

**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 Traffic, Safety and Technology at 651-234-7063 or e-mail at [Rashmi.Brewer@state.mn.us](mailto:Rashmi.Brewer@state.mn.us).

Ridgedale Drive / Ridgehaven Lane

**SECTION 1 – Project Information**

**1.1 CONTACT PERSON (e.g. PROJECT MANAGER)**

Name/Title: Phil Olson, Assistant City Engineer

Agency: City of Minnetonka

Signature: 

Date: 9/12/17

Telephone: 952-939-8239

Email: polson@eminnetonka.com

**1.2 PROJECT LOCATION (list all)**

TH 394 & Plymouth Road (south intersection)

**1.3 PROJECT NUMBER**

1.3A Federal Project Number:

State Aid: 142-153-007

1.3B State/Local Project Number:

State: 2789-154

City (Minnetonka): 16501

**1.4 PROJECT SCHEDULE**

Letting Date: November 2017

Anticipated Start Date: March 2018

**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**

**Information Sharing**

**Traffic Control**

- |  |  |   |
|--|--|---|
| <input type="checkbox"/> Visual Surveillance (e.g. CCTV)   | <input type="checkbox"/> Dynamic Message Sign (DMS)  | <input type="checkbox"/> Lane Control Signs             |
| <input checked="" type="checkbox"/> Traffic Detectors  | <input type="checkbox"/> Radio Broadcasts  | <input type="checkbox"/> Ramp Meters                    |
| <input type="checkbox"/> Condition Reporting System  | <input type="checkbox"/> Web Pages for Construction and Traveler Information   | <input type="checkbox"/> 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 Ridgedale Drive / Ridgehaven Lane reconstruction project, existing equipment at the south intersection of TH 394 and Plymouth Road will be impacted:

- Queue loop detectors on the TH 394 EB on-ramp (will be replaced as part of the project)
- CCTV camera on signal pole luminaire/camera extension (will be replaced as part of the project) – SEE CLASS B-2 CHECKLIST
- Fiber optic pigtail to the signal controller cabinet (will be pulled back and reinstalled as part of the project) – SEE CLASS B-2 CHECKLIST

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

- Internal Assessment     Stakeholder Involvement     Regional ITS Architecture (Volume 9)
- 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"/>	MnDOT ITS Concept of Operations for Freeway Traffic Management <a href="http://www.dot.state.mn.us/its/projects/2006-2010/itssystemseingararterialfreeway/freewayconops.pdf">http://www.dot.state.mn.us/its/projects/2006-2010/itssystemseingararterialfreeway/freewayconops.pdf</a>
Requirements	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MnDOT ITS Concept of Operations for Freeway Traffic Management <a href="http://www.dot.state.mn.us/its/projects/2006-2010/itssystemseingararterialfreeway/freewayconops.pdf">http://www.dot.state.mn.us/its/projects/2006-2010/itssystemseingararterialfreeway/freewayconops.pdf</a>
Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MnDOT ITS Design Manual <a href="http://www.dot.state.mn.us/its/docs/itsmanual.pdf">http://www.dot.state.mn.us/its/docs/itsmanual.pdf</a>
System Test Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
System Verification Plan	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ridgedale Drive Special Provisions Division SZ – Project Testing and Documentation Submittals section (attached) <a href="https://eminnetonka.com/current-projects/street-projects/ridgedale-area">https://eminnetonka.com/current-projects/street-projects/ridgedale-area</a>
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"/>	Class B-1 ITS Systems Engineering Checklist <a href="https://eminnetonka.com/current-projects/street-projects/ridgedale-area">https://eminnetonka.com/current-projects/street-projects/ridgedale-area</a>

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/itssystemseingararterialfreeway/freewayconops.pdf>):

Yes     No

### 1.9 RELATIONSHIP TO OTHER PROJECTS AND PHASES

Please list any construction and tied projects.

**Project Title**

None

**Project Number**

N/A

## 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 Volume 9: Initiative and Project Concepts for Implementation of Minnesota Statewide Regional ITS Architecture, January 2014,

<http://www.dot.state.mn.us/its/projects/2006-2010/mnitsarchitecture/its-volume-9.pdf>)

Yes     No

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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 Traffic, Safety and Technology contact person listed at top of page 1.

If "Yes", Project ID (from *Sections 4.3 and 4.4 of Volume 9*): S16

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 Traffic, Safety and Technology contact person listed at top of page 1.

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## 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 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 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 10 of the *Minnesota Statewide Regional ITS Architecture* document as generated by Turbo Architecture.

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## 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

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## SECTION 3 – Procurement

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**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

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**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)*

PER RTMC, NO COST AS THERE IS NOTHING TO DO UNLESS THE LOOP FAILS.

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**4.2 ESTIMATED ANNUAL OPERATIONS AND MANAGEMENT COSTS**

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

PER RTMC, NO COST AS THERE IS NOTHING TO DO UNLESS THE LOOP FAILS.

**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: 9/28/2017

Telephone: 763-452-4730

Email: jfolkeringa@srfconsulting.com

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

Name/Title: Cathy Huebsch,  
District Federal Aid Engineer

Agency: MnDOT - Metro District

Signature: 

Date: 10/5/2017

Telephone: 651-234-7766

Email: cathy.huebsch@state.mn.us

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**SZ-9**                    **JOB SPECIFIC SPECIFICATION CONSIDERATIONS**

- SZ-9.1                    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-9.2                    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 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 \$1,000.00 per day for each day or portion thereof with which the Engineer determines that the Contractor has not complied.**
- SZ-9.3                    Test the existing FO cables with a power meter (as indicated in the Communication Schematics) before performing any work. Submit FO cable testing documentation from the initial power meter testing to the Project Engineer and TMS Integrator. The Project Engineer and TMS Integrator will review the FO cable testing documentation to determine if there is any damage to the existing FO cable. If damaged FO cables are found, perform an OTDR test to determine the location of the damaged FO cable. After the final FO cable testing is performed the Project Engineer and TMS Integrator will compare the original FO cable testing documentation to the final FO cable testing documentation. Be responsible for repairing any FO cable and/or splices that are damaged by construction operations.
- SZ-9.4                    OTDR testing shall only be performed in one direction (from the signal cabinet).
- SZ-9.5                    Signal Plans and Signal Special Provisions will describe all measurement, payment, quantities, and construction downstream from the NCP.

**SZ-10**                    **PROJECT TESTING AND DOCUMENTATION SUBMITTALS**

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

- SZ-10.1                    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, one submittal for FO Cable Testing, and one submittal for As-builts. Include all required documentation in each submittal. Payment will not be made until a submittal package is received and approved by the Engineer.
- SZ-10.2                    Provide Project Testing and Documentation Submittals for the following items:
- (A)                    Components
  - (B)                    FO Cable Testing
  - (C)                    As-builts
- SZ-10.3                    **COMPONENTS**  
Apply the following provisions to Project Testing and Documentation Submittals for Components:

- (A) Submit Component documentation 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 the 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 Component documentation submittal package for all items listed on the **COMPONENT CHECK-OFF LIST** on page 14-SZ.
- (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 documentation is submitted.
- (G) Complete the check-off list for "Has Met" items and include this list as part of the Component documentation submittal package. See **COMPONENT CHECK-OFF LIST** on page 14-SZ.
- (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 component specifications for Engineer approval prior to installation or payment for the following Loop Detector components:
    - i. Loop assembly.
    - ii. Loop lead-in.
    - iii. Loop conductor.
    - iv. Splice encapsulator.
  - b. 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.
  - c. Identify the location on the Plans.

SZ-10.4 **FO CABLE TESTING**

Apply the following provisions to FO Cable Testing submittals:

- (A) Test the existing FO cables with a power meter (as indicated in the Communication Schematics) before performing any work. Submit FO cable testing documentation from the initial power meter

testing to the Project Engineer and TMS Integrator. The Project Engineer and TMS Integrator will review the FO cable testing documentation to determine if there is any damage to the existing FO cable. If damaged FO cables are found, perform an OTDR test to determine the location of the damaged FO cable. After the final FO cable testing is performed the Project Engineer and TMS Integrator will compare the original FO cable testing documentation to the final FO cable testing documentation. Be responsible for repairing any FO cable and/or splices that are damaged by construction.

- (B) Submit FO Cable Testing documentation 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.
- (C) Submit documentation of test equipment calibration and certification (See **(2550) FIBER OPTIC CABLE TESTING** on page 19-SZ) as part of the FO Cable Testing documentation submittal along with the test results. Provide a calibration certificate dated no more than two years prior to the last date of FO cable testing. FO cable testing will be rejected if calibration certificates are out of date.
- (D) Use the “Communication 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.
- (E) FO cable test parameters are identified in a later section of this document. See **(2550) FIBER OPTIC CABLE TESTING** on page 19-SZ.
- (F) Utilize a manufacturer-recommended “OTDR Trace Analysis” software program. Provide MnDOT with a “OTDR Trace Analysis” viewer application.
- (G) Notify the Engineer prior to beginning the FO cable testing. Provide all test documentation electronically on a CD or USB flash drive. Use MnDOT’s file naming convention for OTDR electronic test files. The Engineer may observe each test.
- (H) 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** on page 22-SZ for the file naming convention.
- (I) 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.

- (J) Provide the Engineer with the manufacturer's reel (spool) test documentation. This is required for all Contractor-furnished FO cable.

SZ-10.5 **AS-BUILTS**

Submit As-built drawings with deviations from the Plan shown in red on the Plan. These sheets do not satisfy the Contractor's responsibilities with regard to Gopher State One Call.

- (A) Submit As-Built documentation to the Engineer subsequent to construction completion. Provide As-Built documentation reflecting the final location of all items constructed for the project, not just the components and FO cable. Additionally, include any roadway or other construction included in the project.

SZ-10.6 **MEASUREMENT AND PAYMENT**

PROJECT TESTING AND DOCUMENTATION SUBMITTALS includes but shall not be limited to Components, FO Cable Testing, As-Builts, 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-10.7 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 Component documentation submittal. 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.

<b>Product Manufacturer</b>	<b>Material Description</b>	<b>Special Provisions Section</b>	<b>“Has Met” or “APL” Part Number (no Submittal required if “Has Met” or “APL” part number listed here)</b>	<b>Submittal Provided (✓)</b>
	Ground Rod Connector	SZ-7.2(F)		
	Lightning Rod Connector	SZ-7.2(F)		
	LTU	SZ-7.5(G)		
	SGU	SZ-7.5(G)		
	Buried Cable Sign – Sign Post Sheath	SZ-16.8		
	Indoor FO Pigtails	SZ-19.4		
	Fiber Bulkhead Adapters	SZ-19.5		
	Pull Vault	SZ-20.6		
	Splice Encapsulator	SZ-21.9		
	Loop Sealant	SZ-21.9		

**SZ-11 INDUSTRY ACCEPTED LUBRICANTS FOR ALL CABLES**

Apply the following provisions to Industry Accepted Lubricants for all Cables:

- SZ-11.1 The “Industry Accepted Lubricants” referenced in 2550.3, used during cable pulling operations shall be U.L. Listed and be compatible with cable insulation materials. They shall not deteriorate the cable insulation or performance.
- SZ-11.2 Use lubricants that do not contain wax or grease.
- SZ-11.3 Apply the appropriate lubricant as specified by the manufacturer for its intended use.

**SZ-12 INSPECTION AND CLEANING EXISTING CONDUIT SYSTEMS**

Apply the following provisions to Inspection and Cleaning Existing Conduit Systems:

- SZ-12.1 Existing TMS conduit systems may consist of stick PVC, stick PE, continuous PE, IMC or RSC.
- SZ-12.2 When installing copper cable or FO cable in existing conduits through existing handholes, visually check the cable route to ensure that there is a smooth transition between exit and entrance elevations and that the horizontal and vertical angle is not so sharp as to cause damage to the cable