Minnesota Statewide Regional ITS Architecture and Systems Engineering Checklist for
CLASS B-2: ARTERIAL 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.

Fiber Optic Signal Interconnect, CCTV Cameras, and Flashing Yellow Arrow Upgrades
(see Class A Checklist for Flashing Yellow Arrow)

SECTION 1 – Project Information

1.1 CONTACT PERSON (e.g. PROJECT MANAGER)

Name/Title: Sarah Tracy, Assistant Traffic Engineer   Agency: Dakota County Transportation
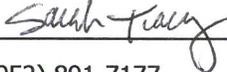
Signature: *Sarah Tracy*   Date: 5/17/18

Telephone: (952) 891-7177   Email: sarah.tracy@co.dakota.mn.us

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1.2 PROJECT LOCATION *(list all)*

CSAH 46 from Kenrick Ave to CSAH 31
CSAH 31 from 170th Street to CSAH 38

1.3 PROJECT NUMBER

1.3A Federal Project Number: CMAQ 1918

1.3B State/Local Project Number:

CP 31-87 (SP 019-030-009)

1.4 PROJECT SCHEDULE

Letting Date: 6/5/2018 (approximate)

Anticipated Start Date: 7/9/2018 (approximate)

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)*

Arterial Traffic Management Features for Project Site(s):

Observation and Detection

☒ Visual Surveillance (e.g. CCTV)

☐ Traffic Detectors (excluding presence detectors at intersections for signal control)

☐ Condition Reporting System

Information Sharing

☐ Dynamic Message Sign (DMS)

☐ Web Pages for Construction and Traveler Information

☐ 511 Phone

Infrastructure Support Tool

☒ Landline Communication (Fiber, Copper, Telephone Lines, DSL Lines)

☐ Wireless Communication (Point-to-Point and Cellular)

☐ Power

Local Area Traffic Control and Traveler Alerts

☐ Dynamic Speed Display Signs

☐ Emergency Vehicle Preemption with or without control center oversight

☐ Red Light Running System

☐ Transit Signal Priority with or without control center oversight

Data Processing and Response Formulation

☐ TMC Software / Central Traffic Signal Control Software

☐ Data Extract Tool

Corridor-wide Traffic Control

☒ Traffic Signal Control System

1.7 NEEDS ASSESSMENT *(please describe the problem statement, goals and objectives of the project)*

To provide a safe and efficient transportation system, Dakota County and the Cities of Apple Valley and Lakeville are proceeding with the project. The project involves 9 miles of fiber optic cable installation for traffic signal interconnection, 12 CCTV camera deployments, as well as signal equipment upgrades to improve traffic operations along County State Aid Highways (CSAH) 46 and CSAH 31. The corridors are major roadways used by the traveling public to commute to Minneapolis/Saint Paul and to access commercial businesses which currently experience capacity issues, especially during the peak hours. The project will enhance traffic management, improve traffic flow, reduce congestion and reduce vehicle emissions.

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

☒ Internal Assessment   ☒ Stakeholder Involvement   ☒ Regional ITS Architecture (Volume 9)

☒ Arterial 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	☐	☐	☐	☒	
Concept of Operations	☒	☐	☐	☐	MnDOT ITS Concept of Operations for Arterial Traffic Management (http://www.dot.state.mn.us/its/projects/2006-2010/itssystemsengarterialfreeway/arterialconops.pdf)
Requirements	☒	☐	☐	☐	MnDOT ITS Concept of Operations for Arterial Traffic Management, which includes high-level requirements (http://www.dot.state.mn.us/its/projects/2006-2010/itssystemsengarterialfreeway/arterialconops.pdf)
Design	☒	☐	☐	☐	MnDOT Traffic Control Signal Design Manual (http://www.dot.state.mn.us/trafficeng/publ/signaldesign/2016signaldesignmanual.pdf) MnDOT ITS Design Manual (http://www.dot.state.mn.us/its/docs/itsmanual.pdf)
System Test Plan	☒	☐	☐	☐	Project System Verification/Test Plan – Attached https://www.co.dakota.mn.us/Transportation/TransportationStudies/Current/Pages/default.aspx
System Verification Plan	☒	☐	☐	☐	Project System Verification/Test Plan – Attached https://www.co.dakota.mn.us/Transportation/TransportationStudies/Current/Pages/default.aspx
Evaluation	☐	☐	☐	☒	
Others (Please Specify)	☒	☐	☐	☐	CP 31-87 (SP 019-030-009) Class B-2 ITS Systems Engineering Checklist https://www.co.dakota.mn.us/Transportation/TransportationStudies/Current/Pages/default.aspx CP 31-87 (SP 019-030-009) Class A ITS Systems Engineering Checklist https://www.co.dakota.mn.us/Transportation/TransportationStudies/Current/Pages/default.aspx

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

☒ Yes   ☐ No

1.9 RELATIONSHIP TO OTHER PROJECTS AND PHASES

Please list any construction and tied projects.

Project Title

CSAH 31 ADA Improvements

Project Number

CP 31-97

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 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

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*): S07, S13

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.

2.2 DOES THE DESIGN INCORPORATE NATIONAL ITS STANDARDS?

☒ Yes ☐ No

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

☒ NTCIP 1201 Global Object Definitions

☐ NTCIP 1209 Data Element Definitions for Transportation Sensor Systems

☐ ASTM WK7604 Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data

☒ NTCIP 1202 Object Definitions for Actuated Traffic Signal Controller Units

☒ NTCIP 1210 Field Management Stations – Part 1: Object Definitions for Signal System Masters

☒ NTCIP Center-to-Field Group

☐ NTCIP 1203 Object Definitions for DMS

☒ NTCIP 1211 Object Definitions for Signal Control and Prioritization (SCP)

☐ NTCIP Center-to-Center Group

☐ NTCIP 1206 Object Definitions for Data Collection and Monitoring Devices

☒ NTCIP 1210 Field Management Stations – Part 1: Object Definitions for Signal System Masters

☐ ITE TMDD 2.1 TMDD and MS/ETMCC

☒ NTCIP 1208 Object Definitions for CCTV Switching

☐ ASTM E2468-05 Standard Practice for Metadata to Support Archived Data Management Systems

☐ 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.

2.3 IS AN INTERAGENCY AGREEMENT NEEDED FOR THIS PROJECT?
☒ Existing ☐ To be Developed ☐ No

A Joint Powers Agreement (AV C0029417, Lakeville C0029418) has been established for this project between Dakota County, Apple Valley, and Lakeville. This agreement covers installation, operations, and maintenance of the facilities installed by this project including fiber optic signal interconnect, CCTV cameras, and flashing yellow arrow upgrades.

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)

Fiber Optic Signal Interconnect: Fiber optic signal interconnect will be added to the existing county fiber optic network which already has resources dedicated for management, operations, and maintenance. Minimal additional resources (2 hours per mile per year) are anticipated.

CCTV Cameras: CCTV cameras will be added to the existing CCTV camera system which already has resources dedicated for management, operations, and maintenance. Minimal additional resources (4 hours per camera per year) are anticipated.

4.2 ESTIMATED ANNUAL OPERATIONS AND MANAGEMENT COSTS
(Question 4.1 staffing labor hours x average direct hourly rate, plus direct expenses)

Fiber Optic Signal Interconnect: 2 hours per mile per year X 9 miles x $100 per hour = $1,800 per year

CCTV Cameras: 4 hours per camera per year X 12 cameras X $100 per hour = $4,800

SECTION 5 - Approval

APPROVAL (Refer to page 7 of the HPDP ITS Systems Engineering Requirements 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, Project Manager   Agency: SRF Consulting Group
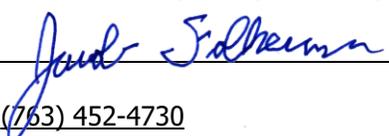
Signature: _Jacob Folkeringa_   Date: 5/15/2018

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,   Agency: MnDOT - Metro District
            District Federal Aid Engineer

Signature: _Catherine Huebsch_   Date: 5/22/2018

Telephone: 651-234-7766   Email: cathy.huebsch@state.mn.us

C O U N T Y

Dakota County CP 31-87

CSAH 46 and CSAH 31

Fiber Optic Signal Interconnect, CCTV Cameras, and Flashing Yellow Arrow (FYA) Upgrades

System Verification/Test Plan

Prepared by: SRF Consulting Group, Inc.

SRF | ENGINEERS
PLANNERS
DESIGNERS

Consulting Group, Inc.

Overview

To provide for safe and efficient travel, managing traffic flow along signalized arterial county highways is critical to minimize delay and maximize the existing capacity of the highway system. This project will address issues with the existing signal coordination and infrastructure to reduce delay and improve overall mobility through the project corridors. This will be accomplished through the replacement of aging interconnection and signal equipment including installation of fiber optic cable along the CSAH 31 and CSAH 46 segments, addition of cameras, updates to signal equipment as needed and the addition of protected/permissive left turn movement operation (flashing yellow arrow) where feasible.

This project aligns with and meets the goals and vision of MnDOT's ITS Concept of Operations for Arterial Traffic Management. MnDOT's ITS Concept of Operations for Arterial Traffic Management document outlines the concept of operations and system requirements for traffic management systems along arterial corridors. As requirements are established and identified, it is important to also test and verify that each requirement is being met. This system verification/test plan documents the steps and tests necessary to ensure all requirements are met and that the final product is a fully functional and reliable traffic management system.

Dakota County will oversee all testing for this project. The tests described within this document will be used during the design and construction of the proposed project to confirm the system is procured, installed, and operating as identified in the system requirements.

The following subsets of testing will be performed:

<u>System Verification</u>

- Test 1: Design/Plan Review
- Test 2: Product/Material Review

<u>System Testing</u>

- Test 3: Installation/Functional Demonstration (1-day test)
- Test 4: System Reliability Demonstration (30-day test)

System Verification

Verification will involve a detailed review of the final system design, including: final plans, specifications, and construction documents. Verification testing will also ensure that all products and materials meet the requirements outlined in the specifications. Testing and review will be conducted by Dakota County or its designated contractor. Once approved, procurement and construction may proceed.

Test 1: Design/Plan Review

- When design is complete, Dakota County, the City of Apple Valley, the City of Lakeville, and MnDOT will review the completed design documents and provide comments or approval.
- Verification of the design documents must be completed by all identified parties prior to procurement of products/materials and construction.

TEST 1: DESIGN/PLAN REVIEW		
Verification Item	**Pass/Fail**	**Comments**
Designer review of final design documents		
Dakota County review of final design documents		
City of Apple Valley review of final design documents		
City of Lakeville review of final design documents		
MnDOT review of final design documents		

Test 2: Product/Material Review

- Products and materials should be identified and assessed against specifications and requirements by project staff prior to procurement and construction.
- Review will be conducted under the direction of Dakota County.

TEST 2: PRODUCT/MATERIAL REVIEW		
Verification Item	**Pass/Fail**	**Comments**
Confirm signal system conduit meets the requirements of SS-2.2.A.		
Confirm electrical cable and conductors meet the requirements of SS-2.2.D.		
Confirm straight, angle, and two-way mount plumbizers are found on MnDOT's APL per SS-2.2.F.		
Confirm mast arm extensions are found on MnDOT's APL per SS-2.2.G.		
Confirm pedestrian caps and seal caps are found on MnDOT's APL per SS-2.2.H.		
Confirm hubs and flange adapters are found on MnDOT's APL per SS-2.2.I.		
Confirm pedestrian signal heads and countdown timers are found on MnDOT's APL per SS-2.2.K.		
Confirm fiber optic cable passes fiber optic testing prior to transporting the reels from the County per SZ-9.2.		

System Testing

System testing will include an installation/functional demonstration (1-day test) and a system reliability demonstration (30- day test). Testing will be performed to demonstrate the successful operation of all field components and to ensure all identified requirements have been met. Testing will also ensure that systems have been installed properly and are operating as required and designed.

Test 3: Installation/Functional Demonstration (1-day test)

- When installation is complete, the following tests must be performed. Tests should be performed within one week of installation.
- Testing will be conducted under the direction of Dakota County with the assistance of the construction contractor.

TEST 3: INSTALLATION/FUNCTIONAL DEMONSTRATION (1-DAY TEST)		
Verification Item	**Pass/Fail**	**Comments**
Project Engineer to complete a final inspection of the fiber optic interconnect and ensure all issues have been resolved, including turf restoration per SZ-4.4.A		
All cables and equipment have been labeled per SZ-8.		
Confirm all fiber optic insertion loss testing meets the requirements of SZ-9.6 including: • Measuring all terminated fibers in both directions • Test in accordance with TIA/EIA 526-7-1998 Method A.1. • Test at 1300nm and 1500nm.		
Confirm all Optical Time Domain Reflectometer (OTDR) testing meets the requirements of SZ-9.7 including: • Event dead zone less than or equal to three meters • Attenuation dead zone less than or equal to five meters • Dynamic range of 25 dB or greater • Test fiber links bi directionally • Test at 1310nm and 1550nm.		
Confirm all Optical Return Loss (ORL) testing meets the requirements of SZ-9.8 including: • Test all connectors for ORL using at OTDR. • The connector's optical return shall be not less than 55 dB.		

Test 4: System Reliability Demonstration (30-day test)

- Following the successful completion of the 1-day test, the 30-day test period will begin. Operation of the system will continue for 30 days to successfully demonstrate reliability of the system.
- Each of the 30 days in the test period, Dakota County will verify that the system is operational (at least 99% uptime).

TEST 4: SYSTEM RELIABILITY DEMONSTRATION (30-DAY TEST)		
Day #	Pass/Fail	Comments
1		
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