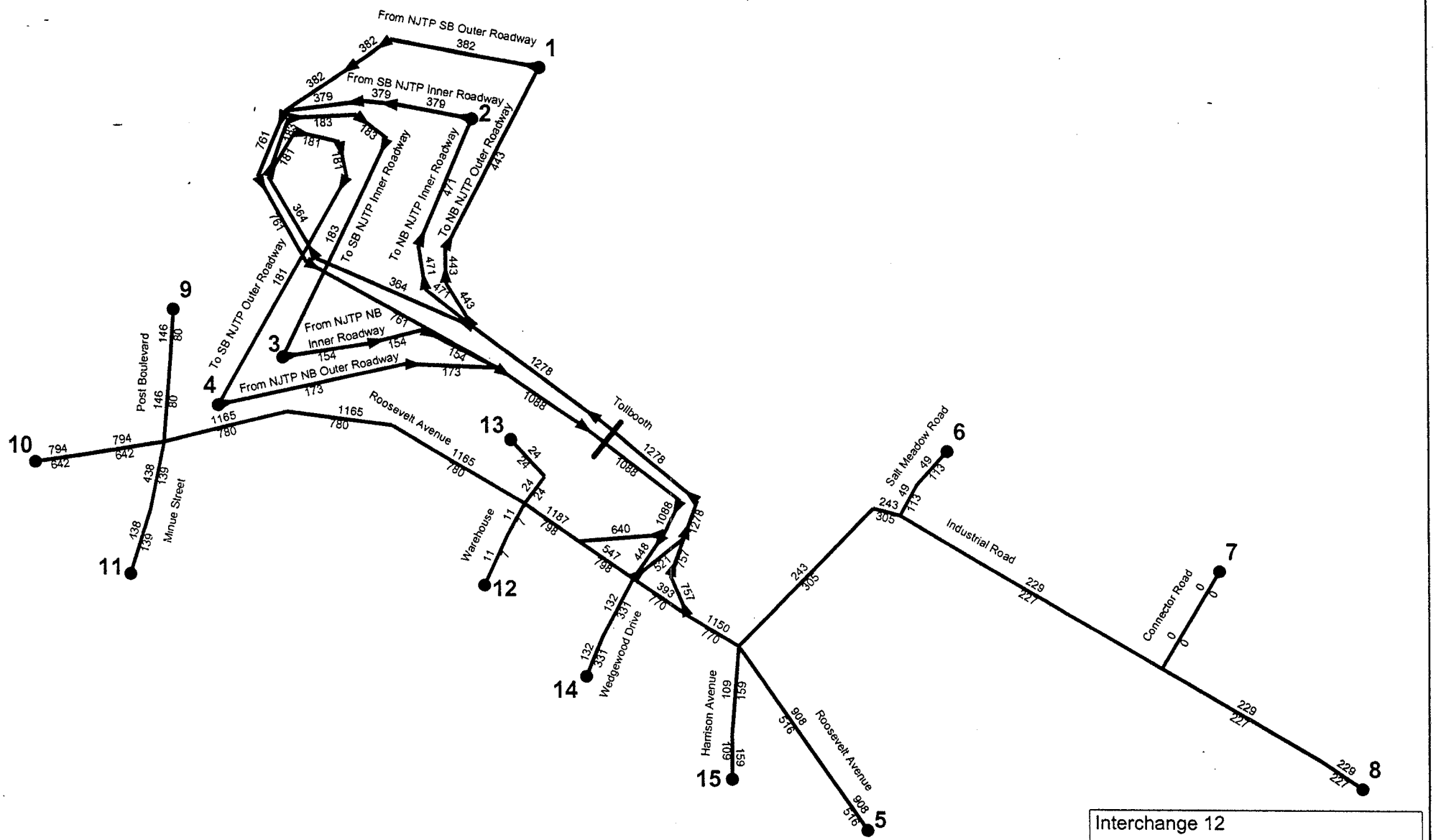
NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
INTERSECTION OF CONNECTOR ROAD
AND TREMLEY POINT ROAD
MARCH 2003
1"=100'

Figure 2

APPENDIX



Interchange 12

Existing Network
AM Peak Hour Existing Volumes
Autos and Trucks

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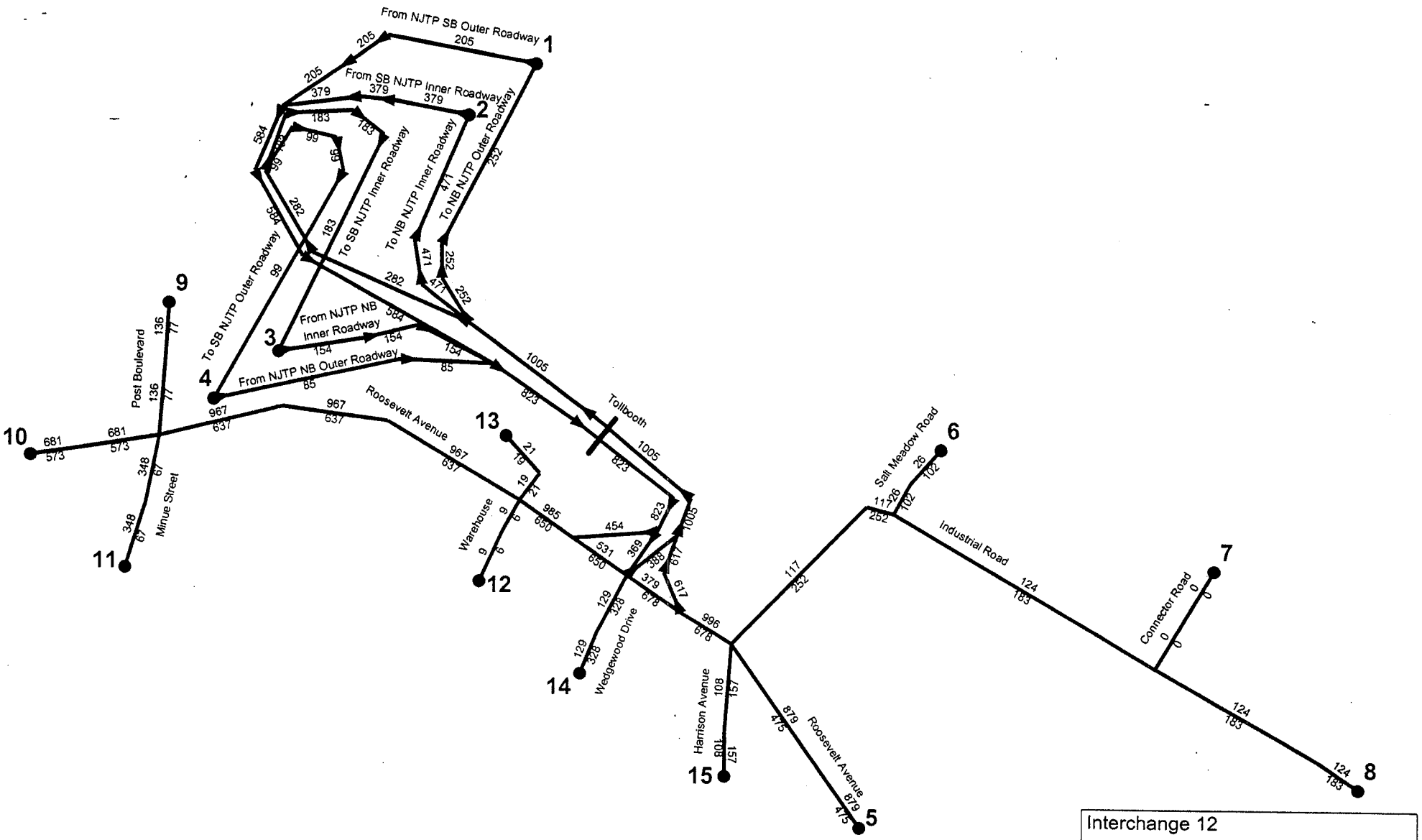
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To NB NJTP Inner Roadway
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Tollbooth
Roosevelt Avenue
Post Boulevard
Minue Street
Warehouse
Wedgewood Drive
Harrison Avenue
Roosevelt Avenue
Salt Meadow Road
Industrial Road
Connector Road
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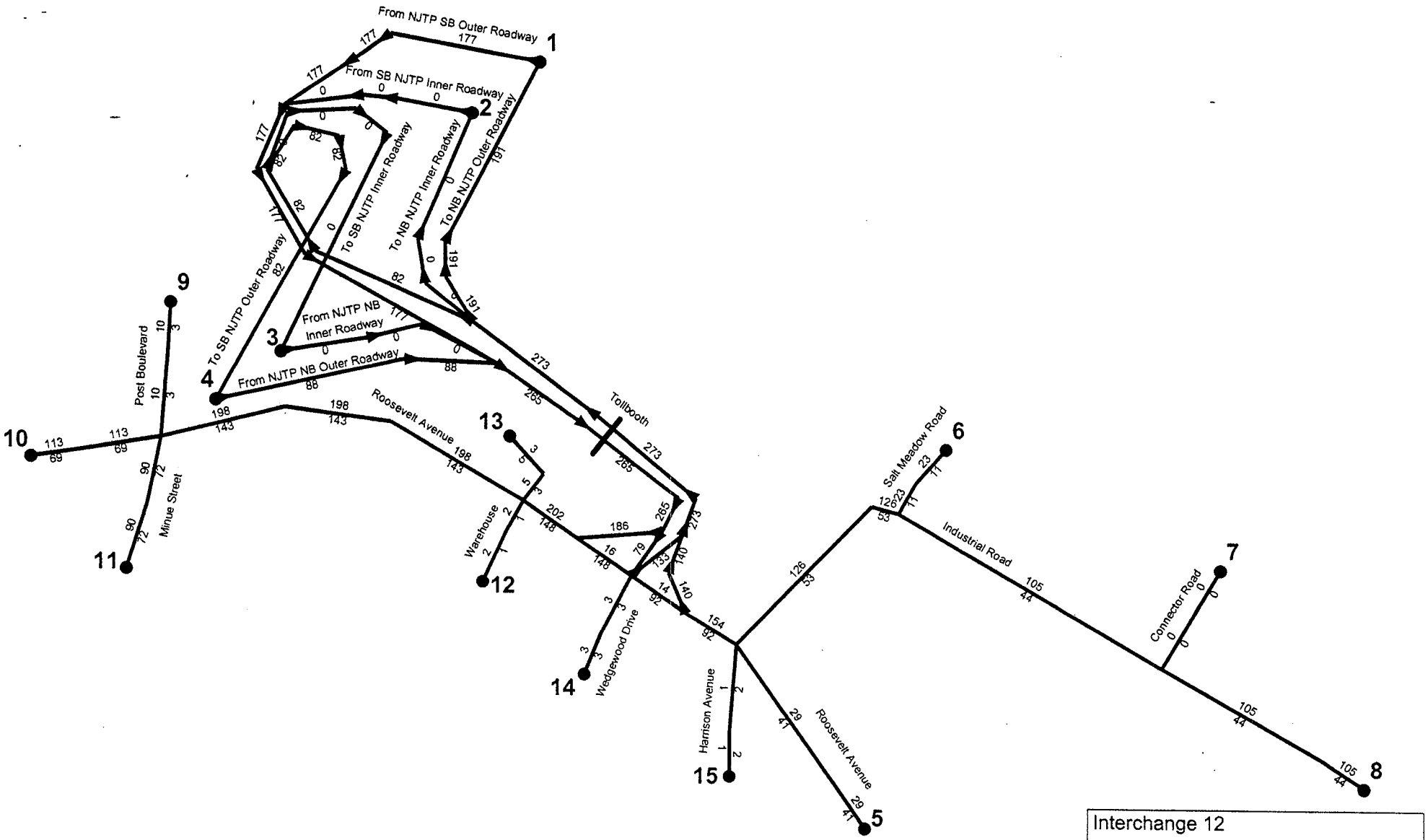
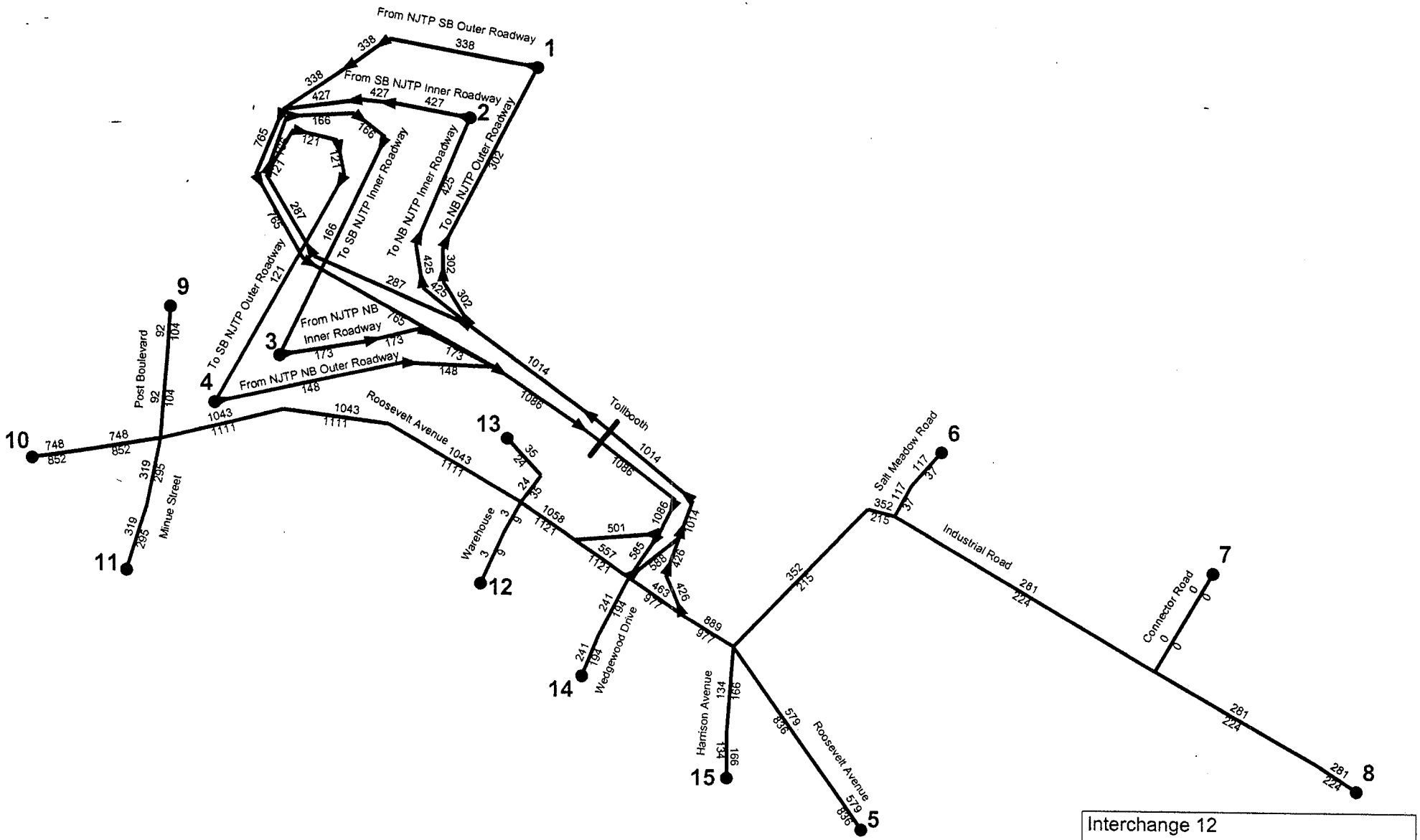
Interchange 12
Existing Network
AM Peak Hour Existing Volumes
Autos
Edwards AND Kelcey



Interchange 12

Existing Network
AM Peak Hour Existing Volumes
Trucks

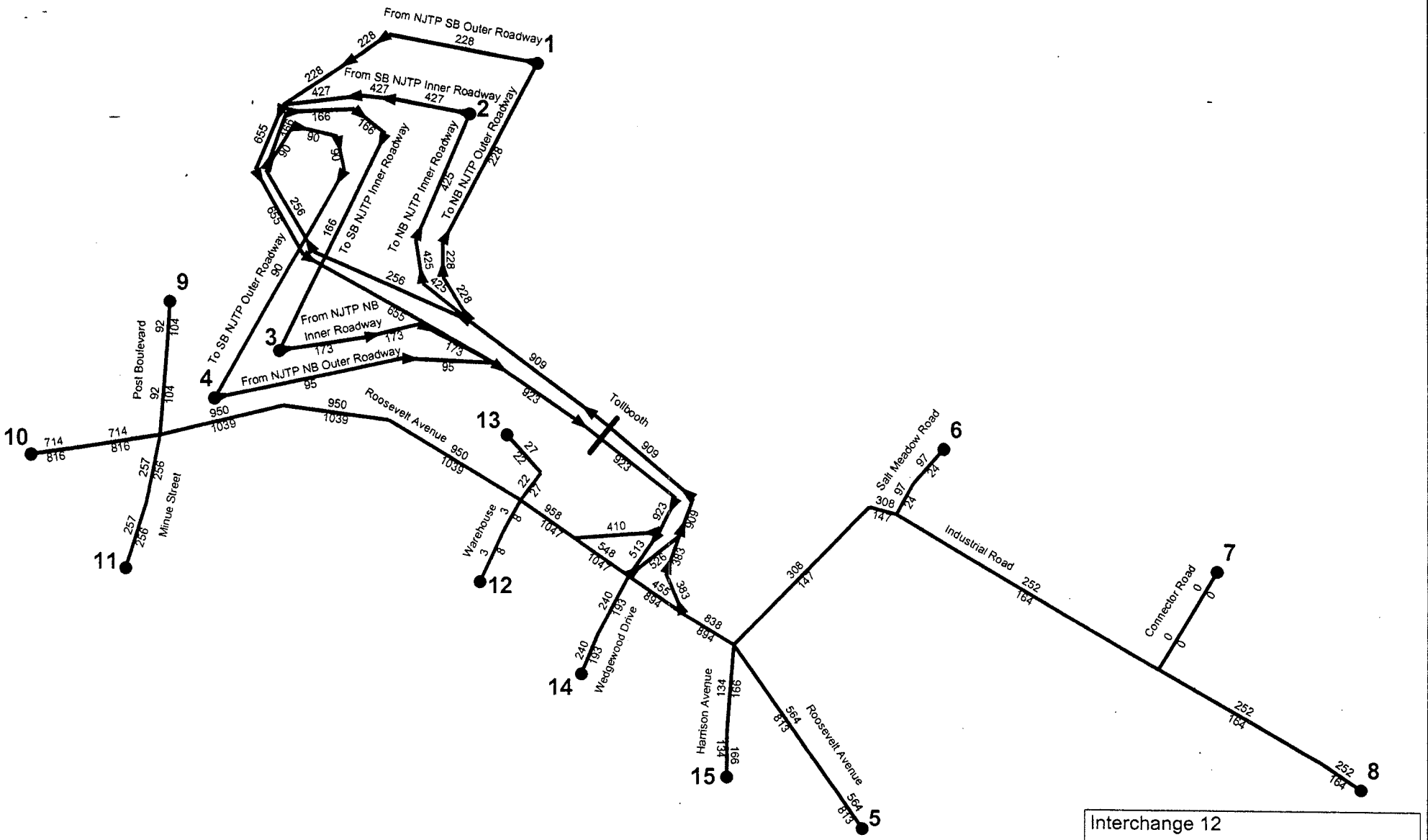
Edwards AND Kelcey



Interchange 12

Existing Network
PM Peak Hour Existing Volumes
Autos and Trucks

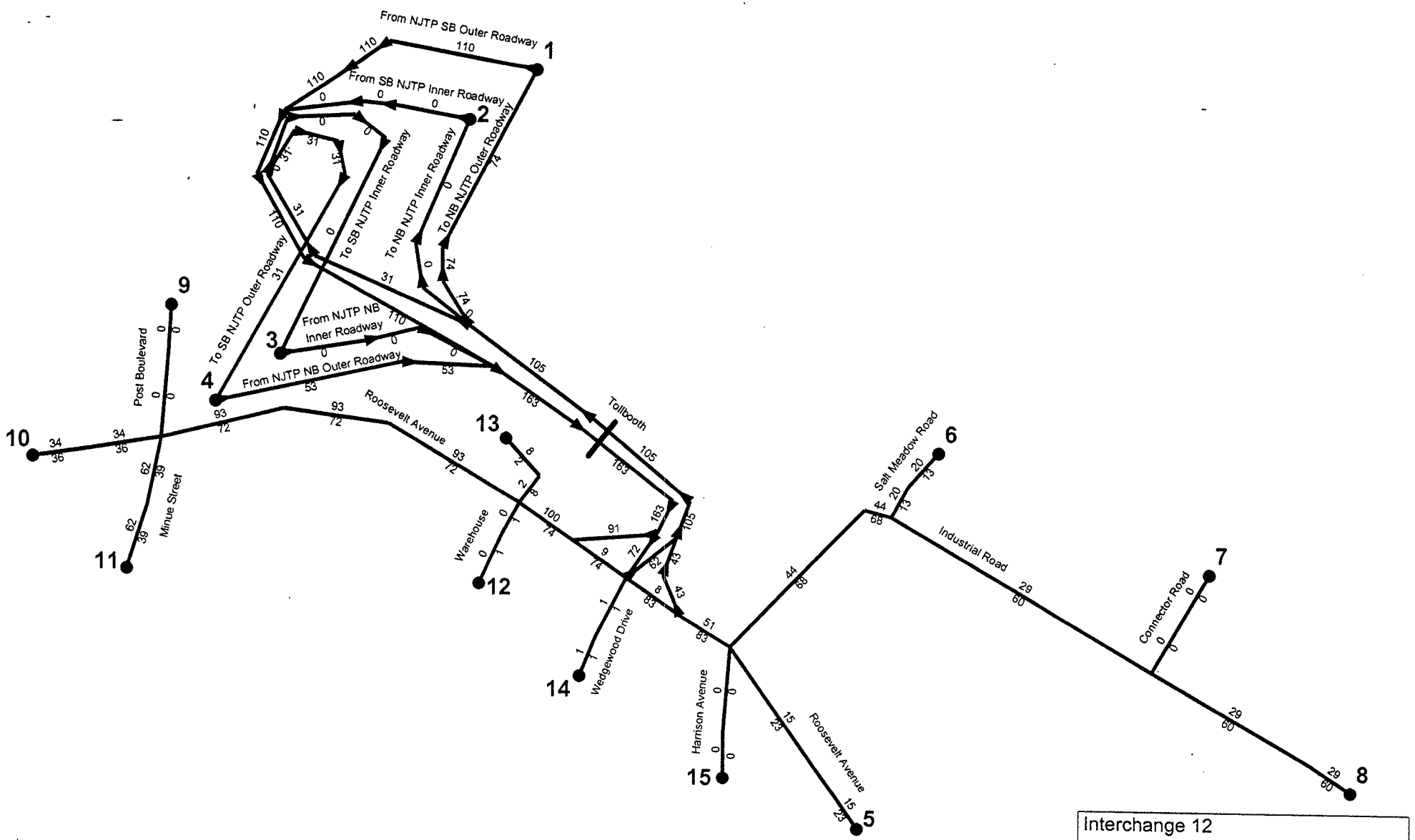
Edwards AND Kelcey



Interchange 12

Existing Network
PM Peak Hour Existing Volumes
Autos

Edwards AND Kelcey

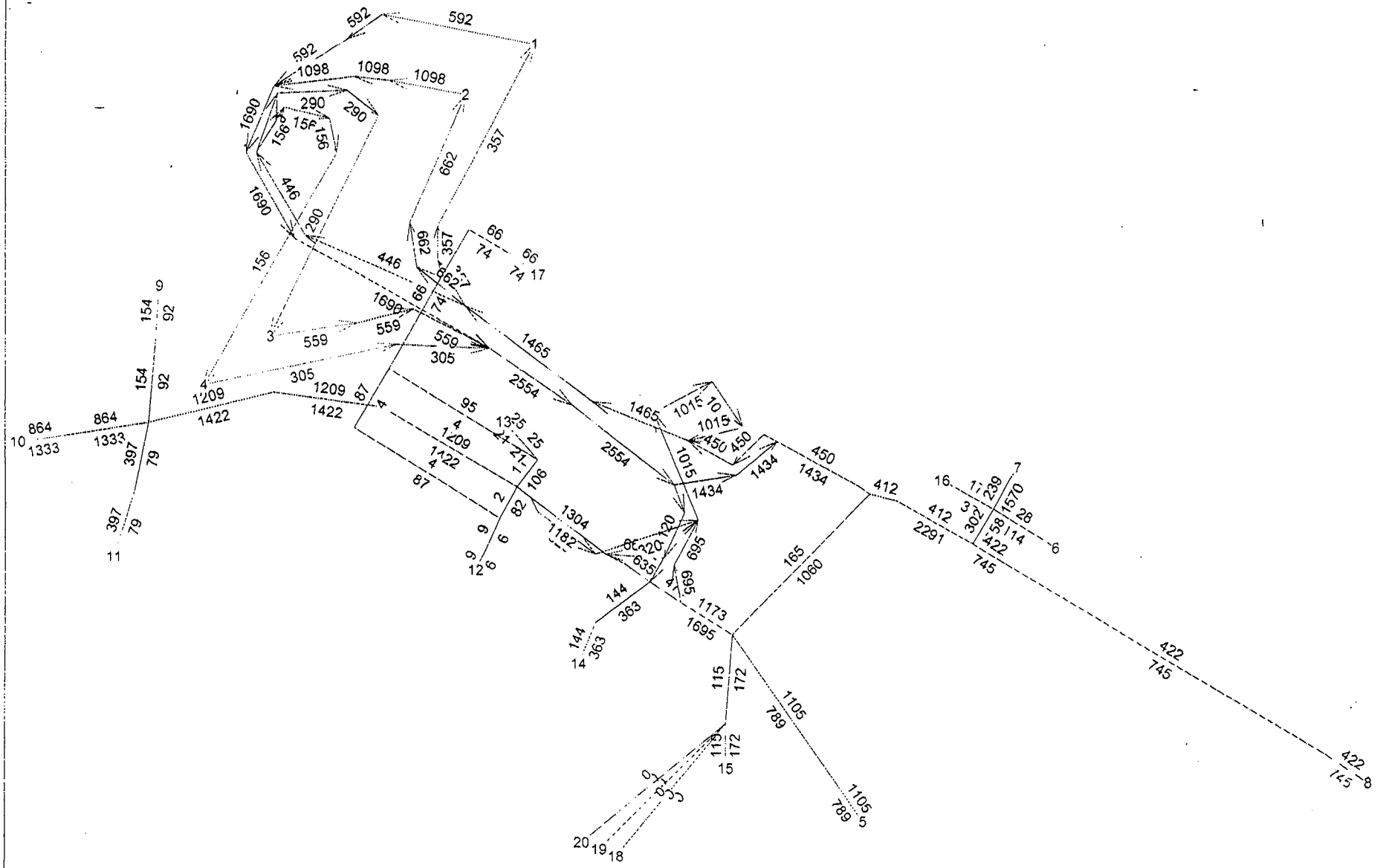


Interchange 12

Existing Network
PM Peak Hour Existing Volumes
Trucks

Edwards AND Kelcey

INTERCHANGE 12 - ALT VA
DESIGN VOLUMES - AM PEAK HOUR AUTOS



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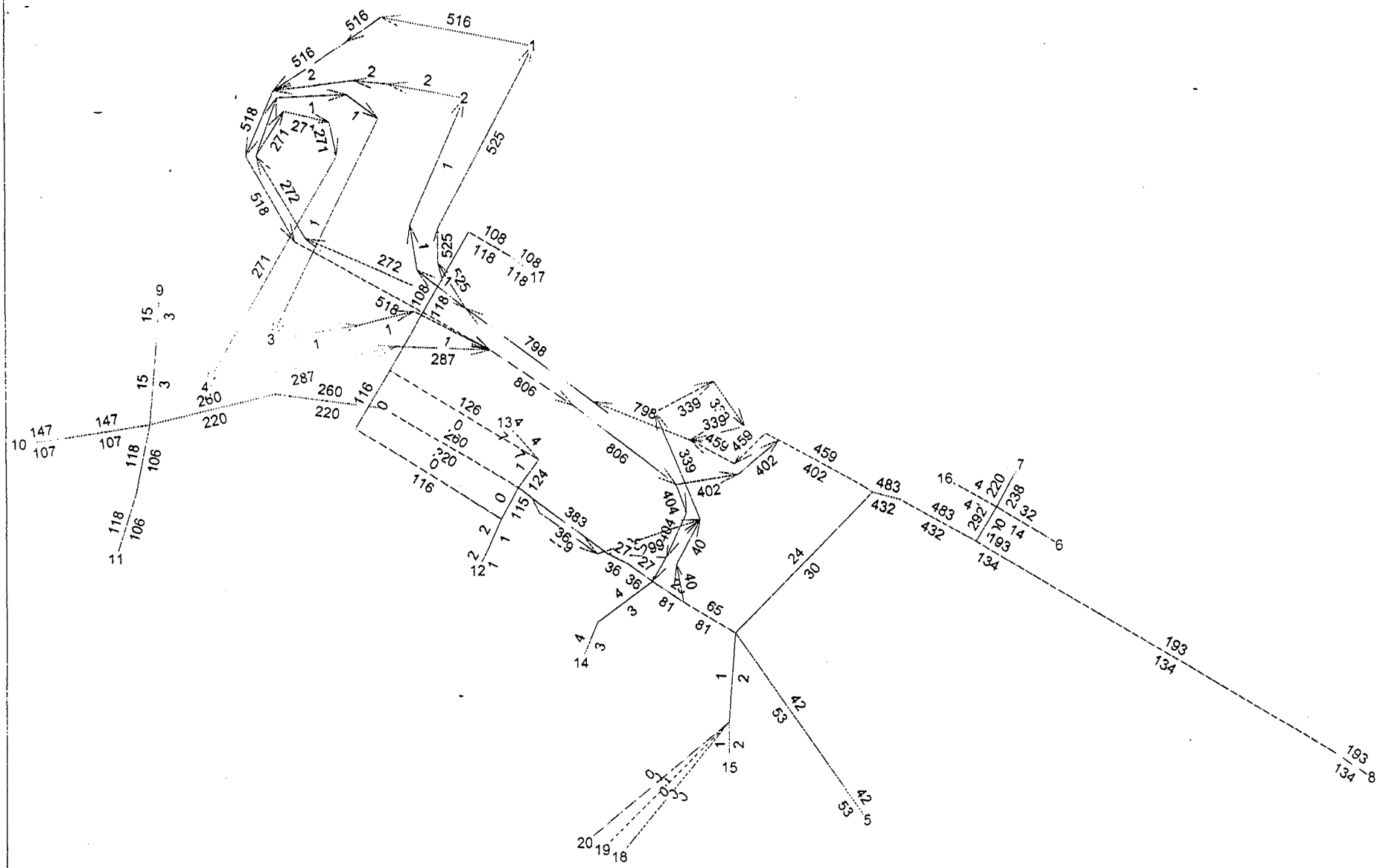
INTERCHANGE 12 - ALT VA
DESIGN VOLUMES - AM PEAK HOUR TRUCKS



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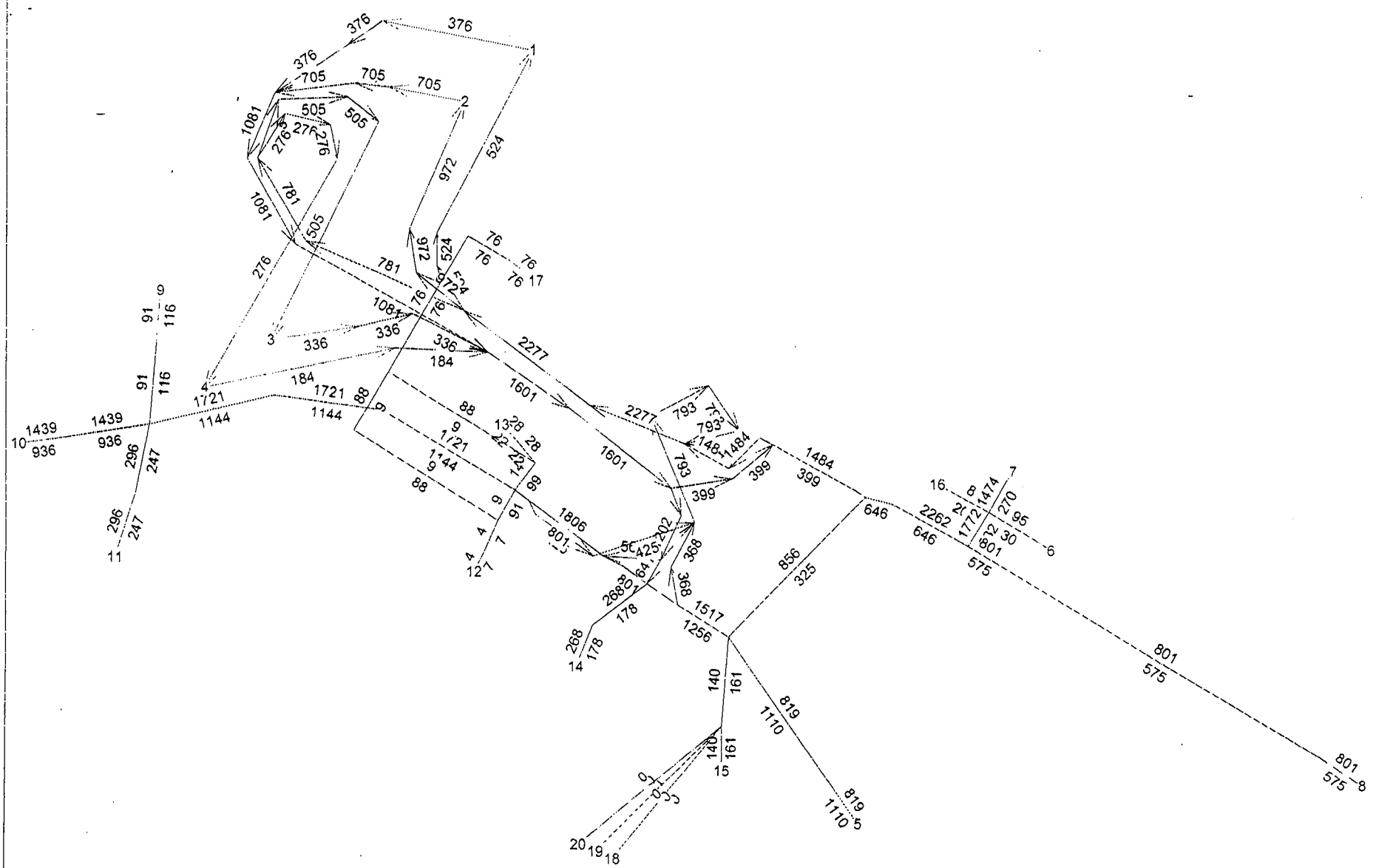
INTERCHANGE 12 - ALT VA
DESIGN VOLUMES - PM PEAK HOUR AUTOS



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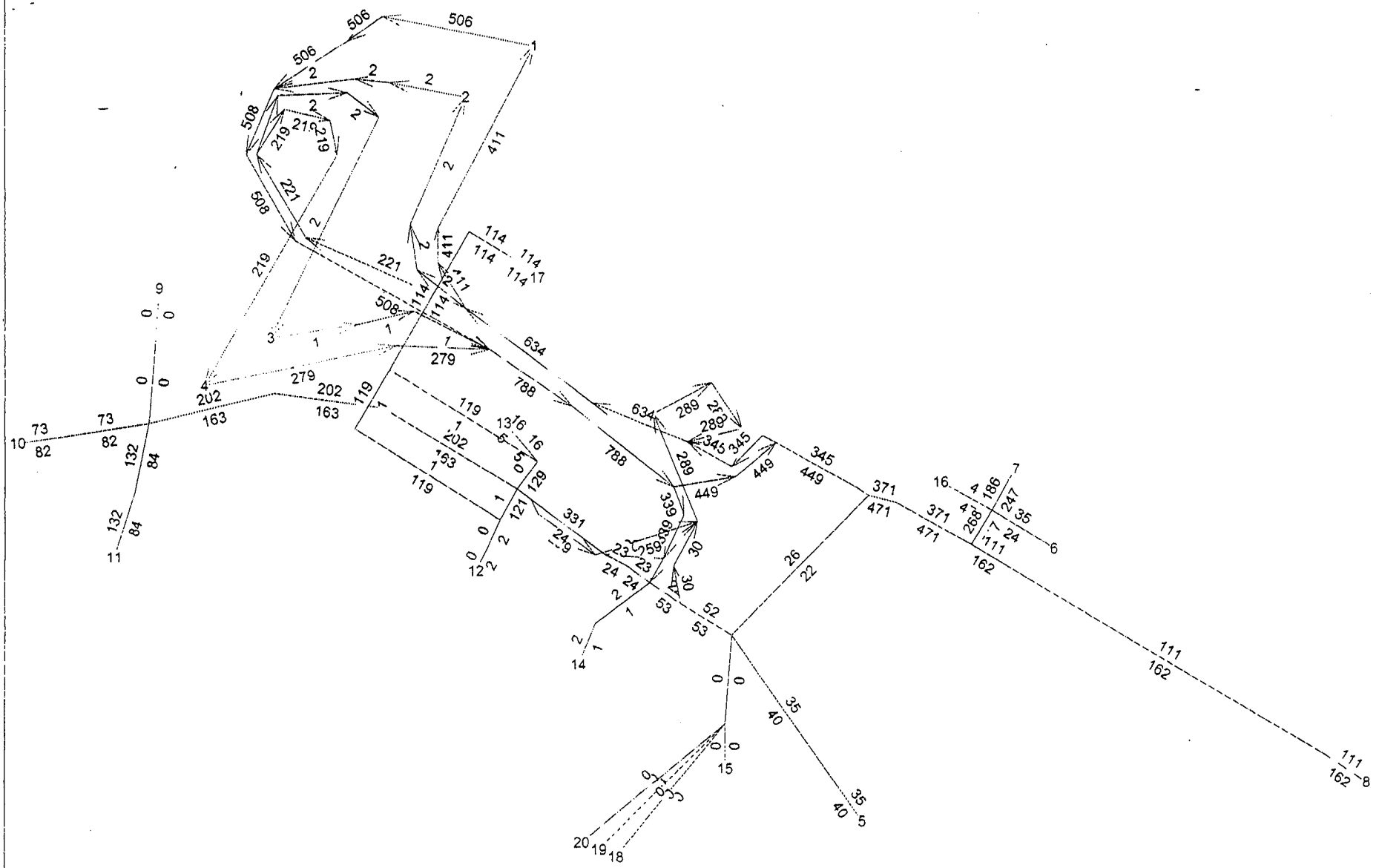
INTERCHANGE 12 - ALT VA
DESIGN VOLUMES - PM PEAK HOUR TRUCKS



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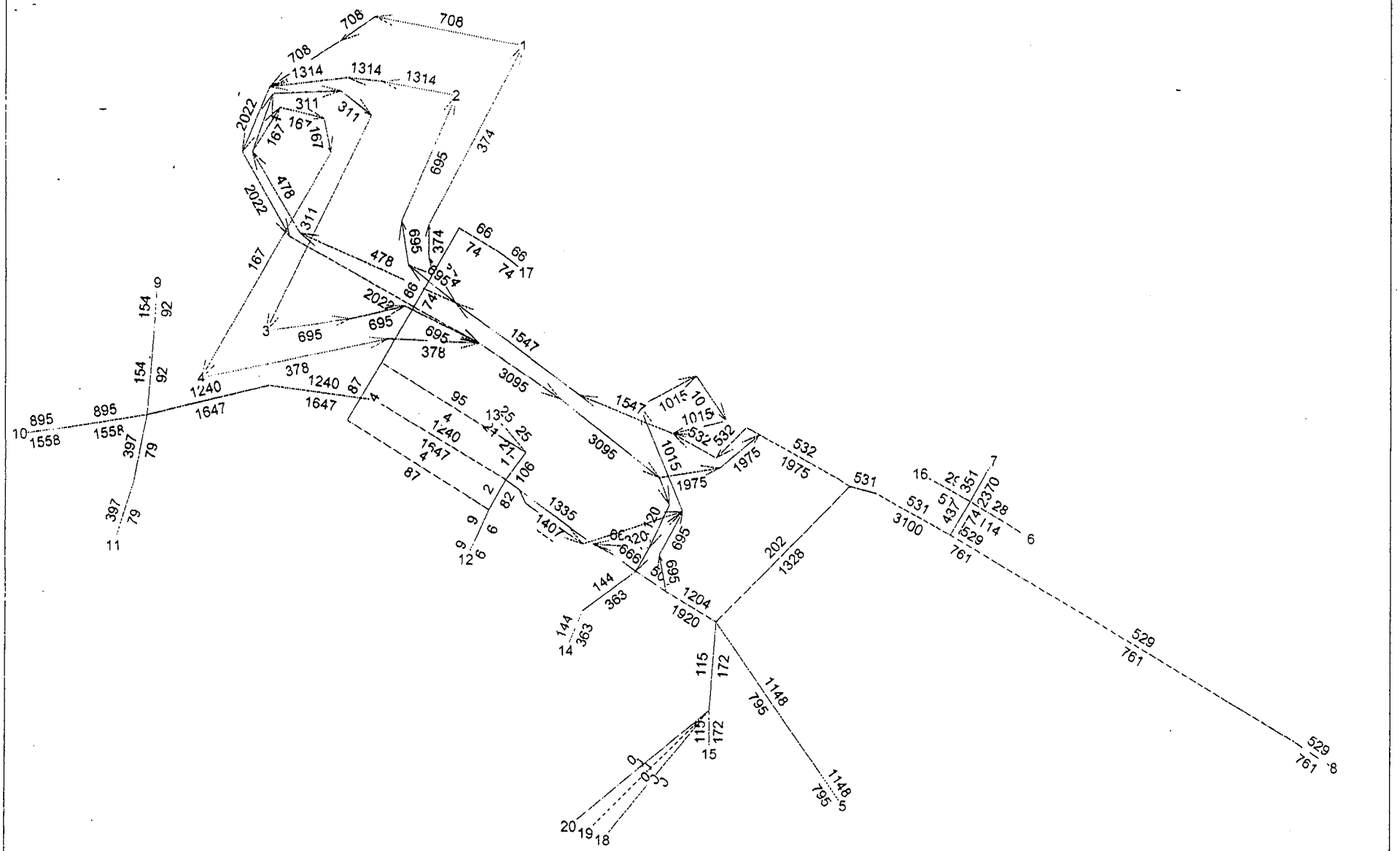
INTERCHANGE 12 - ALT VA
FULL BUILD VOLUMES - AM PEAK HOUR AUTOS



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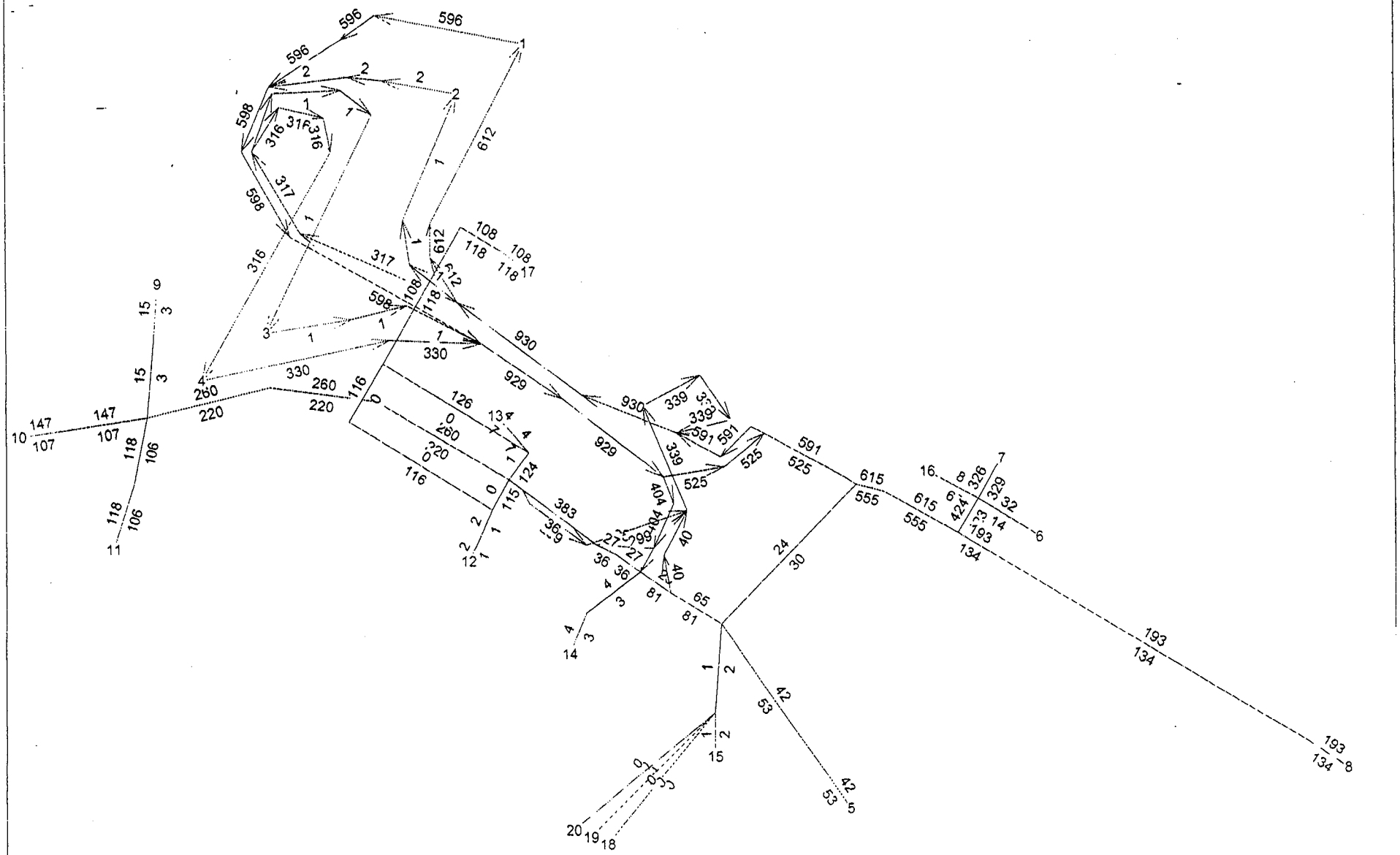
INTERCHANGE 12 - ALT VA
FULL BUILD VOLUMES - AM PEAK HOUR TRUCKS



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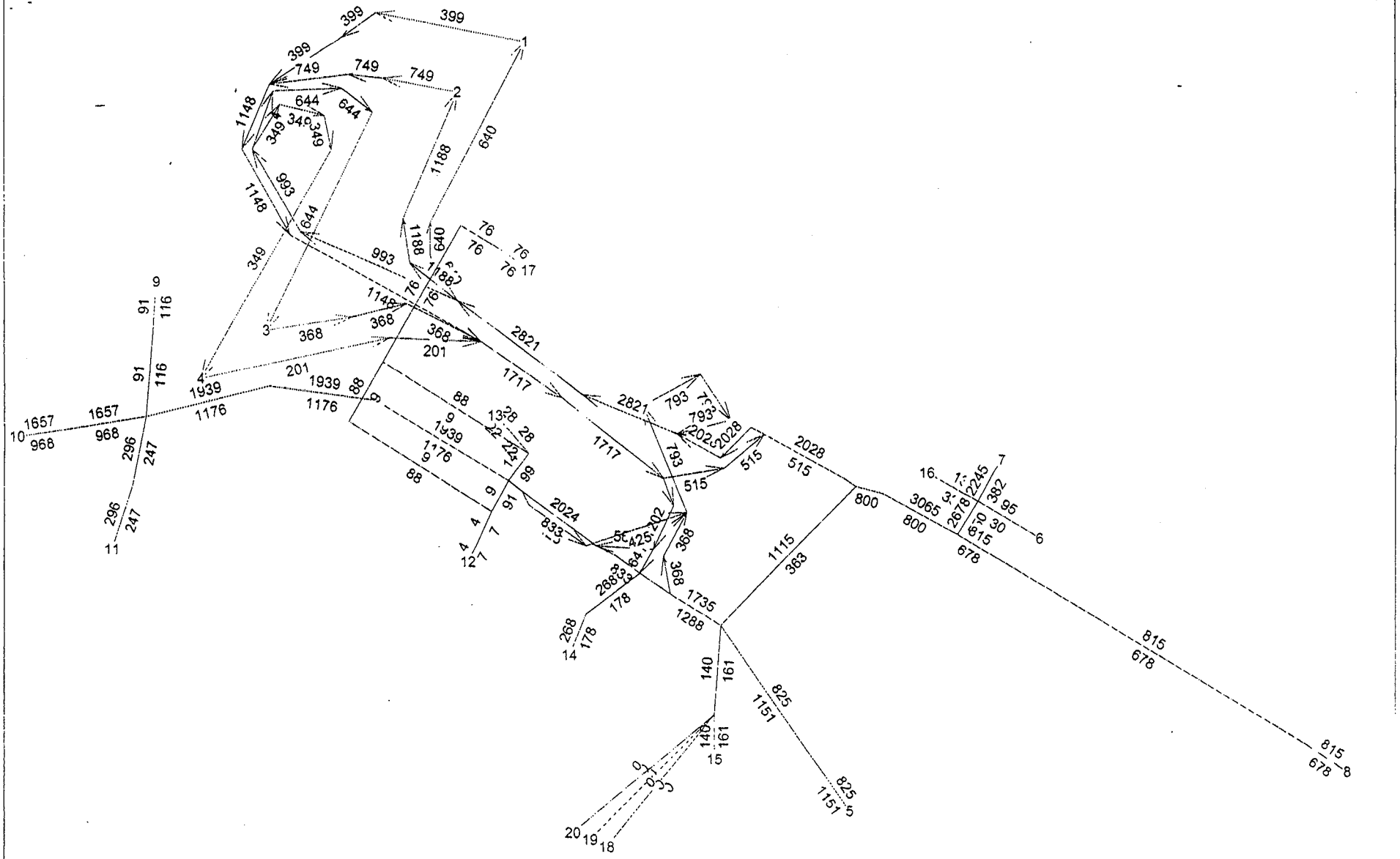
viper

INTERCHANGE 12 - ALT VA
FULL BUILD VOLUMES - PM PEAK HOUR AUTOS



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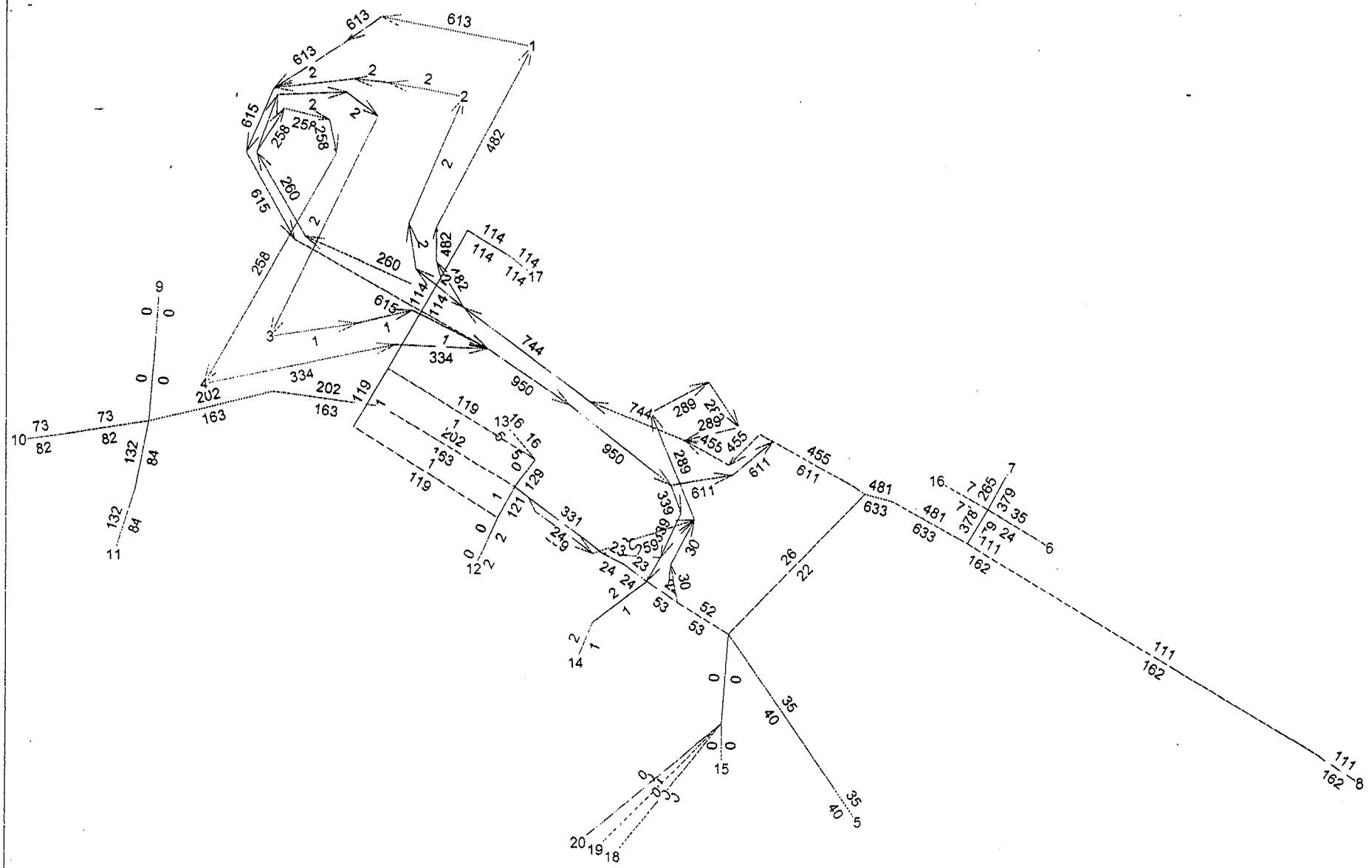
viper

INTERCHANGE 12 - ALT VA
FULL BUILD VOLUMES - PM PEAK HOUR TRUCKS



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viper

APPENDIX

HCS2000: Two-Lane Highways Release 4.1c

ıone: Fax:
Mail:

Directional Two-Lane Highway Segment Analysis

'ılyst MN
ncy/Co. E&K
ıe Performed 2/20/2003
ıalysis Time Period AM Peak
ıway Connector Road
n/To Trem. Pt Rd to Ind. Rd SOUTH
risdiction
ıalysis Year Design Level
cription NB Direction

Input Data

ıway class Class 1 Peak-hour factor, PHF 0.90
ıoulder width 3.0 ft % Trucks and buses 14 %
ne width 12.0 ft % Trucks crawling 0.0 %
ment length 0.0 mi Truck crawl speed 0.0 mi/hr
ain type Level % Recreational vehicles 0 %
ade: Length mi % No-passing zones 0 %
Up/down % Access points/mi 0 /mi

ıalysis direction volume, Vd 2158 veh/h
)posing direction volume, Vo 594 veh/h

Average Travel Speed

rection	Analysis(d)	Opposing (o)
: for trucks, ET	1.5*	1.5*
-: for RVs, ER	1.0	1.0
eavy-vehicle adj. factor,(note-5) fHV	0.935	0.935
de adj. factor,(note-1) fG	1.00	1.00
ctional flow rate,(note-2) vi	2566 pc/h	706 pc/h

ee-Flow Speed from Field Measurement:
d measured speed,(note-3) S FM - mi/h
erved volume,(note-3) Vf - veh/h
ıtimated Free-Flow Speed:
'e free-flow speed,(note-3) BFFS 55.0 mi/h
for lane and shoulder width,(note-3) fLS 2.6 mi/h
ıj. for access points,(note-3) fA 0.0 mi/h

)-flow speed, FFSd 52.4 mi/h

ljustment for no-passing zones, fnp 0.6 mi/h
'erage travel speed, ATSd 26.4 mi/h

Percent Time-Spent-Following

ction	Analysis(d)	Opposing (o)
: for trucks, ET	1.0	1.0
E for RVs, ER	1.0	1.0
eavy-vehicle adjustment factor, fHV	1.000	1.000

ıde adjustment factor,(note-1) fG 1.00 1.00
irectional flow rate,(note-2) vi 2398 pc/h 660 pc/h
ase percent time-spent-following,(note-4) BPTSFd 92.7 %
ustment for no-passing zones, fnp 4.1
..cent time-spent-following, PTSFd 96.8 %

Level of Service and Other Performance Measures

vel of service, LOS F
olume to capacity ratio, v/c 1.51
ık 15-min vehicle-miles of travel, VMT15 0 veh-mi
ık-hour vehicle-miles of travel, VMT60 0 veh-mi
eak 15-min total travel time, TT15 0.0 veh-h

otes:
If the highway is extended segment (level) or rolling terrain, fG = 1.0
vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
or the analysis direction only.
Exhibit 20-21 provides factors a and b.
Use alternative Equation 20-14 if some trucks operate at crawl speeds
ı a specific downgrade.

Passing Lane Analysis

al length of analysis segment, Lt 0.0 mi
ength of two-lane highway upstream of the passing lane, Lu mi
ength of passing lane including tapers, Lpl mi
rage travel speed, ATSd (from above) 26.4 mi/h
cent time-spent-following, PTSFd (from above) 96.8
vel of service,(note-1) LOSd (from above) F

Average Travel Speed

ownstream length of two-lane highway within effective
ength of passing lane for average travel speed, Lde 1.70 mi
gth of two-lane highway downstream of effective
length of the passing lane for average travel speed, Ld mi
li factor for the effect of passing lane
n average speed, fpl 1.11
..rage travel speed including passing lane,(note-2) ATSpl

Percent Time-Spent-Following

ownstream length of two-lane highway within effective length
of passing lane for percent time-spent-following, Lde 3.60 mi
gth of two-lane highway downstream of effective length of
..e passing lane for percent time-spent-following, Ld mi
lj. factor for the effect of passing lane
n percent time-spent-following, fpl 0.62
cent time-spent-following
ncluding passing lane,(note-3) PTSFpl %

Level of Service and Other Performance Measures (note-4)

vel of service including passing lane, LOSpl
k 15-min total travel time, TT15 veh-h

otes:
If LOSd = F, passing lane analysis cannot be performed.
Ld < 0, use alternative Equation 20-22.
Ld < 0, use alternative Equation 20-20.
v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway
Segment Worksheet.

ıone: Fax:
Mail:

Directional Two-Lane Highway Segment Analysis

'lyst MN
ncy/Co. E&K
ıe Performed 2/20/2003
ıalysis Time Period PM Peak
ıway Connector Road
n/To Trem. Pt Rd to Ind. Rd SOUTH
risdiction
'alysis Year Design Level
cription SB Direction

Input Data

ıway class Class 1 Peak-hour factor, PHF 0.90
ıoulder width 3.0 ft % Trucks and buses 13 %
ne width 12.0 ft % Trucks crawling 0.0 %
ment length 0.0 mi Truck crawl speed 0.0 mi/hr
ain type Level % Recreational vehicles 0 %
ade: Length mi % No-passing zones 0 %
Up/down % Access points/mi 0 /mi

ıalysis direction volume, Vd 2040 veh/h
)posing direction volume, Vo 699 veh/h

Average Travel Speed

'ection Analysis(d) Opposing (o)
for trucks, ET 1.5* 1.5*
for RVs, ER 1.0 1.0
ıavy-vehicle adj. factor,(note-5) fHV 0.939 0.939
le adj. factor,(note-1) fG 1.00 1.00
ctional flow rate,(note-2) vi 2414 pc/h 827 pc/h

ee-Flow Speed from Field Measurement:
l measured speed,(note-3) S FM - mi/h
erved volume,(note-3) Vf - veh/h
timated Free-Flow Speed:
e free-flow speed,(note-3) BFFS 55.0 mi/h
for lane and shoulder width,(note-3) fLS 2.6 mi/h
J. for access points,(note-3) fA 0.0 mi/h

-flow speed, FFSd 52.4 mi/h

justment for no-passing zones, fnp 0.4 mi/h
rage travel speed, ATSd 26.8 mi/h

Percent Time-Spent-Following

ction Analysis(d) Opposing (o)
for trucks, ET 1.0 1.0
E for RVs, ER 1.0 1.0
avy-vehicle adjustment factor, fHV 1.000 1.000

de adjustment factor,(note-1) fG 1.00 1.00
rectional flow rate,(note-2) vi 2267 pc/h 777 pc/h
ıse percent time-spent-following,(note-4) BPTSFd 92.4 %
ıstment for no-passing zones, fnp 2.8
.ent time-spent-following, PTSFd 95.3 %

Level of Service and Other Performance Measures

vel of service, LOS F
lume to capacity ratio, v/c 1.42
k 15-min vehicle-miles of travel, VMT15 0 veh-mi
k-hour vehicle-miles of travel, VMT60 0 veh-mi
ak 15-min total travel time, TT15 0.0 veh-h

ıes:
If the highway is extended segment (level) or rolling terrain, fG = 1.0
vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
or the analysis direction only.
Exhibit 20-21 provides factors a and b.
Use alternative Equation 20-14 if some trucks operate at crawl speeds
a specific downgrade.

Passing Lane Analysis

l length of analysis segment, Lt 0.0 mi
ngth of two-lane highway upstream of the passing lane, Lu mi
nqth of passing lane including tapers, Lpl mi
age travel speed, ATSd (from above) 26.8 mi/h
.ent time-spent-following, PTSFd (from above) 95.3
vel of service,(note-1) LOSd (from above) F

Average Travel Speed

wnstream length of two-lane highway within effective
ngth of passing lane for average travel speed, Lde 1.70 mi
ıth of two-lane highway downstream of effective
length of the passing lane for average travel speed, Ld mi
i factor for the effect of passing lane
ı average speed, fpl 1.11
.age travel speed including passing lane,(note-2) ATSpl

Percent Time-Spent-Following

wnstream length of two-lane highway within effective length
of passing lane for percent time-spent-following, Lde 3.60 mi
ıth of two-lane highway downstream of effective length of
..e passing lane for percent time-spent-following, Ld mi
j. factor for the effect of passing lane
n percent time-spent-following, fpl 0.62
ent time-spent-following
ıncluding passing lane,(note-3) PTSFpl %

Level of Service and Other Performance Measures (note-4)

vel of service including passing lane, LOSpl
k 15-min total travel time, TT15 veh-h

ıes:
If LOSd = F, passing lane analysis cannot be performed.
Ld < 0, use alternative Equation 20-22.
Ld < 0, use alternative Equation 20-20.
v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway
egment Worksheet.

HCS2000: Two-Lane Highways Release 4.1c

ıone: Fax:
Mail:

Directional Two-Lane Highway Segment Analysis

lyst MN
ncy/Co. E&K
ıte Performed 2/20/2003
ıalysis Time Period AM Peak
ıway Connector Road
_n/To Trem. Pt Rd to Ind. Rd NORTH
risdiction
lysis Year Design Level
cription NB Direction

Input Data

ıway class Class 1 Peak-hour factor, PHF 0.90
ıoulder width 3.0 ft % Trucks and buses 13 %
ne width 12.0 ft % Trucks crawling 0.0 %
ment length 0.0 mi Truck crawl speed 0.0 mi/hr
ain type Specific Grade % Recreational vehicles 0 %
ade: Length 0.25 mi % No-passing zones 0 %
Up/down 3.0 % Access points/mi 0 /mi

ıalysis direction volume, Vd 1808 veh/h
ɔposing direction volume, Vo 459 veh/h

Average Travel Speed

ction	Analysis(d)	Opposing (o)
E for trucks, ET	1.5	1.5*
E for RVs, ER	1.0	1.0
avy-vehicle adj. factor,(note-5) fHV	0.939	0.939
le adj. factor,(note-1) fG	1.00	1.00
ctional flow rate,(note-2) vi	2139 pc/h	543 pc/h

e-Flow Speed from Field Measurement:
d measured speed,(note-3) S FM - mi/h
ɔserved volume,(note-3) Vf - veh/h
stimated Free-Flow Speed:
e free-flow speed,(note-3) BFFS 55.0 mi/h
for lane and shoulder width,(note-3) fLS 2.6 mi/h
lj. for access points,(note-3) fA 0.0 mi/h

e-flow speed, FFSd 52.4 mi/h

ljustment for no-passing zones, fnp 0.9 mi/h
rage travel speed, ATSd 30.7 mi/h

Percent Time-Spent-Following

ction	Analysis(d)	Opposing (o)
E for trucks, ET	1.0	1.1
E for RVs, ER	1.0	1.0
vy-vehicle adjustment factor, fHV	1.000	0.987

de adjustment factor,(note-1) fG 0.92 1.00
rectional flow rate,(note-2) vi 2184 pc/h 517 pc/h
se percent time-spent-following,(note-4) BPTSFd 91.2 %
stment for no-passing zones, fnp 6.2
cent time-spent-following, PTSFd 97.3 %

Level of Service and Other Performance Measures

vel of service, LOS F
lume to capacity ratio, v/c 1.26
k 15-min vehicle-miles of travel, VMT15 0 veh-mi
k-hour vehicle-miles of travel, VMT60 0 veh-mi
ak 15-min total travel time, TT15 0.0 veh-h

---

tes:
If the highway is extended segment (level) or rolling terrain, fG = 1.0
vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
or the analysis direction only.
Exhibit 20-21 provides factors a and b.
Use alternative Equation 20-14 if some trucks operate at crawl speeds
a specific downgrade.

Passing Lane Analysis

l length of analysis segment, Lt 0.0 mi
ngth of two-lane highway upstream of the passing lane, Lu mi
ngth of passing lane including tapers, Lpl mi
age travel speed, ATSd (from above) 30.7 mi/h
ent time-spent-following, PTSFd (from above) 97.3
vel of service,(note-1) LOSd (from above) F

Average Travel Speed

wnstream length of two-lane highway within effective
ngth of passing lane for average travel speed, Lde 1.70 mi
gth of two-lane highway downstream of effective
length of the passing lane for average travel speed, Ld mi
li factor for the effect of passing lane
average speed, fpl 1.11
rage travel speed including passing lane,(note-2) ATSpl

Percent Time-Spent-Following

wnstream length of two-lane highway within effective length
of passing lane for percent time-spent-following, Lde 3.60 mi
gth of two-lane highway downstream of effective length of
e passing lane for percent time-spent-following, Ld mi
lj. factor for the effect of passing lane
n percent time-spent-following, fpl 0.62
ent time-spent-following
including passing lane,(note-3) PTSFpl %

Level of Service and Other Performance Measures (note-4)

vel of service including passing lane, LOSpl
k 15-min total travel time, TT15 veh-h

tes:
If LOSd = F, passing lane analysis cannot be performed.
Ld < 0, use alternative Equation 20-22.
Ld < 0, use alternative Equation 20-20.
v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway
Segment Worksheet.

HCS2000: Two-Lane Highways Release 4.1c

one: Fax:
Mail:

Directional Two-Lane Highway Segment Analysis

-'yst MN
ıcy/Co. E&K
ıe Performed 2/20/2003
alysis Time Period PM Peak
way Connector Road
ı/To Trem. Pt Rd to Ind. Rd NORTH
ıisdiction
alysis Year Design Level
ɔription SB Direction

Input Data

way class Class 1 Peak-hour factor, PHF 0.90
oulder width 3.0 ft % Trucks and buses 11 %
ne width 12.0 ft % Trucks crawling 0.0 %
nent length 0.0 mi Truck crawl speed 0.0 mi/hr
ain type Specific Grade % Recreational vehicles 0 %
ade: Length 0.25 mi % No-passing zones 0 %
Up/down 3.0 % Access points/mi 0 /mi

aıysis direction volume, Vd 1660 veh/h
posing direction volume, Vo 517 veh/h

Average Travel Speed

ection Analysis(d) Opposing (o)
for trucks, ET 1.5 1.5*
for RVs, ER 1.0 1.0
avy-vehicle adj. factor,(note-5) fHV 0.948 0.948
le adj. factor,(note-1) fG 1.00 1.00
ctional flow rate,(note-2) vi 1946 pc/h 606 pc/h

ee-Flow Speed from Field Measurement:
l measured speed,(note-3) S FM - mi/h
erved volume,(note-3) Vf - veh/h
timated Free-Flow Speed:
free-flow speed,(note-3) BFFS 55.0 mi/h
for lane and shoulder width,(note-3) fLS 2.6 mi/h
. for access points,(note-3) fA 0.0 mi/h

-flow speed, FFSd 52.4 mi/h

justment for no-passing zones, fnp 0.7 mi/h
rage travel speed, ATSd 31.9 mi/h

Percent Time-Spent-Following

ction Analysis(d) Opposing (o)
for trucks, ET 1.0 1.1
E for RVs, ER 1.0 1.0
avy-vehicle adjustment factor, fHV 1.000 0.989

ıde adjustment factor,(note-1) fG 0.92 1.00
ırectional flow rate,(note-2) vi 2005 pc/h 581 pc/h
ase percent time-spent-following,(note-4) BPTSFd 90.2 %
ustment for no-passing zones, fnp 5.1
cent time-spent-following, PTSFd 95.3 %

Level of Service and Other Performance Measures

evel of service, LOS F
olume to capacity ratio, v/c 1.14
ık 15-min vehicle-miles of travel, VMT15 0 veh-mi
ık-hour vehicle-miles of travel, VMT60 0 veh-mi
eak 15-min total travel time, TT15 0.0 veh-h

---

ves:
If the highway is extended segment (level) or rolling terrain, fG = 1.0
vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
or the analysis direction only.
Exhibit 20-21 provides factors a and b.
Use alternative Equation 20-14 if some trucks operate at crawl speeds
ı a specific downgrade.

Passing Lane Analysis

ıl length of analysis segment, Lt 0.0 mi
ıgth of two-lane highway upstream of the passing lane, Lu mi
ngth of passing lane including tapers, Lpl mi
rage travel speed, ATSd (from above) 31.9 mi/h
cent time-spent-following, PTSFd (from above) 95.3
vel of service,(note-1) LOSd (from above) F

Average Travel Speed

ownstream length of two-lane highway within effective
ngth of passing lane for average travel speed, Lde 1.70 mi
gth of two-lane highway downstream of effective
length of the passing lane for average travel speed, Ld mi
li. factor for the effect of passing lane
n average speed, fpl 1.11
rage travel speed including passing lane,(note-2) ATSpl

Percent Time-Spent-Following

ownstream length of two-lane highway within effective length
of passing lane for percent time-spent-following, Lde 3.60 mi
gth of two-lane highway downstream of effective length of
ıe passing lane for percent time-spent-following, Ld mi
lj. factor for the effect of passing lane
on percent time-spent-following, fpl 0.62
cent time-spent-following
ıcluding passing lane,(note-3) PTSFpl %

Level of Service and Other Performance Measures (note-4)

vel of service including passing lane, LOSpl
ak 15-min total travel time, TT15 veh-h

ıes:
If LOSd = F, passing lane analysis cannot be performed.
Ld < 0, use alternative Equation 20-22.
Ld < 0, use alternative Equation 20-20.
v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway
Segment Worksheet.

HCS2000: Multilane Highways Release 4.1c

one:
mail:

Fax:

OPERATIONAL ANALYSIS

nalyst:	MN
gency/Co:	E&K
te:	2/19/2003
..alsis Period:	AM Peak
ighway:	Connector Road
om/To:	Tremley Pt Rd to Ind. Rd SOUTH
risdiction:	
nalysis Year:	Design Level
roject ID:	Interchange 12 - Connector Road (Dir. 1 = NB. Dir. 2 = SB)

FREE-FLOW SPEED

Direction	1		2	
ne width	12.0	ft	12.0	ft
ateral clearance:				
Right edge	3.0	ft	3.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	9.0	ft	9.0	ft
ccess points per mile	0		0	
dian type	Undivided		Undivided	
ee-flow speed:	Base		Base	
FFS or BFFS	55.0	mph	55.0	mph
ne width adjustment, FLW	0.0	mph	0.0	mph
eral clearance adjustment, FLC	0.6	mph	0.6	mph
edian type adjustment, FM	1.6	mph	1.6	mph
cess points adjustment, FA	0.0	mph	0.0	mph
e-flow speed	52.8	mph	52.8	mph

VOLUME

Direction	1		2	
olume, V	2158	vph	666	vph
ak-hour factor, PHF	0.90		0.90	
ak 15-minute volume, v15	599		185	
rucks and buses	14	%	25	%
ecreational vehicles	0	%	0	%
rain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
nber of lanes	2		2	
iver population adjustment, fP	1.00		1.00	
rucks and buses PCE, ET	1.5		1.5	
creational vehicles PCE, ER	1.2		1.2	
avy vehicle adjustment, fHV	0.935		0.889	
low rate, vp	1282	pcphpl	416	pcphpl

RESULTS

Direction	1		2	
)w rate, vp	1282	pcphpl	416	pcphpl
:ee-flow speed, FFS	52.8	mph	52.8	mph
⁄q. passenger-car travel speed, S	52.8	mph	52.8	mph
⁄el of service, LOS	C		A	
:nsity, D	24.3	pc/mi/ln	7.9	pc/mi/ln

)verall results are not computed when free-flow speed is less than 45 mph.

HCS2000: Multilane Highways Release 4.1c

ɔne: Fax:
ıail:

OPERATIONAL ANALYSIS

ıalyst:	MN
ɹency/Co:	E&K
ːe:	2/19/2003
ıalsis Period:	PM Peak
ighway:	Connector Road
ɔm/To:	Trem. Pt Rd to Ind. Rd SOUTH
ːisdiction:	
ıalysis Year:	Design Level
ˀoject ID:	Interchange 12 - Connector Road (Dir. 1 = NB. Dir. 2 = SB)

FREE-FLOW SPEED

Direction	1		2	
..ıe width	12.0	ft	12.0	ft
ıteral clearance:				
Right edge	3.0	ft	3.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	9.0	ft	9.0	ft
ˀcess points per mile	0		0	
ɭian type	Undivided		Undivided	
.ee-flow speed:	Base		Base	
FFS or BFFS	55.0	mph	55.0	mph
ıe width adjustment, FLW	0.0	mph	0.0	mph
ːeral clearance adjustment, FLC	0.6	mph	0.6	mph
ɛdian type adjustment, FM	1.6	mph	1.6	mph
ˀcess points adjustment, FA	0.0	mph	0.0	mph
ɛe-flow speed	52.8	mph	52.8	mph

VOLUME

Direction	1		2	
ɔlume, V	770	vph	2040	vph
ık-hour factor, PHF	0.90		0.90	
ık 15-minute volume, v15	214		567	
ːucks and buses	25	%	13	%
ˀːreational vehicles	0	%	0	%
ːrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
ıber of lanes	2		2	
..ver population adjustment, fP	1.00		1.00	
ːucks and buses PCE, ET	1.5		1.5	
ːreational vehicles PCE, ER	1.2		1.2	
ıvy vehicle adjustment, fHV	0.889		0.939	
.ow rate, vp	481	pcphpl	1207	pcphpl

RESULTS

Direction	1		2	
ɔw rate, vp	481	pcphpl	1207	pcphpl
·ee-flow speed, FFS	52.8	mph	52.8	mph
vg. passenger-car travel speed, S	52.8	mph	52.8	mph
vel of service, LOS	A		C	
ɹnsity, D	9.1	pc/mi/ln	22.9	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

HCS2000: Multilane Highways Release 4.1c

one: Fax:
nail:

OPERATIONAL ANALYSIS

alyst:	MN
gency/Co:	E&K
te:	2/19/2003
alsis Period:	AM Peak
ighway:	Connector Road
om/To:	Trem. Pt Rd to Ind. Rd SOUTH
risdiction:	
alysis Year:	Full Build
roject ID:	Interchange 12 - Connector Road (Dir. 1 = NB. Dir. 2 = SB)

FREE-FLOW SPEED

Direction	1		2	
ne width	12.0	ft	12.0	ft
ateral clearance:				
Right edge	3.0	ft	3.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	9.0	ft	9.0	ft
ccess points per mile	0		0	
dian type	Undivided		Undivided	
ee-flow speed:	Base		Base	
FFS or BFFS	55.0	mph	55.0	mph
ne width adjustment, FLW	0.0	mph	0.0	mph
teral clearance adjustment, FLC	0.6	mph	0.6	mph
edian type adjustment, FM	1.6	mph	1.6	mph
ccess points adjustment, FA	0.0	mph	0.0	mph
ee-flow speed	52.8	mph	52.8	mph

VOLUME

Direction	1		2	
olume, V	3197	vph	965	vph
ak-hour factor, PHF	0.90		0.90	
ak 15-minute volume, v15	888		268	
rucks and buses	13	%	25	%
creational vehicles	0	%	0	%
rain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
mber of lanes	2		2	
iver population adjustment, fP	1.00		1.00	
ucks and buses PCE, ET	1.5		1.5	
reational vehicles PCE, ER	1.2		1.2	
avy vehicle adjustment, fHV	0.939		0.889	
low rate, vp	1891	pcphpl	603	pcphpl

RESULTS

Direction	1		2	
ɔw rate, vp	1891	pcphpl	603	pcphpl
ɾee-flow speed, FFS	52.8	mph	52.8	mph
vg. passenger-car travel speed, S	50.1	mph	52.8	mph
vel of service, LOS	E		B	
ɹnsity, D	37.7	pc/mi/ln	11.4	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

HCS2000: Multilane Highways Release 4.1c

one: Fax:
nail:

OPERATIONAL ANALYSIS

alyst:	MN
gency/Co:	E&K
te:	2/19/2003
alsis Period:	PM Peak
ghway:	Connector Road
om/To:	Trem. Pt Rd to Ind. Rd SOUTH
risdiction:	
alysis Year:	Full Build
roject ID:	Interchange 12 - Connector Road (Dir. 1 = NB. Dir. 2 = SB)

FREE-FLOW SPEED

Direction	1		2	
ne width	12.0	ft	12.0	ft
teral clearance:				
Right edge	3.0	ft	3.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	9.0	ft	9.0	ft
cess points per mile	0		0	
lian type	Undivided		Undivided	
ee-flow speed:	Base		Base	
FFS or BFFS	55.0	mph	55.0	mph
ne width adjustment, FLW	0.0	mph	0.0	mph
eral clearance adjustment, FLC	0.6	mph	0.6	mph
edian type adjustment, FM	1.6	mph	1.6	mph
cess points adjustment, FA	0.0	mph	0.0	mph
ee-flow speed	52.8	mph	52.8	mph

VOLUME

Direction	1		2	
olume, V	1140	vph	3056	vph
ak-hour factor, PHF	0.90		0.90	
ak 15-minute volume, v15	317		849	
ucks and buses	25	%	12	%
creational vehicles	0	%	0	%
rain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
ber of lanes	2		2	
ver population adjustment, fP	1.00		1.00	
ucks and buses PCE, ET	1.5		1.5	
reational vehicles PCE, ER	1.2		1.2	
vy vehicle adjustment, fHV	0.889		0.943	
low rate, vp	712	pcphpl	1799	pcphpl

RESULTS

Direction	1		2	
ɔw rate, vp	712	pcphpl	1799	pcphpl
ɹee-flow speed, FFS	52.8	mph	52.8	mph
ʋg. passenger-car travel speed, S	52.8	mph	50.7	mph
vel of service, LOS	B		E	
nsity, D	13.5	pc/mi/ln	35.5	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

HCS2000: Multilane Highways Release 4.1c

one: Fax:
mail:

OPERATIONAL ANALYSIS

alyst:	MN
ency/Co:	E&K
e:	2/19/2003
alsis Period:	AM Peak
ghway:	Connector Road
m/To:	Trem. Pt Rd to Ind. Rd NORTH
risdiction:	
alysis Year:	Design Level
ject ID:	Interchange 12 - Connector Road (Dir. 1 = NB. Dir. 2 = SB)

FREE-FLOW SPEED

Direction	1		2	
ne width	12.0	ft	12.0	ft
teral clearance:				
Right edge	3.0	ft	3.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	9.0	ft	9.0	ft
ess points per mile	0		0	
dian type	Undivided		Undivided	
ee-flow speed:	Base		Base	
FFS or BFFS	55.0	mph	55.0	mph
e width adjustment, FLW	0.0	mph	0.0	mph
eral clearance adjustment, FLC	0.6	mph	0.6	mph
dian type adjustment, FM	1.6	mph	1.6	mph
ess points adjustment, FA	0.0	mph	0.0	mph
e-flow speed	52.8	mph	52.8	mph

VOLUME

Direction	1		2	
lume, V	1808	vph	512	vph
k-hour factor, PHF	0.90		0.90	
ak 15-minute volume, v15	502		142	
ucks and buses	13	%	25	%
reational vehicles	0	%	0	%
rain type	Grade		Grade	
Grade	3.00	%	3.00	%
Segment length	0.21	mi	0.15	mi
ber of lanes	2		2	
iver population adjustment, fP	1.00		1.00	
ucks and buses PCE, ET	1.5		1.5	
reational vehicles PCE, ER	1.2		1.2	
avy vehicle adjustment, fHV	0.939		0.889	
ow rate, vp	1069	pcphpl	320	pcphpl

RESULTS

Direction	1		2	
ɔw rate, vp	1069	pcphpl	320	pcphpl
:ee-flow speed, FFS	52.8	mph	52.8	mph
'g. passenger-car travel speed, S	52.8	mph	52.8	mph
vel of service, LOS	C		A	
ensity, D	20.3	pc/mi/ln	6.1	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

HCS2000: Multilane Highways Release 4.1c

one: Fax:
nail:

OPERATIONAL ANALYSIS

alyst:	MN
gency/Co:	E&K
te:	2/19/2003
alsis Period:	PM Peak
ighway:	Connector Road
om/To:	Trem. Pt Rd to Ind. Rd NORTH
risdiction:	
alysis Year:	Design Level
roject ID:	Interchange 12 - Connector Road (Dir. 1 = NB. Dir. 2 = SB)

FREE-FLOW SPEED

Direction	1		2	
ne width	12.0	ft	12.0	ft
ateral clearance:				
Right edge	3.0	ft	3.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	9.0	ft	9.0	ft
cess points per mile	0		0	
dian type	Undivided		Undivided	
ee-flow speed:	Base		Base	
FFS or BFFS	55.0	mph	55.0	mph
ne width adjustment, FLW	0.0	mph	0.0	mph
teral clearance adjustment, FLC	0.6	mph	0.6	mph
edian type adjustment, FM	1.6	mph	1.6	mph
cess points adjustment, FA	0.0	mph	0.0	mph
ee-flow speed	52.8	mph	52.8	mph

VOLUME

Direction	1		2	
olume, V	576	vph	1660	vph
ak-hour factor, PHF	0.90		0.90	
ak 15-minute volume, v15	160		461	
rucks and buses	25	%	11	%
creational vehicles	0	%	0	%
rain type	Grade		Grade	
Grade	3.00	%	3.00	%
Segment length	0.21	mi	0.15	mi
mber of lanes	2		2	
iver population adjustment, fP	1.00		1.00	
rucks and buses PCE, ET	1.5		1.5	
creational vehicles PCE, ER	1.2		1.2	
avy vehicle adjustment, fHV	0.889		0.948	
low rate, vp	360	pcphpl	972	pcphpl

RESULTS

Direction	1		2	
ɔw rate, vp	360	pcphpl	972	pcphpl
:ee-flow speed, FFS	52.8	mph	52.8	mph
'g. passenger-car travel speed, S	52.8	mph	52.8	mph
vel of service, LOS	A		C	
:nsity, D	6.8	pc/mi/ln	18.4	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

HCS2000: Multilane Highways Release 4.1c

)ne: Fax:
.nail:

OPERATIONAL ANALYSIS

ıalyst:	MN
'ency/Co:	E&K
:e:	2/19/2003
ıalsis Period:	AM Peak
.ghway:	Connector Road
)m/To:	Trem. Pt Rd to Ind. Rd NORTH
.:isdiction:	
ıalysis Year:	Full Build
)ject ID:	Interchange 12 - Connector Road (Dir. 1 = NB. Dir. 2 = SB)

FREE-FLOW SPEED

Direction	1		2	
.ıe width	12.0	ft	12.0	ft
ıteral clearance:				
Right edge	3.0	ft	3.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	9.0	ft	9.0	ft
'ess points per mile	0		0	
lian type	Undivided		Undivided	
:ee-flow speed:	Base		Base	
FFS or BFFS	55.0	mph	55.0	mph
:e width adjustment, FLW	0.0	mph	0.0	mph
.eral clearance adjustment, FLC	0.6	mph	0.6	mph
:dian type adjustment, FM	1.6	mph	1.6	mph
:ess points adjustment, FA	0.0	mph	0.0	mph
:e-flow speed	52.8	mph	52.8	mph

VOLUME

Direction	1		2	
)lume, V	2699	vph	755	vph
.k-hour factor, PHF	0.90		0.90	
.k 15-minute volume, v15	750		210	
:ucks and buses	12	%	25	%
:reational vehicles	0	%	0	%
'rain type	Grade		Grade	
Grade	3.00	%	3.00	%
Segment length	0.21	mi	0.15	mi
lber of lanes	2		2	
.ıver population adjustment, fP	1.00		1.00	
:ucks and buses PCE, ET	1.5		1.5	
reational vehicles PCE, ER	1.2		1.2	
vy vehicle adjustment, fHV	0.943		0.889	
.ow rate, vp	1589	pcphpl	471	pcphpl

RESULTS

Direction	1		2	
ɔw rate, vp	1589	pcphpl	471	pcphpl
ee-flow speed, FFS	52.8	mph	52.8	mph
ʒ. passenger-car travel speed, S	52.0	mph	52.8	mph
el of service, LOS	D		A	
nsity, D	30.6	pc/mi/ln	8.9	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

HCS2000: Multilane Highways Release 4.1c

one: Fax:
-mail:

OPERATIONAL ANALYSIS

ıalyst:	MN
ency/Co:	E&K
te:	2/19/2003
ıalsis Period:	PM Peak
ighway:	Connector Road
om/To:	Trem. Pt Rd to Ind. Rd NORTH
ırisdiction:	
ıalysis Year:	Full Build
oject ID:	Interchange 12 - Connector Road (Dir. 1 = NB. Dir. 2 = SB)

FREE-FLOW SPEED

Direction	1		2	
ane width	12.0	ft	12.0	ft
ateral clearance:				
Right edge	3.0	ft	3.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	9.0	ft	9.0	ft
cess points per mile	0		0	
dian type	Undivided		Undivided	
ree-flow speed:	Base		Base	
FFS or BFFS	55.0	mph	55.0	mph
ne width adjustment, FLW	0.0	mph	0.0	mph
ateral clearance adjustment, FLC	0.6	mph	0.6	mph
edian type adjustment, FM	1.6	mph	1.6	mph
cess points adjustment, FA	0.0	mph	0.0	mph
ee-flow speed	52.8	mph	52.8	mph

VOLUME

Direction	1		2	
olume, V	855	vph	2510	vph
ak-hour factor, PHF	0.90		0.90	
eak 15-minute volume, v15	238		697	
rucks and buses	25	%	11	%
creational vehicles	0	%	0	%
rrain type	Grade		Grade	
Grade	3.00	%	3.00	%
Segment length	0.21	mi	0.15	mi
mber of lanes	2		2	
river population adjustment, fP	1.00		1.00	
rucks and buses PCE, ET	1.5		1.5	
creational vehicles PCE, ER	1.2		1.2	
eavy vehicle adjustment, fHV	0.889		0.948	
low rate, vp	534	pcphpl	1471	pcphpl

RESULTS

Direction	1		2	
.ow rate, vp	534	pcphpl	1471	pcphpl
ree-flow speed, FFS	52.8	mph	52.8	mph
g. passenger-car travel speed, S	52.8	mph	52.5	mph
vel of service, LOS	A		D	
nsity, D	10.1	pc/mi/ln	28.0	pc/mi/ln

Overall results are not computed when free-flow speed is less than 45 mph.

HCS2000: Signalized Intersections Release 4.1b

nalyst: JA
jency: E & K
ite: 1/28/03
eriod: AM Peak Hour
roject ID: Alt V-A w/Design Volume
W St: Industrial Rd

Inter.: Industrial Rd and Connector Rd
Area Type: All other areas
Jurisd:
Year : 2020

N/S St: Connector Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
. Lanes	2	1	0	0	2	0	0	0	0	1	0	0
Config	L	T			TR					L		
olume	1922	801			379	236				78		
ane Width	12.0	12.0			12.0					12.0		
OR Vol						50						

uration 0.25 Area Type: All other areas

Signal Operations

ase Combination	1	2	3	4	5	6	7	8
B Left	A	P			NB Left			
Thru	A	P			Thru			
Right					Right			
Peds					Peds			
B Left					SB Left	A		
Thru		P			Thru			
Right		P			Right			
Peds					Peds			
Right					EB Right			
Right					WB Right			
reen	32.0	35.0				11.0		
ellow	3.0	3.0				3.0		
l Red	1.0	1.0				1.0		

Cycle Length: 90.0 secs

Intersection Performance Summary

pr/ ne rp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
stbound								
	2153	3336	0.94	0.79	16.0	B		
	1292	1638	0.65	0.79	5.3	A	12.9	B
stbound								
	994	2557	0.60	0.39	24.6	C	24.6	C
orthbound								
outhbound								
	214	1752	0.38	0.12	37.5	D		
							37.5	D

Intersection Delay = 15.4 (sec/veh) Intersection LOS = B

HCS2000: Signalized Intersections Release 4.1b

nalyst: JA
gency: E & K
ate: 1/28/03
eriod: PM Peak Hour
roject ID: Alt V-A w/Design Volume
/W St: Industrial Rd

Inter.: Industrial Rd and Connector Rd
Area Type: All other areas
Jurisd:
Year : 2020

N/S St: Connector Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
o. Lanes	2	1	0	0	2	0	0	0	0	1	0	0
Config	L	T			TR					L		
olume	629	488			842	70				249		
ane Width	12.0	12.0			12.0					12.0		
OR Vol						40						

uration 0.25 Area Type: All other areas

Signal Operations

hase Combination	1	2	3	4	5	6	7	8
B Left	A	P						
Thru	A	P						
Right								
Peds								
B Left								
Thru		P						
Right		P						
Peds								
3 Right								
3 Right								
reen	20.0	33.0			25.0			
ellow	3.0	3.0			3.0			
l Red	1.0	1.0			1.0			

NB Left
Thru
Right
Peds
SB Left A
Thru
Right
Peds
EB Right
WB Right

Cycle Length: 90.0 secs

Intersection Performance Summary

pr/ ane rp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
stbound								
	874	2334	0.76	0.63	16.0	B		
	911	1439	0.56	0.63	10.2	B	13.5	B
estbound								
	1169	3188	0.79	0.37	30.7	C	30.7	C
orthbound								
outhbound								
	492	1770	0.53	0.28	28.7	C		
							28.7	C

Intersection Delay = 21.9 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1b

nalyst: JA
gency: E & K
ate: 03/03/03
eriod: AM Peak Hour
roject ID: Alt V w/Design Volume
W St: Tremley Point Rd.

Inter.: Tremley Pt Rd. & Connector Rd
Area Type: All other areas
Jurisd:
Year : 2020

N/S St: Connector Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
o. Lanes	0	1	2	0	1	0	2	0	1	0	0	0
Config		T	R		LT		L		R			
olume		12	425	34	3		1687		121			
ane Width		12.0	12.0		12.0		12.0		12.0			
OR Vol			0						0			

uration 0.25 Area Type: All other areas

Signal Operations

ase Combination	1	2	3	4			5	6	7	8
B Left					NB	Left	P			
Thru		A				Thru				
Right		A				Right	P			
Peds						Peds				
B Left		A			SB	Left				
Thru		A				Thru				
Right						Right				
Peds						Peds				
Right		P			EB	Right	P			
Right					WB	Right				
reen		17.0					65.0			
ellow		3.0					3.0			
l Red		1.0					1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

pr/ ne rp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
stbound								
	256	1357	0.05	0.19	30.0	C	0.9	A
	1921	1921	0.23	1.00	0.1	A		
estbound								
	159	844	0.25	0.19	31.9	C	31.9	C
orthbound								
	2299	3183	0.77	0.72	10.4	B		
							9.8	A
	1122	1122	0.11	1.00	0.2	A		
outhbound								

Intersection Delay = 8.4 (sec/veh) Intersection LOS = A

HCS2000: Signalized Intersections Release 4.1b

nalyst: JA
gency: E & K
ate: 03/03/03
eriod: PM Peak Hour
roject ID: Alt V w/Design Volume
/W St: Tremley Point Rd.

Inter.: Tremley Pt Rd. & Connector Rd
Area Type: All other areas
Jurisd:
Year : 2020

N/S St: Connector Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
o. Lanes	0	1	2	0	1	0	2	0	1	0	0	0
Config		T	R		LT		L		R			
olume		5	1572	89	9		462		55			
ane Width		12.0	12.0		12.0		12.0		12.0			
OR Vol			0						0			

uration 0.25 Area Type: All other areas

Signal Operations

ase Combination	1	2	3	4		5	6	7	8
B Left					NB Left	P			
Thru	A				Thru				
Right	A				Right	P			
Peds					Peds				
B Left	A				SB Left				
Thru	A				Thru				
Right					Right				
Peds					Peds				
Right	P				EB Right	P			
Right					WB Right				
reen	47.0					35.0			
ellow	3.0					3.0			
l Red	1.0					1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

pr/ ne rp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
stbound								
	936	1792	0.01	0.52	10.3	B	0.7	A
	2515	2515	0.66	1.00	0.6	A		
stbound								
	541	1036	0.19	0.52	11.6	B	11.6	B
orthbound								
	920	2366	0.53	0.39	23.3	C		
							20.8	C
	973	973	0.06	1.00	0.1	A		
outhbound								

Intersection Delay = 5.9 (sec/veh) Intersection LOS = A

HCS2000: Signalized Intersections Release 4.1b

Analyst: JA
Agency: E & K
Date: 1/30/03
Period: AM Peak Hour
Project ID: Alt V-A w/Full Build-out Volume
E/W St: Industrial Rd

Inter.: Industrial Rd and Connector Rd
Area Type: All other areas
Jurisd:
Year : 2020
N/S St: Connector Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	2	1	0	0	2	0	0	0	0	1	0	0
LGConfig	L	T			TR					L		
Volume	2854	801			379	343				94		
Lane Width	12.0	12.0			12.0					12.0		
RTOR Vol						50						

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4	5	6	7	8
EB	Left	A	P						
	Thru	A	P						
	Right								
	Peds								
WB	Left								
	Thru		P						
	Right		P						
	Peds								
NB	Right								
SB	Right								
Green		48.0	22.0			8.0			
Yellow		3.0	3.0			3.0			
All Red		1.0	1.0			1.0			

NB Left
SB Left A

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	2428	3336	1.24	0.82	119.9	F		
T	1347	1638	0.63	0.82	3.9	A	94.4	F
Westbound								
TR	640	2620	1.10	0.24	101.7	F	101.7	F
Northbound								
Southbound								
L	157	1770	0.63	0.09	47.5	D	47.5	D

Intersection Delay = 94.6 (sec/veh) Intersection LOS = F

HCS2000: Signalized Intersections Release 4.1b

Analyst: JA
Agency: E & K
Date: 1/30/03
Period: PM Peak Hour
Project ID: Alt V-A w/Full Build-out Volume
E/W St: Industrial Rd

Inter.: Industrial Rd and Connector Rd
Area Type: All other areas
Jurisd:
Year : 2020
N/S St: Connector Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	2	1	0	0	2	0	0	0	0	1	0	0
LGConfig	L	T			TR					L		
Volume	945	488			842	84				352		
Lane Width	12.0	12.0			12.0					12.0		
RTOR Vol						40						

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4	5	6	7	8
EB	Left	A	P			NB Left			
	Thru	A	P			Thru			
	Right					Right			
	Peds					Peds			
WB	Left					SB Left	A		
	Thru		P			Thru			
	Right		P			Right			
	Peds					Peds			
NB	Right					EB Right			
SB	Right					WB Right			
Green		25.0	30.0				23.0		
Yellow		3.0	3.0				3.0		
All Red		1.0	1.0				1.0		

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	1025	2334	0.97	0.66	35.5	D		
T	943	1439	0.55	0.66	9.0	A	26.5	C
Westbound								
TR	1062	3186	0.88	0.33	38.5	D	38.5	D
Northbound								
Southbound								
L	452	1770	0.82	0.26	43.1	D	43.1	D

Intersection Delay = 32.7 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1b

nalyst: JA
gency: E & K
ate: 03/03/03
eriod: AM Peak Hour
roject ID: Alt V w/Full Build Volume
'W St: Tremley Point Rd.

Inter.: Tremley Pt. Rd & Connector Rd
Area Type: All other areas
Jurisd:
Year : 2020

N/S St: Connector Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
o. Lanes	0	1	2	0	1	0	2	0	1	0	0	0
Config		T	R		LT		L		R			
olume		19	625	52	5		2564		186			
ane Width		12.0	12.0		12.0		12.0		12.0			
OR Vol			0						0			

uration 0.25 Area Type: All other areas

Signal Operations

ase Combination	1	2	3	4		5	6	7	8
B Left					NB Left	P			
Thru	A				Thru				
Right	A				Right	P			
Peds					Peds				
B Left	A				SB Left				
Thru	A				Thru				
Right					Right				
Peds					Peds				
R Right	P				EB Right	P			
Right					WB Right				
reen	10.0					72.0			
ellow	3.0					3.0			
l Red	1.0					1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

pr/ ne rp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
stbound								
	151	1357	0.13	0.11	36.5	D	1.2	A
	1921	1921	0.34	1.00	0.1	A		
stbound								
T	87	780	0.69	0.11	59.2	E	59.2	E
orthbound								
	2546	3183	1.06	0.80	45.3	D		
							42.3	D
	1122	1122	0.17	1.00	0.3	A		
outhbound								

Intersection Delay = 34.9 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1b

Analyst: JA
Agency: E & K
Date: 03/03/03
Period: PM Peak Hour
Project ID: Alt V w/Full Build Volume
E/W St: Tremley Point Rd.

Inter.: Tremley Pt Rd. & Connector Rd
Area Type: All other areas
Jurisd:
Year : 2020
N/S St: Connector Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	2	0	1	0	2	0	1	0	0	0
LGConfig		T	R		LT		L		R			
Volume		8	2374	136	14		723		84			
Lane Width		12.0	12.0		12.0		12.0		12.0			
RTOR Vol			0						0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left	P			
Thru		A			Thru				
Right		A			Right	P			
Peds					Peds				
WB Left		A			SB Left				
Thru		A			Thru				
Right					Right				
Peds					Peds				
3 Right		P			EB Right	P			
3 Right					WB Right				
Green		32.0				50.0			
Yellow		3.0				3.0			
All Red		1.0				1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
	637	1792	0.01	0.36	18.8	B	16.4	B
	2515	2515	0.99	1.00	16.4	B		
Westbound								
LT	353	994	0.45	0.36	23.1	C	23.1	C
Northbound								
	1314	2366	0.58	0.56	15.0	B		
							13.4	B
R	973	973	0.09	1.00	0.2	A		
Southbound								

Intersection Delay = 16.0 (sec/veh) Intersection LOS = B

APPENDIX B

Tremley Point Connector Road Alternatives Analysis Summary

NEW JERSEY TURNPIKE AUTHORITY

OPS 1950

INTERCHANGE 12 IMPROVEMENTS

Tremley Point Connector Road

ALTERNATIVES ANALYSIS SUMMARY

FINAL REPORT

March 27, 2003

PREPARED BY:

Edwards AND Kelcey

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

The New Jersey Turnpike Authority has identified the need and begun design to improve the operations at Interchange 12 to address the current severe congestion at the toll plaza and the adjoining local streets in Carteret. The proposed improvements include the reconfiguration of the toll plaza entrance and exit ramps and improvements to the local roadways in the immediate vicinity of the Turnpike ramps. The improvements will address the projected Turnpike oriented traffic volumes generated by the proposed developments in Carteret and the anticipated traffic generated from the proposed development in the nearby Tremley Point "Brown Fields" areas of Linden. The toll plaza will be reconstructed and widened to effectively address the projected background traffic growth as well as the increased traffic volumes generated by the new developments noted above.

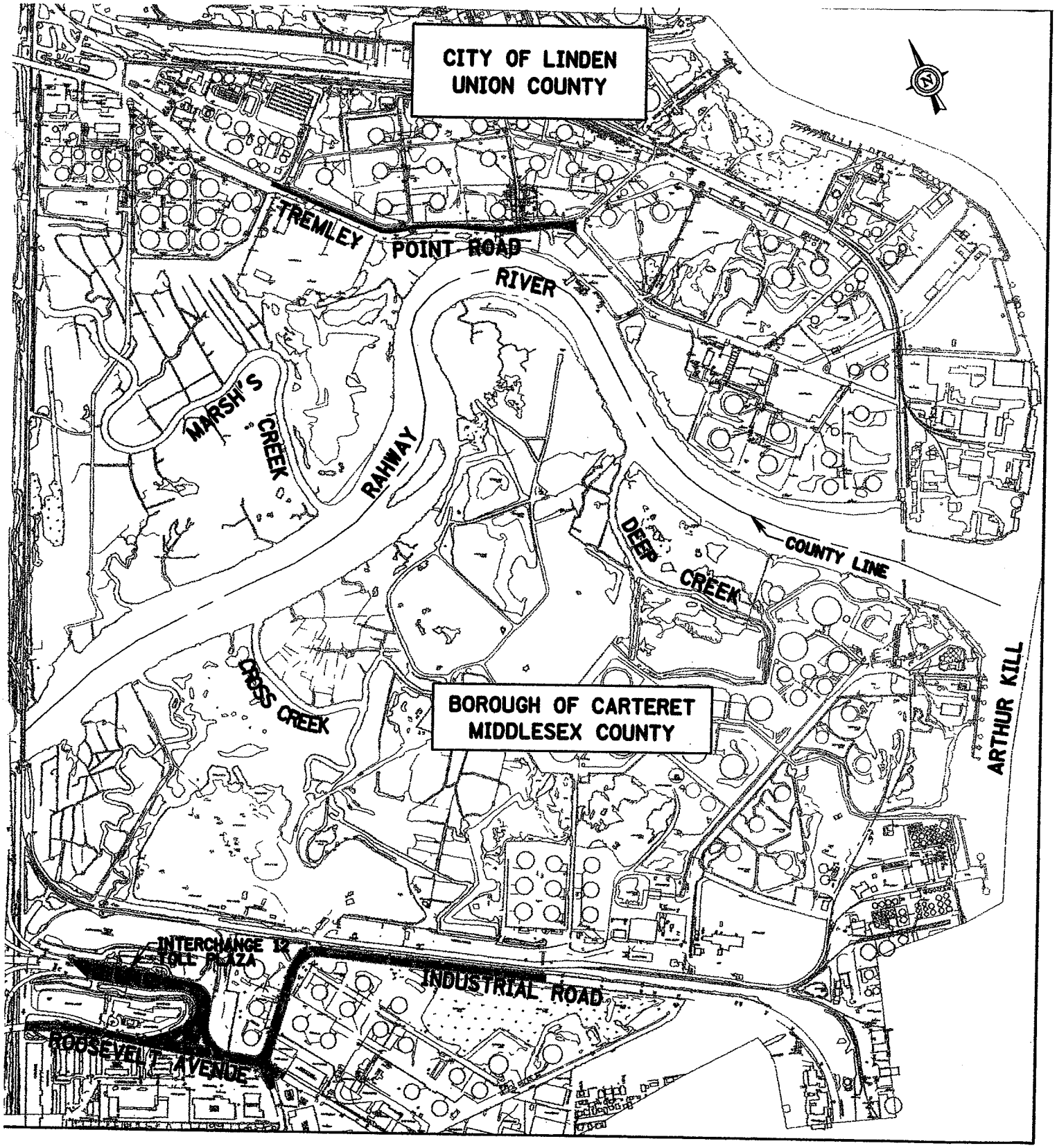
The proposed Tremley Point redevelopment area is located on the north side of the Rahway River approximately 2 miles to the north of the Interchange 12-toll plaza. The anticipated land use in this redevelopment area will generate a significant amount of truck traffic, most of which will be destined to the New Jersey Turnpike. Continued use of the existing local road network to convey this traffic to the Turnpike would require routing this increased traffic volume through the already congested and predominately residential areas of Linden. Union County has formally requested that the Turnpike Authority investigate a direct connection between the Turnpike and Tremley Point Road. In response to this request, the Turnpike Authority proposed to deliver the traffic from the Tremley Point area to the Turnpike via a new roadway between Tremley Point Road in Linden and Industrial Road in Carteret. (Figure 1) This new road will allow traffic to conveniently enter the Turnpike via the improved toll plaza at Interchange 12. The proposed roadway referred to as the "Connector Road" in this and other documents related to this project, includes the construction of a viaduct over the Rahway River and associated roadway approaches supported by walls and embankments.

The New Jersey Turnpike Authority's General Consultant, HNTB Corporation, previously investigated several conceptual alternative alignments for the Connector Road. The results of their investigation were contained in a report titled *Interchange 12 Improvements and Tremley Point Road Connector, Alternatives Study*, dated March 4, 2002. The four alignment alternatives contained in the HNTB report have been refined and are carried forward into this study. The current phase of this project includes the investigation of wetland and NJDEP documentation related to potentially contaminated areas traversed by these alignment alternatives. This investigation of existing conditions in the area and the information obtained related to the constraints due to proposed development in the vicinity of the alignments resulted in the development of three additional alignment alternatives that are included in this report. The current phase of the project also involves performing evaluations of alignment alternatives as necessary to prepare an Environmental Impact Statement in accordance with EO 215 requirements.

The alignment alternatives analysis considered environmental impacts, property acquisitions, impacts on potential development and estimated construction costs. These factors are discussed in the narrative for each alternative in this report.

Based on overall cost, environmental impacts and maintenance and operational concerns, Alternate 6 is considered to be the preferred alternate. The total estimated construction cost for this alternate is $45.4 million. Of all of the alternates considered, this alignment has the best combination of cost, overall travel length, amount of property acquisition and best orientation of the Rahway River crossing. The alignment of Alternate 6 also avoids known severely contaminated sites and utilizes existing upland areas to reduce overall wetland impacts.

The alignment of Alternate 6 will permit a posted speed of 45mph Operationally, the horizontal and vertical alignments are favorable for the large volume of trucks that are anticipated to travel on this facility. In comparison to the other alternates investigated, short length of the roadway in the preferred alternate will result in overall low travel times and vehicle-miles traveled for the vast majority of vehicles that will use this new roadway.



NEW JERSEY TURNPIKE AUTHORITY
CONNECTOR ROAD
CONCEPTUAL STUDIES

PROJECT LOCATION

1" = 1000'

FIGURE 1

II. PROJECT OVERVIEW

Project History – Proposed Connector Road

The New Jersey Turnpike Interchange 12 toll plaza and the adjacent connecting local road network in the Borough of Carteret currently experience severe traffic congestion problems. On a daily basis, the inadequate capacity of the toll plaza and connecting roadways results in significant delays for both Turnpike oriented traffic as well as local through traffic along Roosevelt Ave. Based on initial traffic studies and identification of the need to rectify this traffic congestion and at the request of the Borough of Carteret and Middlesex County, the New Jersey Turnpike Authority has committed to improving the operations at Interchange 12 and local roadways in the immediate vicinity of the Interchange. The proposed improvements include the construction of a new toll plaza with greater capacity than the existing plaza, reconfiguration of the toll plaza entrance and exit ramps and improvements of the local roadways in the vicinity of the toll plaza.

The toll plaza improvements will address the anticipated future traffic volumes in Carteret as well as the projected traffic that will be generated from the proposed development in the Tremley Point "Brown Fields" areas of Linden. The Tremley Point development area is located on the north side of the Rahway River, north of the Interchange 12 toll plaza. The proposed redevelopment of Tremley Point will generate a significant amount of truck traffic, most of which will be seeking access to the New Jersey Turnpike. Using the existing local road network to convey this traffic to the Turnpike requires routing this new traffic through the already congested and predominately residential areas of Linden. To address this undesirable situation, Union County has requested that the Turnpike Authority investigate a direct connection between the Turnpike and the proposed Tremley Point redevelopment area. To convey the traffic between the Tremley Point area and the Turnpike, a new roadway will be constructed between Tremley Point Road in Linden and Industrial Road in Carteret. This new road will allow traffic to enter the Turnpike via the improved toll plaza at Interchange 12. The proposed roadway, referred to as the "Connector Road" in this and other documents related to this project, includes the construction of a roadway through primarily wetland and landfill areas in the floodplain of the Rahway River and a viaduct over the Rahway River.

As an alternative to constructing the Connector Road, the possibility of constructing a new Turnpike interchange on the north side of the Rahway River to serve the new development in Linden was previously investigated. A study was performed by HNTB and documented in a report titled, *Alternatives Study, Proposed Interchange 12A Truck Only Interchange* dated April 18, 2001. The concept was dropped due to operational problems mostly related to the proximity of the proposed ramps for the new interchange relative to the existing ramps of Interchange 12 and Interchange 13.

Subsequent to the investigation of the Interchange 12A concept, HNTB investigated several alternative alignments for the Connector Road. The results of their investigation were contained in a report titled *Interchange 12 Improvements and Tremley Point Road Connector, Alternatives Study*, dated March 4, 2002. The four alignment alternatives contained in the HNTB report are carried forward into this study. The current phase of the project involves performing an evaluation of alignment alternatives as necessary to prepare an Environmental Impact Statement in accordance with EO 215 requirements. Investigation of available wetland and NJDEP documentation related to potentially contaminated areas resulted in the development of three additional alignment alternatives that are also included in this report.

Connector Road Intersections

The orientation of the Connector Road for all of the alternates studied is basically north/south. Both Tremley Point Road at the northern terminus of the Connector Road and Industrial Road at the southern terminus are oriented in the east/west direction. The intersections at both ends of the Connector Road are essentially signalized "T" intersections with multiple turning lanes to address the projected traffic volumes.

The proposed intersection of the Connector Road with Industrial Road at the southern limit of the roadway was analyzed to determine level of service (L.O.S.). For the Design Level traffic volumes an overall L.O.S.of C will be achieved at this intersection. The heaviest traffic moves at the intersection are oriented from Interchange 12 to the Connector Road and the return movement. The configuration of this signalized intersection will require a double left turn lane from eastbound Industrial Road to the northbound Connector Road. (Figure 2) The return move will be addressed by a channelized right turn move. Potentially, if the ultimate development of the Tremley Point area generates the maximum peak hour traffic volumes that would be routed through this intersection, the heavy movements between the Turnpike and the Connector Road would require grade separation. The grade separation of these movements would allow the intersection to operate effectively for both the traffic related to the Connector Road and the significant opposing traffic volumes traversing the intersection from westbound Industrial Road.

All of the alignment alternative plans currently include an at-grade crossing of the Connector Road with the infrequently used Conrail tracks that parallel Industrial Road. Preliminary discussions with Conrail revealed that they may require the crossing to be grade separated. If grade separation at the railroad becomes necessary, the Connector Road and Industrial Road will be raised over the railroad and the same intersection configuration will be maintained to accommodate the Design Level traffic volumes. To minimize wetland and right-of-way impacts the elevated roadway will be constructed using retaining walls.

The location and lane configuration of the proposed roadway intersection that will convey traffic generated by the proposed Tremley Point redevelopment areas in Linden to Tremley Point Road has still not been determined by Union County. Preliminary indications are that the majority of traffic destined for the Connector Road will be from the new development(s), traveling eastbound on Tremley Point Road and will make a right turn to travel south on the Connector Road. Based on current land use along the eastern end of Tremley Point Road, it is not anticipated that a significant number of vehicles will travel westbound on Tremley Point Road and make a left turn onto the Connector Road. With this distribution of traffic, the proposed configuration of the intersection is shown in Figure 3. This configuration of the intersection will operate with an overall L.O.S. C for the Design Level of traffic.

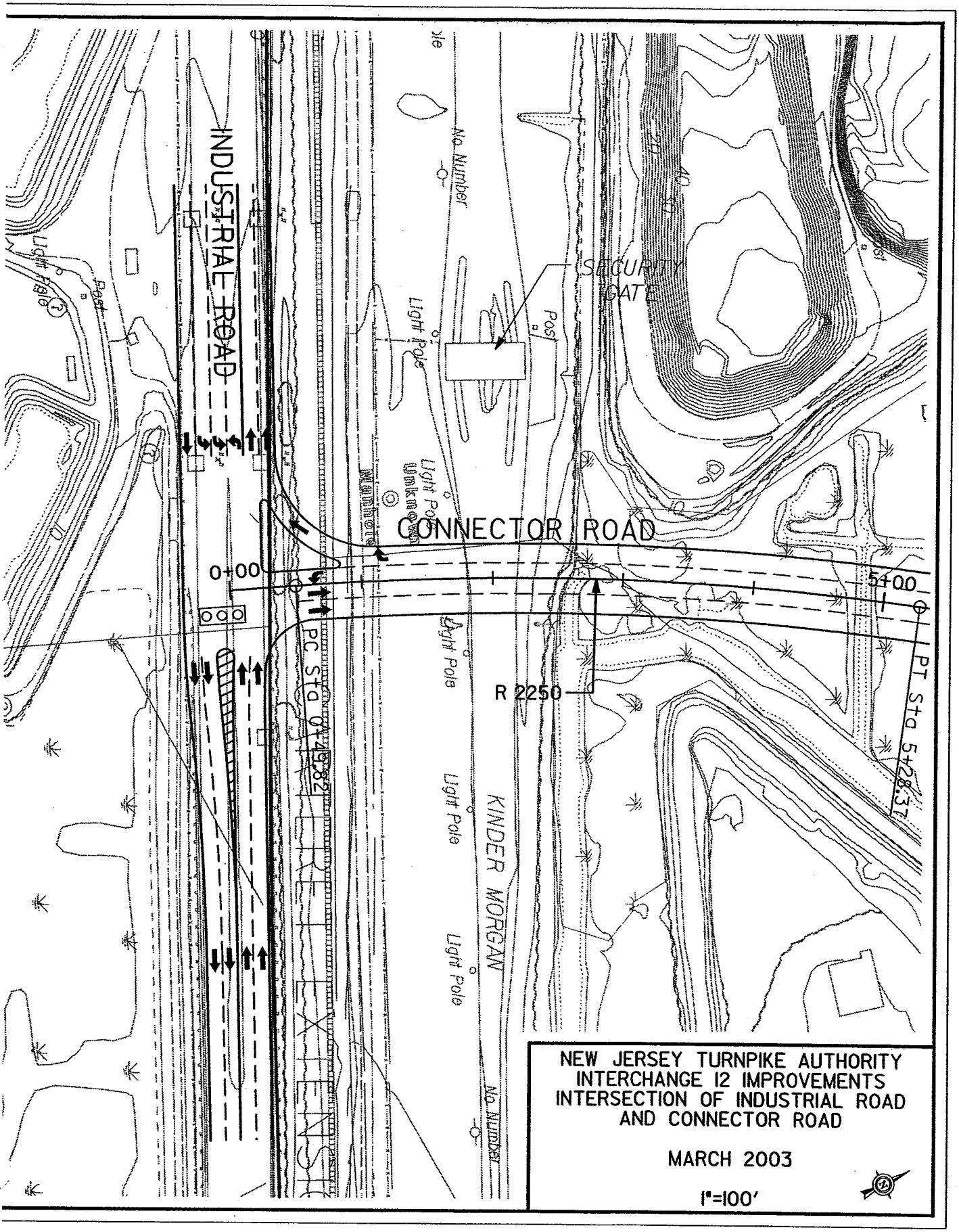
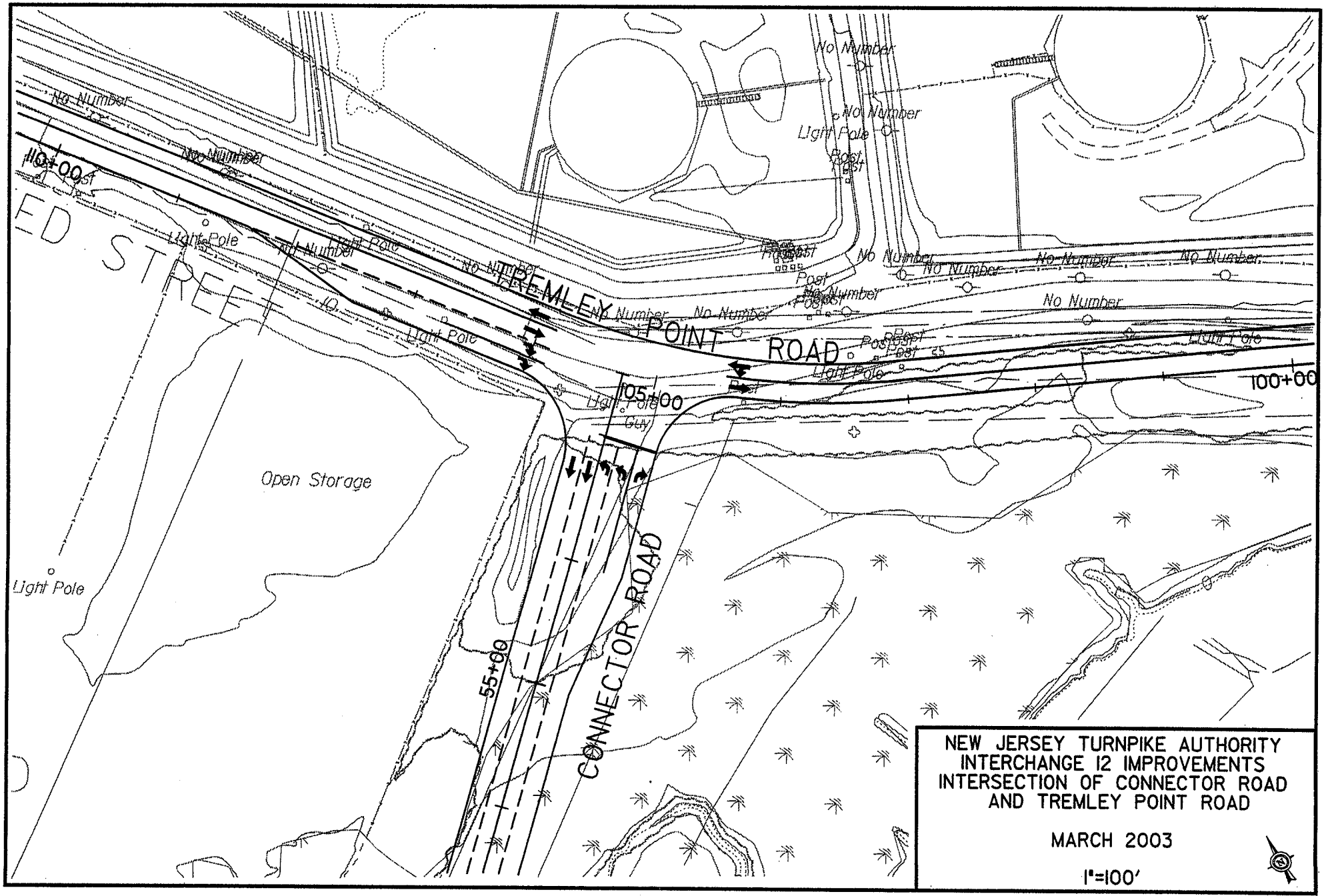

INDUSTRIAL ROAD
CONNECTOR ROAD
SECURITY GATE
KINDER MORGAN
No Number
Light Pole
Post
Manhole
Unknown
0+00
5+00
PC Sta 0+49.82
PT Sta 5+28.37
R 2250
NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
INTERSECTION OF INDUSTRIAL ROAD
AND CONNECTOR ROAD
MARCH 2003
1"=100'

Figure 2


TREMLEY POINT ROAD
CONNECTOR ROAD
110+00
105+00
100+00
55+00
No Number
Light Pole
Post
Guy
Open Storage
NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
INTERSECTION OF CONNECTOR ROAD
AND TREMLEY POINT ROAD
MARCH 2003
1"=100'

Constructibility.

All of the alignment alternatives involve the same constructibility issues. The two major issues are: Construction Access and Soil Conditions. The design of the Connector Road minimizes the footprint of the facility to limit wetland impacts. This will be achieved through the use of retaining walls and a viaduct. Since the alignments of the various alternatives use existing upland areas to reduce the permanent wetland impacts, adjoining areas that will be used for construction access and the area required for construction of the Connector Road itself will mostly be in wetland areas. Use of temporary timber matting can provide a means of vehicle access through the soft soil conditions in the wetlands. Use of the timber matting during construction and its subsequent removal at the completion of construction will not permanently impact the wetland areas. Timber matting can provide a means of traveling adjacent to the construction area to permit transport of materials and equipment to the site. This method of construction access will also provide working platform areas in the vicinity of viaduct piers. It is anticipated that obtaining the wetland permits for the construction of the Connector Road will require that the construction contract include restoring wetland vegetation in the area of the temporary access roadway. The permits for the project will also include provisions to address future maintenance activities that would take place within the Construction and Maintenance Easement areas adjacent to the permanent construction.

The existing soils through the areas of the alternate alignments exhibit two general conditions. The natural soil condition includes a combination of soft, wet, compressible, organic and inorganic materials. The man-made elements include landfills containing contamination. Several of the proposed alignments traverse documented landfill areas or sites that contain contaminates released by previous industrial activity. These impacts are discussed in the narrative for the individual alternates. However, beyond the documented evidence, there is a probability that the soil under any of the proposed alternatives will contain materials that will require special handling or clean-up provisions during construction. A preliminary soil boring program will be performed as an element of this study in the vicinity of the preferred alignment and will yield information related to the basic composition of the soils. Subsequent soil evaluations will also be performed during the final design phase of the project that will provide more detailed information, particularly in final pier and retaining wall locations.

The soil boring information will be used in determining the location and limits of foundation options for the proposed structures. Based on preliminary soils data, pile foundations are anticipated to be used for the piers of the viaduct structure. Depending on the depth of the wet compressible material and any evidence of contamination that is found during the boring operation, the limits and the types of retaining walls and foundations will be adjusted. A mechanically stabilized earth retaining wall system is currently proposed for a majority of the length of the Connector Road. This system will require some areas of pre-consolidation of the soil, in conjunction with the use of wick drains, prior to the final construction. If evidence of contaminated groundwater is revealed, this wall system could be replaced with a system using displacement piles that will greatly reduce the amount of contaminated material that will be removed or require treatment. The final selection of wall types will consider the overall construction cost as well as the constructibility of the system.

Stormwater Management

The approach to stormwater management for all of the alternatives will mainly involve addressing stormwater quality issues. Since all of the alternatives are within the 100 year tidal flood area, water quantity controls will not be required in accordance with NJDEP Stream Encroachment / Waterfront Development Regulations. Water quality control may need to be addressed for proposed drainage connections to existing drainage facilities with inadequate capacity or to address soil erosion stability issues at new outfalls. The primary

method of addressing water quality will be the use of stormwater management basins, supplemented with underground water quality chambers if necessary.

There are three potential locations for the stormwater management basins. The alignments of the Connector Road are oriented to avoid impacts to the existing and proposed development sites (Kinder Morgan and the Slayton Development) near Industrial Road on the southern end of the roadway. This will result in the creation of several valley areas between the fill areas of the adjacent sites and the embankment or retaining walls of the Connector Road. These otherwise unusable areas are potential locations for stormwater management basins. The second potential location for stormwater management basins is located in adjacent upland areas near the Tremley Point road tie-in. Finally, basins could be constructed under the viaduct in the wetland areas that will already be at least partially impacted by the shading affect of the viaduct. The size and capacity of each of these basins will be related to the volume of water that the roadway grading will deliver to a particular basin location. In addition, the elevation of the basin bottom relative to the seasonal high groundwater elevation and the presence of soil or groundwater contamination will be key design issues.

Bridge Scour

Scour protection of the proposed Rahway River crossing and culvert crossings of major ditches is expected to be addressed by the use of pile supported substructures founded on sound bedrock. Riprap may be required at the abutments to prevent washout of embankments and roadways.

Permit Requirements

The Connector Road will require several environmental approvals. Specifically, the construction of the Connector Road would result in disturbance of more than 5,000 square feet of soil, requiring a Soil Erosion and Sediment Control Plan certification from the Freehold and Somerset-Union Soil Conservation Districts (SCDs), pursuant to the Soil Erosion and Sediment Control Act of 1975. The Connector Road will also require authorization under NJDEP's Construction Activity Storm Water General Permit Program of the New Jersey Pollutant Discharge Elimination System (NJPDES), administered jointly by the NJDEP and the SCD.

All of the alternatives impact wetlands on both sides of the Rahway River. All of the wetland areas impacted are considered "intermediate value" wetlands. A Stream Encroachment Permit, Freshwater Wetlands Individual Permit, Waterfront Development Permit and a Riparian Instrument will also be required from the NJDEP. A Stream Encroachment Permit will be required due to activities within the 100-year flood plain. A wetlands permit is necessary due to impacts to tidal wetlands along the proposed roadway alignment. A Waterfront Development Permit and Riparian Instrument will be needed due to historically flowed tidelands within the primary impact area.

As the Connector Road will traverse over the Rahway River, a navigable river used for commerce, U.S. Coast Guard (USCG) approval is also required. This approval will require that a Navigation Study be performed to determine if the 35 foot vertical clearance provided by the alternatives in this study is adequate. In addition, an U.S. Army Corps of Engineers (USACE) Section 10/404 Individual Permit is required for structures and fill that will be placed within navigable waters of the U.S. and tidally influenced wetlands. Subsequent to a meeting with the USCG, it was determined that an Environmental Assessment (EA) pursuant to the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality (CEQ) regulations implementing NEPA will need to be prepared to assist the USCG, USACE and other regulatory and review agencies in their review of the project. The EA will be prepared to determine whether the proposed Connector Road will have potentially significant effects on the environment. If significant impacts are

identified, an Environmental Impact Statement (EIS) would be required. If the impacts of the project after mitigation are less than significant, a Finding of No Significant Impact (FONSI) document may be necessary.

Schedule

All of the alignment alternatives are similar relative to factors that will impact the duration of construction. They all include the construction of a viaduct, retaining walls and pavement. Since the alignments involve mostly new construction, there are only minor concerns related to maintenance of traffic. These factors suggest that construction of the Connector Road can be completed in approximately two years. The design, permit preparation and approvals are also anticipated to take approximately two years.

III. TRAFFIC ANALYSIS

Connector Road Lane Requirements

The proposed Connector Road will cross over the Rahway River and provide a link between Industrial Road in Carteret and Tremley Point Road in Linden. With respect to traffic characteristics this roadway link is made up of two segments with differing traffic volume levels. The southern segment extends from Industrial Road to a point where Kinder Morgan and the proposed Slayton Development will have access. The northern segment includes the bridge over the Rahway River and extends from the aforementioned access drives for Kinder Morgan and the Slayton Development in Carteret to Tremley Point Road.

Traffic lane requirements for these segments are based on two levels of development at Tremley Point. The Design Level includes the anticipated growth of existing industries and new facilities during the next 15 to 20 years. The Full Build Level includes the continued growth of existing industries and the full build-out of the Tremley Point Redevelopment area beyond the Design Level period. Estimated peak hour traffic volumes by segment, type and development level are listed in Table 1.

Table 1

Projected Traffic Volumes

(South Segment)

Development Level	Period	Direction	Cars	Trucks	Total	% Trucks
Design Level	AM	NB	1858	300	2158	14
		SB	302	292	594	49
	PM	NB	382	317	699	45
		SB	1772	268	2040	13
Full Build	AM	NB	2774	423	3197	13
		SB	437	424	861	49
	PM	NB	550	479	1029	47
		SB	2678	378	3056	12

(North Segment)

Design Level	AM	NB	1570	238	1808	13
		SB	239	220	459	48
	PM	NB	270	247	517	48
		SB	1474	186	1660	11
Full Build	AM	NB	2370	329	2699	12
		SB	351	326	677	48
	PM	NB	382	379	761	50
		SB	2245	265	2510	11

The morning northbound and afternoon southbound direction peak volumes contain a substantial number of commuter vehicles while the off-peak direction volumes contain a high percentage of trucks. A cursory evaluation of the full build volumes clearly indicates that a single lane capacity is exceeded in the peak direction both during the AM and PM peak hours.

The Connector Road was analyzed with the design level volumes as a two-lane highway using the Highway Capacity Software (HCS) release 4.1c and the following parameters for the roadway: one 12 foot lane and a three foot shoulder in each direction of travel; maximum grade of 3 percent for distance of 0.25 miles (HCS default minimum) for the north segment; free flow speed of 50 miles per hour (mph); and a peak hour factor (PHF) of 0.90. The analysis was conducted for the peak direction only. The results for the four scenarios analyzed (north segment – AM, north segment – PM, south segment – AM, south segment – PM), revealed levels of service (LOS) "F" with volume to capacity (v/c) ratios between 1.14 and 1.51. Printouts of the two-lane HCS analysis are included in the appendix. The analyses presented show that a two-lane roadway does not accommodate effective operations at design level volumes. A four-lane roadway will be required to accommodate the design level volumes.

Next, the operations of the roadway were tested as an undivided, four-lane highway with a 12-foot inner lane and a 15-foot shoulder lane in each direction of travel. (HCS analysis was conducted for two 12-foot lanes and a three-foot shoulder in each direction). In the northbound direction, there will be a grade of 3 percent for a distance of approximately 1,100 feet, while in the southbound direction a 3 percent grade extends for about 800 feet. A PHF of 0.90 and a free flow speed of 50 mph were also used for the multi-lane highway analysis. Since the multi-lane highway module of HCS limits truck percentages to 25 percent and the off-peak direction truck percents are in the 48-50 percent range, the truck percentage was set to 25 and the remaining trucks over 25 percent converted to cars at a truck equivalency factor (ET) of 1.5 which is consistent with the grades.

The results of the analysis are indicated in Table 2. Overall, the vehicular operations of the north segment, which includes the bridge crossing over the Rahway River, are more efficient than those of the south segment. Under design level conditions, the roadway operates at LOS "C" in the peak direction during both the AM and PM periods. The off-peak direction during both the AM and PM periods operates at LOS "A." The HCS printouts for the multi-lane highway capacity analysis are included in the appendix.

Table 2

Connector Road HCS Analysis Results

Period	Direction	LOS	Density*
	(South Segment)		
AM	NB	C	24.3
	SB	A	7.9
PM	NB	A	9.1
	SB	C	22.9
	(North Segment)		
AM	NB	C	20.3
	SB	A	6.1
PM	NB	A	6.8
	SB	C	18.4

* passenger cars / mile / lane

As shown in the first portion of Table 2, the south segment vehicle operations are slightly more dense than those of the north segment. Under design level conditions, the south segment operates at LOS "C" or better in the peak direction during the AM and PM periods. The off-peak direction operates at LOS "A" during the AM and PM peaks.

IV. ALIGNMENT ALTERNATES

The factors considered during the development and evaluation of the alignment alternatives include wetlands, history of land use, documentation of potential soil contamination, overall cost and proposed future development. The vast majority of the area between Tremley Point Road and Industrial Road consists of wetlands. Most of the alignment alternatives involve significant impacts to wetlands and require associated wetland mitigation measures that contribute significantly to the overall cost of the project. Review of records at the NJDEP revealed that several locations within the project area are former landfill sites. Other locations have a history of soil contamination related to former industrial operations that occupied this area. The disposal cost of contaminated soil as well as landfill impacts were considered for the various alternatives. The current land use as well as plans to develop currently vacant parcels were also considered in this evaluation.

Vertical constraints that were used included maintaining a minimum elevation of at least 10.0' to be above the 100 year flood elevation of 9.0'. The vertical clearance over the navigable portion of the Rahway River was set at thirty-five feet. This is the same clearance as the nearby existing river crossing of the Turnpike mainline located approximately 3000' upstream of the area of the proposed river crossing for the Connector Road. This clearance will require the approval of the US Coast Guard. As discussed during a meeting with the Coast Guard in June 2002, the vertical clearance will be subject to the approval of a Section 9 Bridge Permit that will include a Navigation Study. The Bridge Permit, along with the other environmental permits required for the project, will be prepared during the final design phase of the project.

A discussion of each alternate addressed under this study follows. For concise reference, the costs and the advantages / disadvantages of each alternate are summarized in a table in the Appendix of this report.

A. ALTERNATE 1.

DESCRIPTION

Connector Road Alternate 1 is the most easterly of the Alternates considered. It originates on Industrial Road near the eastern side of the Kinder Morgan facility along the Arthur Kill and follows the abandoned Conrail railroad alignment that parallels the Arthur Kill. The roadway crosses over the Rahway River on a new 800 foot long structure located approximately 600 feet west of the confluence with the Arthur Kill. This crossing is near the location of a former railroadbridge over the Rahway River. On the north side of the river, the Connector Road intersects with the eastern end of Tremley Point Road. The Tremley Point Road intersection is at the end of a long, relatively steep downward grade of 4% on the Connector Road. A northbound to westbound left turn move at this intersection could create potential stopping or overturning problems for the high percentage of trucks that would be making this turn. Thus, the alignment splits at this intersection to provide a more favorable condition for truck traffic. Westbound traffic will follow an alignment located approximately 1,000 feet to the north of Tremley Point Road. This alignment follows the railroad track that traverses the Citgo site. Eastbound traffic will remain on Tremley Point Road and intersect directly with the Connector Road. Truck acceleration will be affected by the steep upward grade heading southbound over the river. However, it is not anticipated to create any safety problems nor will it adversely impact the capacity of the roadway.

The length of the Connector Road for this alternative is approximately 5300 feet. In addition to the new alignment portion of this alternative, an additional 9,000 feet of existing roadway must be upgraded.

GEOMETRY

The horizontal and vertical geometry for the Connector Road was based on the criteria outlined for urban arterials from the 2001 AASHTO Manual entitled " A Policy on Geometric Design of Highways and Streets." The alignment satisfies a design speed of 40 mph which will accommodate a posted speed of 30 to 35 mph. The horizontal curve radii vary from a minimum of 600' to a maximum of 1000'. A maximum superelevation rate of 4% would be utilized for the horizontal curvature with superelevation transition rates based on 2% per second for the design speed. Vertical grades vary from a minimum of 0.5% to a maximum of 4% with minimum vertical curve lengths based on three times the design speed.

ENVIRONMENTAL IMPACTS

The alignment traverses both tidally influenced and freshwater wetlands adjacent to Industrial Road and Rum Creek. Approximately 0.4 acres of wetlands will be impacted by this alignment. Since upland areas that could be converted to wetlands will be difficult to find in this area, it is anticipated that the NJDEP will require purchasing wetlands credits. It is conservatively estimated that the mitigation will involve a 3:1 replacement ratio at a cost of approximately $175,000/acre. The resulting wetland mitigation costs for this alternative are estimated to be $210,000.

Review of NJDEP files indicates that in August 1999 the Amoco Carteret Terminal (Lower Plant) reported a liquid phase hydrocarbon plume (up to 2'+ thickness) along the former railroad alignment . This plume extends north onto the adjacent Phillips Petroleum operation. In 2001 a Remedial Investigation Report was submitted to the NJDEP that focused upon delineation of the free phase product plume, hydrocarbon impacted soil and dissolved phase hydrocarbons in the groundwater. The status of remediation efforts are not known

from review of NJDEP files. As of July 2001, the NJDEP was requiring Amoco to perform additional investigations.

In addition, January 1998 data for a portion of GATX facility reported both a gasoline and diesel plume at the terminal building (occupied by Gateway) to the north of Industrial Road and west of the southern end of Alternate 1. Although not directly within the proposed alignment of this alternative, dewatering activities during excavation may need to consider the potential impacts from contaminated groundwater that may be encountered in this vicinity.

No environmental data for the soil and groundwater were available for the portion of the alignment on GATX property.

In Linden, Alternate 1 runs along the northern portion of the former American Cyanamid Warners Plant. Impacted groundwater has been identified at the Warners Plant (organic and inorganic). A Classification Exception Area (CEA) was not required by NJDEP due to high concentrations of dissolved solids and chloride (groundwater classified as Class III-B) and site-related contaminants of concern do not exceed site-specific quality criteria.

DDT, DDD and DDE impacted sediments have been reported adjacent to the Rahway River at the Warners Plant. A one-half acre of impacted sediments adjacent to Building 69 have been remediated by installation of an armoring system (capping) over the sediments situated in the Rahway River. Building 69 and the adjacent armoring system is in the immediate vicinity of the Alternate 1 alignment.

A site-wide deed restriction was proposed at the Warners Plant to address the presence of historic fill throughout the site. Alterations, improvements and disturbances cannot be performed on this site without consent from the NJDEP.

CONSTRUCTION COST

The estimated construction costs for Alternate 1 is $59.9 million. This cost includes the roadway construction as well as costs associated with utility relocations through the Citgo site and the costs related to the known contamination conditions discussed above. The property acquisitions that will be necessary for the alternate are estimated to be approximately 14.5 acres. This area includes approximately 2.4 acres through the industrial areas on both sides of the Rahway River. An order of magnitude cost for the property based on local tax records and recent sales information is estimated to be $905,000.

ADVANTAGES/DISADVANTAGES

Advantages

Connector Road Alternate 1 has the least impacts to wetlands since it utilizes current upland areas that mostly consist of existing roadway and developed areas.

Disadvantages

The vast majority of vehicles using the Connector Road will be traveling between the western side of the Tremley Point Development area, near the Turnpike mainline, to the Interchange 12 toll plaza. This alternate is the most circuitous and adds approximately 1.5 miles of traveling distance for almost all of vehicles using the roadway. Much of Tremley Point Road is not currently public right-of-way and is used only for access to the existing industries in the area. This alternate would require the most extensive upgrade of Tremley Point Road involving a significant pavement upgrade and acquisition of large areas to establish public right of way.

In addition to improving the pavement conditions along Tremley Point Road, consideration should also be given to raising the profile. Most of the current alignment is significantly below the 100-year flood elevation and in several locations approximately six feet of fill will be necessary to raise the roadway above this elevation. Because of its proximity to residential areas, Carteret officials have opposed this alternate.

In addition, Citgo opposed this alternate because of operational concerns and problems associated with plant security. Similar issues can also be anticipated to arise with the industries on the Carteret side of the river.

In addition to the cost and special construction methods that will be necessary to construct through or near the known contamination areas noted above, the alignment will require costly protection of numerous pipe crossings that are part of the intricate above ground and buried piping network near the Arthur Kill. These pipes are used to transport petroleum products within the Kinder Morgan and Citgo facilities for processing and to off-load vessels on the Arthur Kill.

B. ALTERNATE 2

DESCRIPTION

Connector Road Alternate 2 intersects with Industrial Road approximately 300 feet east of the Kinder Morgan security gate. The alignment runs through the wetland areas along the southeastern edge of the American Cyanamid sludge beds to the vicinity of Deep Creek where it then crosses the Rahway River via a 500 foot long bridge. The alignment meets Tremley Point Road at the C.M. Lacey Trucking property, about 1800 feet west of the tie-in point for Connector Road Alternate 1. The horizontal tie-in to Tremley Point Road can take place in approximately 300-feet with lane tapers being accomplished within that distance. The existing elevation of Tremley Point Road at this location is approximately 4.0 feet. The profile of the existing road can be raised 6 feet within the 300 feet of the intersection to achieve a minimum elevation of 10.0 feet at the intersection.

The length of the Connector Road for this Alternative is slightly less than 5300 feet, in addition to the construction along the new alignment portion of this Alternative, an additional 2,000 feet of existing roadway must be upgraded along Tremley Point Road.

GEOMETRY

In accordance with the 2001 AASHTO Manual entitled "A Policy on Geometric Design of Highways and Streets", the majority of the alignment satisfies a design speed of 35 MPH with curve radii varying from a minimum of 976' to a maximum of 1200'. The sag vertical curve of 150' at the approach to Tremley Point Road will meet a design speed of 25 MPH. A maximum superelevation rate of 4% will be utilized for the horizontal alignment with superelevation transitions based on a rate of 2% per second for the design speed. Vertical grades vary from a minimum of 0.5% to a maximum of 5% with minimum vertical curve lengths based on three times the design speed.

ENVIRONMENTAL IMPACTS

The alignment traverses a large freshwater wetland between Industrial Road and the Rahway River. Approximately 11.5 acres of wetlands will be impacted by this alignment. Since upland areas that could be converted to wetlands will be difficult to find in this area, it is anticipated that the NJDEP will require purchasing wetlands credits. It is conservatively estimated that the mitigation will involve a 3:1 replacement ratio at a cost of approximately $175,000/acre. The resulting mitigation cost would be approximately $6.0 million.

Contaminated soils were encountered during the construction of Industrial Road in the vicinity of the wetlands on the BP / Amoco property. Records of the soil sampling taken during that construction indicated that petroleum hydrocarbons, cyanide, organic compounds and heavy metals were present in the soils. Contamination found at the BP / Amoco site was related to the presence of coal ash, contaminated surface water and contaminated groundwater. A layer of free product floating on the groundwater was also encountered.

There is no available data on the environmental quality of soils and groundwater between Industrial Road and the eastern border of the former American Cyanamid sludge lagoons.

Alternate 2 crosses the southern portion of the 110-acre former American Cyanamid sludge beds (also referred to as a landfill). Sludge wastes were piped via aboveground lines from the Warners Plant, across the Rahway River, and into a series of six impoundments. The two products manufactured were alum and

yellow prussiate of soda (YPS). The production of YPS involved the reaction of calcium cyanide with ferrous sulfate and soda ash to form sodium ferrocyanide. Results of analytical sampling have total cyanide up to 125 ppm in aqueous samples and 3,600 ppm in sludge samples. In April 1995, a Declaration of Environmental Restriction (DER), now referred to as a Deed Notice, was established for the entire site. Alterations, improvements and disturbances will require the consent of the NJDEP.

In Linden, Alternate 2 connects to Tremley Point Road through the western portion of the Citgo site known as the Warners Tank Farm. The Warners Tank Farm was operated as an asphalt refinery from the 1900's to the 1960's, followed by petroleum storage and distribution. Residual product in the soils is reported to be extensive in many areas of the site. Groundwater on the site has been impacted by gasoline constituents (BTEX), gasoline additives (MTBE & TBA), cyanide and arsenic. Alternate 2 appears to cross a portion of the Warners Tank Farm that was formerly utilized as a disposal area for tank bottom residuals. Citgo is in the process of establishing a DER for impacted soils. Once the Deed Notice has been established, alternations, improvements and disturbances will require the consent of the NJDEP.

CONSTRUCTION COST

The estimated construction costs for Alternate 2 is $48.4 million. This cost includes the roadway construction as well as anticipated costs associated with the known contamination conditions discussed above. The property acquisitions that will be necessary for the alternate are estimated to be approximately 9.9 acres. An order of magnitude cost for the property based on local tax records and recent sales information is estimated to be $545,000

ADVANTAGES/DISADVANTAGES

Advantages

Connector Road Alternate 2 causes minimal impacts to the Slayton and Kinder Morgan sites and will require crossings of a relatively small number of streams.

Disadvantages

The alignment crossing the Rahway River is skewed and it traverses the edge of a known American Cynamid contaminated sludge area. The extensive length of this alignment that traverses this site adds considerably to the construction cost due to the expense related to the anticipated disposal and clean-up of contaminated soils and groundwater. In addition, the grade of Tremley Point Road must be raised by approximately 6 feet in order to not exceed the maximum 5% profile grade on the Connector Road and to raise the intersection above the 100-year flood elevation. As noted in Alternate 1, the steep grade of the Connector Road near the Tremley Point Intersection will potentially create a difficult stopping condition for the high percentage of trucks using the roadway. To reduce this grade to a more desirable 3% will require approximately 14 feet of additional fill.

C. ALTERNATE 3

DESCRIPTION

Connector Road Alternate 3 intersects with Industrial Road at approximately the same location as Alternate 2. It follows a much more westerly alignment through wetlands areas, traverses Cross Creek and follows the easterly edge of an upland area created by a former Carteret Sanitary Landfill. The roadway crosses the Rahway River, just west of Cross Creek, via a 600-foot bridge and runs though a large wetland area where it crosses Marsh's Creek. The alignment is a series of viaducts and embankment sections south of the Rahway River and entirely on viaduct on the north side. The alignment meets Tremley Point Road at the vicinity of the EFC Land Development Corporation property opposite the western end of the Tosco Terminal. As with Alternate 2, the horizontal tie-into Tremley Point Road at this location only requires 300-feet to meet the existing roadway. Vertically, the intersection area would be raised approximately 1.5 feet to elevate it above the 100 year flood elevation. The length of the Connector Road for this Alternate is approximately 6700 feet.

GEOMETRY

In accordance with the 2001 AASHTO Manual entitled "A Policy on Geometric Design of Highways and Streets", the alignment satisfies a design speed of 40 MPH with curve radii varying from a minimum of 900' to a maximum of 1500'. A maximum superelevation rate of 4% will be utilized for the horizontal alignment with superelevation transitions based on a rate of 2% per second for the design speed. Vertical grades vary from a minimum of 0.5% to a maximum of 5% with minimum vertical curve lengths based on three times the design speed.

ENVIRONMENTAL IMPACTS

The alignment traverses large tidally influenced freshwater wetland areas on both sides of the Rahway River. Approximately 12.3 acres of wetlands will be impacted by this alignment. Following the same assumptions stated earlier, the resulting wetland mitigation cost would be approximately $6.5 million.

The contaminated soils encountered during construction of the Industrial Road as discussed in Alternate 2 will also be a concern for this alternate.

There is no available data on the environmental quality of soils and groundwater between Industrial Road and the eastern border of the former American Cyanamid sludge lagoons.

This alignment runs through the eastern side of the Carteret Sanitary Landfill. A Landfill Disruption Permit would be required. Contaminants contained within the landfill material may be encountered. Landfill gases generated by the landfill would also need to be addressed.

No environmental quality data for soils, groundwater or sediments is available based on the review of NJDEP files for the Linden portion of this alignment.

CONSTRUCTION COST

The estimated construction costs for Alternate 3 is $68.7 million. This cost includes the roadway construction as well as anticipated costs associated with the known contamination conditions discussed above. The property acquisitions that will be necessary for this alternate are estimated to be

approximately 12.7 acres. An order of magnitude cost for the property based on local tax records and recent sales information is estimated to be $698,000.

ADVANTAGES/DISADVANTAGES

Advantages

Connector 3 crosses the Rahway River on a perpendicular alignment with a 600' long structure.

Disadvantages

The alignment cuts through the northeastern edge of the proposed Slayton Tract adjacent to Cross Creek. In addition, this alignment requires four (4) additional stream crossings when compared to Alternate 6. The combination of high construction costs and significant wetlands impacts results in this being the most expensive alternate.

D. ALTERNATE 4

DESCRIPTION

Connector Road Alternate 4 intersects Industrial Road at a point to the west of the Kinder Morgan security gate. Provision will have to be made for access to the Kinder Morgan property from the alignment. It proceeds through the CDL Industries property where it then follows an alignment similar to Alternate 2 before turning to the west and heading for the Rahway River through the sludge lagoons on the former American Cyanamid site at the "horseshoe" bend in the river. It crosses the river over a 350-foot long bridge and meets Tremley Point Road at the same location as Alternate 3. The length of the Connector Road for this Alternative is approximately 6400 feet.

GEOMETRY

In accordance with the 2001 AASHTO Manual entitled "A Policy on Geometric Design of Highways and Streets", the majority of the alignment satisfies a design speed of 40 MPH with curve radii varying from a minimum of 600' to a maximum of 1500'. The sag vertical curve of 125' at the approach to Tremley Point Road will meet a design speed of 25 MPH. A maximum superelevation rate of 4% will be utilized for the horizontal alignment with superelevation transition rates based on 2% per second for the design speed. Vertical grades vary from a minimum of 0.5% to a maximum of 4.8% with minimum vertical curve lengths based on three times the design speed.

ENVIRONMENTAL IMPACTS

The alignment traverses large tidally influenced freshwater wetland areas on both sides of the Rahway River. Approximately 13.2 acres of wetlands will be impacted by this alignment. Following the same assumptions stated earlier, the resulting wetland mitigation cost would be approximately $6.9 million.

The contaminated soils encountered during construction of Industrial Road, as discussed in Alternate 2, will also be a concern for this alternate.

There is no available data on the environmental quality of soils and groundwater between Carteret Industrial Road and the eastern border of the former American Cyanamid sludge lagoons.

Alternate 4 crosses the southern portion of the 110-acre former American Cyanamid sludge beds (also referred to as a landfill) as described for Alternate 2. In April 1995, a Declaration of Environmental Restriction (DER), now referred to as a Deed Notice, was established for the entire site. Alterations, improvements and disturbances at this site will require the consent of the NJDEP.

No environmental quality data for soils, groundwater or sediments is available based on the review of NJDEP files for the Linden portion of this alignment.

CONSTRUCTION COST

The estimated construction costs for Alternate 4 is $51 million. This cost includes the roadway construction as well as anticipated costs associated with the known contamination conditions discussed above. The property acquisitions that will be necessary for this alternate are estimated to be approximately 12 acres. An order of magnitude cost for the property based on local tax records and recent sales information is estimated to be $660,000.

ADVANTAGES/DISADVANTAGES

Advantages

Connector Road Alternate 4 has the shortest crossing of the Rahway River.

Disadvantages

The alignment for this Alternate traverses highly contaminated soil areas through the former American Cyanamid site. Due to profile constraints, and the short distance between the edge of the river and the intersection, the grade of Tremley Point Road will have to be raised approximately 4 feet to result in a profile grade of 4.8% at the northern end of the Connector Road.

E. ALTERNATE 5

DESCRIPTION

The vast majority of vehicles using the Connector Road will be traveling between Interchange 12 and the western portion of Tremley Point Road near the Turnpike mainline. Of all the alternatives developed, Alternate 5 provides the shortest overall travel distance for these vehicles. The length of the Connector Road for this Alternate is 5700 feet. The alignment intersects Industrial Road at a point located between the embankments for the proposed Slayton Development and the Kinder Morgan Tracts. The alignment then bends to the left (Northeast) with a 1000' radius to avoid the lagoon of the former American Cyanamid site and crosses the Rahway River on a skewed alignment with a 2000' radius to the right and a bridge length of approximately 750'. The alignment continues on a tangent for approximately 1650' where it ties radially to the existing curve on Tremley Point Road, opposite the Tosco Terminal.

GEOMETRY

In accordance with the 2001 AASHTO Manual entitled "A Policy on Geometric Design of Highways and Streets", the alignment satisfies a design speed of 50 MPH with curve radii varying from a minimum of 1000' to a maximum of 2250'. A maximum superelevation rate of 4% will be utilized for the horizontal curvature with superelevation transition rates based on 2% per second for the design speed. Vertical grades vary from a minimum of 0.5% to a maximum of 3% with minimum vertical curve lengths based on three times the design speed. Both the horizontal and vertical geometry will permit a posted speed of 45 mph along the Connector Road.

ENVIRONMENTAL IMPACTS

The alignment traverses large tidally influenced freshwater wetland areas on both sides of the Rahway River. Approximately 7.5 acres of wetlands will be impacted by this alignment. Following the same assumptions stated earlier, the resulting wetland mitigation cost would be approximately $3.9 million. The alignment closely follows the western edge of the Rahway River on the Linden side. This orientation maintains a large contiguous wetland area to the west of the roadway.

There is no available data on the environmental quality of soils and groundwater between Carteret Industrial Road and the eastern border of the former American Cyanamid sludge lagoons.

The alignment is located just to the west of the American Cyanamid sludge lagoons and is intended to avoid or at least minimize the potential contamination problems associated with this site. Pending the results of the soil borings data that will be collected, the alignment could be slightly altered or the type of structure used through the area will be selected to reduce contamination impacts.

Contaminated soils were encountered during the construction of Industrial Road in the vicinity of the wetlands on the BP / Amoco property. Records of the soil sampling taken during that construction indicated that petroleum hydrocarbons, cyanide, organic compounds and heavy metals were present in the soils. Contamination found at the BP / Amoco site was related to the presence of coal ash, contaminated surface water and contaminated groundwater. A layer of free product floating on the groundwater was also encountered.

No environmental quality data for soils, groundwater or sediments is available based on the review of NJDEP files for the Linden portion of this alignment.

CONSTRUCTION COST

The estimated construction costs for Alternate 5 is $46 million.. The property acquisitions that will be necessary for the alternate are estimated to be approximately 9.6 acres. An order of magnitude cost for the property based on local tax records and recent sales information is estimated to be $528,000.

ADVANTAGES/DISADVANTAGES

Advantages

Connector Road Alternate 5 has a fairly direct alignment with flat horizontal curvature from Industrial Road to Tremley Point Road. It causes relatively small impacts to wetlands with minimum impacts to the proposed Slayton Development and Kinder Morgan sites. Also, the alignment on the south side of the river utilizes existing upland areas to minimize wetland impacts.

This alternative has the least wetland and second smallest property acquisition impacts. Due to the direct nature of the alignment, the overall travel length of this alternative is the shortest of all the alternates that were considered. This will reduce the overall time and vehicle-miles traveled for the vast majority of vehicles using the facility.

Disadvantages

The alignment of this alternative requires crossing the Rahway River on a skew with the entire structure being both curved and superelevated. The vertical clearance over the river requires all of the roadway to be carried on a viaduct for several hundred feet through the wetlands areas on both sides of the river for this and all of the other alternatives. Therefore, the skewed alignment of the river crossing does not affect the overall length of the alignment that must be constructed on structure. However, it does result in a longer span that must provide the necessary vertical clearance over the navigable portion of the Rahway River.

F. ALTERNATE 6

DESCRIPTION

Connector Road Alternate 6 intersects Industrial Road at the same location as Alternate 5. From the Industrial Road intersection the alignment heads to the left (northeast) and continues straight for 2300' with a fairly perpendicular crossing of the Rahway River. The length of the structure over the river is approximately 600'. After crossing the Rahway River the alignment turns to the right with a 1200' radius curve and continues straight for 1100' along a tangent. That tangent ties into Tremley Point Road on an alignment that uses a portion of an existing Paper Street ROW east of the Mobil site. The length of the Connector Road for this Alternative is 5750 feet.

GEOMETRY

In accordance with the 2001 AASHTO Manual entitled "A Policy on Geometric Design of Highways and Streets", the alignment satisfies a design speed of 50 MPH with curve radii varying from a minimum of 1000' to a maximum of 2250'. A maximum superelevation rate of 4% will be utilized for the horizontal curvature with superelevation transition rates based on 2% per second for the design speed. Vertical grades vary from a minimum of 0.5% to a maximum of 2.5% with minimum vertical curve lengths based on three times the design speed.

ENVIRONMENTAL IMPACTS

The alignment traverses large tidally influenced freshwater wetland areas on both sides of the Rahway River. Approximately 8.1 acres of wetlands will be impacted by this alignment. Following the same assumptions stated earlier, the resulting wetland mitigation cost would be approximately $4.3 million. The location of the roadway on the north side of the Rahway River bisects the wetlands area located between the Rahway River and Marsh's Creek.

The other environmental impacts discussed for Alternate 5 also apply to this Alternate.

CONSTRUCTION COST

The estimated construction costs for Alternate 6 is $45.4 million. The property acquisitions that will be necessary for the alternate are estimated to be approximately 9.4 acres. An order of magnitude cost for the property based on local tax records and recent sales information is estimated to be $517,000.

ADVANTAGES/DISADVANTAGES

Advantages

Connector Road Alternate 6 crosses the Rahway River on an alignment that is fairly close to perpendicular. In comparison to the skewed crossing in Alternate 5, this results in a shorter span over the navigable portion of the Rahway River. This orientation is preferable form an initial construction standpoint as well as from the long term maintenance perspective. The short river crossing combined with the shorter length of viaduct that will be on a curved structure results in this alternate having the lowest construction cost.

The alignment of this alternate uses existing upland areas on the south side of the river where possible to minimize wetland impacts. This Alternate also uses a portion of an existing Paper Street at Tremley Point Road which results in the smallest property acquisition costs of all the alternates that were considered.

Disadvantages

This alternate is slightly longer than Alternate 5 and has slightly greater wetland impacts

G. ALTERNATE 7

DESCRIPTION

Connector Road Alternate 7 intersects Industrial Road at the same location as Alternates 5 and 6. The alignment then bends to the left (north) with a radius of 960' and then to the right after a short tangent of 250' (minimum to satisfy superelevation transition). The alignment then crosses the Rahway River with a perpendicular tangent and a structure length of 450'. Immediately after crossing the River, the alignment bends to the right for 165' with a 1000' radius curve over Marsh's Creek and then into a short tangent of 266' and reversing again to the left for 550' with a 2000' radius that ties into Tremley Point Road on a skewed alignment which utilizes the existing Paper Street ROW east of the Mobil site. The length of the Connector Road for this alternate is approximately 6400 feet.

GEOMETRY

In accordance with the 2001 AASHTO Manual entitled "A Policy on Geometric Design of Highways and Streets", the alignment satisfies a design speed of 50 MPH with curve radii varying from a minimum of 960' to a maximum of 2250'. A maximum superelevation rate of 4% will be utilized for the horizontal curvature with superelevation transition rate based on 2% per second for the design speed. Vertical grades vary from a minimum of 0.5% to a maximum of 1.8% with minimum vertical curve lengths based on three times the design speed.

ENVIRONMENTAL IMPACTS

The alignment traverses large tidally influenced freshwater wetland areas on both sides of the Rahway River. Approximately 8.3 acres of wetlands will be impacted by this alignment. Following the same assumptions stated earlier, the resulting wetland mitigation cost would be approximately $4.4 million. In addition to bisecting the wetlands as described for Alternate 6, this alternate also impacts the wetland areas to the west of Marsh's Creek.

The other environmental impacts discussed for Alternate 5 also apply to this Alternate

CONSTRUCTION COST

The estimated construction costs for Alternate 7 is $53.3 million. The property acquisitions that will be necessary for the alternate are estimated to be approximately 11.7 acres. An order of magnitude cost for the property based on local tax records and recent sales information is estimated to be $644,000.

ADVANTAGES/DISADVANTAGES

Advantages

Connector Road Alternate 7 crosses the Rahway River on a tangent alignment perpendicular to the river.

Disadvantages

The horizontal alignment is circuitous and segments wetlands on the north side of the river. This alignment in comparison to Alternate 6 requires four (4) additional creek crossings.

V. RECOMMENDATIONS

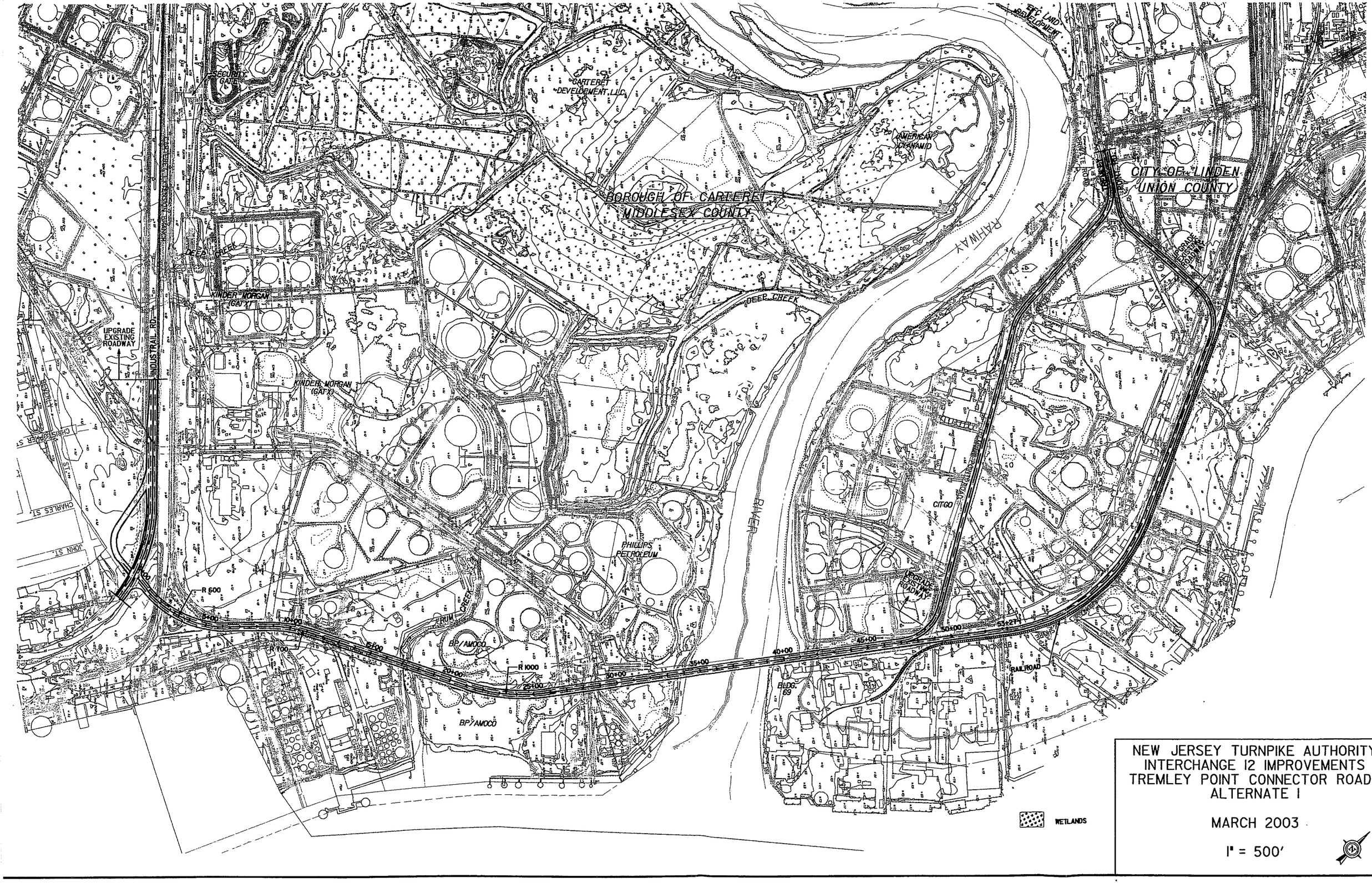
The high volume of truck traffic that the proposed redevelopment of Tremley Point will generate will use the New Jersey Turnpike as a primary corridor for their daily operations. Since routing this traffic through the existing road network on the Linden side of the Rahway River is not an option, the best alternative is to link this proposed development area to Interchange 12 via the Connector Road between Tremley Point Road in Linden and Industrial Road in Carteret.

Based on the best combination of operations, overall cost and environmental impacts, Alternate 6 is the preferred alternate. Of all of the alternates considered, this alignment has close to the shortest overall travel length and requires the smallest amount of property acquisition. The alignment avoids known contaminated sites and occupies existing upland areas where possible to minimize overall wetland impacts.

Operationally, the horizontal and vertical alignment is most favorable for the large volume of trucks that are anticipated to travel on this facility. The alignment will permit a posted speed of 45mph. This combined with the shorter length of roadway will result in overall shorter travel times and lower vehicle-miles traveled for the vast majority of vehicles that are anticipated to use this new facility.

INTERCHANGE 12 : TREMLEY POINT CONNECTOR ROAD ALTERNATIVES SUMMARY

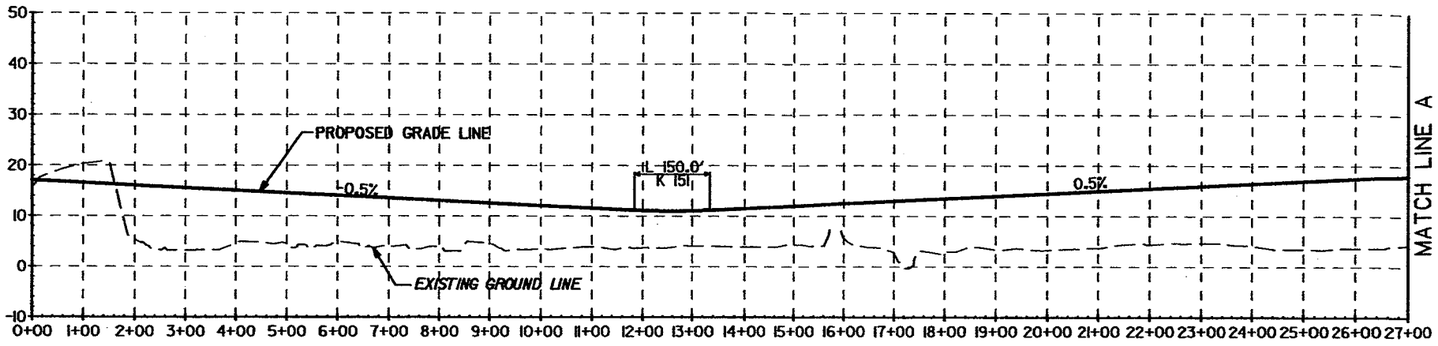
ALTERNATE	CONSTRUCTION COST	PROPERTY ACQUISITION COST	WETLAND IMPACTS (Acre/$)	TOTAL COST ($ Million)	ADVANTAGES	DISADVANTAGES
1	**$59,893,000**	**$905,000**	**0.4Ac/ $210,000**	**61.0**	• Least wetland impacts. • Utilizes current roadway areas .	• Most circuitous. • Opposed by Carteret due to proximity to residents. • Opposed by Citgo due to plant security. • Requires extensive improvements to local roadways.
2	**$48,377,000**	**$545,000**	**11.5 Ac/ $6,037,500**	**54.9**	• Minimal small stream crossings. • Minimal impacts at the Slayton Development. • Minimal impacts at Kinder-Morgan.	• Skewed river crossing. • Additional costs due to contaminated area. • Requires grade of Tremley Point Road to be raised approximately six feet. • Steep profile on north end.
3	**$68,737,000**	**$698,000**	**12.3 Ac/ $6,457,500**	**75.9**	• Perpendicular River Crossing.	• Four additional Stream Crossings compared to Alternate 6. • Cuts through Slayton tract. • Highest overall cost.
4	**$51,063,000**	**$660,000**	**13.2 Ac/ 6,947,500**	**58.7**	• Shortest River Crossing.	• Additional high costs due to highly contaminated soil area. • Profile will require raising Tremley Point road by several feet. • Steep profile at north end.
5	**$46,000,000**	**$528,000**	**7.5 Ac/ $3,920,000**	**50.4**	• Relatively small wetland impacts. • Flat horizontal curvature. • Shortest overall travel length between Industrial Road and Tremley Point Road. • Minimal impacts to Slayton and Kinder Morgan.	• Skewed river crossing. • Longer span necessary to provide the required vertical clearance over the navigable portion of the river. • Curved structure over river is undesirable from maintenance and operational perspectives.
6	**$45,394,000**	**$517,000**	**8.1 Ac/ $4,270,000**	**50.2**	• Close to perpendicular river crossing • Utilizes upland areas south of river. • Lowest construction costs and small property acquisition costs	• Slightly greater wetland impacts and overall travel distance compared to Alternate 5.
7	**$53,353,000**	**$644,000**	**8.3Ac/ $4,357,000**	**58.3**	• Perpendicular River crossing.	• Circuitous horizontal alignment • Four additional stream crossings compared to Alternate 6.

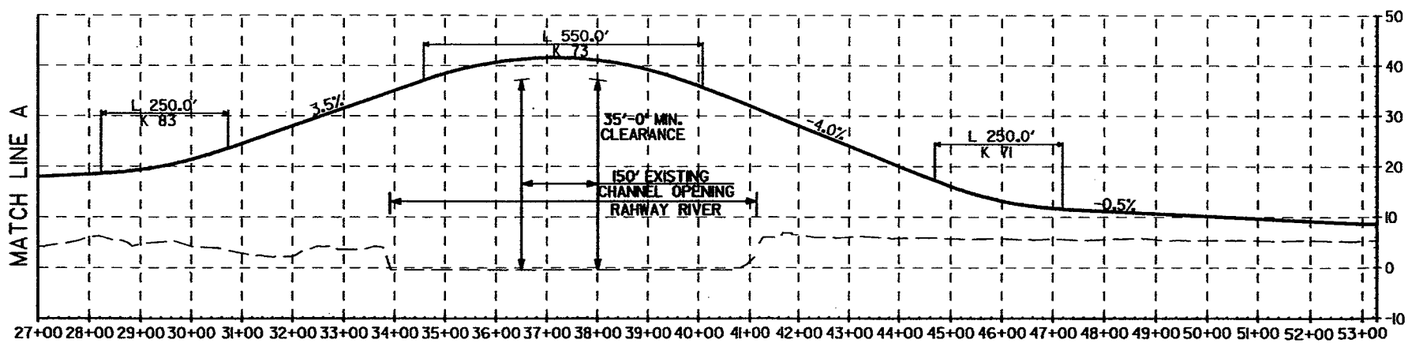


NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
TREMLEY POINT CONNECTOR ROAD
ALTERNATE 1

MARCH 2003

1" = 500'





CONNECTOR ROAD

NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
TREMLEY POINT CONNECTOR ROAD
ALTERNATE 1 PROFILE

MARCH 2003

SCALE
1"=200' HORIZONTAL
1"=20' VERTICAL

BOROUGH OF CARTERET
MIDDLESEX COUNTY

CITY OF LINDEN
UNION COUNTY

RIVER

INDUSTRIAL RD.

SECURITY GATE

CARTERET DEVELOPMENT, LLC.

"PAPER STREET"

E.C. LAND DEVELOPMENT

DEEP CREEK

KINDER MORGAN (GATX)

AMERICAN CYANAMID

EXISTING ROADWAY

UPGRADE

TREMLEY POINT RD.

RAILWAY

PHILLIPS PETROLEUM

RUM CREEK

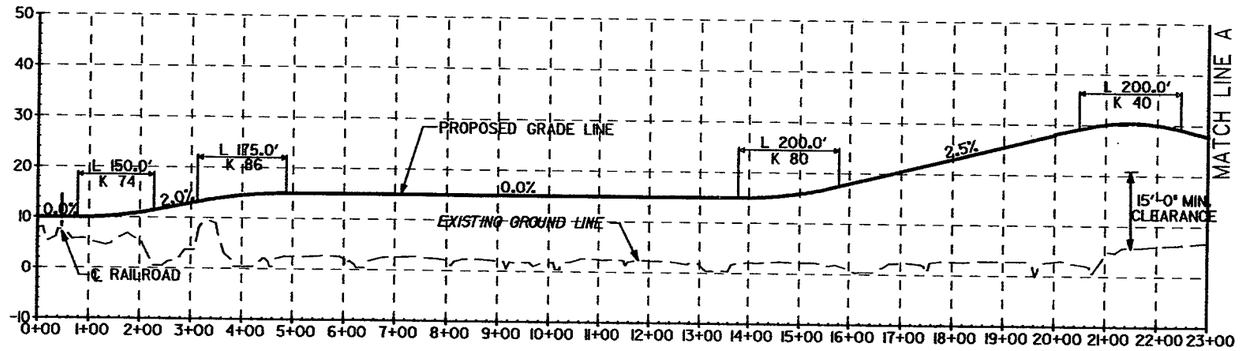
BP/AMOCO

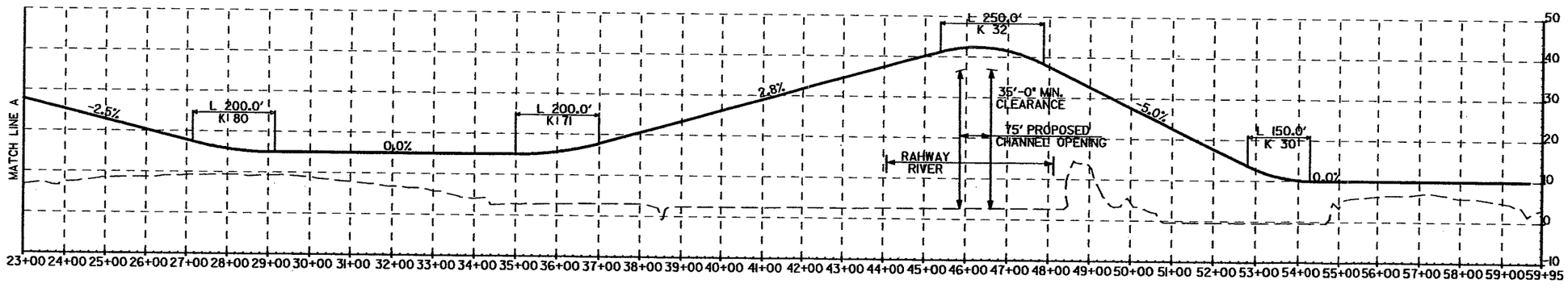
WETLANDS

NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
TREMLEY POINT CONNECTOR ROAD
ALTERNATE 2

FEB 2003

1" = 400'





CONNECTOR ROAD

NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
TREMLEY POINT CONNECTOR ROAD
ALTERNATE 2 PROFILE

MARCH 2003

SCALE
1"=200' HORIZONTAL
1"=20' VERTICAL

BOROUGH OF CARTERET
MIDDLESEX COUNTY

CITY OF LINDEN
UNION COUNTY

RAHWAY

COUNTY AND CITY LINE

RIVER

CROSS CREEK

MARSH'S CREEK

LANDFILL

GATEWAY DEVELOPMENT

MOBIL OIL CORP.

PAPER STREET

LINDEN BULK TRANSPORTATION

TREMLEY POINT ROAD

TOSCO TERM.

E.E.C. LAND DEVELOPMENT

INDUSTRIAL RD.

SECURITY GATE

CARTERET DEVELOPMENT, LLC

AMERICAN CYANAMID

WHITE ROAD

DEEP CREEK

KINDER MORGAN (CAT X)

DEEP CREEK

AHWAY

0+00
5+00
10+00
15+00
20+00
25+00
30+00
35+00
40+00
45+00
50+00
55+00
60+00
65+00
70+00

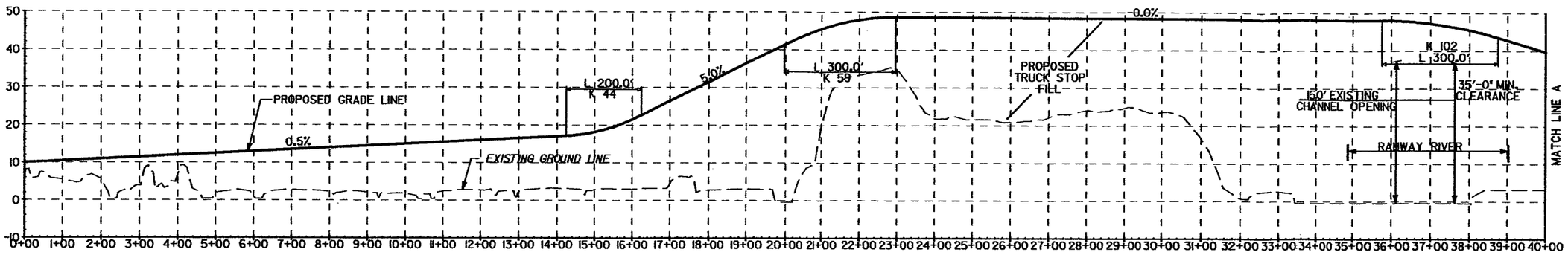
R 1580
R 900
R 1000

WETLANDS

NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
TREMLEY POINT CONNECTOR ROAD
ALTERNATE 3

FEB 2003

1" = 400'

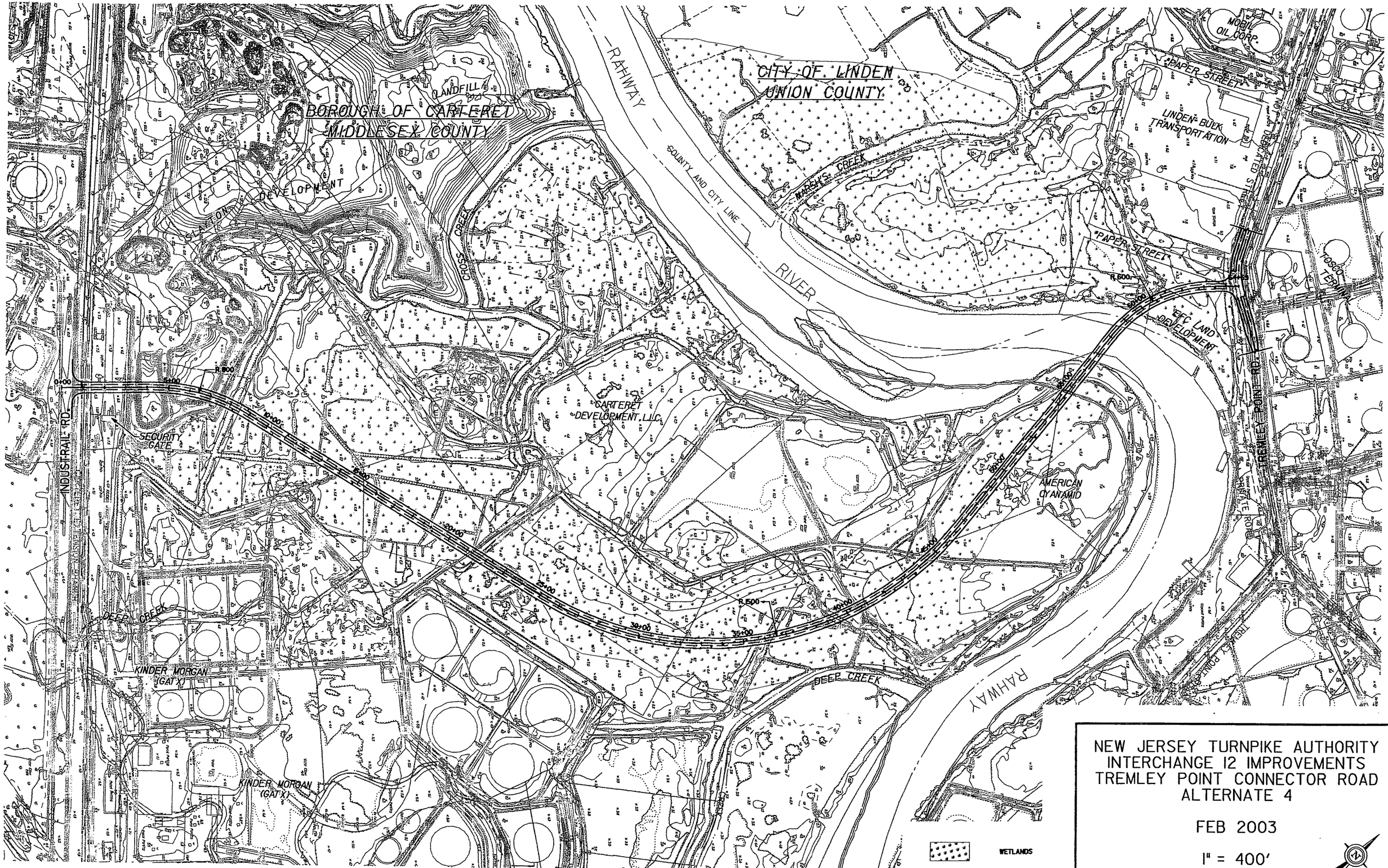


CONNECTOR ROAD

NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
TREMLEY POINT CONNECTOR ROAD
ALTERNATE 3 PROFILE

MARCH 2003

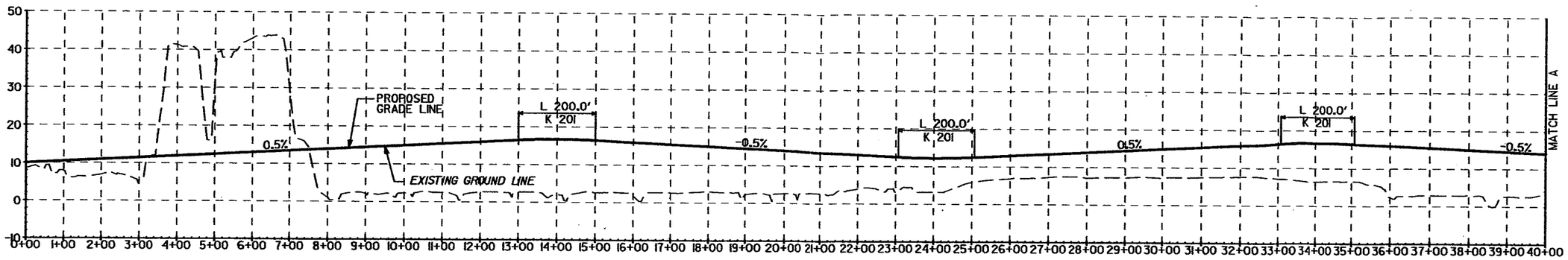
SCALE
1"=200' HORIZONTAL
1"=20' VERTICAL

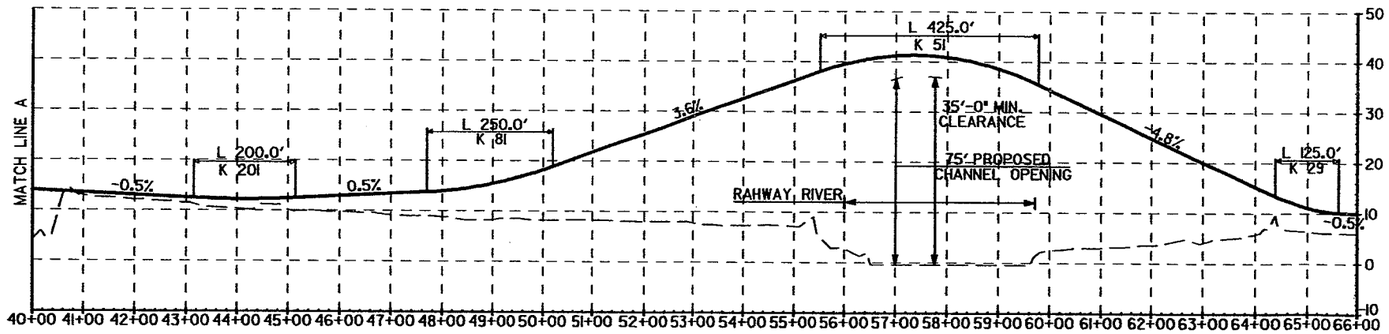


NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
TREMLEY POINT CONNECTOR ROAD
ALTERNATE 4

FEB 2003

1" = 400'



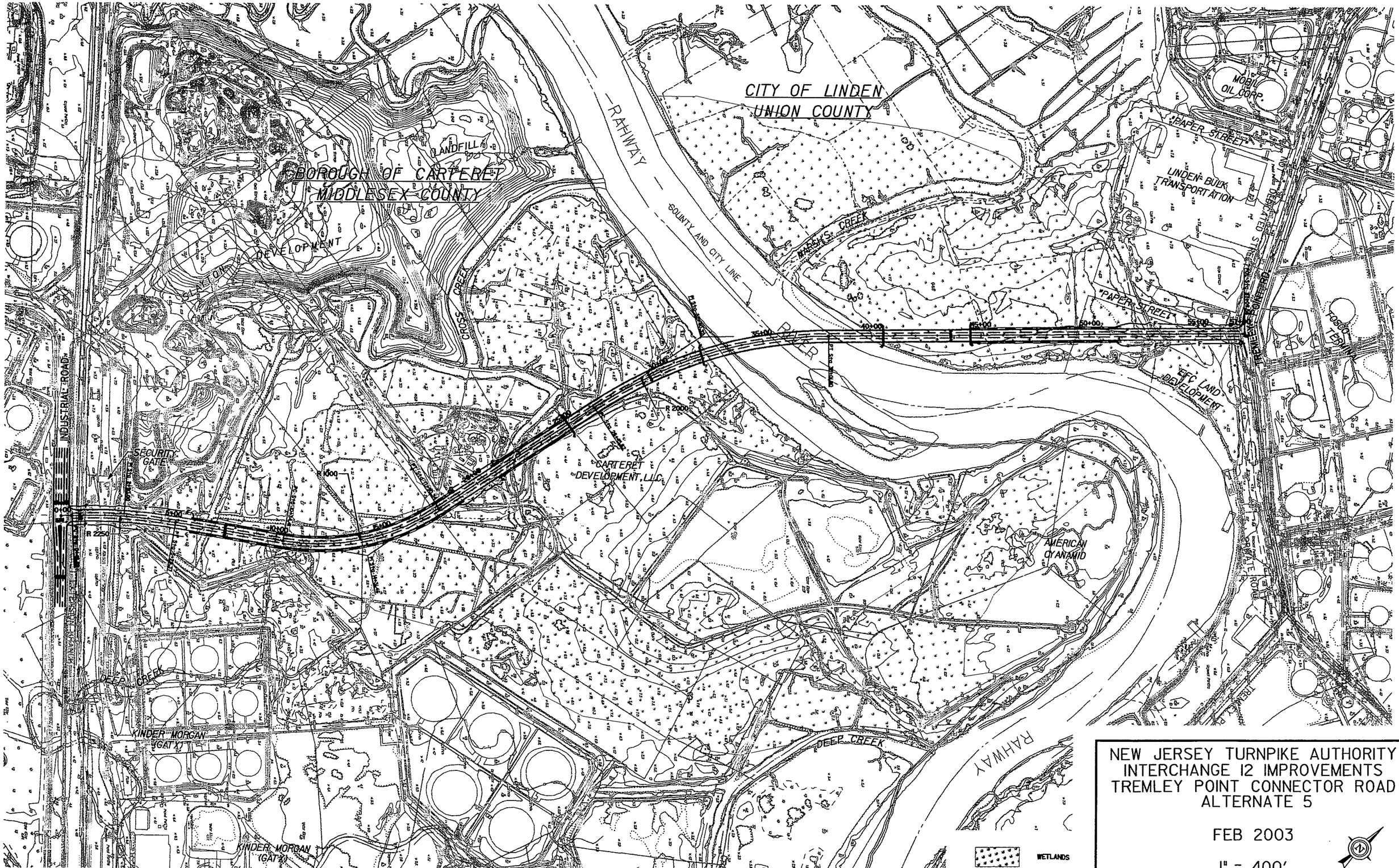


CONNECTOR ROAD

NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
TREMLEY POINT CONNECTOR ROAD
ALTERNATE 4 PROFILE

MARCH 2003

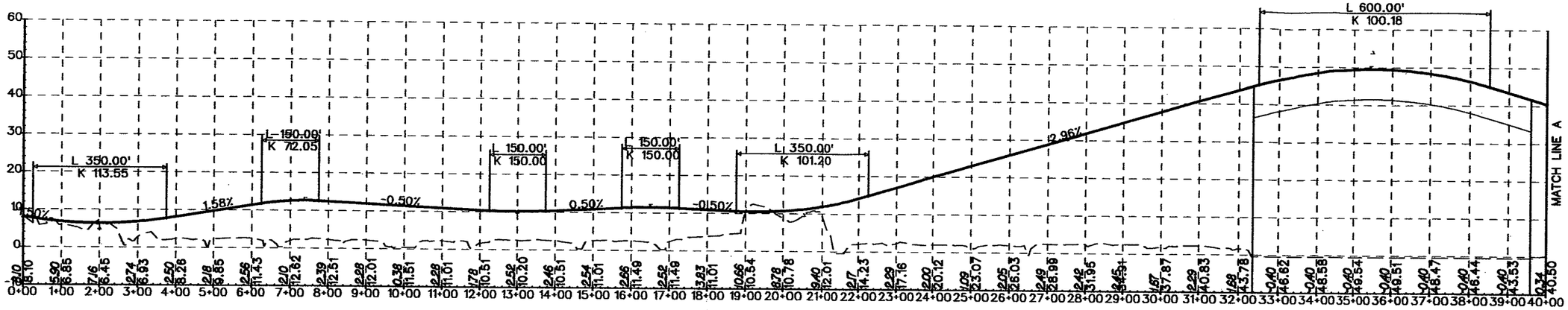
SCALE
1"=200' HORIZONTAL
1"=20' VERTICAL

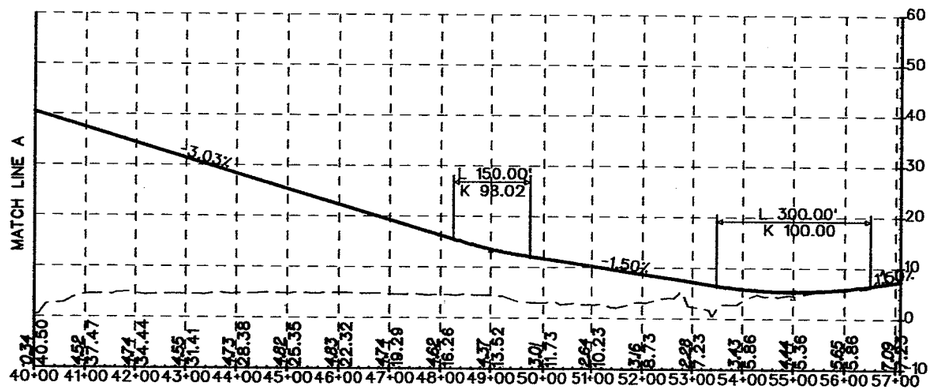


NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
TREMLEY POINT CONNECTOR ROAD
ALTERNATE 5

FEB 2003

1" = 400'





CONNECTOR ROAD

NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12
CONCEPTUAL STUDIES
ALTERNATE 5 PROFILE

DEC 2002

SCALE
1"=200' HORIZONTAL
1"=20' VERTICAL

BOROUGH OF CARTERET
MIDDLESEX COUNTY

CITY OF LINDEN
UNION COUNTY

COUNTY AND CITY LINE

LANDFILL

CROSS CREEK

MARSH'S CREEK

DEEP CREEK

DEEP CREEK

CARTERET DEVELOPMENT

CARTERET DEVELOPMENT, LLC.

MOBIL OIL CORP.

PAPER STREET

LINDEN BULK TRANSPORTATION

TREMLEY POINT ROAD

TPC LAND DEVELOPMENT

TPC TERMINAL

INDUSTRIAL ROAD

SECURITY GATE

AMERICAN CYANAMID

KINDER MORGAN (GATX)

KINDER MORGAN

R 2250

R 1000

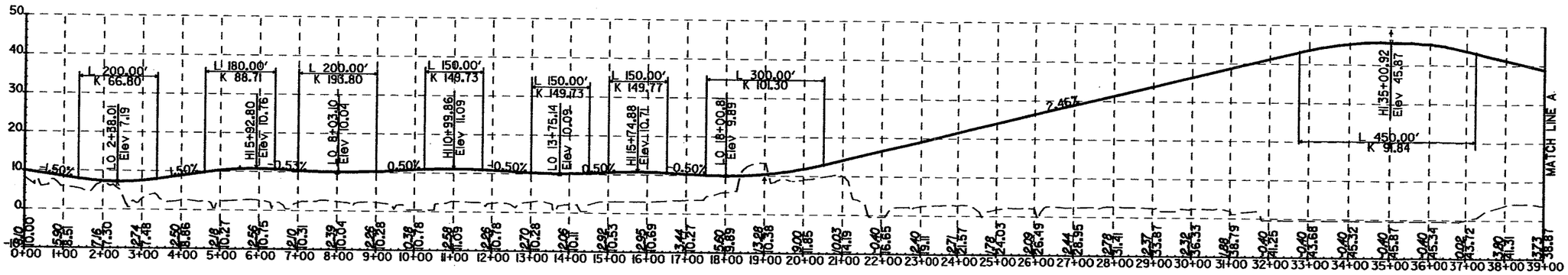
R 1200

WETLANDS

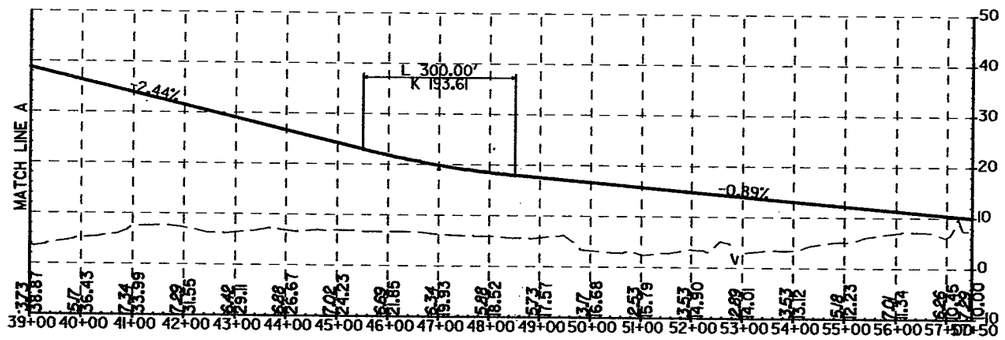
NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
TREMLEY POINT CONNECTOR ROAD
ALTERNATE 6

MARCH 2003

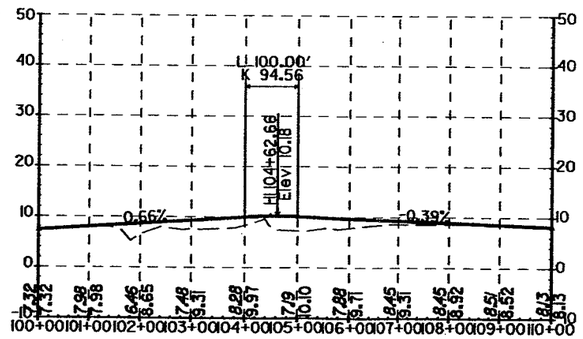
1" = 400'



CONNECTOR ROAD



CONNECTOR ROAD

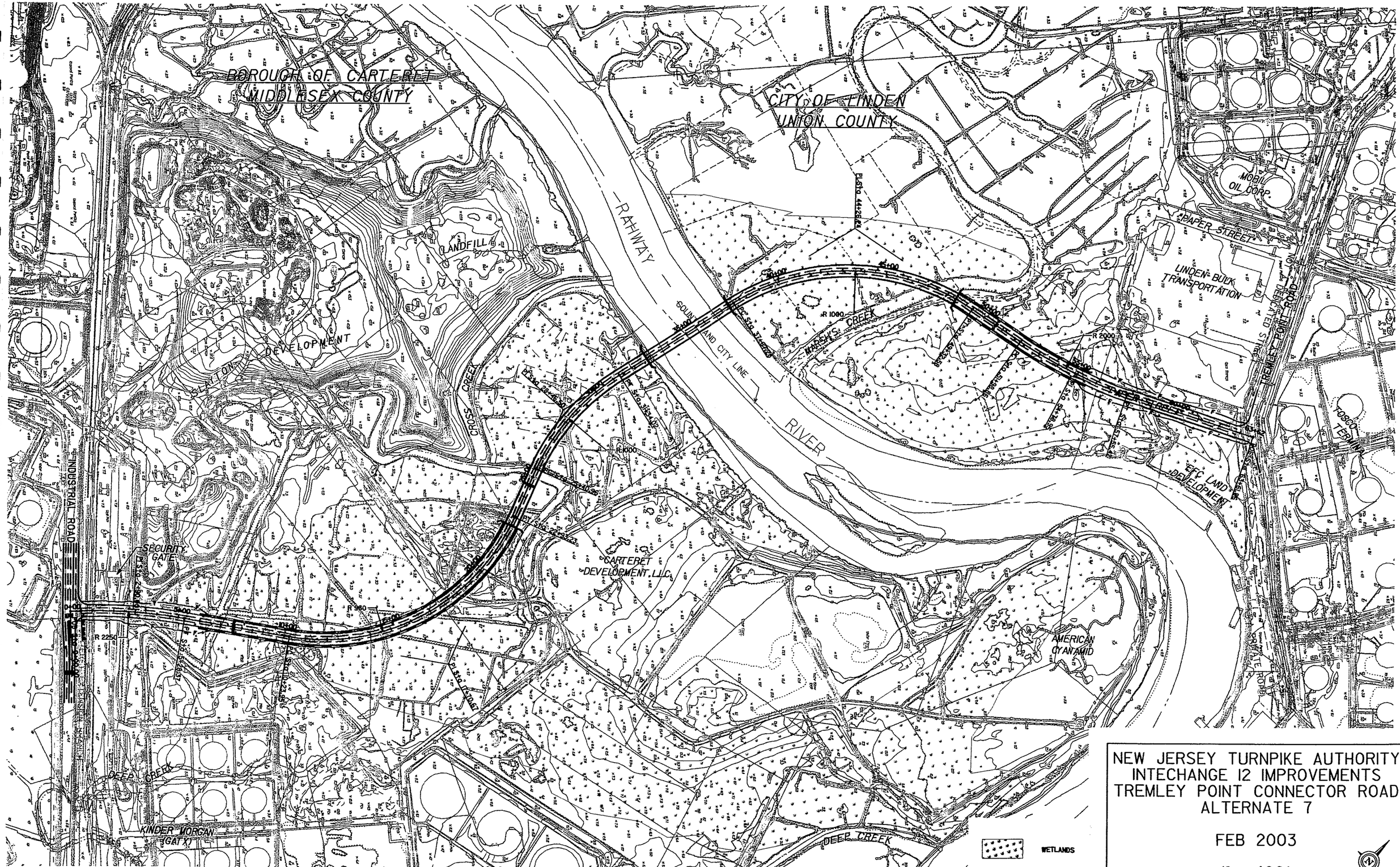


TREMLEY POINT ROAD

NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12 IMPROVEMENTS
TREMLEY POINT CONNECTOR ROAD
ALTERNATE 6 PROFILE

MARCH 2003

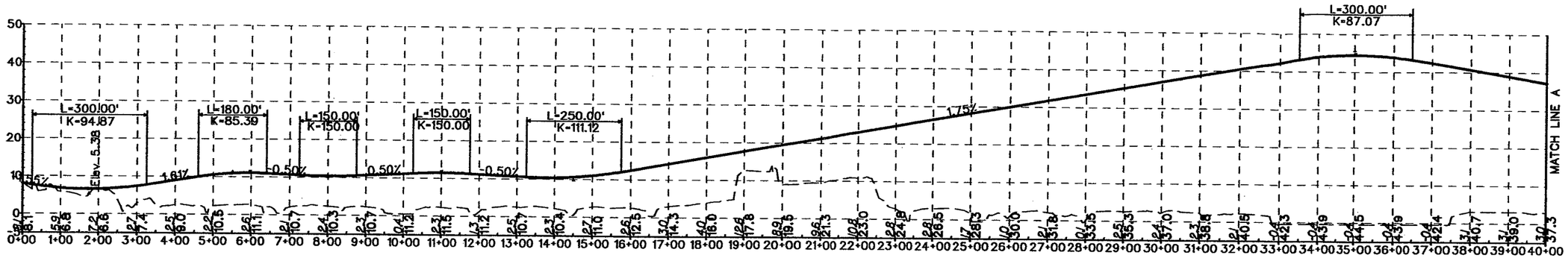
SCALE
1"=200' HORIZONTAL
1"=20' VERTICAL

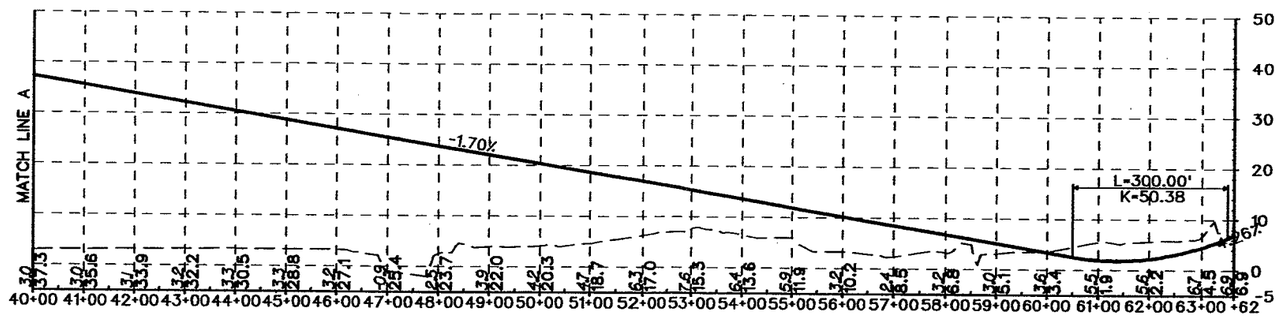


NEW JERSEY TURNPIKE AUTHORITY
INTECHANGE 12 IMPROVEMENTS
TREMLEY POINT CONNECTOR ROAD
ALTERNATE 7

FEB 2003

1" = 400'





CONNECTOR ROAD

NEW JERSEY TURNPIKE AUTHORITY
INTERCHANGE 12
CONCEPTUAL STUDIES
ALTERNATE 7 PROFILE

DEC 2002

SCALE
1"=200' HORIZONTAL
1"=20' VERTICAL