

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

FINAL REPORT
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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 Demiroglu
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.

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16. Abstract <p>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⁾.</p> <p>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.</p> <p>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:</p> <ul style="list-style-type: none"> 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. 			
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TABLE OF CONTENTS

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

LIST OF FIGURES

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

LIST OF TABLES

	Page
Table 1 - NJDOT Training Session Attendee List.....	7
Table 2 - NJDOT Meeting Attendee List.....	18

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 ⁽¹⁾

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 ⁽¹⁾.

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

NAME	CONTACT INFORMATION	DEPARTMENT
Jagdish Rana	E-mail: Jagdish.Rana@dot.state.nj.us Tel: 856-486-6095	NJDOT Traffic Operations North
Ram Patel	E-mail: Ramchandra.Patel@dot.state.nj.us Tel: 609-658-1216	NJDOT-ITS Eng.
Tim Bourne	E-mail: Tim.Bourne@dot.state.nj.us Tel: 201-297-7073	NJDOT Traffic Operations North
Frank M. Prezioso	E-mail: Frank.Prezioso@dot.state.nj.us Tel: 609-530-5938	NJDOT-ITS Eng.

Expert Meetings with NJDOT Personnel

Several meetings have been conducted with the NJDOT personnel:

- February 10th, 2010, with Tim Bourne of NJDOT in Trenton,
- February 16th, 2010, with Tim Bourne of NJDOT in the Transportation Management Center of NJDOT North,
- June 24th, 2010, with the NJDOT personnel in Trenton (see Appendix A for the list of attendees),
- August 19th, 2010, March 15th, 2011 and March 28th, 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).

RITSIMS Release v1.5 Beta (x64)

Program Tools History ITS Manual (Pdf) Pause (Reset)

CLOSED CIRCUIT TELEVISION SYSTEMS

VARIABLE MESSAGE SIGNS

ROADWAY INFO SYSTEMS

COMMUNICATION - DISTRIBUTION SYSTEMS

TRAFFIC DETECTORS

SELECT OPTIONS

INSPECTION MAINTENANCE

TROUBLESHOOTING

SELECT EQUIPMENT

Check Equipment History

NEXT

SELECT INSPECTION EQUIPMENT

SELECT MAINTENANCE COMPONENT

APPLICATION DETAILS

START APPLICATION

Account Manager Inspection Maintenance Troubleshooting History Add/Remove

Select Options: ☒ Inspection ☐ Maintenance

ADD QUESTION

Select Equipment: E

Select Component: CF

Communication and FieldEquipmentCabinet

Question:

ADD Question

Database: ON Inspection Equipments (History) Maintenance Options (History)

Figure 1. Add/Remove Module

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).

CHECKLIST QUESTIONS: Change Answers N/A (SKIP The Question)

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. 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 the trench. Check for proper spacer installation (multiple PVC conduit cross section only) and Boring or jacking operations should not interfere with traffic operation and should be approved by the project engineer. 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 radius of the conduit. PVC conduits should be terminated flush with the top of concrete and the end of the conduit should be sealed. Metallic conduit should enter the junction boxes at right angles and extend 1.5 in. Rigid metal conduit should be cut square, threaded, and reamed on each end with a reamer. Nonmetallic conduit should be terminated flush with the inside wall, and approved sealant should be used on all threaded sections and on any damaged galvanized sections. Galvanized spray should be used on all threaded sections and on any damaged galvanized sections. PVC conduit ends should also be square and free of burrs and sharp edges. Joint compound should be applied to all joints. Nonmetallic conduits should be cleaned before applying the solvent-weld method.

COMMENTS:

UP DOWN Previous answer for Question: New Answer Update

☒ PASS ☐ FAIL NEXT Questions

Checklist Questions: 27 / 27

PASS: 0
FAIL: 0
SKIPPED: 0

Next Component EXIT

Figure 2. Comment Boxes

- 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).

COMMENTS:

[UP](#)
[DOWN](#)
[Previous answer for Question:](#)
[SKIP](#)
[New Answer](#)
[Update](#)

Make sure that all work is done in a professional manner.

[PASS](#)
[FAIL](#)
[SKIP](#)

[NEXT](#)

Figure 3. User Interface Improvement for Changes in the Answers

- 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).

	B	C	D	E	F	G	H	I	J
	DEVICE_TYPE	PRIMARY_ROUTE	SRI	MILEPOST	LOCATION	DIRECTION	STATUS	LATITUDE	LONGITUDE
1	CCTV	1/9	00000001_S	36.5	Hudson Blvd	SB	EXISTING	40.573419	-74.291313
2	CCTV	1/9	00000001_S	37.1	Lord ST	SB	EXISTING	40.579566	-74.285666
3	CCTV	1/9	00000001_S	37.5	S Inman Ave	SB	EXISTING	40.587116	-74.2791389
4	CCTV	1/9	00000001_S	39.4	E Grand Ave	SB	EXISTING	40.606358	-74.261697
5	CCTV	1/9	00000001_S	38.9	Hancock ST	SB	EXISTING	40.602052	-74.268988
6	CCTV	1/9	00000001	40.5	Airport RD	NB	EXISTING	40.618344	-74.250575
7	CCTV	1/9	00000001	41	S Wood Ave	NB	EXISTING	40.62655	-74.2430778
8	CCTV	1/9	00000001	42	RT 278	NB	EXISTING	40.640152	-74.230666
9	CCTV	1/9	00000001_S	42.7	Park Ave	SB	EXISTING	40.6436833	-74.2282611
10	CCTV	1/9	00000001	42.8	Bachelor Ave	MD	EXISTING	40.647816	-74.224502
11	CCTV	1/9	00000001	43.1	Bayway Circle	NB	EXISTING	40.650527	-74.220922
12	CCTV	1/9	00000001	43.7	Grove ST	NB	UNDER CONSTRUCTION	40.6544194	-74.2116361
13	CCTV	1/9	00000001	44.3	E Jersey ST	NB	UNDER CONSTRUCTION	40.662622	-74.20655
14	CCTV	1/9	00000001	44.7	Bond ST	NB	EXISTING	40.667716	-74.203305
15	CCTV	1/9	00000001_S	45.1	Meadow ST	SB	EXISTING	40.675577	-74.198975
16	CCTV	1/9	00000001_S	45.5	Dowd Ave Ramp	SB	EXISTING	40.679086	-74.1953917
17	CCTV	1/9	00000001_S	46.5	Pulaski Skyway S	SB	EXISTING	40.69228	-74.190316
18	CCTV	1/9	00000001	46.4	Pulaski Skyway N	NB	EXISTING	40.69083	-74.190883
19	CCTV	1/9	00000001	46.7	I-78 Connector	NB	EXISTING	40.693572	-74.187766
20	CCTV	1/9	00000001_S	47.3	Haynes Ave	SB	EXISTING	40.701955	-74.185552
21	CCTV	1/9	00000001_S	47.85	RT 21 north bound connector	SB	EXISTING	40.7093917	-74.1803583
22	CCTV	80	00000080	63.2	Palisades Park	EB	EXISTING	40.8421944	-73.9946806
23	CCTV	80	00000080	64	Bergen Blvd	EB	EXISTING	40.8516167	-73.9951083
24	CCTV	80	00000080	64.7	AT GWB Approach	EB	EXISTING	40.8589583	-73.9766167
25	CCTV	1	00000001	12.4	Scudders Mill Rd	NB	EXISTING	40.343788	-74.622777
26	CCTV	1	00000001	14.1	Independence Way	MD	EXISTING	40.36143	-74.601655
27	CCTV	1	00000001	19.9	Henderson RD	MD	EXISTING	40.423063	-74.526461
28	CCTV	1	00000001	24.7	Georges RD	NB	EXISTING	40.462744	-74.455655
29	CCTV	1	00000001	27.2	RT 18	NB	EXISTING	40.482866	-74.4183
30	CCTV	1	00000001	29.9	Old Post RD	NB	EXISTING	40.510905	-74.385605
31	CCTV	1	00000001_S	32	RT 287	SB	EXISTING	40.52905	-74.353775
32	CCTV	4	00000004	3.3	RT 17 SB	EB	EXISTING	40.919591	-74.072711
33	CCTV	4	00000004	3.4	RT 17 NB	EB	EXISTING	40.920238	-74.070855
34	CCTV	4	00000004	5.7	Hackensack Ave	EB	EXISTING	40.905741	-74.033658
35	CCTV	4	00000004_W	9.8	Jones RD	WB	EXISTING	40.871488	-73.972572
36	CCTV	4	00000004	10.2	I-95 SB	EB	EXISTING	40.8657944	-73.9743361
37	CCTV	9	00000009_S	102.8	Kennedy Blvd	SB	EXISTING	40.107094	-74.2196083
38	CCTV	9	00000009	106.2	Aldrich RD	NB	EXISTING	40.15545	-74.229566
39	CCTV	9	00000009	111.21	Wyckoff Mill RD	NB	EXISTING	40.221119	-74.266569
40	CCTV	9	00000009_S	114.2	RT 33	SB	EXISTING	40.259075	-74.291744
41	CCTV	9	00000009_S	116.6	Ryan RD	SB	EXISTING	40.293416	-74.298905
42	CCTV	9	00000009_S	117.3	Taylor's Mills RD	SB	EXISTING	40.302658	-74.303997
43	CCTV	9	00000009	121.4	Texas RD	Median	EXISTING	40.360952	-74.305125
44	CCTV	9	00000009	122.3	Spring Valley RD	Median	EXISTING	40.373683	-74.306658
45	CCTV	9	00000009	126.6	Perrine RD	NB	EXISTING	40.435502	-74.301122
46	CCTV	9	00000009_S	131.5	RT 35	SB	EXISTING	40.498497	-74.299919
47	CCTV	9	00000009	132.3	Thomas Edison Bridge	NB	EXISTING	40.512047	-74.300066
48	CCTV	9	00000009	132	South End of Thomas Edison Bridge	NB	EXISTING	40.504005	-74.30058
49	CCTV	9	00000009	132.7	Smith ST	NB	EXISTING	40.516222	-74.29983
50	CCTV	18	00000018	38.9	Edgeboro RD	NB	EXISTING	40.4638083	-74.4044556
51	CCTV	18	00000018						

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.

Camera Surveillance System: Device Testing - LEVEL A

Test Date: 2/15/2011 Location: SUBMIT

1: VIDEO FEED

1A Perform following tests at Remote Data Port

No.	Task	Required Value	Actual Value	Pass	Fail	Comments
▶ 1A I.	Display Video	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A II.	Verify PTZ controls	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A III.	Verify Alarm Operation of Data Port door	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A IV.	Video Signal quality	1 Vp-p		<input type="checkbox"/>	<input type="checkbox"/>	
* 1A V.	Video signal to noise ratio	>50dB		<input type="checkbox"/>	<input type="checkbox"/>	

2: PAN, TILT AND ZOOM FUNCTIONS

2A Confirm Pan Controls / 2B Confirm Tilt Controls / 2C Confirm Zoom Controls

No.	Task	Required Value	Actual Value	Pass	Fail	Comments
▶ 2A I.	Continuous Pan Rotation	360°		<input type="checkbox"/>	<input type="checkbox"/>	
2A II.	Variable Pan Speed (per second)	Dome:0.1° to 80° Positional:0.1° to 40	X	<input type="checkbox"/>	<input type="checkbox"/>	
2B I.	Variable Tilt Speed (per second)	Dome:0.1° to 40° Positional:0.1° to 20°	X	<input type="checkbox"/>	<input type="checkbox"/>	
2B II.	Vertical Tilt Range Unobstructed	Dome:0.2° to -92° Positional:+33° to -83°	X	<input type="checkbox"/>	<input type="checkbox"/>	
* 2C I.	Zoom	Dome:23X Optical 12X Digital Positional:24X Optical 10X Digital	X	<input type="checkbox"/>	<input type="checkbox"/>	

3: CONTROLLER CAMERA CABINET

3A Cabinet Environment Control / 3B Ground Resistance / 3C AC Voltage / 3D Alarms / 3E Cabinet Light

No.	Task	Required Value	Actual Value	Pass	Fail	Comments
▶ 3A I.	Confirm blower heater control with thermostat	In adjustable range of 40°F to 70°F		<input type="checkbox"/>	<input type="checkbox"/>	
3B I.	Verify Ground Resistance	< 25 Ω		<input type="checkbox"/>	<input type="checkbox"/>	
3C I.	Verify AC Input Voltage	120 Volts		<input type="checkbox"/>	<input type="checkbox"/>	
3C II.	Verify Power supply Voltage	24VAC		<input type="checkbox"/>	<input type="checkbox"/>	
3D I.	Verify Low Temperature Alarm	Below 41° F		<input type="checkbox"/>	<input type="checkbox"/>	
3D II.	Verify Ventilation Failure Alarm	At temperature > 120° F		<input type="checkbox"/>	<input type="checkbox"/>	
* 3E I.	Operate Cabinet Switch to Disable the Lamps	X	X	<input type="checkbox"/>	<input type="checkbox"/>	

Figure 5. Camera Surveillance System (CSS) Testing Form

- A history check option has been created for the ITS Device Testing Forms (Figure 6).

View Device testing History

Location: Utility Pole Rt. 27 (22)

Date: 3/9/2011

Button1

	Task	Answer
▶	Ensure that there are in splices in the section of cable betw...	SKIP
	Verify that terminal block enclosure on the utility pole is weat...	SKIP
	Verify communication between controller and terminal block ...	SKIP
	Confirm that cable connections are in compliance with contr...	SKIP
	Verify minimum required slack	SKIP
	Verify grouping and identification tags on new and existing c...	SKIP
	Verify ground resistance of all conductors including the shield	SKIP
	Perform continuity of each pair to verify resistance	SKIP
*	Verify cable tags provides correct information and are secur...	SKIP

Figure 6. ITS Testing Form History Check

- 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).

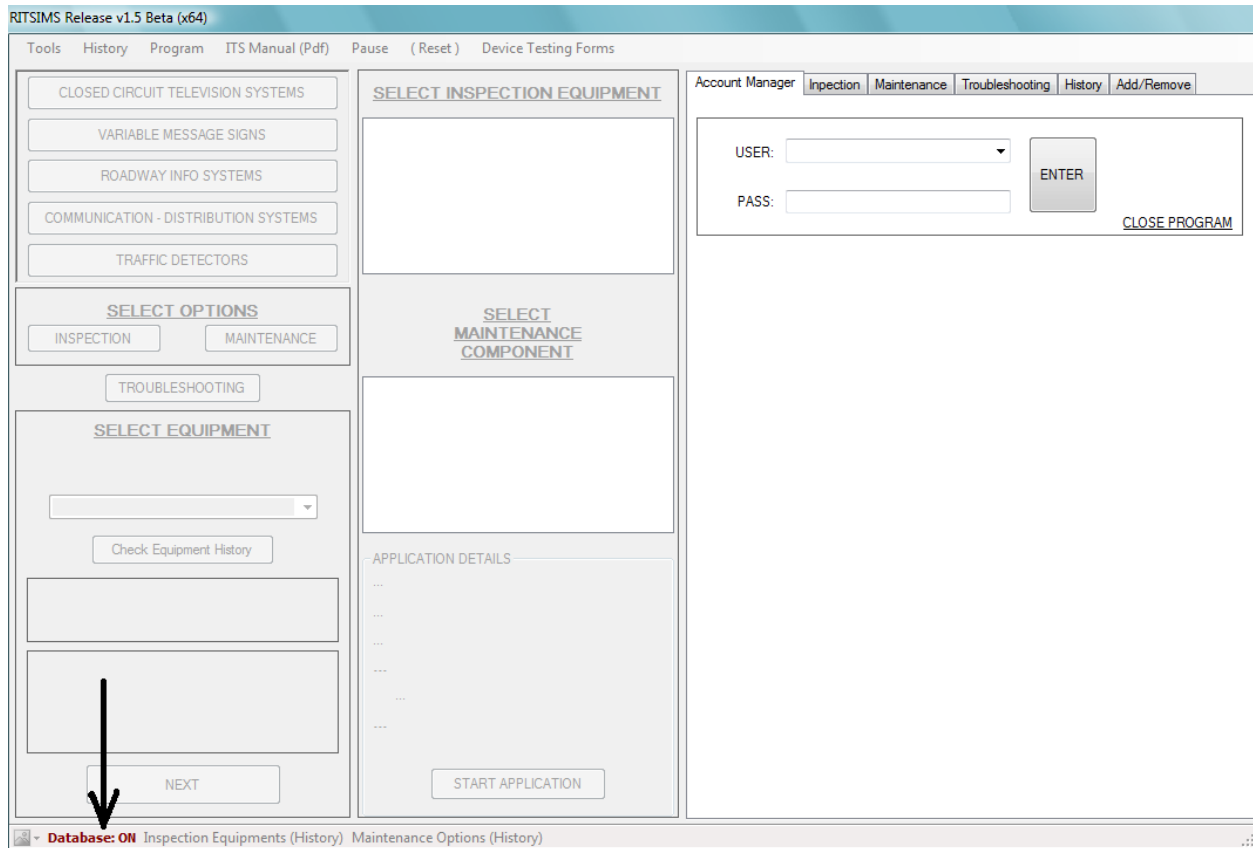


Figure 7. Database Option

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

1. Ozbay, K., Ozguven, E. E., and Sertel, T., "Manual of Guidelines for Inspection of ITS Equipment and Facilities", Technical Report, No: FHWA/NJ-2008-006, September 2008.
2. Ozbay, K., Ozguven, E. E., Sertel, T., Aboobaker, N., Littleton, B., and Caglar, K., "Manual of Guidelines for Inspection and Maintenance of Intelligent Transportation Systems", Transportation Research Record: Journal of Transportation Research Board, Volume 2129, pp. 90-100, 2009.
3. *NJDOT ITS Device Testing Forms*,
<http://www.state.nj.us/transportation/eng/elec/ITS/testing.shtm>.

APPENDIX A – PERSONNEL CONTACT LIST

Table 2 - NJDOT Meeting Attendee List

NAME	CONTACT INFORMATION	DEPARTMENT
Mark Renner	E-mail: Mark.Renner@dot.state.nj.us Tel: 856-486-6095	NJDOT Traffic Operations South
George Carroll	E-mail: George.Carroll@dot.state.nj.us Tel: 609-658-1216	NJDOT Central Region Construction
Donald Mottola	E-mail: Donald.Mottola@dot.state.nj.us Tel: 609-273-3208	NJDOT Central Region Construction
Tim Bourne	E-mail: Tim.Bourne@dot.state.nj.us Tel: 201-297-7073	NJDOT Traffic Operations North
Don Albanese	E-mail: Don.Albanese@dot.state.nj.us Tel: 609-530-6105	NJDOT-ITS Eng.
Victoria Battaglia	E-mail: Victoria.Battaglia@dot.state.nj.us Tel: 609-530-6107	NJDOT-ITS Eng.
Frank M. Prezioso	E-mail: 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/WB/Median			
Nearest Side Street Name: _____						
Longitude: _____			Latitude: _____			
<p>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.</p>						
Testing Software Name: _____						
Service Pole No.: _____						
Camera Manufacturer: _____						
Camera Model No.: _____			Camera Serial No.: _____			
1: VIDEO FEED						
No.	Task	Required value	Actual Value	Pass	Fail	Comments
1A	<i>Perform following tests at Remote Data Port</i>					
I.	Display Video					
II.	Verify PTZ controls					
III.	Verify Alarm Operation of Data Port door					
IV.	Video Signal quality	1 Vp-p				
V.	Video signal to noise ratio	>50dB				
2: PAN, TILT & ZOOM FUNCTIONS						
No.	Task	Required Value	Actual Value	Pass	Fail	Comments
2A	<i>Confirm Pan Controls</i>					
I.	Continuous Pan Rotation	360°				
II.	Variable Pan Speed (per second)	Dome: 0.1° to 80° Positional: 0.1° to 40				
2B	<i>Confirm Tilt Controls</i>					
I.	Variable Tilt Speed (per second)	Dome: 0.1° to 40° Positional: 0.1° to 20°				
II.	Vertical Tilt Range Unobstructed	Dome: 0.2° to -92° Positional: +33° to -83°				
2C	<i>Confirm Zoom Controls</i>					
I.	Zoom	Dome: 23X Optical 12X Digital Positional: 24X Optical 10X Digital				

APPENDIX C – RITSIMS USER MANUAL

HOW TO USE ADD-REMOVE TOOL?

RITSIMS Release v1.5 Beta (x64)

Program Tools History ITS Manual (Pdf) Pause (Reset)

Add/Remove

CLOSED CIRCUIT TELEVISION SYSTEMS

VARIABLE MESSAGE SIGNS

ROADWAY INFO SYSTEMS

COMMUNICATION - DISTRIBUTION SYSTEMS

TRAFFIC DETECTORS

SELECT OPTIONS

INSPECTION MAINTENANCE

TROUBLESHOOTING

SELECT EQUIPMENT

Check Equipment History

NEXT

SELECT INSPECTION EQUIPMENT

SELECT MAINTENANCE COMPONENT

APPLICATION DETAILS

START APPLICATION

Account Manager Inspection Maintenance Troubleshooting History **Add/Remove**

Select Options: ☒ Inspection ☐ Maintenance

ADD QUESTION

Select Equipment: E

Select Component: CF

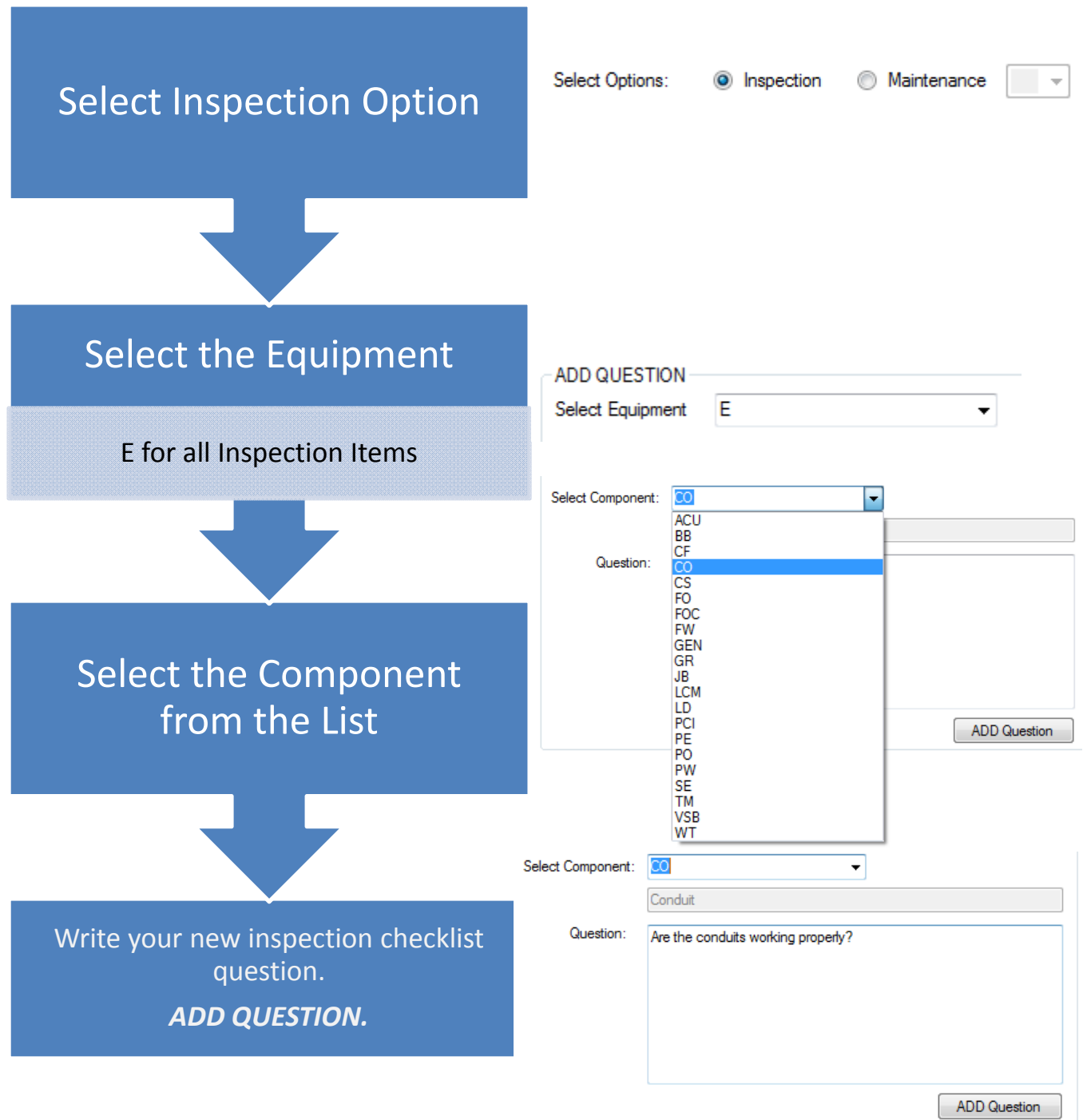
Communication and FieldEquipmentCabinet

Question:

ADD Question

Database: ON Inspection Equipments (History) Maintenance Options (History)

HOW TO ADD A QUESTION TO INSPECTION CHECKLISTS?



HOW TO ADD A QUESTION TO MAINTENANCE CHECKLISTS?

The flowchart on the left outlines the steps 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.

The form on the right shows the corresponding UI elements:

- Select Options:** Radio buttons for ☐ Inspection and ☒ Maintenance, followed by a dropdown menu.
- ADD QUESTION** button.
- Select Equipment:** A dropdown menu with a list containing 'C' (highlighted), 'D', 'RIS', 'V', and 'WWCD'.
- Select Component:** A dropdown menu with a list containing 'ACC', 'BAMC', 'CAB', 'CCA' (highlighted), 'PL', and 'POL'.
- Question:** A text input field containing the question: "Are conduits and cables properly working?".
- ADD Question** button at the bottom right.

COMMENTS FOR THE QUESTIONS

CHECKLIST QUESTIONS:

Change Answers

N/A (SKIP The Question)

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 the trench. Check for proper spacer installation (multiple PVC conduit cross section only) and Boring or jacking operations should not interfere with traffic operation and should be approved by the project engineer. 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 radius of the conduit. PVC conduits should be terminated flush with the top of concrete and the end of the conduit should be sealed. Metallic conduit should enter the junction boxes at right angles and extend 1.5 in. Rigid metal conduit should be cut square, threaded, and reamed on each end with a reamer. Nonmetallic conduit should be terminated flush with the inside wall, and approved sealant should be used on all threaded sections and on any damaged sections. Galvanized spray should be used on all threaded sections and on any damaged sections. PVC conduit ends should also be square and free of burrs and sharp edges. Joint compound should be applied to all joints. Nonmetallic conduits should be cleaned before applying the solvent-weld method.

COMMENTS:

UP

DOWN

Previous answer for Question:

New Answer

Update

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

☒ PASS

☐ FAIL

NEXT
Questions

Checklist Questions: 27 / 27

PASS: 0

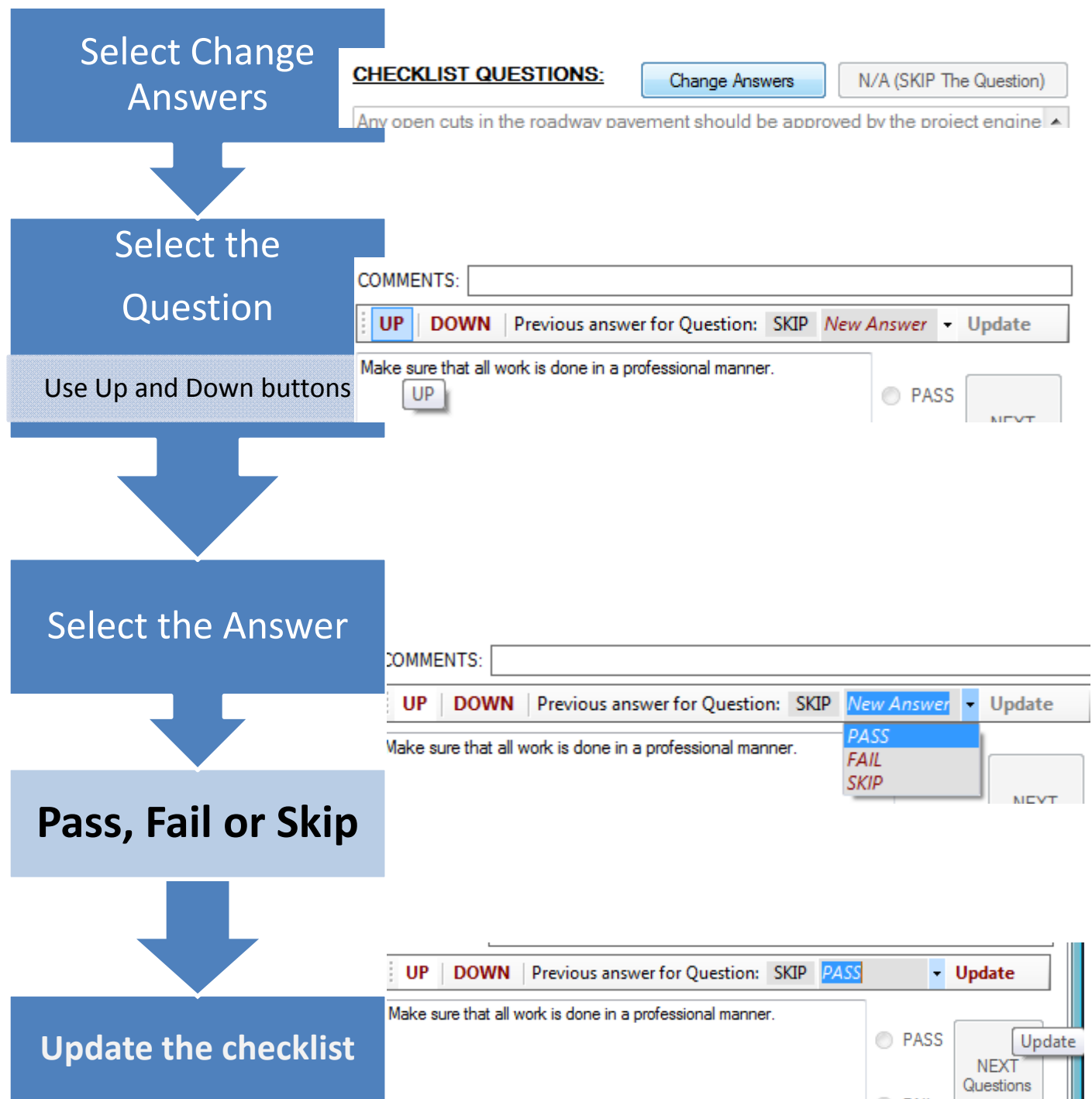
FAIL: 0

SKIPPED: 0

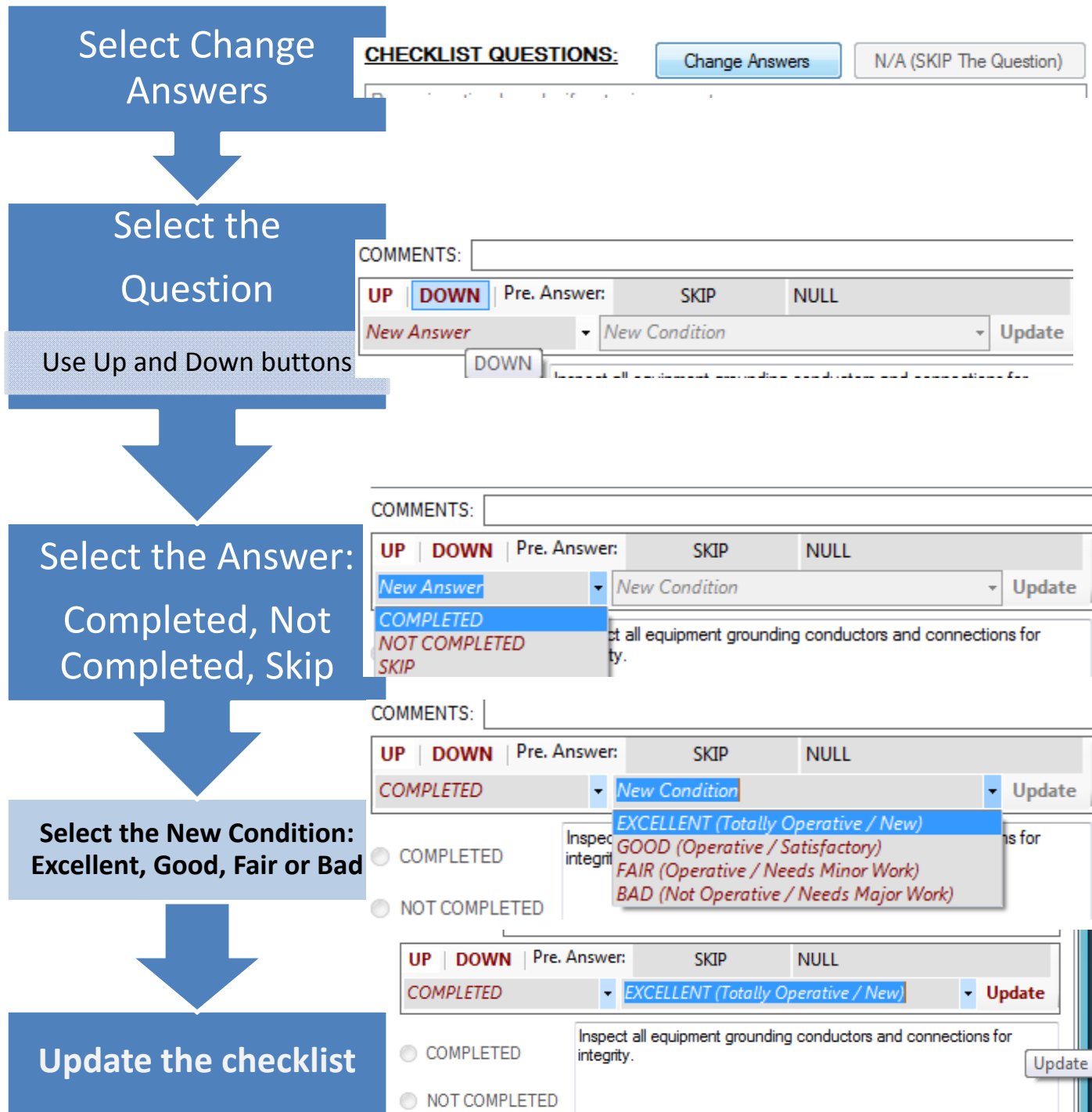
Next Component

EXIT

HOW TO CHANGE ANSWERS FOR INSPECTION QUESTIONS?



HOW TO CHANGE ANSWERS FOR MAINTENANCE QUESTIONS?



HOW TO USE THE ITS DEVICE (CSS) TESTING FORMS (LEVEL A)?

Select the Device Testing Form

Select the Test Date

Use the Scroll button

Select the Location from the Database

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

Choose submit after answering all the questions

The screenshot displays the ITS Device (CSS) Testing Form (Level A) interface. The top menu bar includes Tools, History, Program, ITS Manual (Pdf), Pause, and (Reset). The main content area shows a 'Device Testing Forms' dropdown menu with options: Communication Cable, CSS-Level A (selected), CSS-Level B, CSS-Level C, CTSS-Level A, CTSS-Level C, DMS-Level A, DMS-Level B, DMS-Level C, Level 1, Level A, Level B, Level C, Level A, Level C, Level A, Level C. Below the dropdown, the 'Test Date' is set to 3/16/2011, and the 'Location' is set to Rt. 1 @ I-287 (32). A calendar for March 2011 is visible, showing the date 16 selected. The '1A Perform' section contains a table with 5 rows of test tasks, each with a 'Required Value', 'Actual Value', 'Pass/Fail' status, and 'Comments' column.

No.	Task	Required Value	Actual Value	Pass	Fail	Comments
1A I.	Display Video	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A II.	Verify PTZ controls	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A III.	Verify Alarm Operation of Data Port door	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A IV.	Video Signal quality	1 Vp-p		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A V.	Video signal to noise ratio	>50dB		<input type="checkbox"/>	<input checked="" type="checkbox"/>	

The bottom section of the form shows the 'Test Date' as 3/16/2011 and the 'Location' as Rt. 1 @ I-287 (32). A 'SUBMIT' button is visible. The '1A Perform' section is repeated, showing the same test tasks and results as the top section.

HOW TO USE THE ITS DEVICE (CSS) TESTING FORMS (LEVEL B)?



Tools History Program ITS Manual (Pdf) Pause (Reset) Device Testing Forms

CLOSED CIRCUIT TELEVISION SYSTEMS

VARIABLE MESSAGE SIGNS

ROADWAY INFO SYSTEMS

COMMUNICATION - DISTRIBUTION SYSTEMS

TRAFFIC DETECTORS

SELECT INS

Communication Cable

CSS-Level A

CSS-Level B

CSS-Level C

CTSS-Level A

CTSS-Level C

DMS-Level A

DMS-Level B

DMS-Level C

Level 1

Level A

Level B

Level C

Level A

Level C

Level A

Level C

Test Date: 3/16/2011

Location:

1: VIDEO FEED

1A Perform

March, 2011

Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	28	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			
3	4	5	6			

Today:

Location:

Rt. 1 @ I-287 (32)

Rt. 1 @ Old Post Road (29.9)

Rt. 1 @ Route 18 (27.2)

Rt. 1 @ Independence Way (14.9)

Rt. 1 @ Henderson Road (19.9)

Rt. 1 @ Scudders Mill Road (12.8)

Rt. 1 SB @ Rt. 130 (24.6)

Rt. 1NB @ Rt. 130 (24.8)

Rt. 130 SB South of Rt. 1

Rt. 18 @ NJTPKE (39.6)

Rt. 18 @ Edgeboro Road (38.9)

Rt. 4EB @ Rt. 17 @ MM (3.4)

1: VIDEO FEED

1A Perform following tests at Remote Data Port

No.	Task	Required Value	Actual Value	Pass	Fail	Comments
1A I.	Display Video	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A II.	Verify PTZ controls	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A III.	Verify Alarm Operation of Data Port door	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A IV.	Video Signal quality	1 Vp-p		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A V.	Video signal to noise ratio	>50dB		<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Test Date: 3/16/2011

Location:

SUBMIT

1: VIDEO FEED

1A Perform following tests at Remote Data Port

No.	Task	Required Value	Actual Value	Pass	Fail	Comments
1A I.	Display Video	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A II.	Verify PTZ controls	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A III.	Verify Alarm Operation of Data Port door	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A IV.	Video Signal quality	1 Vp-p		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1A V.	Video signal to noise ratio	>50dB		<input checked="" type="checkbox"/>	<input type="checkbox"/>	

HOW TO USE THE ITS DEVICE (CSS) TESTING FORMS (LEVEL C)?

Select the Device Testing Form

Select the Test Date

Use the Scroll button

Select the Location from the Database and Add a Camera

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

Choose submit after answering all the questions

Tools History Program ITS Manual (Pdf) Pause (Reset) Device Testing Forms

CLOSED CIRCUIT TELEVISION SYSTEMS

VARIABLE MESSAGE SIGNS

ROADWAY INFO SYSTEMS

COMMUNICATION - DISTRIBUTION SYSTEMS

TRAFFIC DETECTORS

SELECT INS

Communication Cable

CSS-Level A

CSS-Level B

CSS-Level C

CTSS-Level A

CTSS-Level C

DMS-Level A

DMS-Level B

DMS-Level C

Level 1

Level A

Level B

Level C

Level A

Level C

Level A

Level C

Test Date: 3/16/2011 Location: Rt. 1 @ I-287 (32)

1: VIDEO FE

1A Perform

March, 2011

Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	28	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			
3	4	5	6			

Today:

Location: Rt. 1 @ I-287 (32)

Rt. 1 @ Old Post Road (29.9)

Rt. 1 @ Route 18 (27.2)

Rt. 1 @ Independence Way (14.9)

Rt. 1 @ Henderson Road (19.9)

Rt. 1 @ Scudders Mill Road (12.9)

Rt. 1 SB @ Rt. 130 (24.6)

Rt. 1NB @ Rt. 130 (24.8)

Rt. 130 SB South of Rt. 1

Rt. 18 @ NJTPKE (39.6)

Rt. 18 @ Edgeboro Road (38.9)

Rt. 4EB @ Rt. 17 @ MM (3.4)

Rt. 4 WB @ Hackensack Ave (1.9)

I-80 WB @ Rt. 17 NB (64.7)

I-80 EB @ Rt. 17 SB (64.8)

I-80 EB @ Polify Rd. (65.5)

I-80 EB @ I-287 (65.7)

Location: Rt. 1 @ I-287 (32)

Camera #1 Rt. 1 @ I-287 (32)

Add a Camera

Finish Adding Cameras

1: CAMERA DATABASE

1 Configure Camera Surveillance System(s) with Nextiva Control Center

No.	Task	Pass	Fail	Comments
1	Configure Camera Surveillance System(s) with Nextiva Control Center	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	

Test Date: 3/16/2011 Location: Rt. 1 @ I-287 (32)

Camera #1 Rt. 1 @ I-287 (32)

Add a Camera

Finish Adding Cameras

SUBMIT

1: CAMERA DATABASE

1 Configure Camera Surveillance System(s) with Nextiva Control Center

No.	Task	Pass	Fail	Comments
1	Configure Camera Surveillance System(s) with Nextiva Control Center	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	

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, Milage Post, Direction and Nearest Street Name

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

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, Milage 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

Tools History Program ITS Manual (Pdf) Pause (Reset) Device Testing Forms

CLOSED CIRCUIT TELEVISION SYSTEMS

VARIABLE MESSAGE SIGNS

ROADWAY INFO SYSTEMS

COMMUNICATION - DISTRIBUTION SYSTEMS

TRAFFIC DETECTORS

Test Date: 3/16/2011 Location: 1: VIDEO FEED

1A Perform

March, 2011

Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	28	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2
3	4	5	6	7	8	9

Today: 3/16/2011

LOCATION

Route MM . Direction

Nearest Side Street Name

1: REMOTE PROCESSING UNIT (RPU) 2: CAM Median SENSOR P

No.	Task	Required Value	Actual Value	Pass	Fail	Comments
I.	Verify PTZ operation	X	X	<input type="checkbox"/>	<input type="checkbox"/>	
II.	Obtain color video still frame image	Max. 8 p...	1	<input type="checkbox"/>	<input type="checkbox"/>	
III.	Continuous Pan rotation	360°		<input type="checkbox"/>	<input type="checkbox"/>	
IV.	Variable Pan Speed	0.5" per ...		<input type="checkbox"/>	<input type="checkbox"/>	
V.	Vertical Tilt range	180° of ...		<input type="checkbox"/>	<input type="checkbox"/>	
VI.	Variable Tilt Speed	0.5" per ...		<input type="checkbox"/>	<input type="checkbox"/>	
VII.	Zoom	Up to 10...		<input type="checkbox"/>	<input type="checkbox"/>	
VIII.	Verify capability to configure preset positions	Up to 64		<input type="checkbox"/>	<input type="checkbox"/>	

Test Date: 3/16/2011 LOCATION

SUBMIT

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, Milage 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

The screenshot shows the 'Device Testing Forms' menu with 'Communication Cable' selected. Below it, a date picker shows 'March, 2011' with the 16th highlighted. The form fields include 'Test Date: 3/16/2011', 'Location:', '1: VIDEO FE', '1A Perform', 'Test Date: 3/16/2011', 'Communication Cable under test runs from: Utility Pole Manhole', 'Route MM', 'Nearest Side Street Name', 'TO: ITS Controller ITS Cabinet', 'Route MM', 'Nearest Side Street Name', and a 'SUBMIT' button.

No.	Task	Required Value	Actual Value	Pass	Fail	Comments
I.	Ensure that there are in splices in the section of cable between the terminal block and the device	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
II.	Verify that terminal block enclosure on the utility pole is weather tight(if applicable)	X	X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
III.	Verify communication between controller and terminal block server	X	X	<input type="checkbox"/>	<input type="checkbox"/>	
IV.	Confirm that cable connections are in compliance with contract documents	X	X	<input type="checkbox"/>	<input type="checkbox"/>	
V.	Verify minimum required slack	Cabinet ...		<input type="checkbox"/>	<input type="checkbox"/>	
VI.	Verify grouping and identification tags on new and existing conductors	X	X	<input type="checkbox"/>	<input type="checkbox"/>	
VII.	Verify ground resistance of all conductors including the shield	X	X	<input type="checkbox"/>	<input type="checkbox"/>	
VIII.	Perform continuity of each pair to verify resistance	X	X	<input type="checkbox"/>	<input type="checkbox"/>	
* IX.	Verify cable tags provides correct information and are secured with nylon cable ties	X	X	<input type="checkbox"/>	<input type="checkbox"/>	

HOW TO PERFORM THE ITS TESTING FORM HISTORY CHECK?

