RADAR DETECTOR SYSTEM TEST PLANS

1. DEVICE NAMING COORDINATION

1.1. The System Integrator shall coordinate with the TMC/ROC to identify the device names for each device.

1.2. The System Integrator shall then send a request to TOTS to identify the network name, IP address, and any pertinent configuration information.

2. EXPLANATION – STANDALONE (SALT) TESTING

2.1. The System Integrator shall work with the DEVICE VENDOR (if required by the testing form) and complete the NDOT specified SALT tests (non-network) on each unit of equipment after installation.

2.2. Conduct SALT testing on each unit of equipment as outlined on the NDOT provided testing form.

2.3. The System Integrator shall coordinate through the Resident Engineer and the Construction Crew to have an appropriate NDOT representative present for the onsite inspection.

2.4. The System Integrator shall submit the DEVICE vendor commissioning documents with the SALT testing to the Engineer for review and approval.

2.5. Supply a bucket truck and operator, or suitable equivalent equipment necessary to carry out procedures as required by the testing documents, at no direct payment.

RADAR DETECTOR SYSTEM (RDS) SALT PROCEDURE

TEST #	SALT TEST PROCEDURE	EXPECTED RESULT	PASS / FAIL
RDS Name:		**IP Address:**	**GPS:**
TOTS Network Name:		**Associated Cabinet Name:**	
Purpose and General Verification			
System Integrator: *This SALT tests the proper installation of a functional RDS. The system integrator will use a laptop to perform this test. Using the GUI of the RDS, the integrator will be able to verify all sensors are reporting data to the System Controller.* ***General Verification****: For each test below, complete the RDS SALT Matrix, circling the "Pass", "Fail" or "N/A" in the appropriate cell. Only indicate a "Pass" on this form if the entire matrix column related to the tested function passes for EACH RDS being tested.*			
System Controller Information			
1.	Verify RDS System Controller Information using the Web User Interface (UI) or the manufacturer software.	**Manufacturer: _____** **Model: _____** **Serial Number: _____** **Firmware Ver: _____**	Pass / Fail
Equipment Verification			
2.	Verify RDS controller is securely mounted in cabinet.	RDS controller is securely mounted in cabinet.	Pass / Fail
3.	Using a meter, verify the system is properly bonded to earth ground.	Meter reading of 5 Ohms or less.	Pass / Fail
4.	Verify Ethernet cable length does not exceed 328 feet from the RDS Controller to the PoE++ injector or PoE++ switch, using either a time domain reflectometer or beginning- and end-foot markers.	The Ethernet cable length is less than 328 feet. **Cable Length: _____**	Pass / Fail
5.	Verify power supply energizes the system.	System is energized.	Pass / Fail
6.	Verify all cabling is labeled with the to/from on each end and at any major transition point and is neatly managed throughout the cabinet.	All premise or inside plant cables originating and ending in the cabinet are properly terminated and labeled. Labeling material rated for Outside Plant (OSP) use. Cables are neatly managed using adjustable hook-and-loop fastener straps.	Pass / Fail
7.	Verify RDS is accessible via User Interface (UI).	RDS accessible via UI.	Pass / Fail / N/A

TEST #	SALT TEST PROCEDURE	EXPECTED RESULT	PASS / FAIL
8.	Verify RDS operations locally via User Interface (UI).	RDS turns on/off via UI.	Pass / Fail / N/A
9.	Using manufacturer's software, issue command to actuate the field device.	Visual confirmation of field device activation.	Pass / Fail
10.	Using manufacturer's software issue command to de-actuate the field device.	Visual confirmation of field device deactivation.	Pass / Fail
11.	Complete Attachment 1.1 "Detector Accuracy Form – Volume Testing".	All loops or lanes have been tested and passed with at least 95% accuracy.	Pass / Fail
12.	Verify the count-detection accuracy of the detector against a manual count. See Test # 11	Recorded observations using Attachment 1.1 titled "Detector Accuracy Form – Volume Testing" at the end of the SALT testing procedure.	Pass / Fail
13.	Complete Attachment 1.2 "Detector Accuracy Form – Speed Testing – Speed Gun".	All lanes have been tested and passed with at least 90% accuracy.	Pass / Fail
14.	Verify the speed-detection accuracy of the detector against a manual count using a calibrated speed gun. See Test #13	Recorded observations using Attachment 1.2 titled "Detector Accuracy Form – Speed Testing – Speed Gun" at the end of the SALT testing procedure.	Pass / Fail
Verification of Settings			
15.	Verify Communication Settings are set to appropriate values per the IP plan.	**IP: _____** **MASK: _____** **GATEWAY: _____** **UDP/TCP PORT: _____**	Pass / Fail

Signatures

DATE	AGENCY/FIRM	PERFORMED BY (Print Name) (Integrator)	INTL	AGENCY/FIRM	WITNESSED BY (Print Name) (NDOT)	INTL

Integrator Signature	
NDOT RE Signature	
NDOT TOTS Signature	

Attachment 1.1 Detector Accuracy Form – Volume Testing

Directions:

(1) From the plans, identify the detection lane(s) or lane(s) to be tested.

(2) Record the number of vehicles per minute on both manual and controller counts.

(3) After 15 minutes or 100 vehicles, whichever occurs first, record the total number of vehicles from both hand counts and reported by the detector during the test window.

(4) Depending on the detector type, accuracy calculations will vary. Refer to manufacturer's documentation, otherwise accuracy is computed as follows:

$$\text{Accuracy} = 100 - \left(100 * \frac{Total\ Manual\ Count - Total\ Detector\ Count}{Total\ Manual\ Count}\right)$$

(5) All testing shall be performed during free flow traffic conditions.

(6) If a lane fails (less than 95% accuracy), it shall be recalibrated and retested.

Cabinet ID:		**Station:**		**Location:**		**Date:**		**Time:**	

	Lane Number (Direction: NB/ EB / SB / WB)									
	Lane 1 (_____)		**Lane 2 (_____)**		**Lane 3 (_____)**		**Lane 4 (_____)**		**Lane 5 (_____)**	
Minute	Manual	Detector	Manual	Detector	Manual	Detector	Manual	Detector	Manual	Detector
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
Total										
Accuracy (%)										
Pass/Fail										

Signatures

DATE	**AGENCY/FIRM**	**PERFORMED BY** (Printed Name) (Integrator)	**INTL**	**AGENCY/FIRM**	**WITNESSED BY** (Print Name) (NDOT)	**INTL**

Integrator Signature	
NDOT RE Signature	
NDOT TOTS Signature	

Attachment 1.2 Detector Accuracy Form – Speed Testing – Speed Gun

Directions:

(1) From the plans, identify the detection lane(s) or lane(s) to be tested.

(2) Record speeds (raw data), using a recently calibrated speed gun and the detector, on a separate paper in addition to submitting this form. Note location, date, and time on raw data record sheet.

(3) After 5 minutes or 20 vehicles have passed, whichever occurs first, stop recording speeds. Calculate the average speed of the vehicles for EACH minute and record in the "Manual" column. Record the average speed per minute of the period reported by the detector or Type 170 controller and record in the "Detector" column.

(4) Depending on the detector type, accuracy calculations will vary. Refer to manufacturer's documentation, otherwise accuracy is computed as follows:

$$\text{Accuracy} = 100 - \left(100 * \frac{Manual\ Speed - Detector\ Speed}{Manual\ Speed}\right)$$

(5) All testing shall be performed during free flow traffic conditions.

(6) If a lane fails (less than 90% accuracy), it shall be recalibrated and retested.

Cabinet ID:		**Station:**		**Location:**		**Date:**		**Time:**	

	Lane Number (Direction: NB / EB / SB / WB)									
	Lane 1 (_____)		**Lane 2 (_____)**		**Lane 3 (_____)**		**Lane 4 (_____)**		**Lane 5 (_____)**	
Minute	Manual (MPH)	Detector (MPH)	Manual (MPH)	Detector (MPH)	Manual (MPH)	Detector (MPH)	Manual (MPH)	Detector (MPH)	Manual (MPH)	Detector (MPH)
1										
2										
3										
4										
5										
Accuracy (%)										
Pass/Fail										

Signatures

DATE	**AGENCY/FIRM**	**PERFORMED BY** (Printed Name) (Integrator)	**INTL**	**AGENCY/FIRM**	**WITNESSED BY** (Print Name) (NDOT)	**INTL**

Integrator Signature	
NDOT RE Signature	
NDOT TOTS Signature	

3. EXPLANATION - SUBSYSTEM (SST) TESTING

3.1. At the beginning of the SST phase, the System Integrator shall submit, in PDF format and original signed hard copies of the certified SALT results for approval by the Engineer.

3.2. The Engineer shall approve all SALT testing prior to the System Integrator starting the SST testing.

3.3. Conduct SST testing in accordance with NDOT's testing documentation for all field and related equipment once the system has been interconnected to form a complete subsystem (i.e. Network connectivity).

3.4. The SST test shall demonstrate connectivity to all field equipment utilizing NDOT's current freeway management system.

3.5. The SST test consists of a 45-day period of operations without major failure of equipment. The Resident Engineer can require the SST be restarted if any major failure occurs. A major failure for the Radar Detector System is defined as:

3.5.1. Any failure of the equipment associated with the PRIMARY FUNCTION of the Radar Detector System

3.6. Demonstrate that the total system (hardware, firmware, software, materials, and construction) are properly installed, free from problems, exhibits stable and reliable performance, and meets project requirements.

3.7. Once per week, the System Integrator shall demonstrate that all system functions tested in the SST are operational and meets requirements.

3.8. The System Integrator shall coordinate through the Resident Engineer and the Construction Crew to have an appropriate NDOT representative present for the onsite inspection.

3.9. The System Integrator must provide proof that each device has been tested each week for the duration of the testing period witnessed by an NDOT representative.

3.10. The testing time must be scheduled a minimum of one week prior and coordinated and approved by the Resident Engineer and the Construction Crew.

Radar Detector System (RDS) SST TEST PROCEDURE

TEST #	SST TEST PROCEDURE	EXPECTED RESULT	PASS / FAIL
RDS Name:		**IP Address:**	**GPS:**
TOTS Network Name:		**Associated Cabinet Name:**	
Purpose and General Verification			
System Integrator: *This SST tests the proper installation of a functional RDS. The system integrator will use an Operator Workstation at the TMC/ROC to perform this test.* ***General Verification****: For each test below, complete the RDS SST Matrix, circling the "Pass" or "Fail" in the appropriate cell. Only indicate a "Pass" on this form if the entire matrix column related to the tested function passes for EACH RDS being tested.*			
System Controller Information			
1.	Verify network connectivity by issuing a ping test.	Controller responds to the ping test.	Pass / Fail
2.	Verify system turns on by issuing a command to turn "on" the system through the freeway management system (FMS).	System responds and turns on.	Pass / Fail
3.	Verify field device operation with system turned on from TMC/ROC.	Visual confirmation of field device activation.	Pass / Fail
4.	Verify system turns off by issuing a command to turn "off" the system through the FMS.	System responds and turns off.	Pass / Fail
5.	Verify field device operation with system turned off from TMC/ROC.	Visual confirmation of field device deactivation.	Pass / Fail
6.	Verify access to the Web User Interface (UI) from the TMC/ROC.	Web User Interface (UI) is accessible.	Pass / Fail
7.	Verify control of the system via UI by the "output" interface. Test by switching the output to "on" and again by turning it "off".	Controller can control the system via the UI.	Pass / Fail
8.	Using the UI issue command to actuate the field device.	Visual confirmation of field device activation.	Pass / Fail
9.	Using the UI issue command to de-actuate the field device.	Visual confirmation of field device deactivation.	Pass / Fail
10.	Activate the local field device using manual actuator bypass.	Visual confirmation that the Freeway Management System (FMS) at the TMC/ROC successfully reads status of manual actuation.	Pass / Fail
11.	Deactivate the local field device using manual actuator bypass.	Visual confirmation that the FMS at the TMC/ROC successfully reads status of manual de-actuation.	Pass / Fail

Signatures					
SST DAY	**DATE**	**PERFORMED BY** (Print Name) (Integrator)	**INTL**	**WITNESSED BY** (Print Name) (NDOT)	**INTL**
1					
8					
15					
22					
29					
36					
45					

Integrator Signature	
NDOT RE Signature	
NDOT TOTS Signature	