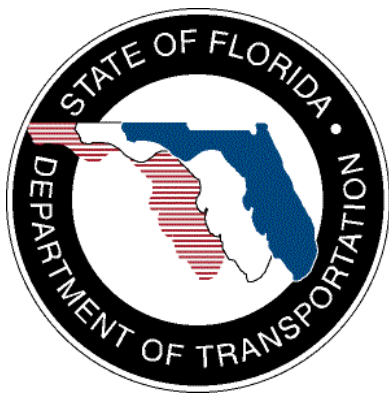**FDOT:**

Ramp Metering Firmware

Software Integration Case Procedures

FDOT-RMF-SICP-1.0.0

Prepared for:

Florida Department of Transportation
Traffic Engineering and Operations Office
605 Suwannee Street, M.S. 90
Tallahassee, Florida 32399-0450
(850) 410-5600

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Acknowledgement Page

To be signed after Testing

The following have witnessed the tests contained in this document being performed. The results of the tests are noted in this document and any deviations/waivers/issues will be contained in the Software Test Report:

_____   _____

FDOT Project Manager   **Date**

_____   _____

SwRI Project Manager   **Date**

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List of Acronyms

DOT ....Department of Transportation
FDOT ....Florida Department of Transportation
IE ....Internet Explorer
IIS ....Internet Information Service
ITN ....Invitation to Negotiate
ITS ....Intelligent Transportation Systems
RDBMS ....Relational Database Management System
RWIS ....Roadway Weather Information System
SICP ....Software Integration Case Procedures
SRS ....Software Requirements Specification
STMCSLS ....Statewide Transportation Management Center Software Library System
SwRI ....Southwest Research Institute
TOD ....Time-of-Day
TSS ....Traffic Sensor Subsystem
W3 ....World Wide Web
WSDOT ....Washington State Department of Transportation

Revision History

Revision	Date	Changes
1.0.0	March 14, 2007	Initial Release.

1. Scope

1.1   Document Identification

This document is the Software Integration Case Procedures (SICP) for the Florida Department of Transportation (FDOT) Ramp Meter Firmware product and the Ramp Metering Subsystem.

1.2   Project Overview

The FDOT is conducting a program that is developing SunGuide[SM] software. The SunGuide[SM] software is a set of Intelligent Transportation System (ITS) software that allows the control of roadway devices as well as information exchange across a variety of transportation agencies. The goal of the SunGuide[SM] software is to have a common software base that can be deployed throughout the state of Florida. The SunGuide[SM] software development effort is based on ITS software available from both the states of Texas and Maryland; significant customization of the software is being performed as well as the development of new software modules. The following figure provides a graphical view of the software to be developed:
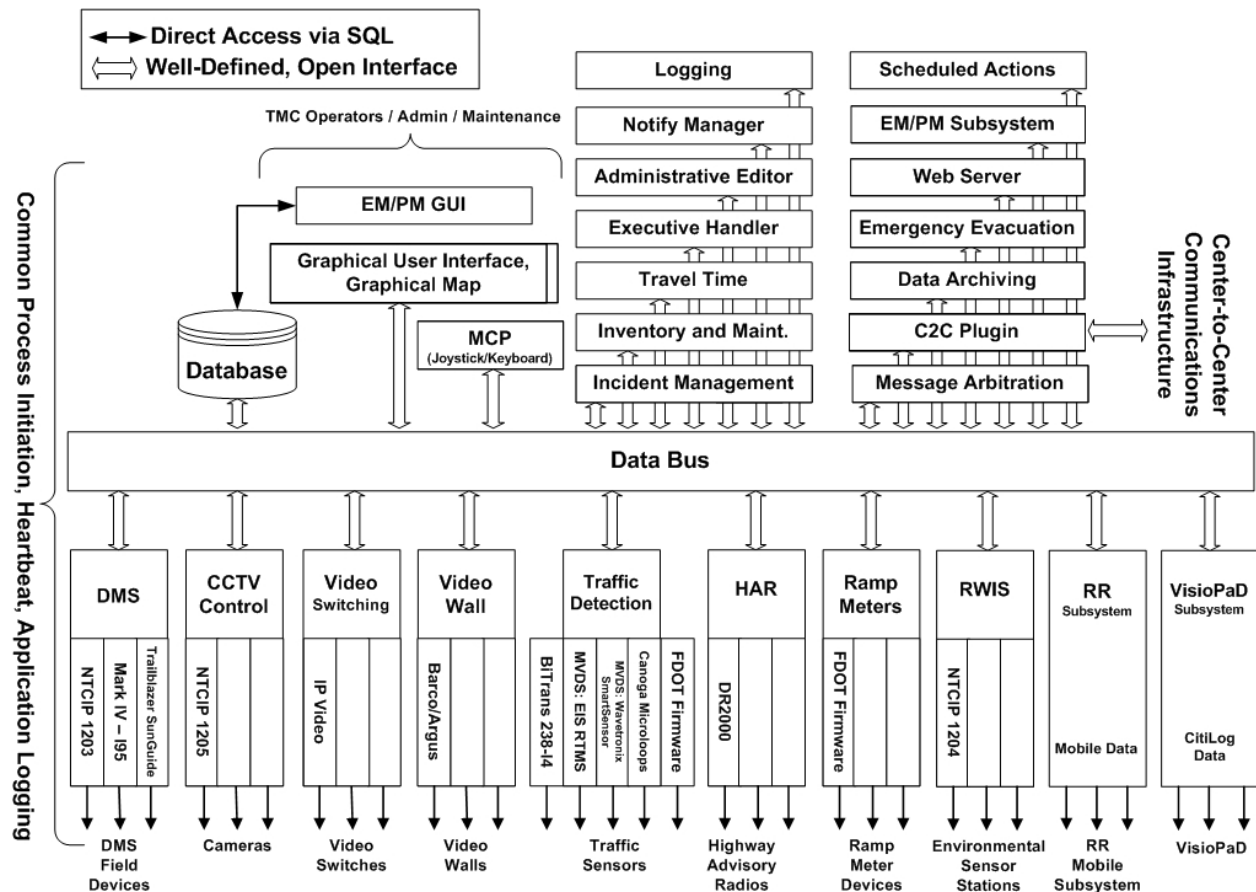
Figure 1.1 - High-Level Architectural Concept

The SunGuide^{SM} development effort spans approximately two years. After the development, the software will be deployed to a number of Districts and Expressway Authorities, counties throughout Florida, enhancement and support activities will be performed.

1.3   Related Documents

The following documents were used to develop this document:

- SwRI Qualification Response: *Response to the Invitation to Negotiate (ITN): Statewide Transportation Management Center Software Library System, Negotiation Number: ITN-DOT-02/03-9025-RR,* SwRI Proposal No. 10-35924, dated: November 18, 2002.

- SwRI Technical Proposal: *Technical Proposal for Invitation to Negotiate (ITN): Statewide Transportation Management Center Software Library System, Negotiation Number: ITN-DOT-02/03-9025-RR,* SwRI Proposal No. 10-35924, dated: January 31, 2003.

- SwRI Cost Proposal: *Cost Proposal for Invitation to Negotiate (ITN): Statewide Transportation Management Center Software Library System, Negotiation Number: ITN-DOT-02/03-9025-RR,* SwRI Proposal No. 10-35924, dated: January 31, 2003.

- SwRI BAFO letter: *Southwest Research Institute® Proposal No. 10-35924, "Invitation to Negotiate (ITN):   Statewide Transportation Management Center Software Library System", Reference: Negotiation Number: ITN-DOT-02/03-9025-RR*, dated: May 5, 2003.

- FDOT procurement document: *Invitation To Negotiate (ITN), Negotiation Number: ITN-DOT-02/03-9025-RR, Statewide Transportation Management Center Software Library System*, dated: October 21, 2002.

- FDOT Scope of Services: *Statewide Transportation Management Center Software Library System: Scope of Services,* September 22, 2003.

- FDOT Requirements Document: *Statewide Transportation Management Center Software Library System: Requirements Specification,* June 3, 2003.

- Southwest Research Institute, *TMC Software Study*, November 15, 2001.

- Southwest Research Institute, *Introduction to an Operational Concept For the Florida Statewide Library*, FDOT – OCD – 1.0, March 31, 2002.

- Southwest Research Institute, *Statewide Transportation Management Center Software Library System: Software Requirements Specification, STMCSLS-SRS-1.0.2*, April 2, 2003.

- World Wide Web Consortium (W3) website: http://www.w3.org.

- SunGuide^{SM} Project website: http://sunguide.datasys.swri.edu.

1.4   Contacts

The following are contact persons for the SunGuide^{SM} software project:

- Elizabeth Birriel, ITS Central Office, elizabeth.birriel@dot.state.fl.us, 850-410-5606
- Liang Hsia, FDOT Project Manager, liang.hsia@dot.state.fl.us, 850-410-5615
- John Bonds, Senior ITS Specialist, jbonds@pbsj.com, 408-873-2514
- David Chang, ITS Specialist, David.Chang@dot.state.fl.us, 850-410-5622
- Steve Dellenback, SwRI Project Manager, sdellenback@swri.org, 210-522-3914
- Robert Heller, SwRI Software Project Manager, rheller@swri.org, 210-522-3824

The following are contacts that will be used by the SunGuide^{SM} software project team to assure consistency with other FDOT projects and FDOT procedures:

- Jim Mosser, PB Farradyne, FDOT C2C Project, mosser@pbworld.com, 754-224-6966
- David Lambert, University of North Florida, RWIS, jlambert@unf.edu, 904-620-3881
- Bob Colins, PBS&J, Emergency Evacuation, bobcolins@pbsj.com, 850-575-1800
- John Fain, FDOT, Comptroller, john.fain@dot.state.fl.us, 850-921-7332
- Leslie Jacobson, PB Farradyne, Ramp Metering, jacobsonl@pbworld.com, 206-382-5290

2. Test Descriptions

The requirements contained in the following sections were extracted from the Release 2 Software Requirements Specification (SRS), identifier: SunGuide-SRS-2.0.3 dated October 13, 2005.

2.1   Test Description Organization

2.1.1 Integration Cases

The Ramp Metering Firmware test case was extracted from the Release 2 SICP, identifier: SunGuide-SICP-2.0.3 dated October 21, 2005.

- ▪ Release 2.x Integration Cases:

    - o IC-11: Ramp Metering Subsystem (RMS)

2.1.2 Test Case Organization

Each test case consists of

1.   a statement describing the test case,

2.   the requirements to be tested by the test case,

3.   preconditions which must be satisfied prior to running the test,

4.   the test procedure itself in table format with space for making pass / fail

2.1.3 SunGuide^{SM} System Installation

The test cases are intended to be run against an installed and running SunGuide^{SM} software system. This section describes the minimal configuration that is utilized for these integration cases. Individual *Test Procedures* which have additional equipment requirements or conditions which must be met before running the test procedure have those noted within the description of the *Test Procedure*.

2.1.3.1 Equipment Needed

The tests described within this document are written with the assumption that the described testing will occur in Southwest Research Institute® (SwRI®) ITS testing facilities. The following sections further describe the hardware and software that are necessary for the testing.

2.1.3.1.1   Hardware Preparation

The hardware in that facility is shown in Appendix A.

2.1.3.1.2   Software Preparation

Software needs to be installed as shown in the following table. The SunGuide^{SM} software installation makes use of two *config.xml* files, one for the non-Internet Information Service (IIS)

applications, and one for the IIS applications[1]. These two configuration files are listed in Appendices C and D of this document.

Software Installation	SunGuide^{SM} Application Server	SunGuide^{SM} Database Server	SunGuide^{SM} Workstation A	SunGuide^{SM} Workstation B	Test Hardware
Windows 2003 Server with current service packs and hot fixes	✓	✓			
IIS on the application server	✓				
Oracle RDBMS on the database serve		✓			
SunGuide^{SM} software	✓				
Windows XP (current service packs and hot fixes)			✓	✓	
IE 6A (current service packs and hot fixes)			✓	✓	
Oracle 10g client		✓	✓	✓	
Oracle 10g Enterprise Manager Console		✓	✓	✓	
Status Logger Viewer	✓		✓	✓	
Executive Handler Viewer	✓		✓	✓	
Statuslogclient	✓		✓	✓	
ClientTester	✓		✓	✓	
TSS Simulator	✓				
Model 170 Controller					✓
Loop simulator					✓

2.1.4 Record Keeping

Each test step within this test procedure includes a place to note whether a specific test step passed or failed. This shall be maintained in both hardcopy and softcopy form. The hardcopy

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[1] This is due to the inability of the IIS applications (administrative subsystem) inability to access files outside the IIS directory structure.

will be signed by witnesses from FDOT and SwRI respectively. Witnesses will note the start time and stop time for each test.

2.2   IC-11: Ramp Metering (R2.0)

The following tests will test the RMS and driver.

2.2.1   Objectives

The objective of this integration case is to test the requirements associated with the development, display, and control of the RMS system and controllers.

2.2.2   Requirements to be Tested

Table 2.1 contains a list of the Ramp Metering requirements that will be tested during the formal acceptance testing of the SunGuide[SM] software.

Table 2.1 - Ramp Metering Requirements

Subsystem	Requirement Number	Requirement Name	Test Method
RMS	FEAT 15.1.1	Download parameters	Demonstration
RMS	FEAT 15.1.2	Online status	Demonstration
RMS	FEAT 15.1.3	Associate detectors	Demonstration
RMS	FEAT 15.1.4	Modify vehicle release mode	Demonstration
RMS	FEAT 15.1.5	Responsive mode	Demonstration
RMS	FEAT 15.1.6	Manual override	Demonstration
RMS	FEAT 15.2.1	System operating parameters	Demonstration
RMS	FEAT 15.2.2	Controller groups	Demonstration
RMS	FEAT 15.2.3	Central overrides	Demonstration
RMS	FEAT 15.2.4	Monitoring status	Demonstration
RMS	FEAT 15.2.5	Metering on/off	Demonstration
RMS	FEAT 15.2.6	Logging	Demonstration
RMS	FEAT 15.3.1	Automatic polls	Demonstration
RMS	FEAT 15.3.2	Manual poll	Demonstration
RMS	FEAT 15.3.3	Synchronize clock	Demonstration

Table 2.2 - FDOT Ramp Metering Firmware Requirements

Subsystem	Requirement Number	Requirement Name	Test Method
RMS	FEAT21.1.1	Provide ramp metering firmware	Inspection
RMS	FEAT21.1.2	Model 170 equipment	Demonstration
RMS	FEAT21.1.3	68HC11 processor	Inspection
RMS	FEAT21.1.4	Controller firmware support	Inspection
RMS	FEAT21.1.5	Standardized communications	Inspection
RMS	FEAT21.1.6	Common access keypad	Demonstration
RMS	FEAT21.1.7	WsDOT firmware implementation	Inspection
RMS	FEAT21.1.8	Surveillance functions	Demonstration

Subsystem	Requirement Number	Requirement Name	Test Method
RMS	FEAT21.1.9	Meter traffic flow	Demonstration
RMS	FEAT21.2.1	Input source	Demonstration
RMS	FEAT21.2.2	Pre-defined configurable parameters	Demonstration
RMS	FEAT21.2.3	Clock and calendar function	Demonstration
RMS	FEAT21.2.4	Configurable number of lanes	Demonstration
RMS	FEAT21.3.1	Data collection and RM algorithms	Inspection
RMS	FEAT21.3.2	Downloaded or manually set parameters	Demonstration
RMS	FEAT21.4.1	Data collection surveillance services	Demonstration
RMS	FEAT21.4.2	Local or central command modes	Demonstration
RMS	FEAT21.4.3	Local mode operation	Demonstration
RMS	FEAT21.4.4	Central command mode	Demonstration
RMS	FEAT21.4.5	Local mode implementation	Demonstration
RMS	FEAT21.4.6	Metering rates	Demonstration
RMS	FEAT21.4.7	Central command mode operation	Demonstration
RMS	FEAT21.4.8	Ramp meter controller	Demonstration

2.2.3 Test Approach

The following is a brief description of the test procedures that will be used to test this integration case:

- The RMS system will demonstrate its ability to perform tasks as described by the requirements. These tasks include initialization, configuration, control, modification and monitoring of the ramp meter controllers.

- The RMS firmware will demonstrate its ability to perform tasks as described by the requirements. These tasks include initialization, configuration, control, modification and monitoring of the Model 170 controllers.

2.2.4 Test Descriptions

The following sections detail the tests to be performed.

2.2.4.1 RMS Setup (RMS-1)

This test will demonstrate the RMS systems ability to integrate with the Traffic Sensor Subsystem (TSS) subsystem as stated in the following requirement.

2.2.4.1.1   Requirements Addressed

The following requirements are addressed by this test:

Requirement Number	Requirement Name	Requirement Statement
FEAT 15.1.3	Associate detectors	The system shall allow mainline and on-ramp traffic detectors to be associated with a ramp meter controller.

2.2.4.1.2   Prerequisite Conditions

The following systems should be running:

- RmsSubsystem (SG RMS 170 Driver Svc)
- RmsDriverSvc (SG RMS Service)
- WsDOTDriverSvc (SG WsDOT 170 Driver Service)
- TSS Subsystem

The SunGuide^{SM} Admin Editor application must be available for this test.

2.2.4.1.3   Test Procedure

Test Start Date / Time	

Perform the following steps on the SunGuide^{SM} client:

Requirement Number	Test Steps	Expected Result	P	F
FEAT 15.1.3	Access the SunGuide^{SM} Admin Editor. Verify a tss detector is present in a rampmeter configuration. Verify the detector is mapped in a rampmeter configuration. The detector is required to have links to associate with lanes for MainLine, RampQueue, and Adv RampQueue. Select one of the lanes from the detector map. Note the zone number _____ for that id. Open the firmware params dialog on the Operator Map, select loop function codes. Verify the zone number noted above is assigned to the appropriate lane type. Select RMS-RMC Controllers. Verify a RMC Controller is present with the same ID as the previously viewed tss detector. Select Fuzzy Lanes then the id of the controller previously viewed. Verify fuzzy lanes for MainLine, RampQueue, and Adv RampQueue with the corresponding lanes/links on the corresponding tss detector and any other upstream or down stream tss detectors. Note: UpStream and DownStream will be assigned to other detectors respectfully.	A tss detector is mapped with a ramp meter configuration. A ramp meter controller is created with the same id as the tss detector. The zones of the tss detector correlate to the loops of the rms controller. Fuzzy Lanes are associated with the tss detector for use by the fuzzy logic of the controller.	☐	☐

Test End Date & Time	
FDOT Witness	
SwRI Witness	

2.2.4.2 RMS Initialization (RMS-2)

This test demonstrates the RMS systems ability to meet the following requirements.

2.2.4.2.1   Requirements Addressed

The following requirements are addressed by this test:

Requirement Number	Requirement Name	Requirement Statement
FEAT 15.1.1	Download parameters	The system shall allow operational parameters to be downloaded to one or more ramp meter controllers. These parameters currently include: · Metering rate table · Mode control · Time of day table
FEAT 15.1.4	Modify vehicle release mode	The system shall allow the vehicle release mode of a ramp meter controller to be modified. Release modes currently include: · Single car · 2-car tandem · 2-car platoon · 2-car staggered · HOV bypass
FEAT 15.2.2	Controller groups	The system shall allow groups of ramp meter controllers to be defined. Groups of groups may also be defined.
FEAT21.1.2	Model 170 equipment	The Ramp Meter controller firmware shall control equipment consisting of standard transportation management hardware equivalent to the Model 170 controller.
FEAT21.1.3	68HC11 processor	The Ramp Meter controller firmware shall be developed for the 68HC11 processor.
FEAT21.1.4	Controller firmware support	The Ramp Meter controller firmware shall support Model 170 controller keypad, LED display, indicators, communications input and output functionality
FEAT21.1.6	Common access keypad	The Ramp Meter controller shall allow use of a common access keypad for manual access to firmware parameters and controller operation.
FEAT21.1.9	Meter traffic flow	The Ramp Meter controller shall meter a configurable number of lanes up to three lanes.
FEAT21.2.1	Input source	The source for input to the Ramp Meter controller shall be configurable.
FEAT21.2.2	Pre-defined configurable parameters	The Ramp Meter controller shall accept pre-defined configurable firmware parameters.
FEAT21.2.4	Configurable number of lanes	The Ramp Meter controller shall meter a configurable number of lanes up to three lanes.
FEAT21.3.1	Data collection and RM algorithms	Firmware parameters shall be utilized for data collection and ramp metering algorithms.
FEAT21.3.2	Downloaded or manually set parameters	The Ramp Meter controller shall allow firmware parameters to be downloaded from a central system or manually input from the keypad.

2.2.4.2.2   Prerequisite Conditions

The test requires the following conditions:

- A ramp meter controller configured for one lane metering.
- A ramp meter controller configured for two lane metering.
- Status Logger is running and filter set for the RmsSubsystem and Bitran-170 driver, both should be running in detail mode.
- The FDOT Ramp Metering firmware is 2-car staggered by default.

2.2.4.2.3   Test Procedure

Test Start Date / Time	

Perform the following steps on the SunGuide^{SM} client:

Requirement Number	Test Steps	Expected Result	P	F
FEAT21.1.2 FEAT21.1.3 FEAT21.1.4	Ensure the controller power switch is in the OFF position. View the front panel of the controller and verify the model stamp states "Model 170E…Controller Unit". Warning: The individual performing the next step must ground him/her self to remove any static electricity potential prior to handling the circuit boards. Open the front panel door. Find the CPU circuit board and remove. Find the CPU chip and verify it contains the stamp "68HC11". Verify the controller possesses a phased display, keyboard and multiple input and outputs. Replace CPU board, close front panel, if not done already and turn controller back on. Ensure driver reconnects with the controller before proceeding.	The controller utilized during testing is the Model170 controller with a 68HC11 processor chip. The controller should have multiple input/outputs, display and keypad entry point.	☐	☐

Requirement Number	Test Steps	Expected Result	P	F
FEAT21.2.1	Right-click on the ramp meter controller in single lane configuration and select RMC Firmware Params. Select "Loop Function Codes" on the drop-down box. Note 40 selection boxes. Select a drop down box to view loop function types.	Manually configure loop function inputs and sources.	☐	☐
FEAT 15.1.1 FEAT21.2.2 FEAT21.3.1 FEAT21.3.2	Right-click on the ramp meter controller in single lane configuration and select RMC Firmware Params. Select "170 Global Parameters" on the drop-down box. Note the value of the parameter "CarsPerGreen". Right-click on the Operator Map. Select RMS-RMC Control Manager. Select multiple devices from the list box. Press the download parameters button. From the front panel of the 170 controller the parameters were downloaded to, access the "CarsPerGreen" value on the C-Page at address "C81". Verify the value matches the previously noted value from the Firmware Params dialog. Use the controller keypad to change the value of "CarsPerGreen" to 2. Verify the newly entered value was saved. Return the "CarsPerGreen" value to it's original state. View the Status Logger messages showing the params were sent to the device.	Multiple devices are selected. The parameters are downloaded to the respective controllers. The controller firmware is updated with the parameter value used for metering. The controller firmware allows for manual adjustment of firmware parameters. Dialog displays the firmware parameters utilized for data surveillance and ramp metering functions.	☐	☐
FEAT 15.1.4	Right-click on the ramp meter controller in single lane configuration and select RMC Firmware Params. Single car test: Select "170 Global Parameters" on the drop-down box. Verify the parameter "Number of Metering Lanes".	Verifies the controller is in the single car mode.	☐	☐

Requirement Number	Test Steps	Expected Result	P	F
FEAT 15.1.4 FEAT21.1.9 FEAT21.2.4	Right-click on the ramp meter controller in two lane configuration and select RMC Firmware Params. 2-car tandem test: Verify "Ramp Lane Parameters" on the drop-down box. Verify both Lanes 1 and 2 have parameters set. Verify the parameter "percentage of MeterRateAdj for lane" is set. Select "170 Global Parameters" on the drop-down box to view the Global Parameters for the controller. Verify that "number of Metering Lanes" is set to 2.	Able to change view of the ramp meter parameters. Verifies the ability of the controller to enter 2-car tandem operations. Verifies the ability of the controller to meter a configurable number of lanes.	☐	☐
FEAT 15.1.4	Right-click on the ramp meter controller in single lane configuration and select RMC Firmware Params. 2-car platoon test: Verify "Ramp Lane Parameters" on the drop-down box. Verify Lane 1 has parameters set. Select "170 Global Parameters" on the drop-down box to view the Global Parameters for the controller. Verify the "Cars to Release per Green Cycle" value is set to 2. If parameter is not 2, set to this value.	Capable of changing the view of the ramp meter parameters. Ability to set the CarsPerGreen parameter to 2 allowing the controller to enter the 2-car platoon mode.	☐	☐
FEAT 15.1.4	Right-click on the ramp meter controller in two lane configuration and select RMC Firmware Params. HOV by-pass test: Verify "Ramp Lane Parameters" on the drop-down box. Set the "HOV delay added to red timer" value to 10.	The Firmware Params dialog is displayed. Able to change view of the ramp meter parameters. Ability to set the" HOV delay added to red timer (sec)" parameter to 10 allowing the controller to enter HOV by-pass mode.	☐	☐

Requirement Number	Test Steps	Expected Result	P	F
FEAT 15.2.2	Access the SunGuide^{SM} Admin Editor application. Select RMS-Groups. Select Add. Enter name of group and select controllers to add to the group. Click Save.	The new group of ramp meter controllers is created and added to the subsystem. The user is returned to Groups selection dialog.	☐	☐

Test End Date & Time	
FDOT Witness	
SwRI Witness	

2.2.4.3 RMS Status (RMS-3)

The following integration scenario will demonstrate the system's ability to meet the following requirements.

2.2.4.3.1   Requirements Addressed

The following requirements are addressed by this test:

Requirement Number	Requirement Name	Requirement Statement
FEAT 15.1.2	Online status	The system shall allow ramp meter controllers operational status to be manually changed to inactive/active.
FEAT 15.2.4	Monitoring status	The system shall monitor ramp meter controller status and change the operator display to indicate failed or marginal to reflect the current ramp meter controller status.
FEAT 15.3.1	Automatic polls	The system shall poll ramp meter controllers for their current status periodically at a rate that is configurable by a user who has appropriate permissions.
FEAT 15.3.2	Manual poll	The system shall allow ramp meters to be manually polled for their current status.
FEAT21.1.5	Standardized communications	The Ramp Meter controller shall provide standardized communications that conform to the WSDOT ramp metering protocol as described in "170 Communications Protocol:VAX-170-DOC05".
FEAT21.1.8	Surveillance functions	The Ramp Meter controller shall provide Surveillance functions.
FEAT21.4.1	Data collection surveillance services	The Ramp Meter controller shall provide data collection surveillance services in a local mode.

2.2.4.3.2   Prerequisite Conditions

This test assumes the user is logged into the SunGuide^SM Operator Map with proper permissions to access the RMS subsystem.

- Return controllers to 2-car staggered mode.
- Same prerequisite conditions as RMS-1

2.2.4.3.3 Test Procedure

Test Start Date / Time	

Perform the following steps on the SunGuide^{SM} client:

Requirement Number	Test Steps	Expected Result	P	F
FEAT 15.1.2	Right-click on a ramp meter controller and select RMC Control Manager. Select a new status for a controller in the status drop down box. Click Set Status.	Status is set to either Active or Out of Service depending on the state of the device at the time.	☐	☐
FEAT 15.3.1 FEAT 15.3.2 FEAT21.1.5 FEAT21.1.8 FEAT21.1.4.1	Open the Status Logger application. If Detail Columns are not viewable, Select View-Detail Columns. Filter View by deselecting all Process Names but Bitran-170, also filter by code "150623". Find the RmsPollDriverCommand and verify it is periodically polling the controller. Select Manual Poll. Note the time. Filter View by deselecting all Process Names but RMSSubsystem, also filter by code "140020". Find the handleManualPollResponse for that time. Compare data in POLL response to "170 Communications Protocol:VAX-170-DOC05" document.	The selected filtering of Status Logger displays the RmsDriverSvc periodically polling the controller. The second filtering task displays the manual poll request being sent to the controller. Communications is consistent with "170 Communications Protocol:VAX-170-DOC05" document. The controller provides data collection surveillance functionality.	☐	☐
FEAT 15.2.4	Right-Click on the map not occupied by an icon. Select RMS-RMC Status to display the Metering Status dialog.	The Metering Status dialog is displayed showing current status of the ramp meter controllers.	☐	☐

Test End Date & Time	
FDOT Witness	
SwRI Witness	

2.2.4.4 RMS Operation (RMS-4)

The following tests display the RMS system's ability to meet the below stated requirements.

2.2.4.4.1   Requirements Addressed

The following requirements are addressed by this test:

Requirement Number	Requirement Name	Requirement Statement
FEAT 15.1.5	Responsive mode	The system shall allow demand-responsive mode parameters to be modified for a ramp meter controller. Responsive mode parameters currently include: · Mainline occupancy · Queue length
FEAT 15.1.6	Manual override	The system shall allow a user with appropriate permissions to override the automatic control of a ramp meter.
FEAT 15.2.1	System operating parameters	The system shall allow the central operating parameters to be modified. These parameters currently include: · Ramp Metering(demand-responsive) Algorithm · Time of day (for selecting mode of operation and for selecting times to activate or deactivate ramp metering).
FEAT 15.2.3	Central overrides	The system shall allow a local time of day (TOD) ramp metering control table to be defined for each ramp meter. The local TOD table is downloaded to the controller to control ramp metering in the case of communication failure.
FEAT 15.2.5	Metering on/off	The system shall turn ramp metering operations on or off based on the WSDOT/UW algorithm using traffic conditions input from mainline and on-ramp detectors associated with ramp metering.
FEAT 15.2.6	Logging	The system shall log the following events: Communication errors with ramp meter controllers · Manual overrides of ramp meter control · Changes between modes of operation (on/off, TOD, etc.)
FEAT 15.3.3	Synchronize clock	The system shall allow the clocks on a ramp meter controller to be synchronized with the current system date and time.
FEAT21.1.1	Provide ramp metering firmware	The SunGuide system shall provide a ramp metering firmware for controlling traffic flow onto a roadway from an on-ramp.
FEAT21.1.7	WsDOT firmware implementation	The Ramp Meter controller front panel shall provide controller metering and data collection status in a manner consistent with the WsDOT Firmware implementation.
FEAT21.1.9	Meter traffic flow	The Ramp Meter controller shall meter traffic flow.
FEAT21.2.3	Clock and calendar function	The Ramp Meter controller shall provide a manually configurable Clock and calendar function.
FEAT21.4.2	Local or central command modes	The Ramp Meter controller shall operate in a local or central command mode.
FEAT21.4.3	Local mode operation	The Ramp Meter controller local mode shall operate based on local traffic conditions and firmware parameters consistent with the WsDOT implementation.

Requirement Number	Requirement Name	Requirement Statement
FEAT21.4.4	Central command mode	The Ramp Meter controller central command mode shall operate based on algorithms defined by the central system.
FEAT21.4.5	Local mode implementation	The Ramp Meter controller metering algorithms shall be defined for local mode consistent with the WsDOT firmware implementation.
FEAT21.4.6	Metering rates	While in central mode, the Ramp Meter controller shall implement the metering rates sent from the SunGuide software.
FEAT21.4.7	Central command mode operation	The Ramp Meter controller shall allow for manual starting, stopping and modifying the metering from central command.
FEAT21.4.8	Ramp meter controller	The Ramp Meter controller shall meter in local mode when active and disconnected from central command.

2.2.4.4.2   Prerequisite Conditions

The following systems should be running:

- RmsSubsystem (SG RMS 170 Driver Svc)
- RmsDriverSvc (SG RMS Service)
- WsDOTDriverSvc (SG WsDOT 170 Driver Service)
- TSS Subsystem
- RmsSubsystem and RmsDriverSvc should be running in detail mode.

2.2.4.4.3   Test Procedure

Test Start Date / Time	

Perform the following steps on the SunGuide^{SM} client:

Requirement Number	Test Steps	Expected Result	P	F
FEAT 15.1.5 FEAT 15.2.6	Right-click on a ramp meter controller and select RMC Firmware Params.

Verify the "Ramp Lane Parameters" is displayed in the drop-down box.

Select one of the mainline occupancy level parameters. For example: "First mainline occupancy level in local algorithm".

Change the value of this parameter to 25 and press save.

View the Status Logger messages for modifying the firmware parameters. | Verify that Mainline Occupancy is modified. | ☐ | ☐ |

Requirement Number	Test Steps	Expected Result	P	F
FEAT 15.1.6 FEAT 15.2.6 FEAT21.1.1 FEAT21.4.3 FEAT21.4.5	Right-click on a ramp meter controller and select RMS-RMC Control Manager Select local in the Metering Status drop down box. Select Set Metering Status. Verify the Metering Status reflects this change in the info pane. Enter a value in the Metering Rate Lane. Click Set Rate. Verify the Metering Rate changes to the indicated value and the Metering Status changes to Manual. Verify the Status Logger shows the changes in metering modes.	The controller meters in a local mode based on firmware parameters. Metering Status changes to Local. The Metering Rate value should be set, to the rate requested. In addition, the Metering Status should reflect the new Manual status. Does the Status Logger show the metering mode change?	☐	☐

Requirement Number	Test Steps	Expected Result	P	F
FEAT 15.2.1 FEAT 15.2.6 FEAT 15.2.5 FEAT21.1.7 FEAT21.4.2 FEAT21.1.9 FEAT21.4.6 FEAT21.4.4 FEAT21.4.7	Right-click on a ramp meter controller and select RMC Firmware Params. Select "170 Global Parameters" from the drop-down box. Select "TOD Table Metering" from the Control Switch drop-down box. Press the Save button. The CALL/ACTIVE light 5 on the 170 controller will light indicating the controller is in Local control. Verify the Interval window of the controller displays defined TOD metering state. Refer to the FDOT-RMF-SUM 1.0.0. Select "Central Metering" from the Control Switch drop-down box. Press the Save button. The CALL/ACTIVE light 5 on the 170 controller will extinguish indicating the controller is no longer in Local control. And light 4 will illuminate indicating central control. Right-click on a ramp meter controller and select RMC Central TOD Configuration. Select Add TOD. In the Add Time of Day Config dialog, select Mon,Tue, and Wed, current hour for Start time, current hour and plus 15 minutes for End time and Fuzzy for algorithm. Click Save. Verify metering status is Fuzzy. Monitor the VPM momentarily for changes due to traffic flow conditions. This may be a few minutes of monitoring and the percentage changes may be small. Verify the Interval window of the controller displays "F" for Fuzzy metering state. Find a FPOLL in Status Logger. Verify the fuzzy metering rate is sent to the controller.	The user is able to put the controller into "Local TOD Metering" and Central Metering" modes? The controller meters based on traffic flow. The controller meters in a local and central command mode. The user is able to add a TOD configuration from the ADD TOD dialog. The controller modifies metering based on traffic flow. The front panel of the controller displays metering and data collection status. The controller central command mode shall operate based on algorithms defined by the central system. The controller utilizes metering rates sent from the central system. Does the controller display the current metering state?	☐	☐

Requirement Number	Test Steps	Expected Result	P	F
FEAT21.4.8	Verify a Local TOD is defined for the current time of testing. Disconnect the C2 cable from the back of the controller. Wait for the controller communications to signal loss of communications with central. Call Lights 4 and 6 should extinguish and Call Light 5 should illuminate. The display should indicate metering in a local mode. Call lights 1, 2,and 3 should continue indicating signal head status. Call light 0 should remain illuminated indicating Active metering.	The controller meters in local mode when active and disconnected from central.	☐	☐
FEAT15.2.3 FEAT 15.2.6	Right-click on a ramp meter controller and select RMC Firmware Params. Select Time of Day Table from the drop-down box. Enter Hour and Minute for Entry 4. Select Mon and Tue, verify In Use is checked and enter a metering rate of 12.5. Click Save. View the Status Logger entries containing the modified firmware parameters.	The RMC Firmware Params Dialog displays the local time of day table. The modified entry is updated to the controller. The Status Logger recorded the modified parameters.	☐	☐
FEAT15.3.3 FEAT21.2.3	Turn the Bi Tran 170 driver off. Select a 170 controller and turn it off. Restart and initialize the controller using prescribed procedures in the FDOT-RMF-SUM 1.0.0. From the 170 controller access memory address "8" + "0" and "8" + "1" to view the default time and date information respectively. Open the Status Logger application. If Detail Columns are not viewable, Select View-Detail Columns. Restart BiTran-170 driver and immediately put into detail mode. Filter View by deselecting all Process Names but "Bitran-170" , also filter by code "150803". From the 170 controller access memory address "8" + "0" and "8" + "1" to view the time and date information respectively. Manually set the controller clock and calendar using procedures defined in the FDOT-RMF-SUM 1.0.0.	Was the time on the controller was synchronized? The controller clock and calendar values were manually modified through the keyboard.	☐	☐

Test End Date & Time	
FDOT Witness	
SwRI Witness	

3. Notes

None.