

Minnesota Statewide Regional ITS Architecture and Systems Engineering Checklist for CLASS B-1: FREEWAY TRAFFIC MANAGEMENT FHWA Final Rule 940 and FTA National ITS Architecture Policy

For all ITS projects or projects with an ITS component, a Systems Engineering Checklist shall be completed and submitted with the Project Submittal Form. For questions regarding the completion of this checklist contact Rashmi Brewer, P.E. – MnDOT Office of Connected & Automated Vehicles (CAV-X) at 651-234-7063 or e-mail at Rashmi.Brewer@state.mn.us.

Dayton Parkway Interchange

SECTION 1 – Project Information

1.1 CONTACT PERSON (e.g. PROJECT MANAGER)

Name/Title: Tina Goodroad, City Administrator

Agency: City of Dayton

Signature: *Tina Goodroad*

Date: 11-6-19

Telephone: 763-421-3487

Email: tgoodroad@cityofdaytonmn.com

1.2 PROJECT LOCATION (list all)

Dayton Parkway Interchange

1.3 PROJECT NUMBER

1.3A Federal Project Number: STPF 2720 (021)

1.3B State/Local Project Number:

2780-100

1.4 PROJECT SCHEDULE

Letting Date: March 2020

Anticipated Start Date: June 2020

1.5 NATURE OF WORK (Check all that apply)

- Scoping
 Design
 Software/Integration
 Construction
 Operations & Management
 Evaluations
 Planning
 Equipment Replacement
 Research & Development
 Others (Please Specify) _____

1.6 PROJECT FEATURES AND TYPES OF ITS APPLICATIONS (Check all that apply)

Freeway Traffic Management Features for Project Site(s):

Observation and Detection

- Visual Surveillance (e.g. CCTV)
 Traffic Detectors
 Condition Reporting System

Information Sharing

- Dynamic Message Sign (DMS)
 Radio Broadcasts
 Web Pages for Construction
 and Traveler Information

Traffic Control

- Lane Control Signs
 Ramp Meters
 Electronic Toll Collection

- | | | |
|--|--|---|
| <input type="checkbox"/> Automatic Vehicle Location (AVL) for FIRST, maintenance and State Patrol vehicles | <input type="checkbox"/> 511 Phone | <input type="checkbox"/> Automated Gate Closure Systems |
| <input type="checkbox"/> Weather Sensors and Provision of Current and Forecast Weather Conditions | <input type="checkbox"/> Computer Aided Dispatch (CAD) for FIRST, maintenance, and State Patrol vehicles, including CAD-CARS integration | |

Data Processing and Response Formulation

- TMC Software
- Data Extract Tool

Infrastructure Support Tools

- Landline Communication (Fiber, Copper, Telephone Lines, DSL Lines)
- Wireless Communication (Point-to-Point and Cellular)
- Power

1.7 NEEDS ASSESSMENT

Please describe the problem statement, goals and objectives of the project.

As part of the Dayton Parkway Interchange construction project, the following TITS components will be deployed per standard RTMC practices:

- CCTV camera
- Vehicle detection (loop detectors on ramps)
- Ramp meters
- Associated communications and power facilities

How were these needs identified? (Check all that apply)

- Internal Assessment Stakeholder Involvement Regional ITS Architecture (Implementation Volume)
- Freeway Traffic Management Systems Engineering Concept of Operations/High Level Functional Requirements
- Other ITS Planning or Technical Documents (Please Specify) _____
- Design Documents (Please Specify) _____

1.8 SYSTEMS ENGINEERING DOCUMENTATION

| | Existing | Existing To Be Modified | To Be Developed | Not Applicable | Document Reference (file number, name, or web link)/Comments |
|-----------------------|-------------------------------------|--------------------------|--------------------------|-------------------------------------|--|
| Alternatives Analysis | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| Concept of Operations | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | CCTV Camera: MnDOT Video Systems Engineering – Concept of Operations, Requirements & Test Plan (PDF) Vehicle Detection: MnDOT Traffic Detection Systems Engineering – Concept of Operations, Requirements & Test Plan (PDF) |

| | | | | | |
|------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|--|
| | | | | | <p>Ramp Meters: MnDOT Ramp Metering Systems Engineering – Concept of Operations, Requirements & Test Plan (PDF)</p> <p>Communications: MnDOT Communication Systems Engineering – Concept of Operations, Requirements & Test Plan (PDF)</p> |
| Requirements | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <p>CCTV Camera: MnDOT Video Systems Engineering – Concept of Operations, Requirements & Test Plan (PDF)</p> <p>Vehicle Detection: MnDOT Traffic Detection Systems Engineering – Concept of Operations, Requirements & Test Plan (PDF)</p> <p>Ramp Meters: MnDOT Ramp Metering Systems Engineering – Concept of Operations, Requirements & Test Plan (PDF)</p> <p>Communications: MnDOT Communication Systems Engineering – Concept of Operations, Requirements & Test Plan (PDF)</p> |
| Design | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <p>MnDOT ITS Design Manual https://www.dot.state.mn.us/its/docs/itsmanual.pdf</p> |
| System Test Plan | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <p>CCTV Camera: MnDOT Video Systems Engineering – Concept of Operations, Requirements & Test Plan (PDF)</p> <p>Vehicle Detection: MnDOT Traffic Detection Systems Engineering – Concept of Operations, Requirements & Test Plan (PDF)</p> <p>Ramp Meters: MnDOT Ramp Metering Systems Engineering – Concept of Operations, Requirements & Test Plan (PDF)</p> <p>Communications: MnDOT Communication Systems Engineering – Concept of Operations, Requirements & Test Plan (PDF)</p> |

| | | | | | |
|--------------------------|-------------------------------------|--------------------------|--------------------------|-------------------------------------|---|
| System Verification Plan | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Project Special Provisions Division SZ – Project Testing and Documentation Submittals section (attached) https://cityofdaytonmn.com/city-projects/ |
| Evaluation | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| Others (Please Specify) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Project Class B-1 ITS Systems Engineering Checklist https://cityofdaytonmn.com/city-projects/ |

Standard Systems Engineering/Concept of Operations/Functional Requirements have been reviewed (Refer to ITS Concept of Operations for Freeway Traffic Management, June 2010, <http://www.dot.state.mn.us/its/projects/2006-2010/itssystemsengarterialfreeway/freewayconops.pdf>):

Yes No

1.9 RELATIONSHIP TO OTHER PROJECTS AND PHASES

Please list any construction and tied projects.

Project Title

Project Number

I-94 Maple Grove to Rogers – Temporary Widening

SP 2780-99

I-94 Maple Grove to Rogers – Design-Build

SP 2780-97

SECTION 2 – Regional Architecture Assessment

2.1 PROJECT IS INCLUDED IN THE MINNESOTA STATEWIDE REGIONAL ITS ARCHITECTURE

(Refer to Sections 4.3 and 4.4 of the Implementation Volume, **Minnesota Statewide Regional ITS Architecture**, 2018, <http://www.dot.state.mn.us/its/projects/2016-2020/itsarchitecture/implementation-volume.pdf>)

Yes No

If "No", please list additional ITS devices, features, and/or functions that are not listed in **1.6** and send a copy of the complete checklist via email to the MnDOT Office of Connected & Automated Vehicles (CAV-X) contact person listed at top of page 1.

If "Yes", Project ID (from *Sections 4.3 and 4.4 of the Implementation Volume*): S16 and S24

Is the project consistent with the description in the Architecture? Yes No

If "No", please summarize the differences below and send a copy of the complete checklist via email to the MnDOT Office of Connected & Automated Vehicles (CAV-X) contact person listed at top of page 1.

2.2 DOES THE DESIGN INCORPORATE NATIONAL ITS STANDARDS?

Yes No

If "Yes", please specify what ITS Standards are being used:

- | | | |
|--|---|---|
| <input checked="" type="checkbox"/> NTCIP 1201 Global Object Definitions | <input checked="" type="checkbox"/> NTCIP 1208 Object Definitions for CCTV Switching | <input checked="" type="checkbox"/> NTCIP Center-to-Field Group |
| <input type="checkbox"/> NTCIP 1203 Object Definitions for DMS | <input checked="" type="checkbox"/> NTCIP 1209 Data Element Definitions for Transportation Sensor Systems | <input type="checkbox"/> NTCIP Center-to-Center Group |
| <input type="checkbox"/> NTCIP 1204 Object Definitions for Environmental Sensor Stations | <input type="checkbox"/> ASTM E2468-05 Standard Practice for Metadata to Support Archived Data Management Systems | <input type="checkbox"/> ITE TMDD 2.1 TMDD and MS/ETMCC |
| <input checked="" type="checkbox"/> NTCIP 1206 Object Definitions for Data Collection and Monitoring Devices | <input type="checkbox"/> ASTM WK7604 Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data | |
| <input checked="" type="checkbox"/> NTCIP 1207 Object Definitions for Ramp Meter Control Units | <input type="checkbox"/> IEEE 1455-1999 Standard for Message Sets for Vehicle/Roadside Communications | |
| <input type="checkbox"/> Other (Please Specify) | | |

General information on ITS Standards can be found at <http://www.standards.its.dot.gov/>.
 *Minnesota Standards are listed in Section 10 of Volume 13 of the *Minnesota Statewide Regional ITS Architecture* document as generated by RAD-IT.

2.3 IS AN INTERAGENCY AGREEMENT NEEDED FOR THIS PROJECT?

- Existing To be Developed No

Please describe: (Agency name, agreement number, and nature of contract)

N/A

SECTION 3 – Procurement

3.1 PROCUREMENT METHODS (Check all that apply)

- Construction Contract
- Professional Technical Services Contract/Agreement
- Joint Powers Contract/Agreement
- Interagency Contract/Agreement
- Work Order Contract/Agreement
- Commodities Contract
- Purchase Order (State/Local Furnish)
- Other

Comments: None

SECTION 4 – Operations and Management Commitment

4.1 STAFFING AND RESOURCES NEEDED FOR OPERATIONS AND MANAGEMENT

(Staff hours covering, for example, device/system maintenance plus management. Estimate and specify per year and per site or for all sites in project)

CCTV CAMERA (1 SITE): 3 HOURS/YEAR (PER RTMC)

LOOP DETECTION (6 LOOPS): NO COST, AS THERE IS NOTHING TO DO UNLESS THE LOOP FAILS (PER RTMC)

RAMP METERS (1 RAMP – 2 METERS): 3 HOURS/YEAR (PER RTMC)

FIBER: THE FIBER NETWORK ALREADY EXISTS IN THIS AREA AND ADDING A PIGTAIL DOES NOT CHANGE ANY CURRENT RESOURCES REQUIRED FOR OPERATIONS, MAINTENANCE, AND MANAGEMENT (PER RTMC)

4.2 ESTIMATED ANNUAL OPERATIONS AND MANAGEMENT COSTS

(Question 4.1 staffing labor hours x average direct hourly rate, plus direct expenses)

CCTV CAMERA (1 SITE): 3 HOURS/YEAR X \$70/HOUR = \$210/YEAR (PER RTMC)

LOOP DETECTION (6 LOOPS): NO COST, AS THERE IS NOTHING TO DO UNLESS THE LOOP FAILS (PER RTMC)

RAMP METERS (1 RAMP – 2 METERS): 3 HOURS/YEAR X \$70/HOUR = \$210/YEAR (PER RTMC)

FIBER: THE FIBER NETWORK ALREADY EXISTS IN THIS AREA AND ADDING A PIGTAIL DOES NOT CHANGE ANY CURRENT RESOURCES REQUIRED FOR OPERATIONS, MAINTENANCE, AND MANAGEMENT (PER RTMC)

SECTION 5 - Approval

APPROVAL (Refer to page 7 of the HPDP ITS Systems Engineering Requirement for a list of approval agencies)

I certify that to the best of my knowledge all of the information on this checklist is accurate. I acknowledge that I am aware of the requirements set forth in the HPDP – ITS Systems Engineering for this project.

Name/Title: Jacob Folkeringa, Engineer

Agency: SRF Consulting Group

Signature: 

Date: 11/8/2019

Telephone: 763-452-4730

Email: jfolkeringa@srfconsulting.com

REVIEWED FOR COMPLIANCE WITH STATE AND FEDERAL RULES/POLICY, AND APPROVED FOR FEDERAL AID FUNDING

Name/Title: Dan Erickson
District State Aid Engineer

Agency: MnDOT - Metro District

Signature: 

Date: 11/12/19

Telephone: 651-234-7763

Email: dan.erickson@state.mn.us

(C) Secure approval from the Engineer for any changes to the Electrical Service shown in the Plan.

(D) The Power Utility Company name is Xcel Energy. Following are the name, phone number, location, premise number, and account number, responsibilities for each of the Project Power Utility Company Designers:

a. John Pfothenauer
763-493-1876
John.F.Pfothenauer@xcelenergy.com

i. 14500 TH 94
Dayton, MN 55327
Account No.: 12779101
Premise No.: 304850547

SZ-9.6 Notify MnDOT Business Services Section when MnDOT is to assume ownership of the proposed source of power. Following is the contact information:

Brandon Gfrerer (651) 234-7441
Metro Accounts Payable-MnDOT Mailstop 050
Waters Edge Building
1500 County Road B2
Roseville MN 55113

SZ-9.7 **MEASUREMENT AND PAYMENT**

No measurement will be made of the various Items that constitute Electrical Service, but all such work will be construed to be included. Provide the Engineer a copy of the invoice from the power company. Payment will be made for the invoice cost paid to the power company plus 10%. This payment will be compensation in full for all costs incidental thereto, including but not limited to providing power to service panels, power company fees, Power Utility Company Coordination, notifying MnDOT of ownership details, and all materials and labor necessary to construct the Electrical Service.

SZ-10 JOB SPECIFIC SPECIFICATION CONSIDERATIONS

SZ-10.1 Maintain full operation of the Traffic Management System Monday through Friday from 5:00am to 9:00am and 3:00pm to 7:00pm unless approved by the Engineer.

SZ-10.2 Maintain full operation and connectivity to the RTMC network of all Trunk FO Cables located outside the project limits and impacted by the project construction Monday through Friday from 5:00am to 9:00am and 3:00pm to 7:00pm unless approved by the Engineer. Construct temporary connections if Trunk FO Cables will be non-operational during the above required hours of full operation. Acquire MNDOT TMS Integrator approval of the temporary system and consider it incidental. **The Contractor will be subject to a daily charge assessed at a rate of \$1000.00 per day for each day or portion thereof with which the Engineer determines that the Contractor has not complied.**

SZ-10.3 Other construction will be taking place in this area as part of SP 2780-99 (I-94 Maple Grove to Rogers – Temporary Widening) and SP 2780-97 (I-94 Maple Grove to Rogers – Design-Build).

SZ-11 PROJECT TESTING AND DOCUMENTATION SUBMITTALS

Provide Project Documentation Submittals for Components and FO Cable Testing in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-11.1 Present Project Testing and Documentation Submittals directly to the Engineer. Present Project Testing and Documentation Submittals as three complete packages unless prior authorization is made with the Engineer. Complete packages will be defined as one submittal for Components and one submittal for Testing. Include all required documentation in each submittal. Payment will not be made until a submittal package is received and approved by the Engineer.

SZ-11.2 Provide Project Testing and Documentation Submittals for the following items:

- (A) Components
- (B) FO Cable Testing.

SZ-11.3 **COMPONENTS**

Apply the following provisions to project component testing and documentation submittals for

Components:

- (A) Submit Component Documentation Submittals to the Engineer within two weeks subsequent to contract approval. **The Contractor will be subject to a daily charge assessed at a rate of \$200.00 per day for each day or portion thereof with which the Engineer determines that the Contractor has not complied.** The Engineer will reserve the right to allow the Contractor greater than two weeks after contract approval to make submittals.
- (B) Submit two sets of component specifications and/or shop drawings for each project component, assembled or whole, to the Engineer. Forward any MnDOT recommended revisions to the Manufacturer.
- (C) Two separate copies of project Component documentation shall be submitted as a complete and organized package unless otherwise directed by the Engineer.
- (D) The Engineer will approve or reject submittals within two weeks of receipt. The Component Documentation Submittal package will be approved by the Engineer prior to installation or payment for the component.
- (E) Include the Manufacturer's name, specifications, and detailed drawings as part of the Project Component Documentation submittals for all items listed on the **COMPONENT CHECK-OFF LIST**.
- (F) Do not submit Manufacturer's information for components already identified as meeting the specification as a "Has Met" or is listed on the Traffic Management System / ITS APL. This includes components listed on the Traffic Management System / ITS APL when the Contract is advertised and at the time the Project Testing and Documentation Submittal is submitted.
- (G) Complete the check-off list for "Has Met" items and include this list as part of the Project Documentation Component Submittal package.

(H) **Loop Detectors and Loop Detector Splices**

Apply the following provisions to Project Testing and Documentation Submittals for Loop

Detectors and Loop Detector Splices:

- a. Submit Loop Detector Splice component specifications for Engineer approval prior to installation or payment for the following Loop Detector Splice components:
 - i. Loop lead-in.

- ii. Splice encapsulator.
- b. Submit Loop Detector Design Preformed component specifications for Engineer approval prior to installation or payment for the following Loop Detector Design Preformed components:
 - i. Loop assembly.
 - ii. Loop lead-in.
 - iii. Splice encapsulator.
- c. Notify the Engineer and TMS Integrator when the Loop Detector tail conductor and lead-in cable have been spliced and are ready for testing and termination.
- d. Identify the location on the Plan Detail.

SZ-11.4 **FO CABLE TESTING**

Apply the following provisions to FO Cable Testing Submittals:

- (A) Submit Fiber Optic Testing Documentation Submittals to the Engineer within 30 Working days subsequent to the last test. **The Contractor will be subject to a daily charge assessed at a rate of \$200.00 per day for each day or portion thereof with which the Engineer determines that the Contractor has not complied.** The Engineer will reserve the right to allow the Contractor greater than 30 working days after contract approval to provide submittals.
- (B) Submit Documentation of test equipment calibration and certification part of the Project Documentation Submittal for FO Cable Testing along with the test results. Provide a calibration certificate dated no more than two year prior to the last date of FO Cable Testing. FO cable testing will be rejected if calibration certificates are out of date.
- (C) Use the “Fiber Optic Schematic” sheets in the Plan as a template for recording power meter and OTDR test data as well as the physical characteristics of the FO cable and FO cable run.
- (D) FO Cable test parameters are identified in a later section of this document. See **(2550) FIBER OPTIC CABLE TESTING.**
- (E) Utilize a Manufacturer-recommended “OTDR Trace Analysis” software program. Provide MnDOT with a “OTDR Trace Analysis” Viewer application.
- (F) Notify the Engineer prior to beginning the FO system testing. Provide all test documentation electronically on a CD or USB flash drive. Use the MnDOT’s file naming convention for OTDR electronic test files. The Engineer may observe each test.
- (G) Store OTDR electronic files under a directory folder named by the launch point cable identification (ID) description found on the test schematics. Include the following items in the files:
 - a. Date of each test completed.
 - b. The “index of refraction” for the FO cable as recorded on the cable spool by the manufacturer or for existing FO cable, the index of refraction that was utilized.
 - c. File names and notes as described by the MnDOT file naming convention. See **FO CABLE TEST DOCUMENTATION** for file naming convention example.
- (H) Provide a test summary describing the following items:
 - a. Final measurements that are out of range.

- b. Engineer and TMS Integrator approved changes in specified methods.
 - c. OTDR manufacturer, equipment model number, and last date calibrated.
 - d. Dates of tests performed by both power meter and OTDR.
 - e. The method used to set a launch power reference regarding the additional launching cables used for power meter testing.
 - f. Special circumstances.
- (I) Provide the Engineer with the Manufacturer's reel (spool) test documentation. This is required for all Contractor-furnished FO cable.

SZ-11.5 **MEASUREMENT AND PAYMENT**

PROJECT TESTING AND DOCUMENTATION SUBMITTALS includes but shall not be limited to Testing and Documentation Submittals, Components, FO Cable Testing, and all materials and labor necessary to prepare and submit the Project Testing and Documentation Submittals. Consider PROJECT TESTING AND DOCUMENTATION SUBMITTALS incidental for which no direct compensation will be made.

SZ-11.6 **COMPONENT CHECK-OFF LIST**

Complete the following Component check-off list for “Has Met” and “APL” items and include this list as part of the submittal package. For “Has Met” components the Contractor may choose to submit components of equal quality to the Engineer for TMS Integrator approval. For “APL” components the Contractor may choose to submit components through the process for listing products on the APL. Provide submittals for items that do not have a Has Met or are not on the APL.

| Product Manufacturer | Material Description | Special Provisions Section | “Has Met” or “APL” Part Number (no submittal required if “Has Met” or “APL” part number listed here) | Submittal Provided (✓) |
|-----------------------------|---|-----------------------------------|---|-----------------------------------|
| | Ground Rod Connector | SZ-7.2 | | |
| | Lightning Rod Connector | SZ-7.2 | | |
| | Lightning Protection Conductor | SZ-7.5 | | |
| | Parallel Splicer | SZ-7.5 | | |
| | LTU | SZ-7.8 | | |
| | SGU | SZ-7.8 | | |
| | Buried Cable Sign Plastic-Resin Sheath | SZ-17.8 | | |
| | RCS | SZ-18 | N/A-Submittal Required | |
| | 8-inch LED | SZ-18.8 | | |
| | RCS Head | SZ-18.9 | | |
| | CCTV Cabinet | SZ-19.6 | | |
| | Service Cabinet | SZ-21.6 | | |
| | CCTV Hardware | SZ-26.8 | | |
| | CCTV Folding Pole | SZ-26.8 | | |
| | Indoor FO Pigtails | SZ-27.4 | | |
| | Fiber Bulkhead Adaptors | SZ-27.5 | | |
| | Pull Vault | SZ-28.7 | | |
| | Loop Preformed | SZ-29.16 | | |
| | Splice Encapsulator | SZ-29.16 | | |
| | Armored FO Pigtail Cable | SZ-30.2 | | |