Implementation of Manual Guidelines for the Inspection of ITS Equipment and Facilities

FINAL REPORT
September 2011

Submitted by

Dr. Kaan Ozbay
Professor
Center for Advanced Infrastructure and Transportation (CAIT)
Civil and Env. Engineering
Rutgers University

Eren Erman Ozguven
Research Assistant
Center for Advanced Infrastructure and Transportation (CAIT)
Civil and Env. Engineering
Rutgers University

Tolga Sertel
Software Engineer
Center for Advanced Infrastructure and Transportation (CAIT)
Civil and Env. Engineering
Rutgers University

Sami Demiroluk
Research Assistant
Center for Advanced Infrastructure and Transportation (CAIT)
Civil and Env. Engineering
Rutgers University

NJDOT Research Project Manager
Nazhat Aboobaker, Ph.D., P.E.

In cooperation with

New Jersey Department of Transportation
Bureau of Research

And

U.S. Department of Transportation
Federal Highway Administration
DISCLAIMER STATEMENT

"The contents of this report reflect the views of the author(s) who is (are) responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the New Jersey Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation."

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated under the sponsorship of the Department of Transportation, University Transportation Centers Program, in the interest of information exchange. The U.S. Government assumes no liability for the contents or use thereof.
In a recent study funded by NJDOT, Rutgers Intelligent Transportation Systems (RITS) researchers successfully developed a state-of-the-art Intelligent Transportation Systems inspection and maintenance manual (ITSIMM) and Rutgers ITS inspection and maintenance software (RITSIMS) based on ITSIMM \(^1\). The results of this unique research project were presented at the 2009 Transportation Research Board conference in Washington D.C. in the form of a research paper that was also published in the journal, Transportation Research Record \(^2\).

The Rutgers research team conducted a number of training workshops to introduce RITSIMS to its potential users. RITSIMS was also installed in several NJDOT inspection, maintenance, and operations staff’s computers to allow them to test the software. The initial feedback from these expert users of the manual and its software was very positive both in terms of its operational approach and user-friendly interface. Comments and suggestions of the training session attendees and NJDOT users were solicited to identify possible future improvements. Regarding these recommendations and suggestions, a need for the enhancements in ITSIMM and RITSIMS emerged. The most important enhancements needed were an additional module for changes and additions to be able to add new questions without using the access database tables, an extended database to include the new equipments installed, and the incorporation of the new ITS testing forms in the software.

Thus, to ensure RITSIMS’ long-term usage as NJDOT’s ITS maintenance and inspection tool, it is important to conduct an implementation study of RITSIMS to obtain the enhanced version, namely Enhanced-RITSIMS (E-RITSIMS). This implementation study will address two major goals:

- To enhance the contents of the ITSIMM and the software namely, RITSIMS based on the recommendations of the expert users of the manual and software.
- To deploy E-RITSIMS for its prospective users from NJDOT operations, inspection and maintenance departments to ensure its use as an efficient tool by NJDOT.
ACKNOWLEDGMENTS

The authors wish to thank various staff members without whom this rewrite would not have been possible. We thank Nazhat Aboobaker and Tim Bourne of the New Jersey Department of Transportation (NJDOT) for their invaluable contributions to the success of this project from its inception to completion of the final report. At each step of the project, they provided the project team with timely advice that significantly enhanced the quality of the final product.

This project was funded by a grant from New Jersey Department of Transportation (NJDOT), and administered through the Center for Advanced Infrastructure and Transportation (CAIT).

Their support is both acknowledged and appreciated.
TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td>1</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>3</td>
</tr>
<tr>
<td>NEED FOR ENHANCEMENTS</td>
<td>5</td>
</tr>
<tr>
<td>Training Sessions (1)</td>
<td>6</td>
</tr>
<tr>
<td>Expert Meetings with NJDOT Personnel</td>
<td>7</td>
</tr>
<tr>
<td>Feedback from NJDOT Personnel</td>
<td>8</td>
</tr>
<tr>
<td>IMPLEMENTATIONS</td>
<td>9</td>
</tr>
<tr>
<td>User Manual</td>
<td>15</td>
</tr>
<tr>
<td>CONCLUSIONS AND RECOMMENDATIONS</td>
<td>16</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>17</td>
</tr>
<tr>
<td>APPENDIX A – PERSONNEL CONTACT LIST</td>
<td>18</td>
</tr>
<tr>
<td>APPENDIX B – SAMPLE ITS TEST FORM</td>
<td>19</td>
</tr>
<tr>
<td>APPENDIX C – RITSIMS USER MANUAL</td>
<td>20</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Add/Remove Module</td>
<td>9</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Comment Boxes</td>
<td>10</td>
</tr>
<tr>
<td>Figure 3</td>
<td>User Interface Improvement for Changes in the Answers</td>
<td>11</td>
</tr>
<tr>
<td>Figure 4</td>
<td>A Sample from the Extended ITS Database</td>
<td>11</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Camera Surveillance System (CSS) Testing Form</td>
<td>13</td>
</tr>
<tr>
<td>Figure 6</td>
<td>ITS Testing Form History Check</td>
<td>14</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Database Option</td>
<td>15</td>
</tr>
</tbody>
</table>

LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>NJDOT Training Session Attendee List</td>
<td>7</td>
</tr>
<tr>
<td>Table 2</td>
<td>NJDOT Meeting Attendee List</td>
<td>18</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

This report describes and documents the work completed on an implementation project funded by New Jersey Department of Transportation (NJDOT) and conducted by Rutgers Intelligent Transportation Systems (RITS) researchers.

In a recent study funded by NJDOT, Rutgers Intelligent Transportation Systems (RITS) researchers successfully developed a state-of-the-art Intelligent Transportation Systems inspection and maintenance manual (ITSIMM) and Rutgers ITS inspection and maintenance software (RITSIMS) based on ITSIMM\(^{(1)}\). The results of this unique research project were presented at the 2009 Transportation Research Board conference in Washington D.C. in the form of a research paper that was also published in the Journal of Transportation Research Record \(^{(2)}\). Several agencies and departments of transportation expressed interest in the ITSIMM and RITSIMS tool. As a result of this study, NJDOT now has an inspection and maintenance manual as a reference document to assist NJDOT's inspectors, ITS design, traffic operations, and maintenance personnel, in minimizing inspection and maintenance related problems, monitoring the performance of equipment, and providing a cost-effective approach to inspecting, maintaining, upgrading, and operating ITS equipment on roadways.

Moreover, RITSIMS provides NJDOT with complete, practical, and efficient inspection procedures for the proper installation, inspection, and maintenance of ITS equipment by:

- Implementing efficient inspection, maintenance, and troubleshooting practices,
- Monitoring the performance of personnel and equipment,
- Increasing the useful life of equipment and keeping inventory costs lower,
- Scheduling the maintenance activities and recording failure rates in a more professional way.

The Rutgers research team conducted a number of training workshops to introduce RITSIMS to its potential users, and RITSIMS was installed on several NJDOT inspection, maintenance, and operations staff’s computers to allow them to test the software. The feedback from these expert users of the manual and its software was very positive both in terms of its operational approach and user-friendly interface.

Comments and suggestions of the training session attendees, and expert meetings with NJDOT users were solicited to identify possible future improvements. Regarding these recommendations and suggestions, a need for an improvement in ITSIMM and
RITSIMS emerged as a separate implementation project. The most important enhancements needed were an additional module for changes and additions to be able to add new questions without using the access database tables, an extended database to include the new equipments installed, and the incorporation of the new ITS device testing forms\(^{(3)}\) in the software.

Thus, to ensure RITSIMS' long-term usage as NJDOT's ITS maintenance and inspection tool, RITS Lab researchers conducted an implementation study of RITSIMS to obtain the enhanced version, namely Enhanced-RITSIMS (E-RITSIMS).

This implementation study addressed two major goals:

- To enhance the content of the ITSIMM and its software, RITSIMS, based on the recommendations of the expert users of the manual and software.
- To deploy E-RITSIMS and train its prospective users through a series of hands-on interactive workshops to ensure its use as a cost-saving and efficiency tool by NJDOT.
INTRODUCTION

To ensure that ITS will meet the needs of both the New Jersey Department of Transportation (NJDOT) and the traveling public, Rutgers University Intelligent Transportation Systems Lab (RITS Lab) researchers successfully developed a state-of-the-art Intelligent Transportation Systems inspection and maintenance manual (ITSIMM) and Rutgers ITS inspection and maintenance software (RITSIMS) based on ITSIMM (1). A vast amount of knowledge has been extracted and incorporated into ITSIMM from knowledgeable and experienced NJDOT personnel, and well-trained inspectors and subcontractors. With this knowledge and information, ITSIMM has been created as a comprehensive reference document that has separate inspection (acceptance), maintenance, and troubleshooting sections. These comprehensive guidelines have been implemented in RITSIMS with these specific characteristics:

- A user-friendly interface for usage by any personnel (not only experts on the subject),
- A unique system to perform all the inspection and maintenance checks of ITS equipment on site from beginning to end,
- A simple database system that can allow further changes and queries,
- An efficient database synchronization system to ensure the up-to-dateness of all the computers used.

This manual and computer program are currently being used to improve the efficiency and effectiveness of inspection and maintenance procedures conducted by NJDOT personnel.

The Rutgers research team conducted a number of training workshops to introduce RITSIMS to its potential users, and RITSIMS was also installed in several NJDOT inspection, maintenance, and operations staff's computers to allow them to test the software. The feedback from these expert users of the manual and its software was very positive both in terms of its operational approach and user-friendly interface.

After the training workshops, several meetings have been conducted with NJDOT personnel to discuss the future steps for RITSIMS in terms of improving the functionalities of the software and the database (See the list of attendees in Appendix A). During these meetings, new equipment database and ITS device testing forms were received (3), and the latest version of RITSIMS was installed on key NJDOT personnel's computers to obtain their suggestions. This software was also given to engineers and experts for further debugging of the user interface.
Comments and suggestions of the meetings and training session attendees and NJDOT users were solicited to identify possible future improvements. Regarding these recommendations and suggestions, a need for the enhancements in ITSIMM and RITSIMS emerged. The most important enhancements needed were:

- an additional module for changes and additions, such as new questions, without using the access database tables,
- a comment box to add comments and suggestions for any question,
- a user interface change to be able to go back and forth between questions, by adding new buttons with which answers can be changed easily,
- an extended database to include newly installed equipment, and
- the incorporation of the new ITS testing forms in the software.

In this report, the Rutgers ITS Inspection and Maintenance Software (RITSIMS) was enhanced using the comments and suggestions obtained based on the training workshops and expert meetings. As a result, the enhanced software (E-RITSIMS) for inspection and maintenance of ITS equipment was implemented for use by NJDOT personnel. A new extended database of ITS equipment was included in the new software, and the new ITS testing forms used by NJDOT were added into the program. Another important feature of E-RITSIMS is the capability to be able to add new questions without using the access database tables, as opposed to the previous version of RITSIMS.

This report details the development of the implementations for the manual and software, and is divided into four sections including the introduction:

Section 2 provides a brief overview of the need to develop the enhanced version of the manual and its software. Section 3 explains how ITSIMM and RITSIMS were enhanced using the new databases, ITS testing forms, and additional modules. Finally, Section 4 presents the results of the work as well as conclusions and recommendations.
NEED FOR ENHANCEMENTS

This research stems from previous work that was conducted during 2006-2008\(^1\). During this time period several tasks were completed. They were:

- Review the existing literature, conduct surveys, expert meetings, and training sessions,
- Develop a state-of-the-art inspection and maintenance manual for checklists for ITS equipment,
- Develop a user friendly and efficient software tool (RITSIMS) to be able to perform these inspection and maintenance checks electronically, and
- Identify and investigate future needs.

As a continuation of this work, the main challenge in this project was to obtain the comments and suggestions of the expert users, and therefore to determine the needs for implementation using a diverse set of experts and sources. Based on a series of training workshops, meetings with NJDOT contacts and debugging of the software, RITS Lab researchers have discovered several potential enhancements that would help NJDOT personnel use the ITSIMM and RITSIMS more efficiently in their inspection and maintenance activities.

As our role is to define an effective process that will capture the expertise of NJDOT personnel as the main resource, we supplemented this resource with knowledge that already existed at NJDOT databases as well as the published material and inspection forms for the Intelligent Transportation Systems NJDOT created to able to perform inspections of ITS equipment.

This step involved obtaining new databases and forms, meeting with experts, reviewing their suggestions and comments, and debugging of the software, to acquire the knowledge to be used in enhancing the knowledge base necessary to produce the content for the ITSIMM, its checklists, and the RITSIMS software.

The meeting and training session attendees were identified by Tim Bourne of New Jersey Traffic Operations North (NJDOT) as personnel highly experienced in inspection and/or maintenance of ITS components.
Training Sessions

Extensive training sessions of RITSIMS were held for NJDOT traffic operations, inspection, and construction (north, south, and central regions) personnel. More than 30 NJDOT personnel attended these initial training sessions.

There were two basic sessions:

- In the first session, a brief introduction about the study was presented to the attendees. The functionalities of the software were introduced, and several inspection and maintenance example checks were interactively performed.
- In the second session, the basic features of the software were shown to the attendees using case-based scenarios. These scenarios include:
  - Inspection,
  - Maintenance,
  - Updating (inspection and maintenance answers),
  - Troubleshooting,
  - Database synchronization, and
  - History checks and queries.

The case-based scenarios for inspection and maintenance procedures using RITSIMS were given to the attendees, and they successfully performed both scenarios. During and after the training, comments and suggestions of the attendees were also solicited to identify possible future improvements.

On April 20th, 2011, another training session was held with the following NJDOT personnel, where several new implementations are suggested:
Table 1 - NJDOT Training Session Attendee List

<table>
<thead>
<tr>
<th>NAME</th>
<th>CONTACT INFORMATION</th>
<th>DEPARTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jagdish Rana</td>
<td>E-mail: <a href="mailto:Jagdish.Rana@dot.state.nj.us">Jagdish.Rana@dot.state.nj.us</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tel: 856-486-6095</td>
<td>NJDOT Traffic Operations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>North</td>
</tr>
<tr>
<td>Ram Patel</td>
<td>E-mail: <a href="mailto:Ramchandra.Patel@dot.state.nj.us">Ramchandra.Patel@dot.state.nj.us</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tel: 609-658-1216</td>
<td>NJDOT-ITS Eng.</td>
</tr>
<tr>
<td>Tim Bourne</td>
<td>E-mail: <a href="mailto:Tim.Bourne@dot.state.nj.us">Tim.Bourne@dot.state.nj.us</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tel: 201-297-7073</td>
<td>NJDOT Traffic Operations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>North</td>
</tr>
<tr>
<td>Frank M. Preziosso</td>
<td>E-mail: <a href="mailto:Frank.Preziosso@dot.state.nj.us">Frank.Preziosso@dot.state.nj.us</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tel: 609-530-5938</td>
<td>NJDOT-ITS Eng.</td>
</tr>
</tbody>
</table>

Expert Meetings with NJDOT Personnel

Several meetings have been conducted with the NJDOT personnel:

- February 10\textsuperscript{th}, 2010, with Tim Bourne of NJDOT in Trenton,
- February 16\textsuperscript{th}, 2010, with Tim Bourne of NJDOT in the Transportation Management Center of NJDOT North,
- June 24\textsuperscript{th}, 2010, with the NJDOT personnel in Trenton (see Appendix A for the list of attendees),
- August 19\textsuperscript{th}, 2010, March 15\textsuperscript{th}, 2011 and March 28\textsuperscript{th}, 2011, with Tim Bourne of NJDOT North at the Department Civil and Environmental Engineering at Rutgers University.

These meetings were arranged for the following purposes:

- to discuss the results of the research efforts,
- to concentrate on major issues,
- to work on specific cases, and
- to obtain a consensus for the next stages of ITSIMM and RITSIMS, and
- to facilitate training sessions of E-RITSIMS for NJDOT personnel.

The expert meetings were especially important in terms of capturing the long-term knowledge of NJDOT personnel responsible for ITS maintenance and inspection issues.
The experts provided a number of comments and problem-specific information to the manual and its software, RITSIMS.

**Feedback from NJDOT Personnel**

Through these meetings and training sessions with experienced personnel of NJDOT, it was possible to have a more accurate way of understanding the department’s ITS needs and problems. These meetings served mainly as a means of gathering specific information about the possible usage of ITSIMM and RITSIMS in the current state of practice of the inspection and maintenance process of ITS equipment in New Jersey. Therefore, these meetings included the following:

1. Discussion of the structure and content of the inspection and maintenance activities within NJDOT.
2. Discussion of follow-up enhancements and implementations on RITSIMS by improving the functionalities of the software to obtain a more practical and efficient way of the ITS maintenance and inspection procedures that were being performed within NJDOT.
3. Submission of the latest version of RITSIMS to the attendees to obtain their new suggestions.

The feedback from the expert users of the manual and its software is very positive in terms of its operational approach and its user-friendly interface.

The manual and its software RITSIMS were also constantly revised by experts from NJDOT. Comments of the experts were obtained several times for different versions of the manual and its software to verify the efficiency and effectiveness of ITSIMM and RITSIMS.

As a result of the meetings and continuous revisions by expert NJDOT personnel, several needs for the implementations were identified.
IMPLEMENTATIONS

Since the release of the original "Manual of Guidelines for Inspection of ITS Equipment and Facilities" Report in September of 2008 (1), RITS Lab researchers and the New Jersey Department of Transportation have worked together to advance several of the primary recommendations put forth by expert NJDOT users. These include the addition of new modules and enhancements in the structure (a manual to use the additional modules and improvements of E-RITSIMS is provided in Appendix C). These implementation measures can be broken down into seven distinct categories.

1. RITSIMS was improved with the functionality of an additional module for changes and additions, and to be able to add new questions without using the access database tables. This module is called the Add/Remove Tool (Figure 1).

![Figure 1. Add/Remove Module](image)

2. A comment box is added to every question to be able to add comments and suggestions, and the results are saved in the access databases as before (Figure 2).
3. Several user interface changes are added to RITSIMS to make the software more user-friendly, based on the comments and suggestions made at the training sessions. The most important user interface change was making it possible to go back and forth between questions by adding new buttons (Figure 3).
4. The Rutgers University research team has updated the ITS equipment database of RITSIMS based on the new data obtained from Tim Herlihy of NJDOT. Now, we have approximately 700 equipments in the database, including CCTV, VMS, HAR, RTMS, WIM equipment (Figure 4).

Figure 4. A Sample from the Extended ITS Database
5. Regarding our meetings with Tim Bourne of NJDOT, the software is updated using the new ITS testing forms of NJDOT. A sample ITS device form can be seen in Appendix B. There are 22 ITS testing forms being implemented into the software, of which 17 are distinct:

- Communication Cable - CC (General)
- Camera Surveillance Systems - CSS (Level A, B and C)
- Fiber Optics - FO (Level 1 and 2)
- Controlled Traffic Signal System - CTSS (Level A and C)
- Travel Time Systems - TTS (Level A, B and C)
- Road Weather Information Systems - RWIS (Level A, B and C)
- Dynamic Message Systems - DMS (Level A, B and C)
- Weight in Motion Systems - WIMS (Level A and C)
- Traffic Volume Systems - TVS (Level A and C)

An example ITS device, Level A testing form for a Camera Surveillance Systems (CSS), can be seen in Figure 5.
Figure 5. Camera Surveillance System (CSS) Testing Form

6. A history check option has been created for the ITS Device Testing Forms (Figure 6).
Database history is changed in a way that it can be seen at the bottom of the interface and results are being saved to the database while the inspection and maintenance operations are performed (Figure 7).
8. Several software-related bugs are fixed.

User Manual

A comprehensive user manual for the new implementations of RITSIMS, given in Appendix C, was also prepared and submitted to NJDOT. This manual includes all the key features and functionalities of the enhancements in the software.
CONCLUSIONS AND RECOMMENDATIONS

This study has enhanced the state-of-the-art Intelligent Transportation Systems Inspection and Maintenance Manual (ITSIMM) and Rutgers ITS Inspection and Maintenance Software (RITSIMS) based on ITSIMM. These enhancements are as follows:

- ITS equipment database is improved and updated based on the new data obtained from NJDOT (Now, we have approximately 700 equipments in the database, including CCTV, VMS, HAR, RTMS, WIM equipment).
- An additional module for allowing additions/changes to the questions inside the software is created.
- Comment buttons are added to any active question in the checklists, to able to write comments for every specific question.
- New buttons are added to be able to go back and forth between the checklist questions.
- Database history is changed in a way that it can be seen at the bottom of the interface and results are being saved to the database while the inspection and maintenance operations are performed.
- New ITS device testing forms obtained from NJDOT are implemented in the software and integrated with the previous features of the RITSIMS.
- Location database is integrated, and answers to the questions are saved in the same database of the old version of RITSIMS as a separate sheet.
- Several hand-on sessions were conducted at different stages of the project to obtain feedback from prospective users of this tool at NJDOT, and also to introduce them to the new features.
- Enhanced RITSIMS is installed on the computers of the prospective users to let them experiment with the tool and its functionalities. This is another way to obtain additional feedback for possible improvements that will make the manual and its software implementation more useful.

A manual to use the additional modules and improvements of E-RITSIMS is provided in Appendix C. The feedback from the expert users of the manual and its software is very positive in terms of its operational approach and its user-friendly interface. NJDOT plans to conduct a pilot test of E-RITSIMS to ensure its long-term usage as the main ITS maintenance and inspection tool. The research team is working closely with NJDOT to set up a field implementation of E-RITSIMS in the near future, and there are several recommendations that can be implemented to enhance E-RITSIMS as a second phase. Among them, the most promising future recommendations are:

- We do not have editing and modification capabilities for the new ITS testing forms right now but these features will also be added after the implementation of all forms are completed.
• We plan to have history check features and integration module with the old features of RITSIMS available for the new forms.
• Database structure should be improved in order to satisfy the space requirements of some ITS device testing forms.
• Outreach to inspection, operations, and ITS personnel in NJDOT to introduce this tool, is one of our key tasks. Meetings and training sessions will be held for this purpose for the new features of RITSIMS, such as the new ITS testing forms.
• A field implementation with NJDOT personnel is proposed to understand the advantages and drawbacks of the software while being used in the field for inspection and maintenance operations.
• Current versions of RITSIMS installed in the computers of NJDOT key personnel will be updated with E-RITSIMS, version 1.5 Beta.
• New equipment will be added into the database.
• Access limitations via passwords can be implemented.
• We plan to have printable PDF versions of the inspection and maintenance reports, so that these PDF documents can be sent via e-mail.

REFERENCES

# Appendix A – Personnel Contact List

Table 2 - NJDOT Meeting Attendee List

<table>
<thead>
<tr>
<th>NAME</th>
<th>CONTACT INFORMATION</th>
<th>DEPARTMENT</th>
</tr>
</thead>
</table>
| Mark Renner         | E-mail: [Mark.Renner@dot.state.nj.us](mailto:Mark.Renner@dot.state.nj.us)  
Tel: 856-486-6095 | NJDOT Traffic Operations South    |
| George Carroll      | E-mail: [George.Carroll@dot.state.nj.us](mailto:George.Carroll@dot.state.nj.us) 
Tel: 609-658-1216 | NJDOT Central Region Construction |
| Donald Mottola      | E-mail: [Donald.Mottola@dot.state.nj.us](mailto:Donald.Mottola@dot.state.nj.us) 
Tel: 609-273-3208 | NJDOT Central Region Construction |
| Tim Bourne          | E-mail: [Tim.Bourne@dot.state.nj.us](mailto:Tim.Bourne@dot.state.nj.us)  
Tel: 201-297-7073 | NJDOT Traffic Operations North    |
| Don Albanese        | E-mail: [Don.Albanese@dot.state.nj.us](mailto:Don.Albanese@dot.state.nj.us) 
Tel: 609-530-6105 | NJDOT-ITS Eng.                   |
| Victoria Battaglia  | E-mail: [Victoria.Battaglia@dot.state.nj.us](mailto:Victoria.Battaglia@dot.state.nj.us) 
Tel: 609-530-6107 | NJDOT-ITS Eng.                   |
| Frank M. Prezioso   | E-mail: [Frank.Prezioso@dot.state.nj.us](mailto:Frank.Prezioso@dot.state.nj.us) 
Tel: 609-530-5938 | NJDOT-ITS                        |
APPENDIX B – SAMPLE ITS TEST FORM

NEW JERSEY DEPARTMENT OF TRANSPORTATION

CAMERA SURVEILLANCE SYSTEM
DEVICE TESTING - LEVEL A

Project Name: ________________________________  Test Date: ____________

Camera #: ______ Route: ______ MM: _______ NB/SB/EB/WE/Median
Nearest Side Street Name: ____________________________
Longitude: _______________________  Latitude: ________________________

This procedure outlines Level A device test to be performed on Camera Surveillance System. Perform the following tests at controller camera sites using vendor certified Software. Level A device testing demonstrates that the individual devices at each work site are fully operational.

Testing Software Name: ________________________________

Service Pole No.: ______________________________________

Camera Manufacturer: ____________________________
Camera Model No.: ____________________________  Camera Serial No.: ____________

1: VIDEO FEED

<table>
<thead>
<tr>
<th>No.</th>
<th>Task</th>
<th>Required Value</th>
<th>Actual Value</th>
<th>Pass</th>
<th>Fail</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Perform following tests at Remote Data Port</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.</td>
<td>Display Video</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II.</td>
<td>Verify PTZ controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III.</td>
<td>Verify Alarm Operation of Data Port door</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV.</td>
<td>Video Signal quality 1 Vp-p</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V.</td>
<td>Video signal to noise ratio &gt;50dB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2: PAN, TILT & ZOOM FUNCTIONS

<table>
<thead>
<tr>
<th>No.</th>
<th>Task</th>
<th>Required Value</th>
<th>Actual Value</th>
<th>Pass</th>
<th>Fail</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2A</td>
<td>Confirm Pan Controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.</td>
<td>Continuous Pan Rotation 360°</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II.</td>
<td>Variable Pan Speed (per second)</td>
<td>Dome: 0.1° to 80°  Positional: 0.1° to 4°</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2B</td>
<td>Confirm Tilt Controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.</td>
<td>Variable Tilt Speed (per second)</td>
<td>Dome: 0.1° to 40°  Positional: 0.1° to 20°</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II.</td>
<td>Vertical Tilt Range Unobstructed</td>
<td>Dome: 0.2° to 92°  Positional: +25° to -23°</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2C</td>
<td>Confirm Zoom Controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.</td>
<td>Zoom</td>
<td>Dome: 23X Optical  12X Digital  Positional: 24X Optical  10X Digital</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date: Jan. 05, 2009

Page 1 of 3
HOW TO USE ADD-REMOVE TOOL?

![Image of RITSIMS User Manual page showing how to use the Add-Remove tool.]
HOW TO ADD A QUESTION TO INSPECTION CHECKLISTS?

1. Select Inspection Option
2. Select the Equipment
   - E for all Inspection Items
3. Select the Component from the List
4. Write your new inspection checklist question.
   
   **ADD QUESTION.**
HOW TO ADD A QUESTION TO MAINTENANCE CHECKLISTS?

Select Maintenance Option
Select the Type of Maintenance: Preventive, Brand or Specific

Select the Equipment
CCTV, VMS, HAR, Comm&Dist. Systems, Detectors

Select the Component from the List
or Troubleshooting (This option can be selected any time regardless of equipment selection)

Write your new maintenance checklist question.
ADD QUESTION.
COMMENTS FOR THE QUESTIONS

CHECKLIST QUESTIONS:

All conduits should be of types approved for electrical use and should have the proper identification mark and customer identification numbers (NJDOT approved conduits).

Installation should be made in conformance with minimum requirements of state. Check that conduit is the proper size and type as detailed in the plans and specifications. Verify that all subsurface utilities have been located (i.e. marked out) before excavation.

NJDOT standard specifications require 1-800 ONE notification and separate notification.

Check excavation trench width and depth for compliance with plans and specifications. Check that conduit is placed at proper depth and slope. Conduit should drain into a catch basin for proper spacer installation (multiple PVC conduit cross section only) and Boring or jacking operations should not interfere with traffic operation and should not be done in the roadway pavement.

Any open cuts in the roadway pavement should be approved by the project engineer. The radius of the curve of the inner edge of any field bend shall not be less than the conduit size. PVC conduits should be terminated flush with the top of concrete and the end of the conduit should enter the junction box at right angles and extend 1.5 in. Rigid metal conduit should be cut square, threaded, and reamed on each end. Nonmetallic conduit should be terminated flush with the inside wall, and approved. Galvanized spray should be used on all threaded sections and on any damaged parts. PVC conduit ends should also be square and free of burrs and sharp edges. Joint Nonmetallic conduits should be cleaned before applying the solvent-weld method.

COMMENTS: 

Checklist Questions: 27 / 27

PASS: 0
FAIL: 0
SKIPPED: 0
HOW TO CHANGE ANSWERS FOR INSPECTION QUESTIONS?

1. Select Change Answers
2. Select the Question
3. Use Up and Down buttons
4. Select the Answer
5. Pass, Fail or Skip
6. Update the checklist
HOW TO CHANGE ANSWERS FOR MAINTENANCE QUESTIONS?

1. Select Change Answers
2. Select the Question
3. Use Up and Down buttons
4. Select the Answer: Completed, Not Completed, Skip
5. Select the New Condition: Excellent, Good, Fair or Bad
6. Update the checklist
HOW TO USE THE ITS DEVICE (CSS) TESTING FORMS (LEVEL A)?

1. Select the Device Testing Form
2. Select the Test Date
3. Use the Scroll button
4. Select the Location from the Database
5. Answer the Questions, PASS or FAIL, write any comment if needed
6. Choose submit after answering all the questions

Answer the Questions, PASS or FAIL, write any comment if needed

Choose submit after answering all the questions
HOW TO USE THE ITS DEVICE (CSS) TESTING FORMS (LEVEL B)?

1. Select the Device Testing Form
2. Select the Test Date
3. Use the Scroll button
4. Select the Location from the Database
5. Answer the Questions, PASS or FAIL, write any comment if needed
6. Choose submit after answering all the questions
HOW TO USE THE ITS DEVICE (CSS) TESTING FORMS (LEVEL C)?

1. Select the Device Testing Form
2. Select the Test Date
   - Use the Scroll button
3. Select the Location from the Database and Add a Camera
4. Answer the Questions, PASS or FAIL, write any comment if needed
5. Choose submit after answering all the questions
HOW TO USE THE ITS DEVICE (RWIS) TEST FORMS (LEVEL A)?

Select the Device Testing Form

Select the Test Date

Use the Scroll button

Write the Location Info: Route, Mileage Post, Direction and Nearest Street Name

Answer the Questions, PASS or FAIL, write any comment if needed

WRITE THE ACTUAL VALUE!

Choose submit after answering all the questions
HOW TO USE THE ITS DEVICE (RWIS) TEST FORMS (LEVEL B)?

Select the Device Testing Form

Select the Test Date

Use the Scroll button

Write the Location Info: Route, Mileage Post, Direction and Nearest Street Name

Answer the Questions, PASS or FAIL, write any comment if needed

WRITE THE ACTUAL VALUE!

Choose submit after answering all the questions
HOW TO USE THE ITS DEVICE (CO. CABLE) TEST FORMS?

Select the Device Testing Form

Select the Test Date

Use the Scroll button

Write the Location Info: Route, Mileage Post, Direction and Nearest Street Name

Answer the Questions, PASS or FAIL, write any comment if needed

WRITE THE ACTUAL VALUE!

Choose submit after answering all the questions
HOW TO PERFORM THE ITS TESTING FORM HISTORY CHECK?

Select the View History Option

Select the Location

Select the Date

Click on the Button1

See the answers for the questions