A programmatic SE analysis has been developed. Available SE documents are:

**Actions:**
- Review appropriate SE documents for the application to ensure consistency.
- Complete the corresponding Class A (A-1 or A-2) Checklist.

**Flood warning systems**

**Communications**

**Traffic detection**

**Dynamic message signs**

**Road Weather Information Systems**

**Railroad**

**Automated gate closure systems**

**Ramp meters**

**Detection systems**

**Radio broadcast**

**Web pages for construction and traveler information**

**Computer aided dispatch**

**Dynamic speed display signs**

**Incident management systems**

**Emergency vehicle preemption**

**Railroad preemption**

**Traffic signal control system**

**Localized adaptive signal control system**

**at least one of the following measures**

**Traffic signal priority with or without control center oversight**

**Emergency vehicle preemption**

**Railroad preemption**

**Flashing yellow arrows**

**PTZ cameras**

**Video surveillance cameras**

**TMC software**

**Data extract tool**

**Infrastructure Support Tools**

**Lighting**

**Traffic signal control system**

**Dynamic message signs (DMS)**

**Lane control signs**

**Ramp meters**

**Electronic toll collection**

**Automated gate closure systems**

**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**

**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**

**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**

**Data Processing and Response Formulation**

**TMC software**

**Data extract tool**

**Class A – A-1 and A-2**

Programmatic ITS Applications

**Traffic signals**

**Traffic signal interconnect (closed loop)**

**Flashing yellow arrows**

**Advanced warning flashes**

**Railroad preemption**

**Emergency vehicle preemption (local)**

**Enforcement lights (e.g., blue lights)**

**Road Weather Information Systems (RWIS)**

**Environmental sensor stations**

**Communication system for data transfer**

**Central hardware and software to collect and disseminate field data**

**PTZ cameras**

**Railroad/Highway Grade Crossing**

**Railroad flashing-light signals**

**Railroad cantilever flashing-light signals**

**Standard railroad gates**

**Four quadrant railroad gates**

**Traffic signal preemption**

**Weight-in-Motion (WIM) Systems**

**WIM for CVO inspection**

**Class A-2 Applications**

**Dynamic message signs (DMS)**

**Traffic detection**

**Video (e.g., CCTV)**

**Ramp meters**

**Communications**

**Flood warning systems**

Note I – Class A (A-1 and A-2) Programmatic ITS Applications

Class A-1 Applications include:

- Traffic signals
- Traffic signal interconnect (closed loop)
- Flashing yellow arrows
- Advanced warning flashes
- Railroad preemption
- Emergency vehicle preemption (localized without control center oversight)
- Transit signal priority (localized without control center oversight)
- Enforcement lights (e.g., blue lights)
- Road Weather Information Systems (RWIS)
- Environmental sensor stations
- Communication system for data transfer
- Central hardware and software to collect and disseminate field data
- PTZ cameras
- Railroad/Highway Grade Crossing
- Railroad flashing-light signals
- Railroad cantilever flashing-light signals
- Standard railroad gates
- Four quadrant railroad gates
- Traffic signal preemption
- Weight-in-Motion (WIM) Systems
- WIM for CVO inspection

Class A-2 Applications include:

- Dynamic message signs (DMS)
- Traffic detection
- Video (e.g., CCTV)
- Ramp meters
- Communications
- Flood warning systems

Note II – Class A-1 or A-2 Applications

Does the project include applications only listed in Note I?

Yes

**Actions:**
- Develop Concepts of Operations (CoPs) and a test plan.
- Review appropriate SE documents as a reference.
- Perform a full SE analysis following the SE process on page 3 of HPDP-ITS
- Complete the corresponding Class A-1 or A-2 Checklist.

No

**Actions:**
- Develop Concepts of Operations (CoPs) and a test plan.
- Review appropriate SE documents as a reference.
- Perform a full SE analysis following the SE process on page 3 of HPDP-ITS
- Complete the corresponding Class A-1 or A-2 Checklist.

Note III – Class B-1 Applications: Freeway Traffic Management

Arterial Traffic Management Applications include:

- Observation and Detection
- Video (e.g., camera)*
- Traffic detection*
- Condition reporting system
- Weather sensors and projection of current and forecast weather conditions
- Automatic vehicle location (AVL) for FIRST, maintenance, and State Patrol vehicles
- Information Sharing
- Dynamic message signs (DMS)*
- Radio broadcast
- Web pages for construction and traveler information
- 511 phone
- Computer aided dispatch (CAD) for FIRST, maintenance, and State Patrol vehicles, including CAD-CARS integration
- Traffic Control
- Lane control signs
- Ramp meters*
- Electronic toll collection*
- Automated gate closure systems
- 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
- Data Processing and Response Formulation
- TMC software (for example, central traffic signal control software)*
- Data extract tool

* Systems engineering documents have been developed for these applications that are specific to MnDOT deployment.

Note IV – Class C Applications: Large/Complex Projects

Class C Applications include:

- Integrated Corridor Management (ICM)
- Bus Rapid Transit (BRT)
- Communications (for example, fiber network)*
- Transportation management center (TMC)
- Incident management systems
- Intersection conflict warning systems
- Infrastructure-based safety systems
- Truck priority
- Smart work zone
- Other complex applications not listed above and not listed in Class B-1 or B-2

Note V – Class B-2 Applications

Does the project include applications only listed in Note III?

Yes

**Actions:**
- Develop Concepts of Operations (CoPs) and a test plan.
- Review appropriate SE documents as a reference.
- Perform a full SE analysis following the SE process on page 3 of HPDP-ITS
- Complete the corresponding Class B-2 Checklist.

Note VI – Class B-3 Applications

Does the project include applications only listed in Note III?

Yes

**Actions:**
- Develop Concepts of Operations (CoPs) and a test plan.
- Review appropriate SE documents as a reference.
- Perform a full SE analysis following the SE process on page 3 of HPDP-ITS
- Complete the corresponding Class B-3 Checklist.

No

**Actions:**
- Develop Concepts of Operations (CoPs) and a test plan.
- Review appropriate SE documents as a reference.
- Perform a full SE analysis following the SE process on page 3 of HPDP-ITS
- Complete the corresponding Class B-3 Checklist.

Note VII – Class C Applications: Road Weather Information Systems

- WIM for CVO Inspection
- Transportation management center (TMC)
- Environmentally sensitive roadways
- ICM
- Maintenance�
- State Patrol vehicles
- PTZ cameras
- Video surveillance cameras
- CCTV
- Observation and Detection
- Video (e.g., camera)*
- Traffic detection*
- Condition reporting system
- Weather sensors and projection of current and forecast weather conditions
- Automatic vehicle location (AVL) for FIRST, maintenance, and State Patrol vehicles
- Information Sharing
- Dynamic message signs (DMS)*
- Radio broadcast
- Web pages for construction and traveler information
- 511 phone
- Computer aided dispatch (CAD) for FIRST, maintenance, and State Patrol vehicles, including CAD-CARS integration
- Traffic Control
- Lane control signs
- Ramp meters*
- Electronic toll collection*
- Automated gate closure systems
- 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
- Data Processing and Response Formulation
- TMC software (for example, central traffic signal control software)*
- Data extract tool

* Systems engineering documents have been developed for these applications that are specific to MnDOT deployment.
**WHEN ITS SYSTEMS ENGINEERING PROCESS FOR RULE 940 COMPLIANCE APPLIES**

- Implementing the ITS SE Process for Rule 940 compliance is required for **All ITS projects funded (in whole or in part) with the highway trust fund** (Includes National Highway System (NHS) and non-NHS facilities).
- In addition, MnDOT requires that the ITS SE Process for Rule 940 compliance is followed on all **State Funded ITS projects** in which ITS component(s) will be connected/integrated to another ITS component, project or system.

The ITS Systems Engineering Process applies to all ITS Class A-1, A-2, B-1, B-2 and C projects. *This allows projects to move forward, taking proper consideration of interoperability and future expansion needs to enable full integration of ITS.*

**ITS SYSTEMS ENGINEERING FINAL DELIVERABLES**

<table>
<thead>
<tr>
<th>Class A (A-1 and A-2) Programmatic ITS Applications</th>
<th>Class B-1 Applications: Freeway Traffic Management</th>
<th>Class B-2 Applications: Arterial Traffic Management</th>
<th>Class C Applications: Large/Complex Projects</th>
</tr>
</thead>
</table>
| If your project is consistent with the Concept of Operations, Functional Requirements and Test Plan, then the Final Deliverables shall include:  
  - Class A-1 or A-2 ITS SE Checklist | If your project is consistent with the Concept of Operations, then the Final Deliverables shall include:  
  - Requirements,  
  - Test Plan, &  
  - Class B-1 ITS SE Checklist | If your project is consistent with the Concept of Operations, then the Final Deliverables shall include:  
  - Requirements,  
  - Test Plan, &  
  - Class B-2 ITS SE Checklist | **Full SE analysis required and the Final Deliverables shall include:**  
  - Concept of Operations,  
  - Requirements,  
  - Test Plan, &  
  - Class C ITS SE Checklist |
| If your project is **not** consistent with the Concept of Operations, Functional Requirements and Test Plan, then the Final Deliverables shall include:  
  - Concept of Operations,  
  - Requirements,  
  - Test Plan,  
  - Class A-1 or A-2 ITS SE Checklist, &  
  - Class B-1, B-2 or C ITS SE Checklist as appropriate | If your project is **not** consistent with the Concept of Operations, then the Final Deliverables shall include:  
  - Concept of Operations,  
  - Requirements,  
  - Test Plan,  
  - Class B-1 ITS SE Checklist, &  
  - Class C ITS SE Checklist as appropriate | If your project is **not** consistent with the Concept of Operations, then the Final Deliverables shall include:  
  - Concept of Operations,  
  - Requirements,  
  - Test Plan,  
  - Class B-2 ITS SE Checklist, &  
  - Class C ITS SE Checklist as appropriate |

Please note when completing the ITS Systems Engineering Checklist(s):

- Use the Decision Tree as a guide to identify the appropriate ITS Systems Engineering Checklist(s) for your project.
- Complete the checklist(s) and obtain signatory approval(s). Refer to page 8 of the HPDP ITS Systems Engineering Requirement for a list of approval agencies.
- Save the approved checklist(s) in the project file, both electronically and paper copy.
- Submit the approved checklist(s) along with the Project Memo for approval.
- For questions regarding the completion of the checklist, contact Rashmi Brewer, P.E., MnDOT CAV-X via e-mail at Rashmi.Brewer@state.mn.us.