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

FINAL REPORT
September 2011

Submitted by

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16. Abstract

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.

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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, 2011and 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).

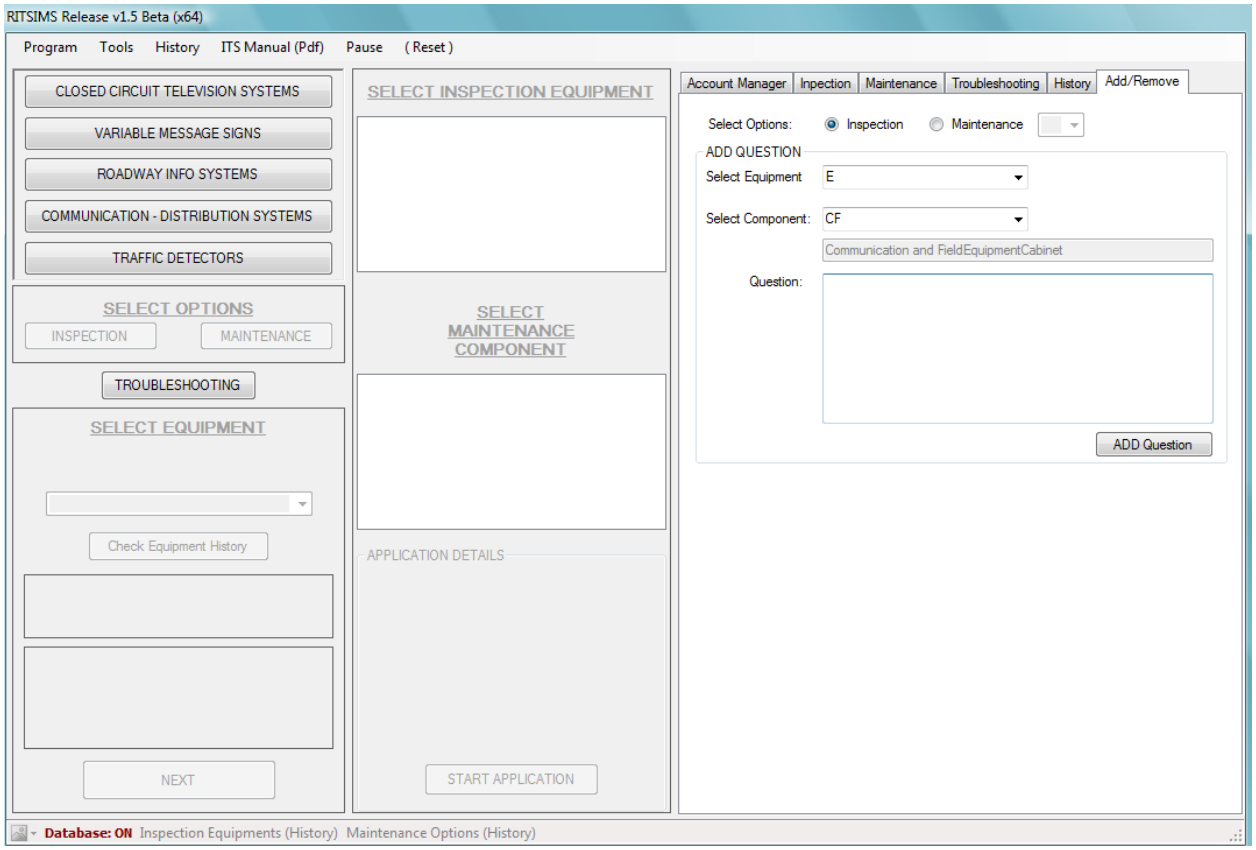


Figure 1. Add/Remove Module

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).

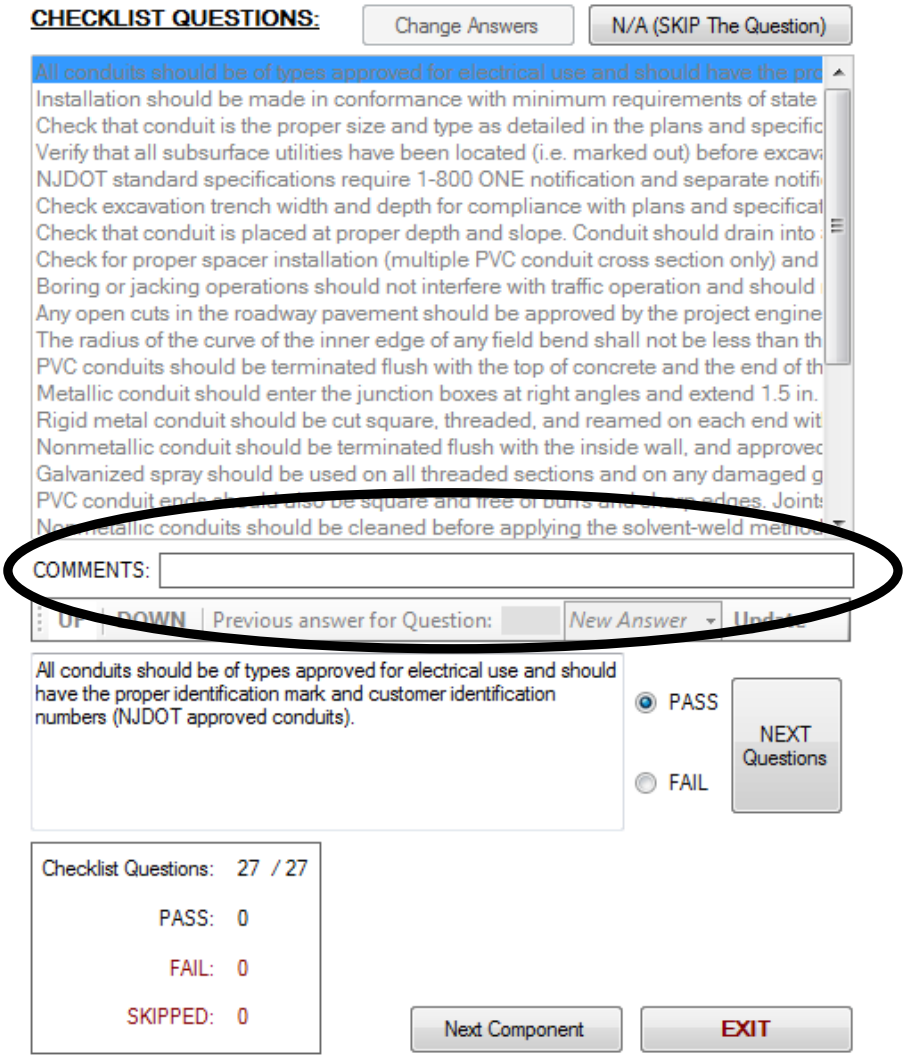


Figure 2. Comment Boxes

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).

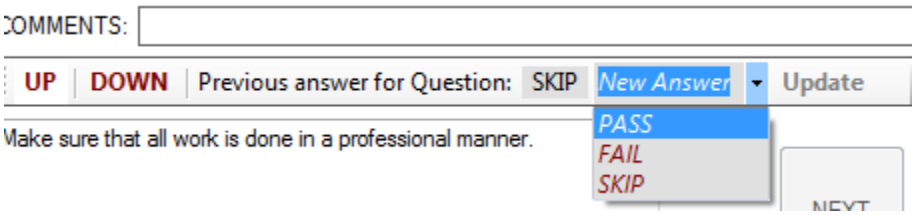


Figure 3. User Interface Improvement for Changes in the Answers

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).

	B	C	D	E	F	G	H	I	J
1	DEVICE_TYPE	PRIMARY_ROUTE	SRI	MILEPOST	LOCATION	DIRECTION	STATUS	LATITUDE	LONGITUDE
2	CCTV	1/9	00000001_S	36.5	Hudson Blvd	SB	EXISTING	40.573419	-74.291313
3	CCTV	1/9	00000001_S	37.1	Lord ST	SB	EXISTING	40.579566	-74.285666
4	CCTV	1/9	00000001_S	37.5	S Inman Ave	SB	EXISTING	40.587116	-74.2791389
5	CCTV	1/9	00000001_S	39.4	E Grand Ave	SB	EXISTING	40.606358	-74.261697
6	CCTV	1/9	00000001_S	38.9	Hancock ST	SB	EXISTING	40.602052	-74.268988
7	CCTV	1/9	00000001__	40.5	Airport RD	NB	EXISTING	40.618344	-74.250575
8	CCTV	1/9	00000001__	41	S Wood Ave	NB	EXISTING	40.62655	-74.2430778
9	CCTV	1/9	00000001__	42	RT 278	NB	EXISTING	40.640152	-74.230666
10	CCTV	1/9	00000001_S	42.7	Park Ave	SB	EXISTING	40.6436833	-74.2282611
11	CCTV	1/9	00000001__	42.8	Bachellor Ave	MD	EXISTING	40.647816	-74.224502
12	CCTV	1/9	00000001__	43.1	Bayway Circle	NB	EXISTING	40.650527	-74.220922
13	CCTV	1/9	00000001__	43.7	Grove ST	NB	UNDER CONSTRUCTION	40.6544194	-74.2116361
14	CCTV	1/9	00000001__	44.3	E Jersey ST	NB	UNDER CONSTRUCTION	40.662622	-74.20655
15	CCTV	1/9	00000001__	44.7	Bond ST	NB	EXISTING	40.667716	-74.203305
16	CCTV	1/9	00000001_S	45.1	Meadow ST	SB	EXISTING	40.675577	-74.198975
17	CCTV	1/9	00000001_S	45.5	Dowd Ave Ramp	SB	EXISTING	40.679086	-74.1953917
18	CCTV	1/9	00000001_S	46.5	Pulaski Skyway S	SB	EXISTING	40.69228	-74.190316
19	CCTV	1/9	00000001__	46.4	Pulaski Skyway N	NB	EXISTING	40.69083	-74.190883
20	CCTV	1/9	00000001__	46.7	I-78 Connector	NB	EXISTING	40.693572	-74.187766
21	CCTV	1/9	00000001_S	47.3	Haynes Ave	SB	EXISTING	40.701955	-74.185552
22	CCTV	1/9	00000001_S	47.85	RT 21 north bound connector	SB	EXISTING	40.7093917	-74.1803583
23	CCTV	80	00000080__	63.2	Palisades Park	EB	EXISTING	40.8421944	-73.9946806
24	CCTV	80	00000080__	64	Bergen Blvd	EB	EXISTING	40.8516167	-73.9851083
25	CCTV	80	00000080__	64.7	AT GWB Approach	EB	EXISTING	40.8589583	-73.9766167
26	CCTV	1	00000001__	12.4	Scudders Mill Rd	NB	EXISTING	40.343788	-74.622777
27	CCTV	1	00000001__	14.1	Independence Way	MD	EXISTING	40.36143	-74.601655
28	CCTV	1	00000001__	19.9	Henderson RD	MD	EXISTING	40.423063	-74.526461
29	CCTV	1	00000001__	24.7	Georges RD	NB	EXISTING	40.462744	-74.455655
30	CCTV	1	00000001__	27.2	RT 18	NB	EXISTING	40.482866	-74.4183
31	CCTV	1	00000001__	29.9	Old Post RD	NB	EXISTING	40.510905	-74.385605
32	CCTV	1	00000001_S	32	RT 287	SB	EXISTING	40.52905	-74.353775
33	CCTV	4	00000004__	3.3	RT 17 SB	EB	EXISTING	40.919591	-74.072711
34	CCTV	4	00000004__	3.4	RT 17 NB	EB	EXISTING	40.920238	-74.070855
35	CCTV	4	00000004__	5.7	Hackensack Ave	EB	EXISTING	40.905741	-74.033658
36	CCTV	4	00000004_W	9.8	Jones RD	WB	EXISTING	40.871488	-73.972572
37	CCTV	4	00000004__	10.2	I-95 SB	EB	EXISTING	40.8657944	-73.9743361
38	CCTV	9	00000009_S	102.8	Kennedy Blvd	SB	EXISTING	40.107094	-74.2196083
39	CCTV	9	00000009__	106.2	Aldrich RD	NB	EXISTING	40.15545	-74.229566
40	CCTV	9	00000009__	111.21	Wyckoff Mill RD	NB	EXISTING	40.221119	-74.266569
41	CCTV	9	00000009_S	114.2	RT 33	SB	EXISTING	40.259075	-74.291744
42	CCTV	9	00000009_S	116.6	Ryan RD	SB	EXISTING	40.293416	-74.298905
43	CCTV	9	00000009_S	117.3	Taylors Mills RD	SB	EXISTING	40.302658	-74.303997
44	CCTV	9	00000009__	121.4	Texas RD	Median	EXISTING	40.360952	-74.305125
45	CCTV	9	00000009__	122.3	Spring Valley RD	Median	EXISTING	40.373683	-74.306658
46	CCTV	9	00000009__	126.6	Perrine RD	NB	EXISTING	40.435502	-74.301122
47	CCTV	9	00000009_S	131.5	RT 35	SB	EXISTING	40.498497	-74.299919
48	CCTV	9	00000009__	132.3	Thomas Edison Bridge	NB	EXISTING	40.512047	-74.300066
49	CCTV	9	00000009__	132	South End of Thomas Edison Bridge	NB	EXISTING	40.504005	-74.30058
50	CCTV	9	00000009__	132.7	Smith ST	NB	EXISTING	40.516222	-74.29983
51	CCTV	18	00000018__	38.9	Edgeboro RD	NB	EXISTING	40.4638083	-74.4044556

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.

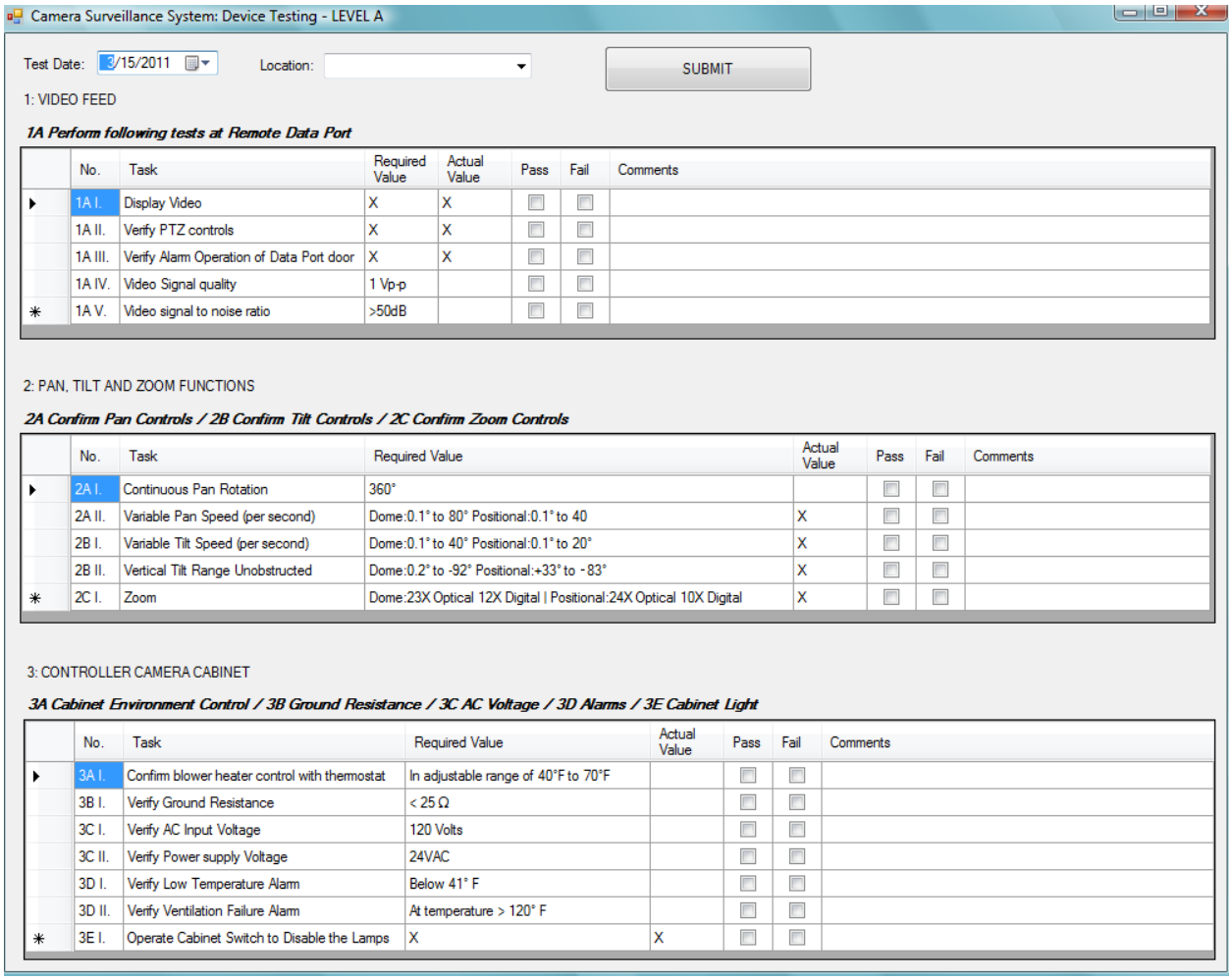


Figure 5. Camera Surveillance System (CSS) Testing Form

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

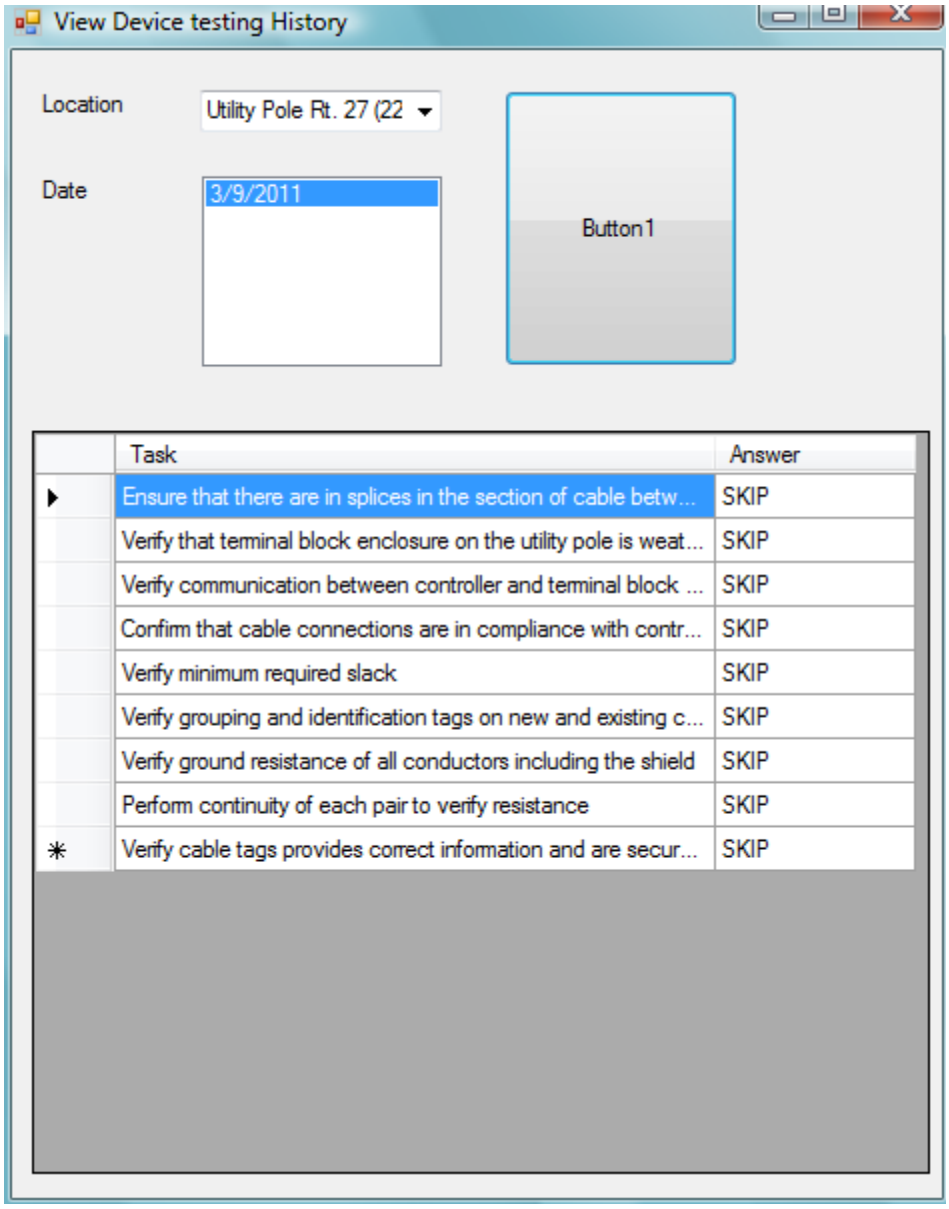


Figure 6. ITS Testing Form History Check

7. 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).

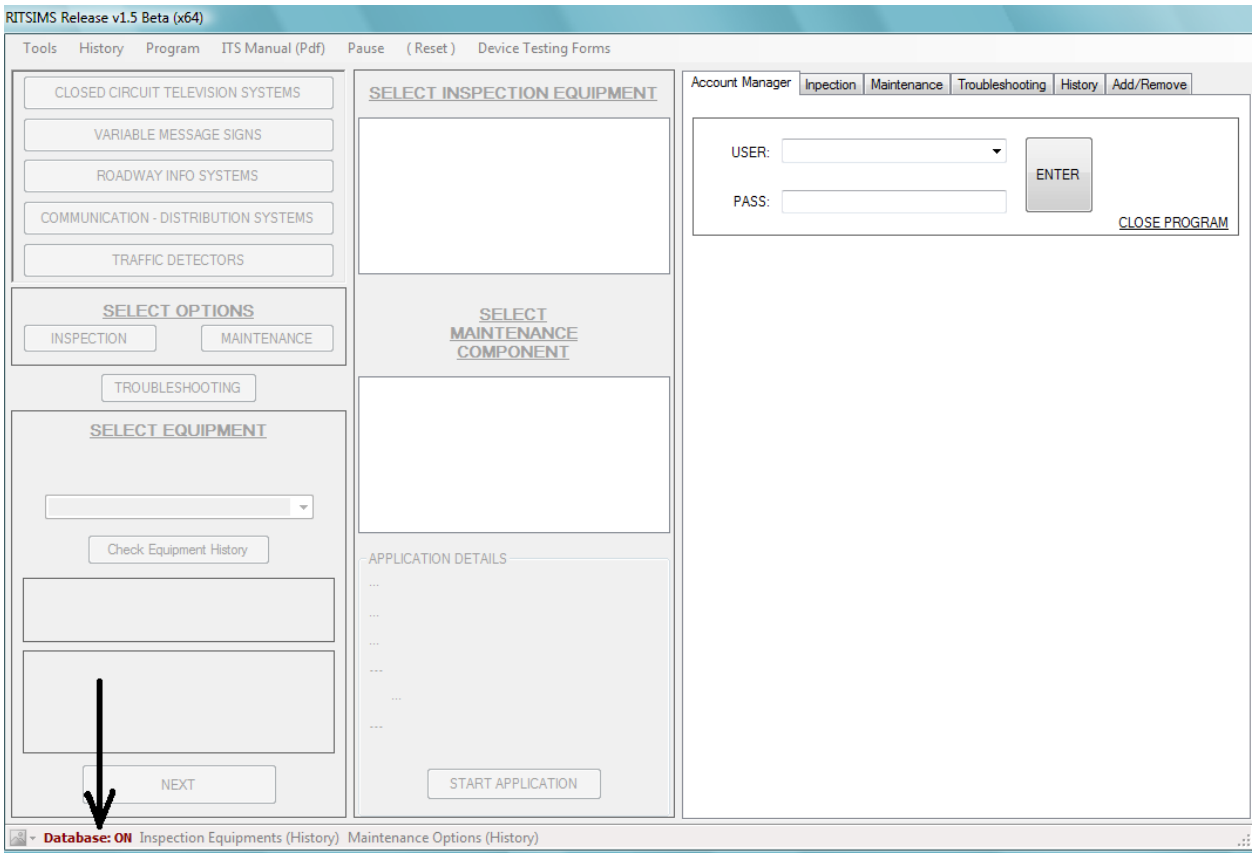


Figure 7. Database Option

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:** _____

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

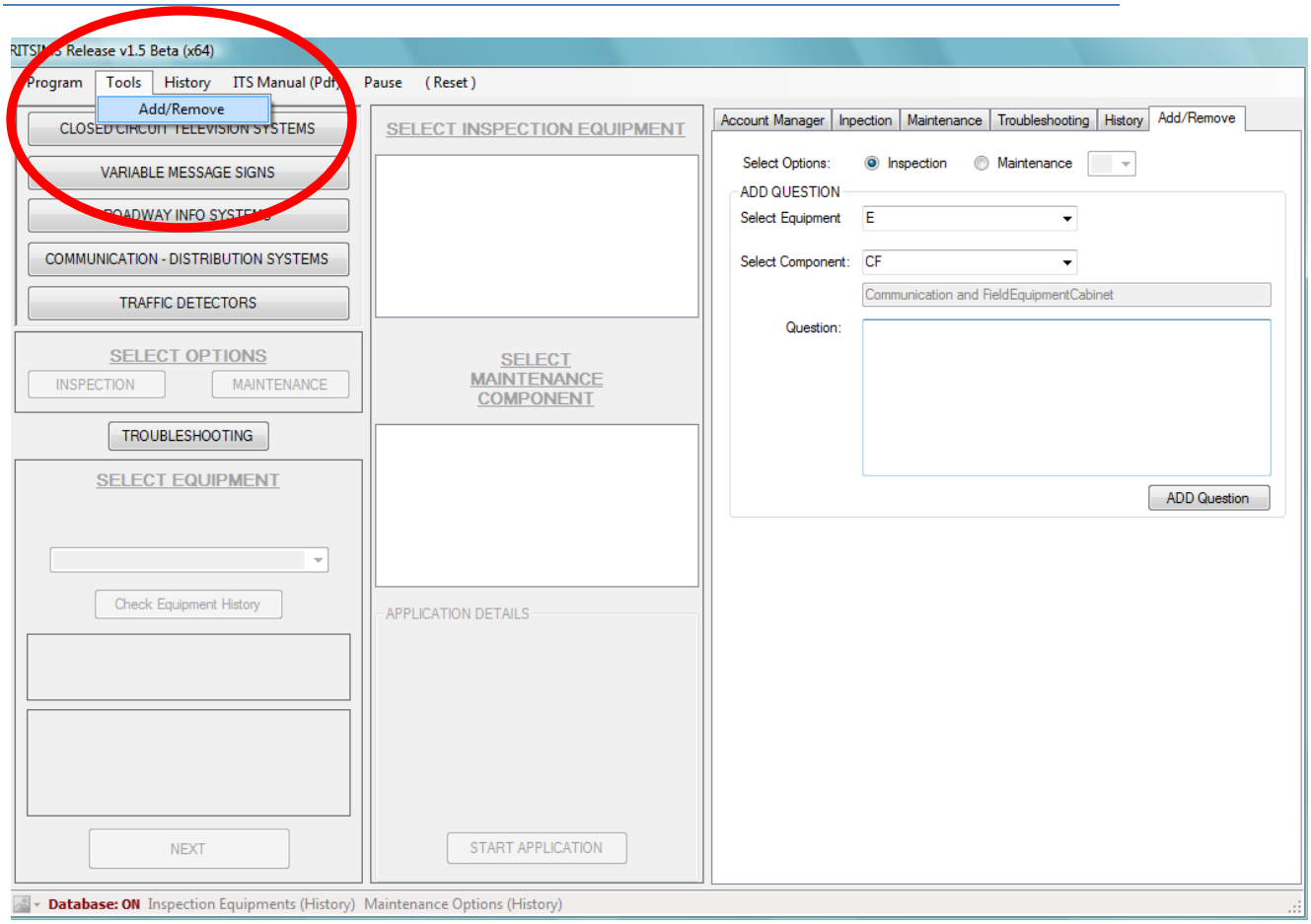
No.	Task	Required value	Actual Value	Pass	Fail	Comments
1A	*Perform following tests at Remote Data Port*					
I.	Display Video					
II.	Verify PTZ controls					
III.	Verify Alarm Operation of Data Port door					
IV.	Video Signal quality	1 Vp-p				
V.	Video signal to noise ratio	>50dB				

2: PAN, TILT & ZOOM FUNCTIONS

No.	Task	Required Value	Actual Value	Pass	Fail	Comments
2A	*Confirm Pan Controls*					
I.	Continuous Pan Rotation	360°				
II.	Variable Pan Speed (per second)	Dome: 0.1° to 80° Positional: 0.1° to 40				
2B	*Confirm Tilt Controls*					
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	*Confirm Zoom Controls*					
I.	Zoom	Dome: 23X Optical 12X Digital Positional: 24X Optical 10X Digital				

APPENDIX C – RITSIMS USER MANUAL

HOW TO USE ADD-REMOVE TOOL?



HOW TO ADD A QUESTION TO INSPECTION CHECKLISTS?

Select Inspection Option

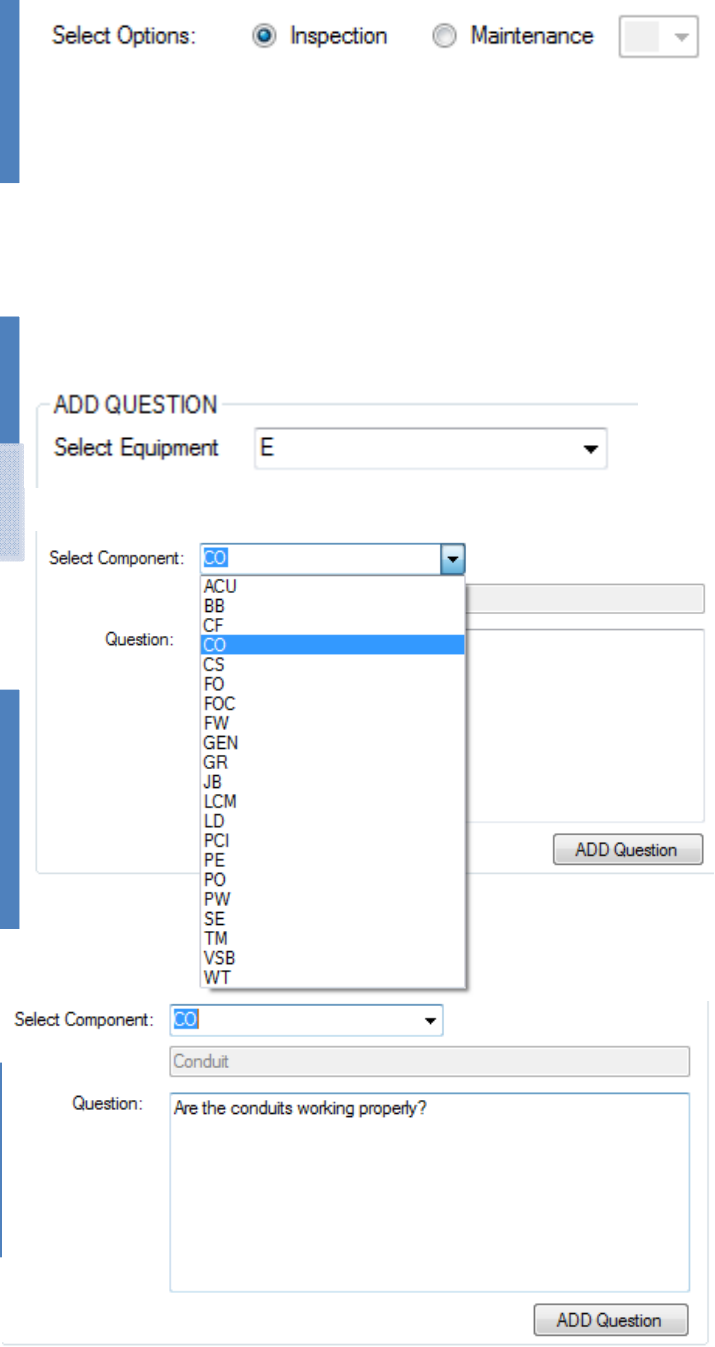
Select the Equipment

E for all Inspection Items

Select the Component from the List

Write your new inspection checklist question.

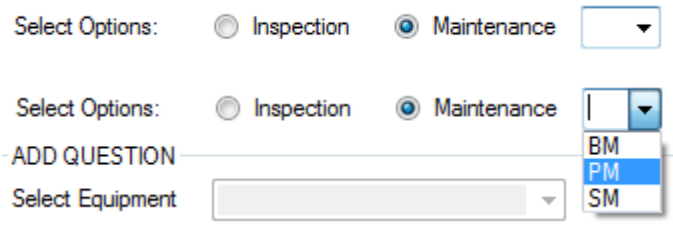
ADD QUESTION.



HOW TO ADD A QUESTION TO MAINTENANCE CHECKLISTS?

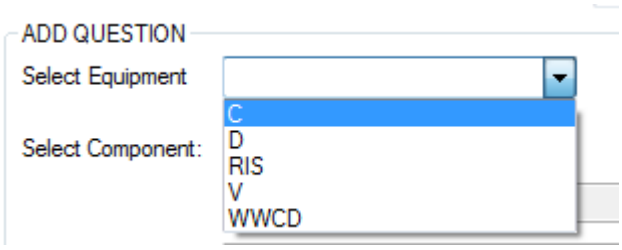
Select Maintenance Option

Select the Type of Maintenance: Preventive, Brand or Specific

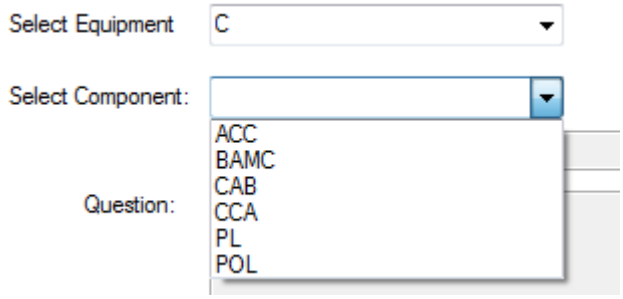


Select the Equipment

CCTV, VMS, HAR, Comm&Dist. Systems, Detectors



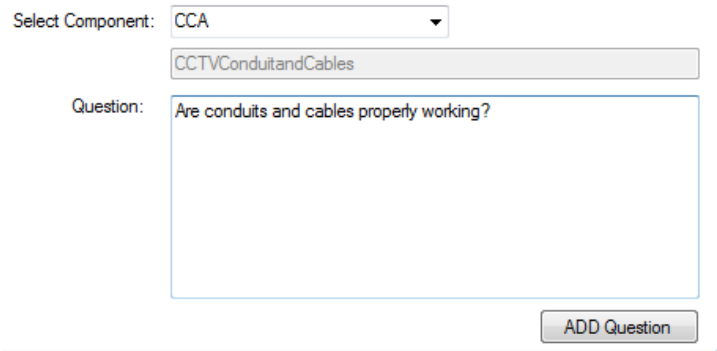
Select the Component from the List



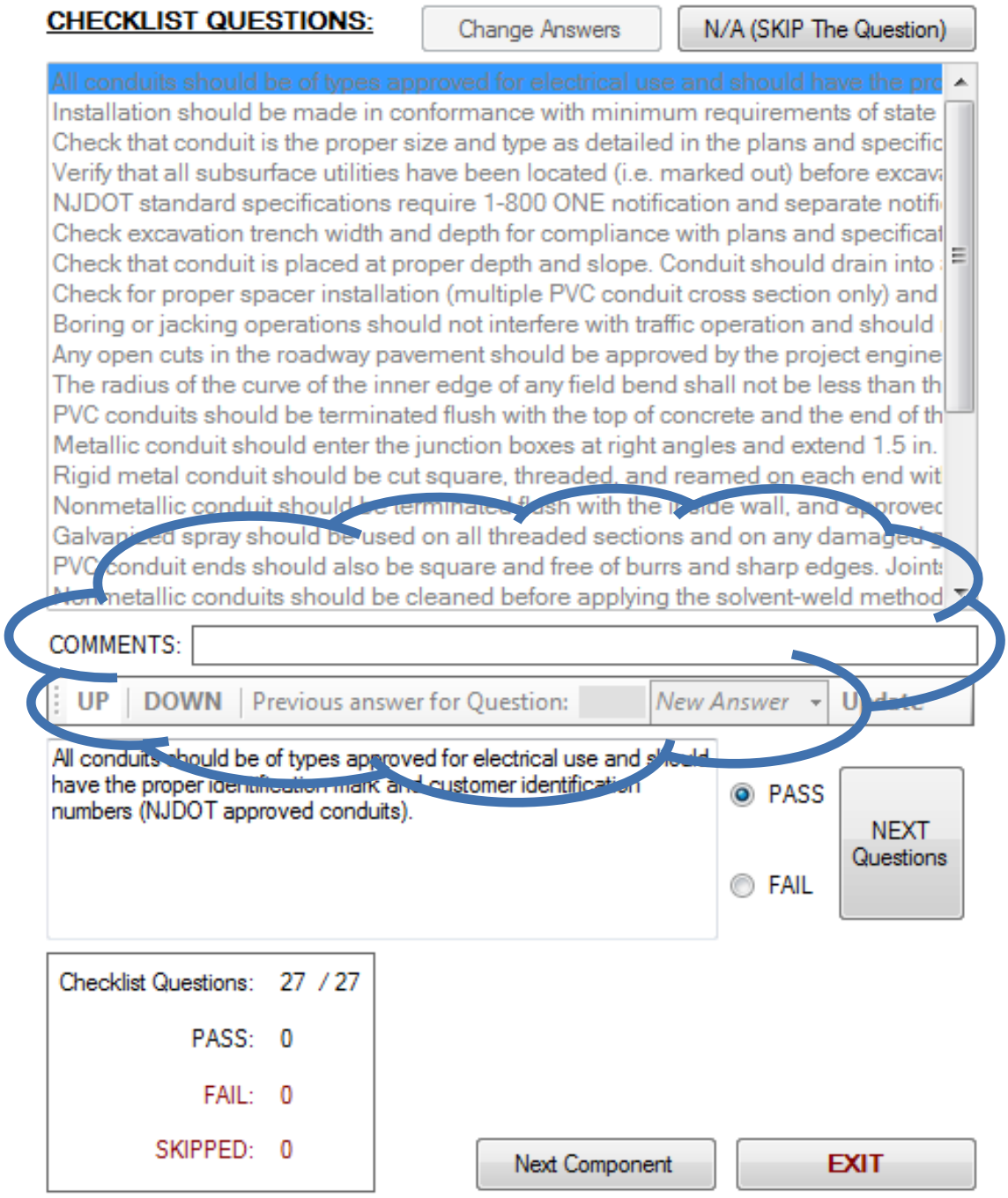
or Troubleshooting (This option can be selected any time regardless of equipment selection)

Write your new maintenance checklist question.

ADD QUESTION.

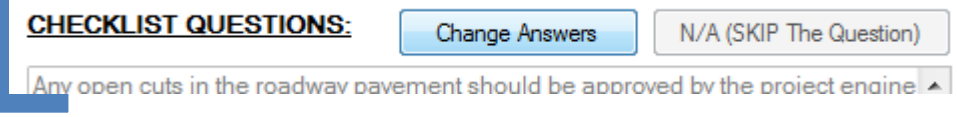


COMMENTS FOR THE QUESTIONS



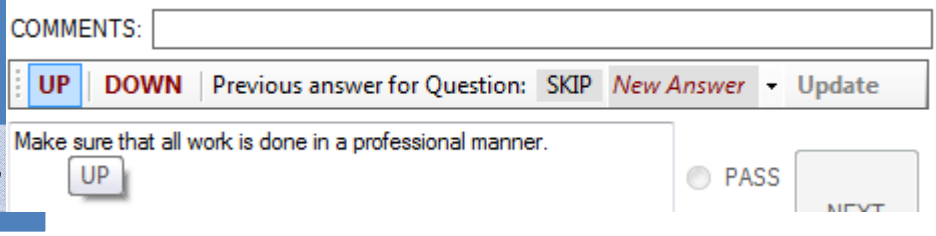
HOW TO CHANGE ANSWERS FOR INSPECTION QUESTIONS?

Select Change Answers

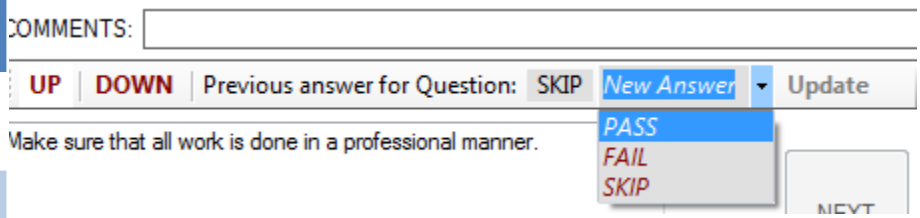


Select the Question

Use Up and Down buttons

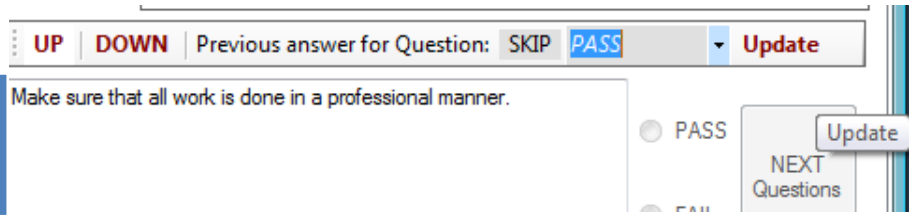


Select the Answer



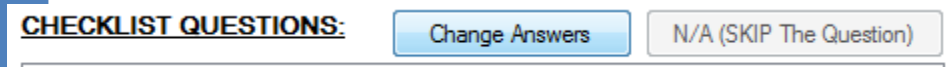
Pass, Fail or Skip

Update the checklist



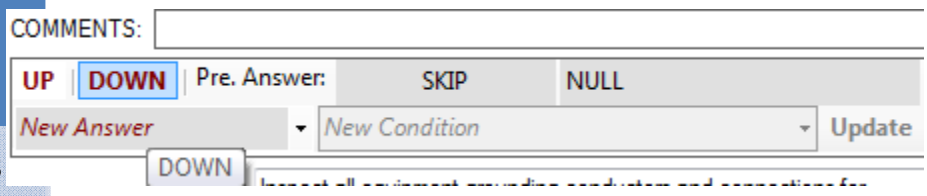
HOW TO CHANGE ANSWERS FOR MAINTENANCE QUESTIONS?

Select Change Answers

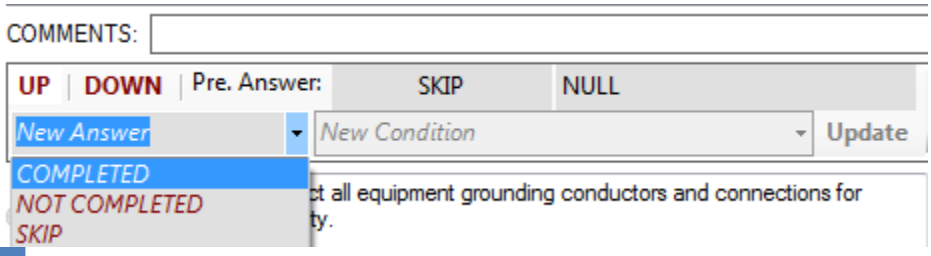


Select the Question

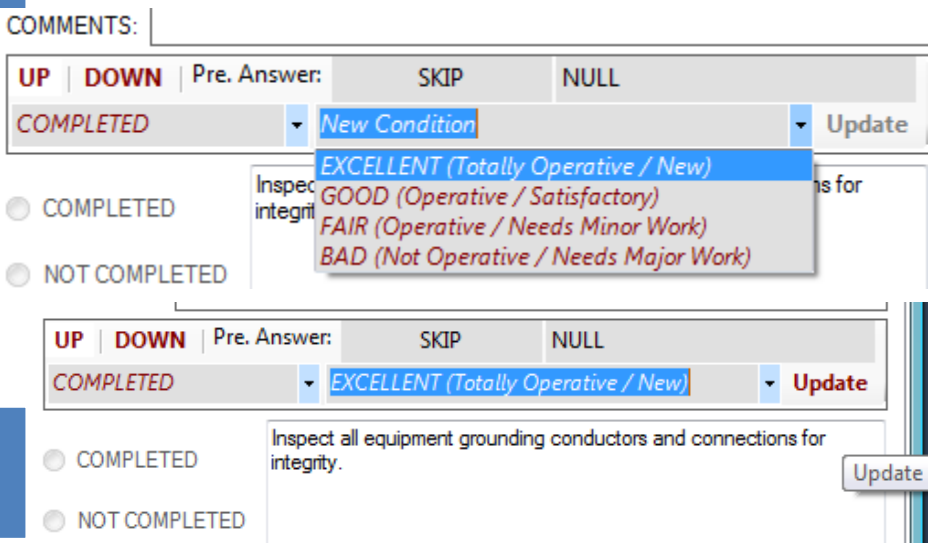
Use Up and Down buttons



Select the Answer: Completed, Not Completed, Skip



Select the New Condition: Excellent, Good, Fair or Bad



Update the checklist

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

Select the Device Testing Form

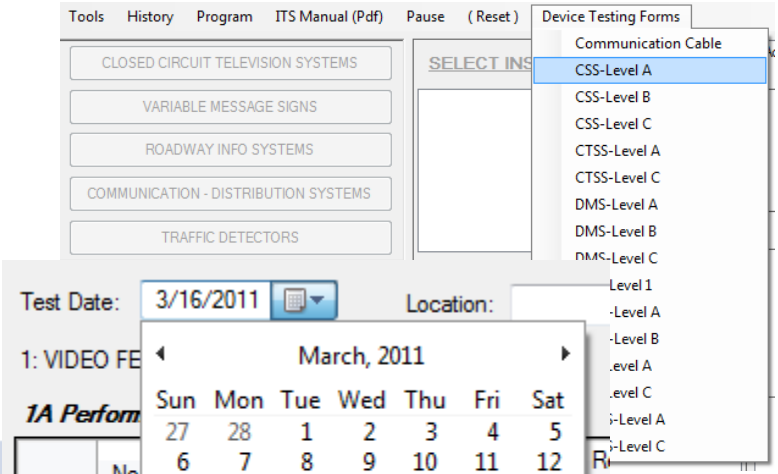
Select the Test Date

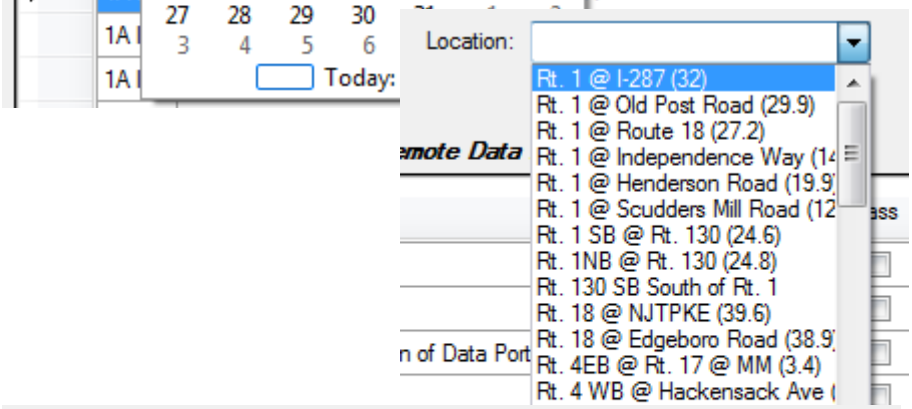
Use the Scroll button

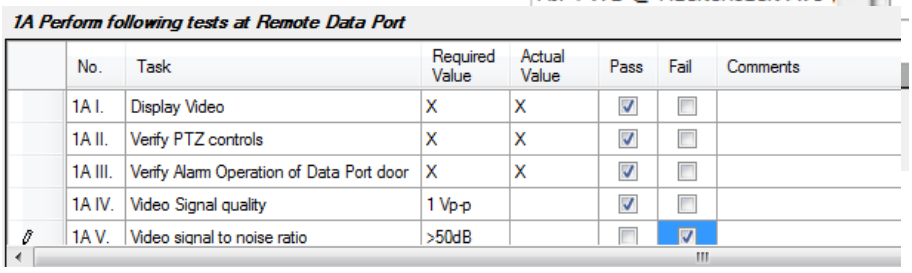
Select the Location from the Database

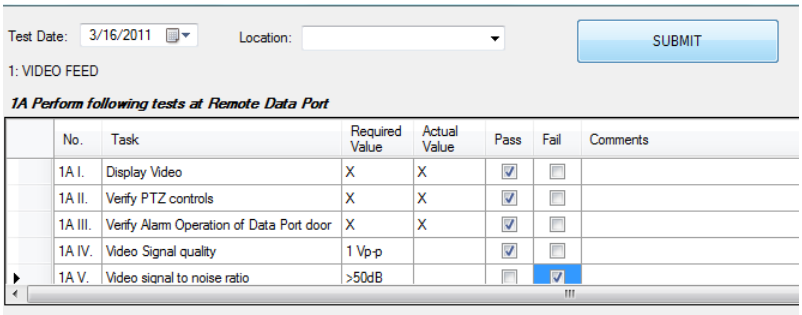
Answer the Questions, PASS or FAIL, write any comment if needed

Choose submit after answering all the questions









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

Select the Device Testing Form

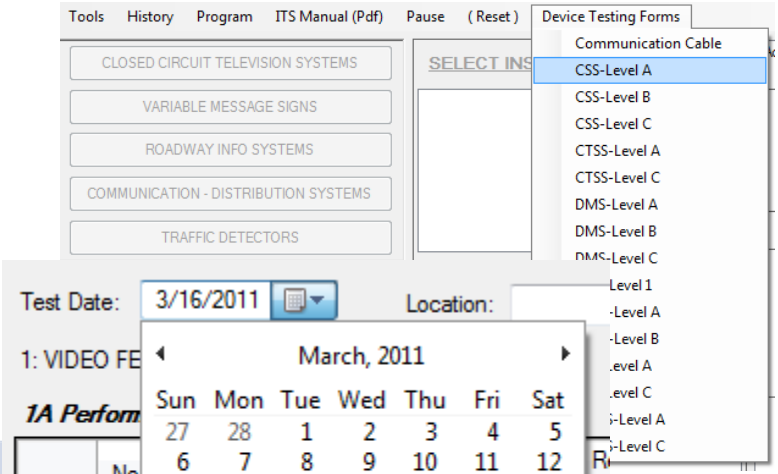
Select the Test Date

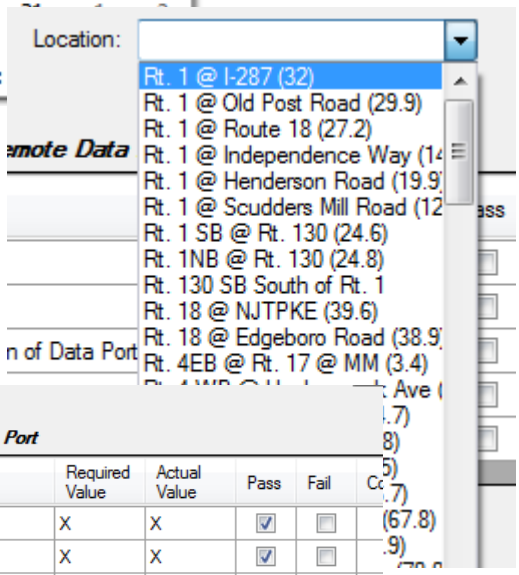
Use the Scroll button

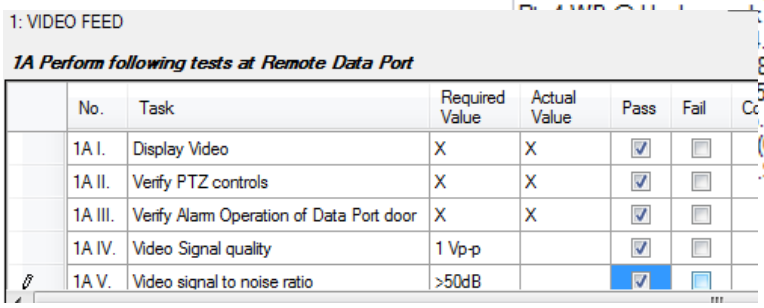
Select the Location from the Database

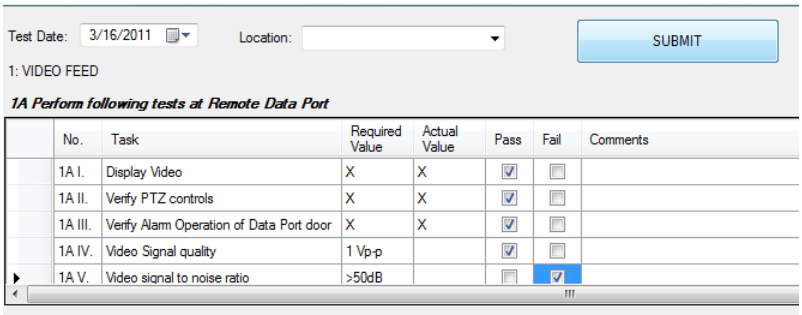
Answer the Questions, PASS or FAIL, write any comment if needed

Choose submit after answering all the questions



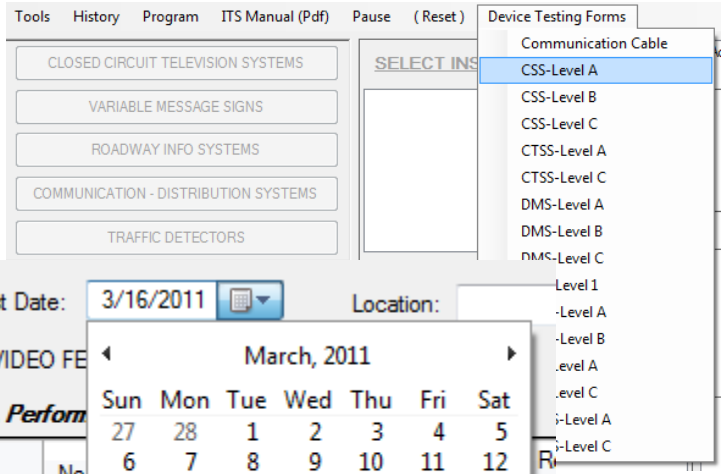






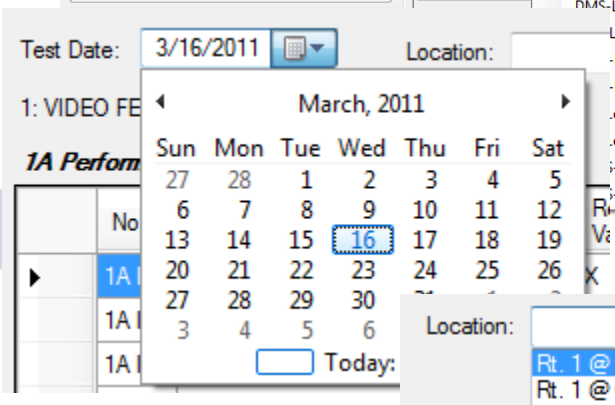
HOW TO USE THE ITS DEVICE (CSS) TESTING FORMS (LEVEL C)?

Select the Device Testing Form

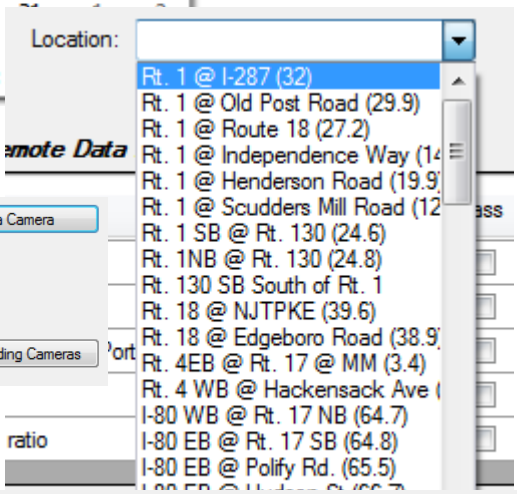


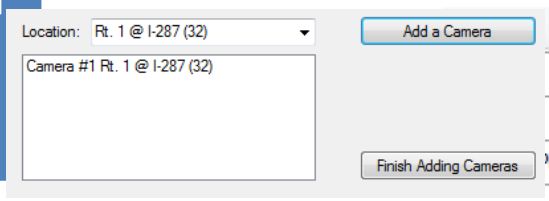
Select the Test Date

Use the Scroll button

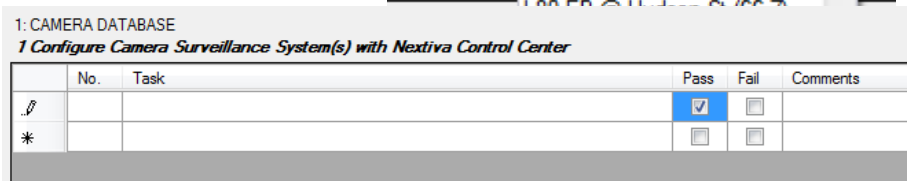


Select the Location from the Database and Add a Camera

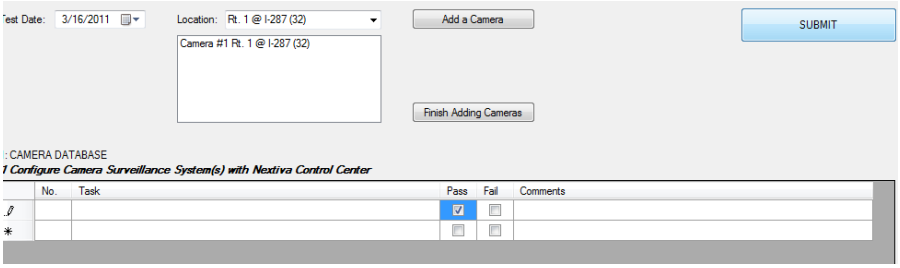




Answer the Questions, PASS or FAIL, write any comment if needed

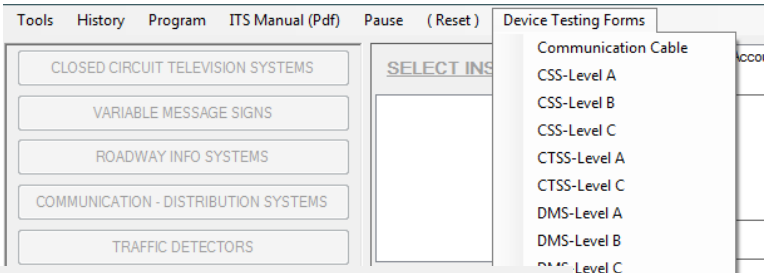


Choose submit after answering all the questions



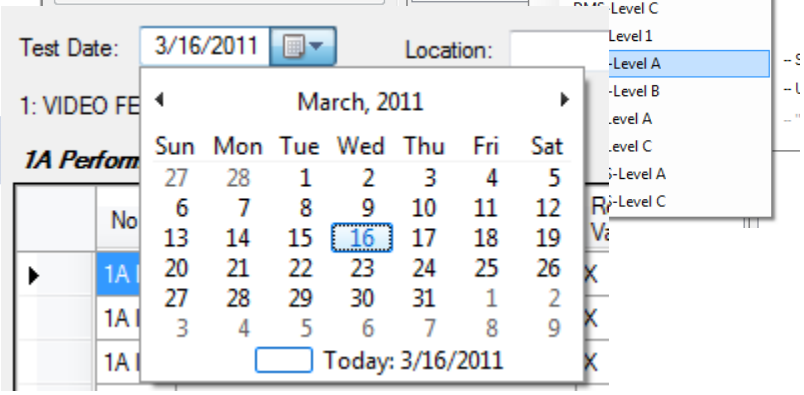
HOW TO USE THE ITS DEVICE (RWIS) TEST FORMS (LEVEL A)?

Select the Device Testing Form

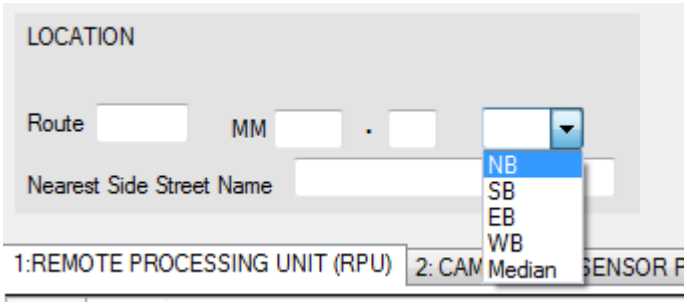


Select the Test Date

Use the Scroll button

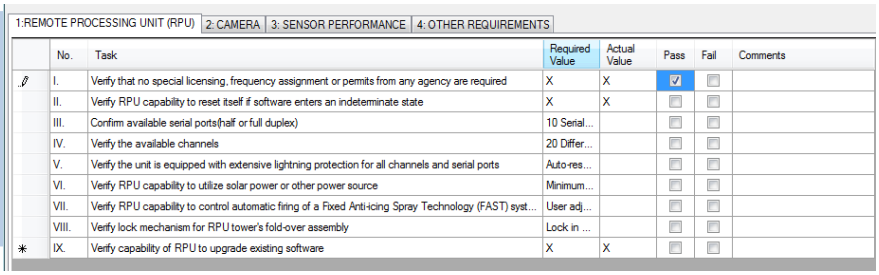


Write the Location Info: Route, Milage Post, Direction and Nearest Street Name

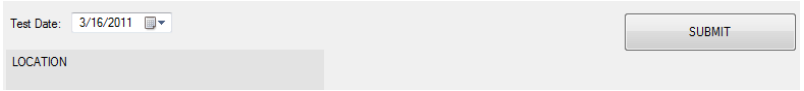


Answer the Questions, PASS or FAIL, write any comment if needed

WRITE THE ACTUAL VALUE!

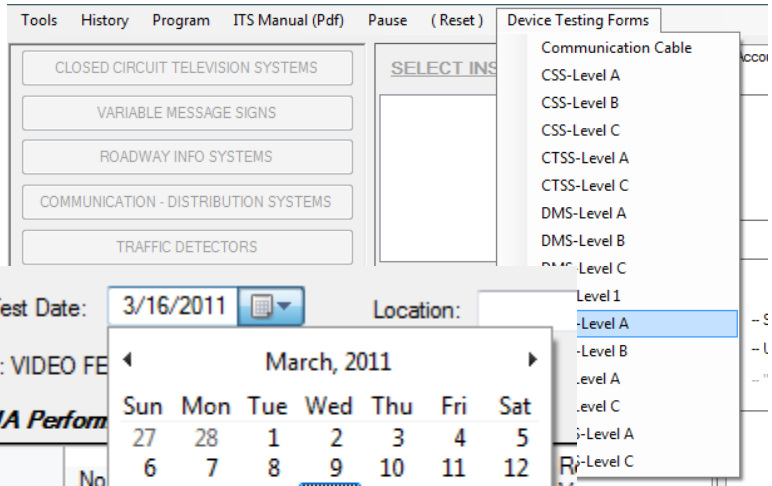


Choose submit after answering all the questions



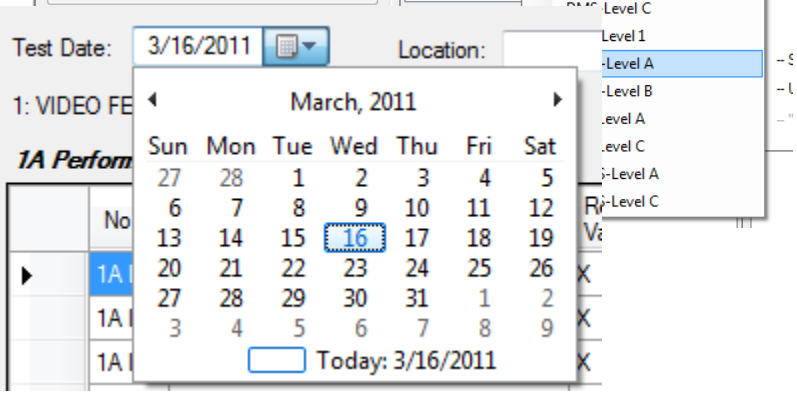
HOW TO USE THE ITS DEVICE (RWIS) TEST FORMS (LEVEL B)?

Select the Device Testing Form

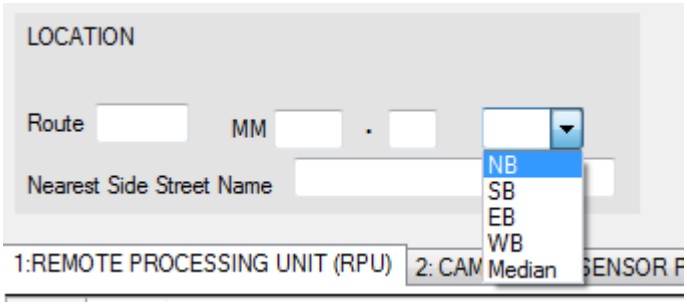


Select the Test Date

Use the Scroll button

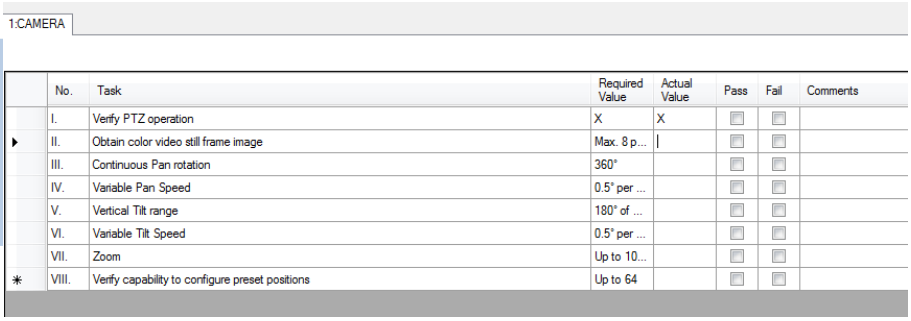


Write the Location Info: Route, Milage Post, Direction and Nearest Street Name

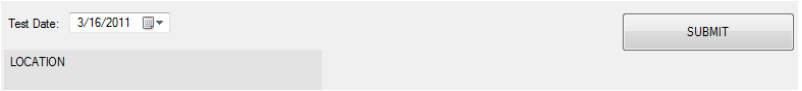


Answer the Questions, PASS or FAIL, write any comment if needed

WRITE THE ACTUAL VALUE!

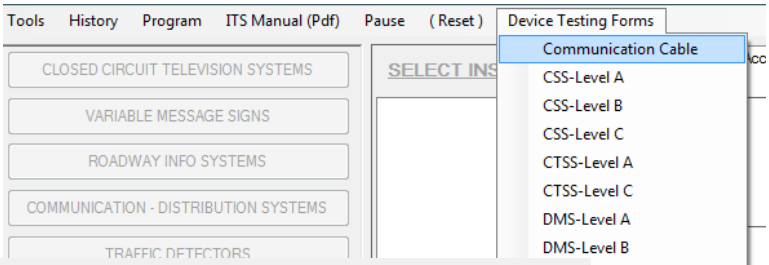


Choose submit after answering all the questions



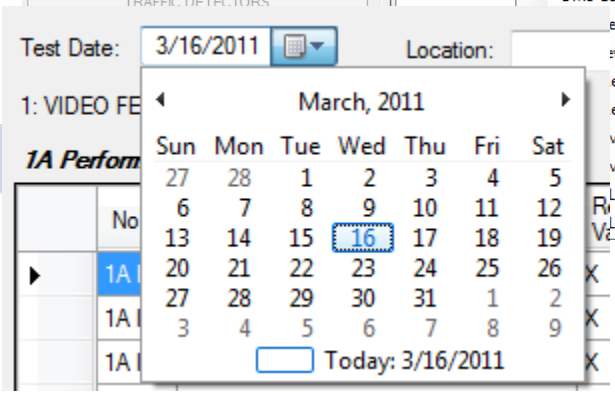
HOW TO USE THE ITS DEVICE (CO. CABLE) TEST FORMS?

Select the Device Testing Form

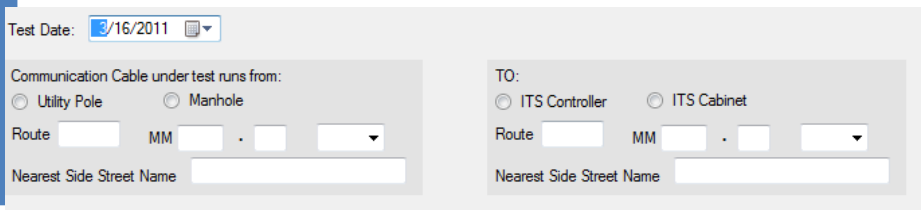


Select the Test Date

Use the Scroll button

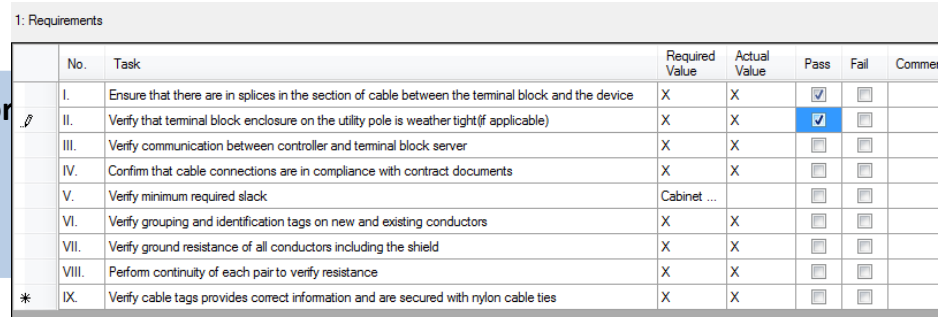


Write the Location Info: Route, Milage Post, Direction and Nearest Street Name

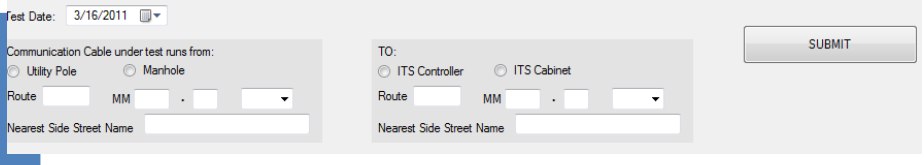


Answer the Questions, PASS or FAIL, write any comment if needed

WRITE THE ACTUAL VALUE!

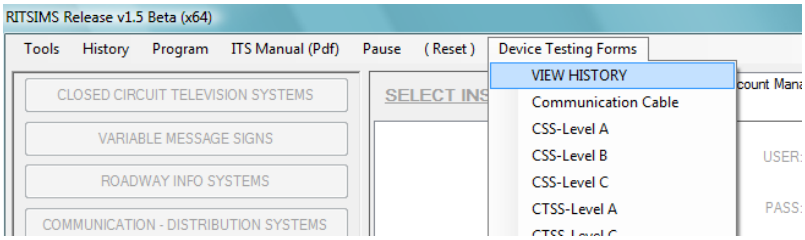


Choose submit after answering all the questions

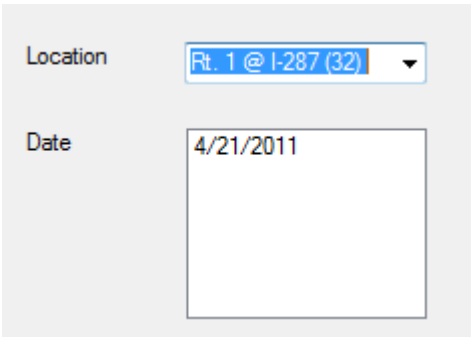


HOW TO PERFORM THE ITS TESTING FORM HISTORY CHECK?

Select the View History Option

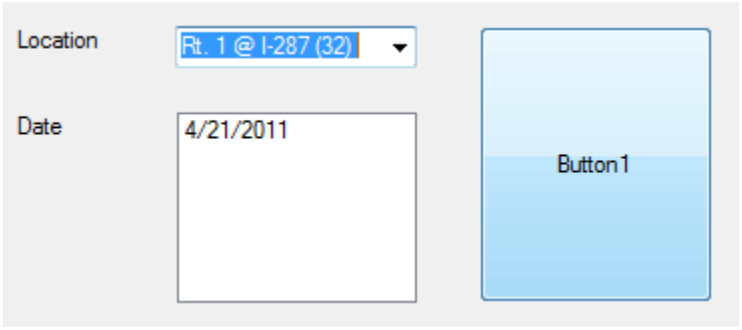


Select the Location



Select the Date

Click on the Button1



See the answers for the questions