



Scott County Highway Improvement: Trunk Highway (TH) 169, TH 41, County Highway (CH) 78 Interchange, and CH 14 Overpass Transportation Management System

Validation Plan

Forward

This System Validation Plan is developed by WSB & Associates, Inc.(WSB) based on a previous validation plan prepared by Athey Creek Consultants in association with Alliant Engineering for the Scott County Traffic Management System project. WSB has modified the validation plan to focus on the closed-circuit television (CCTV) cameras, fiber optic communications and fiber optic vault locations to facilitate future non-intrusive detection (NID) deployments designed as part of the Scott County Trunk Highway (TH) 169, TH 41, County Highway (CH) 78 Interchange, and CH 14 Overpass project.

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1. Introduction

Scott County is developing a design of CCTV cameras, fiber optic communications and future connectivity for non-intrusive detection (NID) locations to address transportation safety and mobility challenges associated with traffic around the interchange of Trunk Highway (TH) 41/County Highway (CH) 78 and US Highway (Hwy) 169 within the City of Shakopee. Currently, this interchange is slated for reconstruction beginning in late summer 2018. The new geometrics will change traffic patterns surrounding the interchange, thus creating the need for improved traffic management. The goals of this project are to:

1. Provide CCTV surveillance to Scott County and MnDOT of the interchange and on TH 169 up to 2 miles south of the interchange,
2. Provide communications to all devices with approximately 2.5 miles of new fiber optic trunk line, and
3. Provide connection/access points along the proposed fiber optic cable for future NID units.

Scott County has previously developed a Concept of Operations as part of the Scott County Traffic Management System project. System requirements have also been created to address stakeholder needs and these requirements shall apply to the TH 169/TH41/CH 78 project. The validation plan within this document will be used during the design and construction stages of this project to confirm that the system is procured, installed and operating as specified by the system requirements.

Testing is necessary to ensure system requirements are met. For this project, testing will be done on two levels. First, verification testing will be conducted on system components as they are identified for procurement and incorporated into design. This will confirm that available products meet specified requirements and it will be performed primarily through document review before the system is procured. Acceptance testing is the second level of validation for this project and it will take place after the initial system components are installed. System acceptance will confirm that the products fulfill their intended use and it will be completed when the system is in its operational environment to allow for demonstrations as the primary form of testing. Once the initial installation is accepted, all remaining installation may proceed.

Scott County will oversee all verification and acceptance testing for the project with the following four suggested test cases.

Verification Testing

1. Product Specification Review
2. Plan Set Review

Acceptance Testing

3. Functional Demonstration (1-Day)
4. Reliability Demonstration (30-Day)

Test procedures and validation instructions describe which system components will be inspected or demonstrated to verify the corresponding system requirements. The test procedures also recommend who will lead and who should participate in each test case. Some system components will be validated at more than one point and are noted as such in the validation instructions. Test log details are also included to use during testing as formal documentation of whether the system passed or failed to meet requirements. Comments about each validation step should be entered in the log with enough detail to make product, design or installation modifications as needed.

2. Verification Testing

Components for the CCTV and fiber optic communications will be procured according to the system requirements and final design specifications approved by Scott County in coordination with MnDOT. Verification testing will occur as the components are identified for procurement to ensure requirements are met. Any items failed during verification testing will be corrected and then presented again to Scott County and MnDOT for final approval. Once this stage of testing is completed and approved by Scott County, procurement may proceed. Each product should also be accompanied by manufacturer documentation of successful Factory Acceptance Testing prior to shipping. The following tables present two test cases, environment, procedures, verification instructions, relevant system requirements and logs that will be used for verification testing.

Test Case 1: Product Specification Review Environment: Office or Factory / Warehouse

Procedure: As system components are identified and assessed prior to procurement, the Design Contractor and Scott County will review product specifications for requirements verification and approval. Once approved, procurement may proceed. *Most steps described in the verification instructions below will be repeated during Test Case 3.*

Participants: This test case will be led by the Design Contractor, with participation from Scott County.

Verification Instructions	System Requirement	Test Log	
		Pass/Fail	Comments
1a. Confirm that cameras and related cabling are rated for outdoor use.	2.3	Test Case 1 Results	
1b. Confirm that cameras provide at least three individually configurable full resolution video streams at 30 frames per second (NTSC) in all resolutions up to 704 x 480 pixels or 25 frames per second (PAL) in all resolutions up to 704 x 576 pixels.	2.4	Test Case 1 Results	
1c. Confirm that cameras allow users to pan, tilt and zoom remotely.	2.5	Test Case 1 Results	
1d. Confirm that cameras have day and night functionality to manage image quality.	2.6	Test Case 1 Results	
1e. Confirm that cameras support fiber to communicate with control software.	2.7	Test Case 1 Results	
1f. Confirm that cameras allow video to be transmitted over IP networks.	2.9	Test Case 1 Results	
1g. Confirm that cameras utilize MJPEG, MPEG4 or h.264 formats for video compression.	2.1	Test Case 1 Results	
1h. Confirm that cameras utilize a non-proprietary, common format (e.g. MPEG 4) for video storage.	2.13	Test Case 1 Results	
1i. Confirm that fiber optic cable is found within MnDOT's Approved/Qualified Products List (APL/QPL) http://www.dot.state.mn.us/products/trafficmgtsystems/fiberopticcables.html	N/A	Test Case 1 Results	

Test Case 2: Plan Set Review

Procedure: After detailed design is complete, Scott County and MnDOT will review with the Design Contractor a completed plan set for validation of requirements and approval. The process involves standard MnDOT Central Office review (which includes MnDOT functional groups) and Scott County reviewing the plan set. This test case emphasizes the need for all plans to be reviewed and approved prior to procurement and field installation of equipment. *All of the verification steps in this test case will be repeated in Test Case 3.*

Participants: This test case will be led by Scott County and MnDOT (Central Office and Functional Groups).

Verification Instructions	System Requirement	Test Log	
		Pass/Fail	Comments
2a. Confirm that cameras operate on power over Ethernet or 120/240 Volts AC with a power drop from the local utility company. In Test Case 2, power from local utility should be verified on plan set.	2.3	Test Case 2 Results	
2b. Confirm that cameras are protected from degradation of power with voltage surge suppression.	2.4	Test Case 2 Results	
2c. Confirm that fiber optic splice vaults or fiber optic pull vaults are included at future NID locations.	3.5	Test Case 2 Results	

3. Acceptance Testing

This stage of testing will include a functional (1-day) test and a reliability (30-day) test to be conducted at the first installation of new field devices. The functional test will be conducted to demonstrate that all system requirements are adequately met. For the remaining installations, reliability tests will be conducted to validate that the systems are properly installed and operate as required. The following tables present two test cases, environment, procedures, validation instructions, relevant system requirements and log that will be used for system acceptance testing.

Test Case 3: Functional Demonstration (1-Day)

Procedure: Once the first installation is complete, the Construction Contractor(s) will schedule 1-day functional demonstration to allow for Scott County and MnDOT observation under dawn/dusk lighting and peak/off-peak traffic conditions. Authorized access from computers at Scott County and MnDOT will be required to operate and observe CCTV performance for validation and approval. *All of the validation steps in this test case will be conducted first in Test Case 1 or Test Case 2. The instructions and test log have been included here as well for completion during acceptance testing.*

Participants: This test case will be led by the Construction Contractor, Scott County and MnDOT.

Validation Instructions	System Requirement	Test Log	
		Pass/Fail	Comments
3a. Confirm that cameras provide at least three individually configurable full resolution video streams at 30 frames per second (NTSC) in all resolutions up to 704 x 480 pixels or 25 frames per second (PAL) in all resolutions up to 704 x 576 pixels.	2.4	Test Case 3 Results	
3b. Confirm that cameras allow users to pan, tilt and zoom remotely.	2.5	Test Case 3 Results	
3c. Confirm that cameras have day and night functionality to manage image quality.	2.6	Test Case 3 Results	
3d. Confirm that cameras support fiber to communicate with control software.	2.7	Test Case 3 Results	
3e. Confirm that cameras utilize a non-proprietary, common format (e.g. MPEG 4) for video storage.	2.13	Test Case 3 Results	
3f. Confirm that fiber optic cable is found within MnDOT's Approved/Qualified Products List (APL/QPL) http://www.dot.state.mn.us/products/trafficmgtsystems/fiberopticcables.html	N/A	Test Case 3 Results	
3g. Confirm that cameras operate on power over Ethernet or 120/240 Volts AC with a power drop from the local utility company. In Test Case 2, power from local utility should be verified on plan set.	2.3	Test Case 3 Results	
3h. Confirm that cameras are protected from degradation of power with voltage surge suppression.	2.4	Test Case 3 Results	
3i. Confirm that fiber optic splice vaults or fiber optic pull vaults are included at future NID locations.	3.5	Test Case 3 Results	

Test Case 4: Reliability Demonstration (30-Day)

Environment: Installation Sites

Procedure: Following completion of Test Case 3, Scott County and MnDOT will continue operation of the system for another 30 days to demonstrate reliability and validate the associated requirements. Each day Scott County and MnDOT will validate default operation of all CCTV and the corresponding control software. *All of the validation steps in this test case have been conducted in previous test cases. Because these steps must be completed each day for 30 days, the instructions and test log entries are provided to accommodate documentation of pass/fail status for each day.*

Participants: This test case will be led by Scott County with participation from MnDOT and the Construction Contractor(s).

Validation Instructions		System Requirement
4a. Confirm that control software allows users to pan, tilt and zoom cameras remotely.		2.5
Test Log		
Pass/Fail	Comments	Day
		Day 1
		Day 2
		Day 3
		Day 4
		Day 5
		Day 6
		Day 7
		Day 8
		Day 9
		Day 10
		Day 11
		Day 12
		Day 13
		Day 14
		Day 15
		Day 16
		Day 17
		Day 18
		Day 19
		Day 20
		Day 21
		Day 22
		Day 23
		Day 24
		Day 25
		Day 26
		Day 27
		Day 28
		Day 29
		Day 30