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Module 24:
Transit Signal Priority in Connected Vehicle Environment
Instructor

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Learning Objectives

Describe how transit signal priority may be provided in a connected vehicle environment

Describe Transit Signal Priority (TSP) Standards in a Connected Vehicle Environment

Describe what agencies need to do to prepare for Connected Vehicle (CV) TSP implementation

Implementation Considerations
Learning Objective 1

Describe how transit signal priority may be provided in a connected vehicle environment
Describe how transit signal priority may be provided in a connected vehicle environment

- Define what is a **connected vehicle (CV) environment**
- Describe **how** Transit Signal Priority (TSP) is currently implemented and the role of **NTCIP 1211**
- Identify **what information** is exchanged for TSP in a connected vehicle environment
- Describe potential **advantages** of a CV implementation over traditional TSP implementations
What is a Connected Vehicle Environment?

Transportation Challenges

**Safety**
- 37,113 motor vehicle deaths in 2017
- 6,452,000 crashes in 2017

**Mobility**
- 8.8 billion hours of travel delay
- $166 billion cost of urban congestion

**Environment**
- 3.3 billion gallons of wasted fuel

*Source: US Department of Transportation, 2019 Urban Mobility Report, TTI*
The CV Environment

CV environment consists of:
• Connected vehicles
• Connected individuals (vulnerable road users)
• Connected infrastructure

CV Communications
• Wireless
• Mixture of
  o Short-range communications
  o Remote communications

Source: US Department of Transportation
What is a Connected Vehicle Environment?

Source: US Department of Transportation
What is a Connected Vehicle Environment?

Source: US Department of Transportation
An operational strategy that provides preferential treatment (priority) to facilitate the movement of transit vehicles through signalized intersections

- Does not degrade the overall performance of the traffic network
- Provides more efficient use of the street network by increasing the throughput of travelers
- Improves reliability (on-time performance and scheduled adherence) of public transportation

Signal Priority applications can apply for emergency and freight vehicles also

- Address mobility and environmental challenges
How Transit Signal Priority (TSP) is Currently Implemented

Current Systems

Optical Systems

- An optical emitter on the vehicle requests preemption/priority
  - Activated manually by the driver or based on location
- An optical detector near the traffic signal controller
Current Systems

Optical Systems – Limitations:

- **Requires line of sight.** The detector must be aligned in the direction of the emitter, optical emitters/receivers could get dirty or misaligned, limited range.
- **Limited information** transmitted (timestamp, vehicle id maybe)
- **Schedule** may need to be maintained on the vehicle
- **Proprietary.** Hinders extending / connecting TSP corridors.
- **Requires equipment** at each intersection and on each vehicle.
- **Lack of security.**
NTCIP 1211

An information content standard that defines aspects of a communications interface standard for a Signal Control Priority (SCP) system

- Defines data elements (object definitions) used to monitor, configure and control a SCP system
- References NTCIP 1201 for generic data elements
NTCIP 1211

- **Priority Request Generator (PRG).** Generates the priority requests for signal priority
- **Priority Request Server (PRS).** Receives the priority requests and processes the requests to determine the optimal signal timing to service the priority requests, then transmits service requests to the CO
- **Coordinator (CO).** Receives the service requests from the PRS and provides the signal priority
What Information is Exchanged for TSP in a Connected Vehicle Environment

Vehicle to Infrastructure

Priority Requests

- Requests for preferential treatment
  - When is priority needed (i.e., when does the vehicle expects to arrive at the intersection)?
  - Where is the vehicle going (i.e., Where direction is the vehicle moving and will it turn)?
  - How high a priority is the priority request?

Legend

- Physical Component
- Logical Component

[Diagram showing the flow of information between Vehicle to Infrastructure, including Priority Request Generator (PRG), On Board Unit (OBU), Roadside Unit (RSU), Priority Request Server (PRS), and Coordinator (CO).]
What information is Exchanged for TSP in a Connected Vehicle Environment

Vehicle to Infrastructure

Vehicle Information

• Broadcasts their location and kinematics
What Information is Exchanged for TSP in a Connected Vehicle Environment

Infrastructure to Vehicle

Priority Status

- Acknowledges that the priority request was received
  - Indicates the status of the priority request
  - Indicates what priority treatment is being provided (if any)?
- Indicates when will priority treatment will be provided?

Legend

Physical Component
Logical Component

![Diagram showing the exchange of information between a Priority Request Generator (PRG), an On Board Unit (OBU), a Roadside Unit (RSU), a Priority Request Server (PRS), and a Coordinator (CO).]
What Information is Exchanged for TSP in a Connected Vehicle Environment?

Infrastructure to Vehicle

- **Signal Phase and Timing (SPaT)** information, which provides *dynamic* signal phase and timing data from one or more traffic signal controllers
  - What movements (by lane) are currently allowed and when will the movement state is likely to end
- **MAP (roadway geometry)** provides *static* roadway geometric information (e.g., lane information)
  - May be required from the infrastructure to support TSP
- Both messages are defined in SAE J2735
- For additional information, see **CV273, Introduction to SPaT/MAP Messages**
Potential Advantages of a CV Implementation over Traditional TSP Implementations

• **Low initial costs** if vehicles and infrastructure is already connected
  - V2V safety applications
  - Signalized intersection applications
  - See Module 11, Transit and the Connected Vehicle Environment/Emerging Technologies, Applications, and Future Platforms for other transit applications
  - Just need to add support for TSP application
Potential Advantages of a CV Implementation over Traditional TSP Implementations

- **Standardized messages**
  - Also supports emergency vehicles and freight vehicles

- **Standardized security measures** among all vehicle types and services

- Additional performance metric information

- Line of sight not required
What is a disadvantage of using a traditional optical TSP system?

Answer Choices

a) Special equipment is required for each intersection
b) Line of sight is required
c) Limited amount of information can be transferred
d) All of the above
a) Special equipment required for each intersection

Incorrect. Optical equipment is required on each intersection and vehicle.

b) Line of sight is required

Incorrect. The required line of sight has a relatively high possibility of being obstructed.

c) Limited amount of information can be transferred

Incorrect. Relatively little information about the vehicle can be obtained.

d) All of the above

Correct! All of the above are disadvantages.
Learning Objective

Describe TSP Standards in a Connected Vehicle Environment
• Previously described **what** data is needed to support TSP in a Connected Vehicle Environment

• The next several slides describe how the standards **define** this data
Relevant Standards and the Maturity of the Standards

SAE J2735 Standard

- Dedicated Short Range Communications (DSRC) Message Set Dictionary
  - A data dictionary for the CV environment.
  - Defines messages and data elements
  - Includes vehicle kinematic information, position correction information, traveler information
Relevant Standards and the Maturity of the Standards

SAE J2735 Standard

Message  
(sentence)

Data frames  
(Phrases)

Data Elements  
(words)

MSG_SignalRequestMessage

requests  
1..32

messageId  
timeStamp  
second  
requests  
minute  
second  
duration  
…
Signal Request Message (SRM)

- Broadcast by a vehicle (On-Board Unit) to infrastructure (Roadside Unit)
- Asks for preferential (preemption/priority) treatment for one or more signalized intersections
  - Includes approach and desired egress lane, and estimated times
- Must be configured to work reliably and with security protections

Diagram:
- On Board Unit (OBU) to Road Side Unit (RSU) via SRM
- RSU to OBU via SSM
Signal Request Message (SRM)

- **messageId.** DE_DSRCmsgID = 14
- **timestamp.** Number of elapsed minutes in the year
- **second.** Number of milliseconds within the minute
- **sequenceNumber.** Message counter
- **requests.** Data for the priority request (up to 32)
- **requestor.** Data about the requesting vehicle
- **regional.** Regional extensions

### MSG_SignalRequestMessage

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Type</th>
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<tbody>
<tr>
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</tr>
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<td>Time stamp</td>
<td>mandatory</td>
</tr>
<tr>
<td>second</td>
<td>Second</td>
<td>mandatory</td>
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<tr>
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<td>Sequence number</td>
<td>mandatory</td>
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<td>requests</td>
<td>Requests data for priority request</td>
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</tr>
<tr>
<td>requestor</td>
<td>Requestor data</td>
<td>optional</td>
</tr>
<tr>
<td>regional</td>
<td>Regional extensions</td>
<td>optional</td>
</tr>
</tbody>
</table>

**On Board Unit (OBU)**

**RoadSide Unit (RSU)**
Signal Request Message (SRM)

- **id.** Identifies the target intersection for the priority request
- **requestID.** An identifier for the priority request
- **requestType.** Request type (new, update, cancel)
- **inboundLane.** Identifier of the lane the requestor expects to enter the intersection
Signal Request Message (SRM)

- **minute.** Estimated time of arrival (ETA) in number of elapsed minutes in the year
- **second.** Estimated time of arrival (ETA) in number of elapsed seconds into the minute
**Signal Request Message (SRM)**

- **duration.** Represents milliseconds after the ETA, to create a window that the requestor will arrive at the intersection.

- **outboundLane.** Identifier of the lane the requestor expects to exit the intersection.
Signal Request Message (SRM)

- **id.** Identifier of the requestor. Generally, a fixed id.
- **type.** Represents the type of requestor (emergency, public transit, truck, fire, police, cyclist, pedestrian, etc…)
  - May include regional subroles
  - Importance level
  - Highway Performance Monitoring System (HPMS) classification type
Signal Request Message (SRM)

- **position.** Latitude, longitude, elevation (optional)
- **heading.** Direction of travel of the requestor
- **speed.** Transmission state and vehicle speed
- **name.** A descriptive name for debugging
- **routeName.** A route name for transit use
Signal Request Message (SRM)

- **transitStatus.** Status of the transit vehicle. E.g., parked, ADA access in progress, loading bicycle, vehicle door open, at stop line.
- **transitOccupancy.** Relative level of ridership (7 levels from Empty to Full).
- **transitSchedule.** Schedule adherence delta of the requesting vehicle in 10 second steps.
Signal Request Message (SRM)

Mandatory Elements

- **second.** Time message was generated
- **id.** Identifier of the requestor. Generally a fixed id.

Request for Service

- **id.** Identifies the target intersection for the priority request
- **requestID.** An identifier for the priority request
- **requestType.** Request type (new, update, cancel)
- **inboundlane.** Identifier of the lane the requestor expects to enter the intersection
Signal Request Message (SRM)

Example

1. A transit vehicle enters DSRC range and approaches two signalized intersections

2. The transit vehicle wirelessly broadcasts a SRM, with its ETA and the identifier of the lanes to enter and egress at both intersections

3. The RSU for at both intersections receives the SRM and relays the request to the PRS, which processes the request.
Signal Status Message (SSM)

• Broadcast by the infrastructure (Roadside Unit) and can be received by a vehicle (On-Board Unit)
• Provides the status of each priority request received by one or more signalized intersections
Signal Status Message (SSM)

- **messageId**: DE_DSRCmsgID = 15
- **timestamp**: Number of elapsed minutes in the year
- **second**: Number of milliseconds within the minute
- **sequenceNumber**: Message counter.
- **status**: Data about an intersection and received requests
- **regional**: Regional extensions
**Signal Status Message (SSM)**

- **sequenceNumber.** Message counter for the intersection. Increments when the status changes.
- **id.** Regionally unique intersection identifier.
- **inBoundOn.** The identifier of the lane for entering the intersection.
Signal Status Message (SSM)

- **status.** Status of the priority request. Values include processing, granted, rejected, maxPresence, reserviceLocked

- **requester.** Data about the priority request – vehicle identifier, requestID, and message counter.
Signal Status Message (SSM)

- **outboundOn.** The identifier of the lane for exiting the intersection.
- **minute.** Estimated time of arrival (ETA) in number of elapsed minutes in the year
- **second.** Estimated time of arrival (ETA) in number of elapsed seconds into the minute
Signal Status Message (SSM)

Example

1. A RSU receives two SRM requests and the PRS processes the request

2. The signal controller provides the PRS with the status of the requests, then the PRS generates a SSM that is broadcasted by the RSU with the status of all SRM requests received.

3. Transit vehicles receive the SSM and travel through the signalized intersection when service is provided.
Basic Safety Message (BSM)

- Broadcasted by an **OBU**
  - Provides the **location**, kinematics, and sensor information about the vehicle
  - Optionally, provides the **type** of vehicle
  - If certified, indicates what (security) permissions it has

- BSMs may be used to determine if priority should be granted based on the **location**, **vehicle type** and (security) **permissions** of the vehicle

- Must be configured to work reliably and with security protections
Basic Safety Message (BSM)

- **messageld.** DE_DSRCmsgID = 20
- **coreData.** Critical data elements included with every basic safety message including location, positional accuracy, transmission, speed, heading, acceleration, brake status and vehicle size
- **Part II.** Optional extensions including event states, exterior light status, path history, and vehicle classification (type)
- **regional.** Regional extensions
Basic Safety Message (BSM)

Example

1. A transit vehicle enters DSRC range and approaches two signalized intersections, while wirelessly broadcasting BSMs

2. The RSU receives and processes the BSM information to determine its location, vehicle type and service permissions

3. If the transit vehicle satisfies the established criteria for signal priority, the RSU sends a priority request to the priority request server (PRS)
IEEE 1609.2

- IEEE 1609.2 Certificates
  - Part of the CV security system
    - Participants in the CV environment trusting the validity of information received from other system participants
  - Indicates that the sender is trusted and has been granted the privileges to transmit the messages
Service Specific Permissions (SSP)

- Included as part of the IEEE 1609.2 certificates to indicate additional privileges
  - Such as the ability to request preferential treatment.
- Equipping authorized transit and emergency vehicles with these certificates authorizing the TSP requests, requests from non-eligible vehicles can be excluded from the priority services.
- See CV265, Introduction to IEEE 1609 Family of Standards for Wireless Access in Vehicular Environments (WAVE)
- See CSE201, Introduction to Security Credential Management System (SCMS)
Early Adoption of the Standards

• Few actual TSP in CV implementations at this time
  • Most are single agencies
• Several implementations are planned
• Need regional interoperability
• TSP applications are communications technology neutral
• Same standards/messages used for emergency vehicles/freight vehicles
ACTIVITY
What is a mandatory element of the SRM?

**Answer Choices**

a) Request Identifier
b) Requestor Identifier
c) SequenceNumber (message counter)
d) Estimated time of arrival
Review of Answers

a) Request Identifier

Incorrect. A request identifier is not mandatory unless a specific request is made.

b) Requestor Identifier

Correct! The identifier of the requestor must be included in all Signal Request Messages.

c) SequenceNumber (message counter)

Incorrect. The message counter is optional.

d) Estimated Time of Arrival

Incorrect. The estimated time of arrival of the requestor is optional.
Learning Objective 3

Describe What Agencies Need to Do to Prepare for CV TSP Implementation
What Agencies Need to do to Prepare for CV TSP Implementation

• Define the **roles** and **responsibilities** of the traffic and transit agencies

• Define the **physical architecture**

• Present additional **deployment guidance** (security, authorization, vehicle priority, check-in/check-out, nearside vs farside)
Roles and Responsibilities of the Traffic and Transit Agencies

Transit Agencies

• Responsible for identifying the **business rules** when Priority Requests are generated
  • Schedule adherence
  • Transit vehicle load
  • Transit vehicle in service/not in service

• Identify the goals and objectives (**performance measures**) for the TSP system

• **Outreach** to other local agencies that may need preferential treatment to fit within the priority structure
  • Emergency vehicle operators
  • Freight operators
  • May include cost-sharing
Traffic Agencies

• Responsible for granting priority requests based on the business rules provided by the transit agency
• Identify constraints on the business rules based on the traffic signal system infrastructure
• Describes six common but different system architectures for SCP, including the physical components, the logical components (PRG, PRS, CO) and the interfaces between them.

• Implementations are allowed to use a different architecture, and may support multiple architectures.
Physical Architecture

Connected Vehicle Environment

• What communications technology to use?
  • DSRC vs. 3GPP PC5 Mode 4
• How is security provided?
SRM / SSM

- The SAE J2735 SRM and SSM are exchanged between the OBU and the RSU
- PRG generates the priority request
  - May be part of the vehicle on-board systems, the OBU, or a separate physical device
- PRS receives the priority requests and generates a service request to the CO
  - May be part of the Coordinator (controller), the RSU, a separate device in the cabinet or a central location
Physical Architecture

SRM / SSM

Legend
- Logical Component
- Physical Component

Alternate

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority Request Generator</td>
<td>Vehicle</td>
</tr>
<tr>
<td>OBU</td>
<td>J2735 SRM</td>
</tr>
<tr>
<td>RSU</td>
<td>Priority Request Server</td>
</tr>
<tr>
<td>Traffic Signal Cabinet</td>
<td>Coordinator</td>
</tr>
</tbody>
</table>

Physical Architecture
The SAE J2735 BSM is broadcasted by the OBU and received by the RSU.

PRG generates the priority request based on the vehicle’s current location, current kinematics (speed, heading), (vehicle) type, and/or permissions.

- May be part of the RSU or a separate physical device in the cabinet or a central location.

Legend:
- **Logical Component**
- **Physical Component**
- **Traffic Signal Cabinet**
- **Controller**
- **Alternate**

Diagram:
- Vehicle
- OBU
- J2735 BSM
- RSU
- Priority Request Generator
- Priority Request Server
- Coordinator
Physical Architecture

BSM

• PRS receives the priority requests and generates a service request to the CO
  • May be part of the Coordinator (controller) or a separate device in the cabinet or a central location

Legend

Physical Component

Logical Component

Vehicle
OBU
RSU
Traffic Signal Cabinet
J2735 BSM

Priority Request Generator
Priority Request Server
Coordinator

Alternate

NTCIP 1211
NTCIP 1211
Vehicle Type/Class

- Used to determine priority
- Different type of vehicles (e.g., railroad, emergency vehicles, transit vehicles, freight)
- Can also distinguish between different classes of the same vehicle type (e.g., for transit vehicles: LRT, BRT, express bus, or local bus)
  - Called subRole in SAE J2735
  - Called vehicle class in NTCIP 1211
Check In / Check Out

Check In

• **When** should the PRG begin generating priority requests?
  • Consider the transmission signal strength of the OBU and the receiving strength (sensitivity) of the RSU
  • Consider the transmission rate and latency of the communications technology (and the AVL system)

Check Out

• **When** will the traffic signal controller know that the requestor has checked out?
Additional Deployment Guidance

Nearside / Farside

Nearside

• Estimated Time of Arrival for nearside bus stops varies widely, impacting signal coordination
  • How long will the vehicle be stopped?
  • Door open / left turn signal indication is helpful
  • Right turning vehicles are another issue
Additional Deployment Guidance

Nearsid / Farsid

Nearsid

• Queue jumps may be effective
  • The check-in point may be the stopbar

Farsid

• Approach speeds toward the intersection will not vary much (more predictable)
Where would a PRS NOT likely to be located?

Answer Choices

a) A transit vehicle
b) A traffic management center
c) A traffic signal controller cabinet
d) A traffic signal controller
Review of Answers

a) A transit vehicle

Correct! A PRS is not likely to be found aboard a transit vehicle

b) A traffic management center

Incorrect. The functions of the PRS may be performed at a centralized server at a traffic management center.

c) A traffic signal controller cabinet

Incorrect. A PRS could be a physical device in the cabinet.

d) A traffic signal controller

Incorrect. The functions of the PRS may be performed by the traffic signal controller.
Learning Objective 4

Implementation Considerations
CASE STUDY
Case Studies

- Multi-Modal Intelligent Traffic Signal Systems (MMITSS)
- Tampa Hillsborough Expressway Authority (THEA) Connected Vehicle Pilot
- Redwood Road, Salt Lake City, Utah
- SANDAG Bus-on-Shoulders
Introduction

- First implementations of signal priority in a CV Environment
  - Anthem, AZ
  - Palo Alto, CA
- Funded under the Connected Vehicle Pooled Fund Study.
- Used SAE J2735_200911
  - SRM, SSM, MAP, SPaT messages
  - Some minor differences with the SAE J2735_201603 version
- Used NTCIP 1202 to exchange data between the RSU and the signal controller
Multi-Modal Intelligent Traffic Signal Systems (MMITSS)

System Architecture

**Signal timing**

- **SRM**
- **SSM**

[Diagram showing system architecture with nodes and connections labeled SRM and SSM.]
Multi-Modal Intelligent Traffic Signal Systems (MMITSS)

Lessons Learned

• Supports emergency vehicles and transit vehicles.

• This implementation considered priority based on performance measures such as overall delay
  • Prior signal priority implementations were generally on a first come, first serve basis, particularly based on vehicle class (e.g., emergency vehicles).

• Improved vehicle travel time and travel time reliability

• Reduced delay for equipped transit vehicles by 8.2%
Introduction

• One of the sites for USDOT’s CV Pilot Deployment Program
• Multimodal deployment in downtown Tampa, Florida
• Includes a transit signal priority application
  • 10 Hillsborough Area Regional Transit (HART) buses
• Based on the MMITSS implementation, but with some modifications
  • Adds support for coordination
  • Converts SRM to NTCIP 1211 priority requests to the controller and NTCIP 1211 priority status objects from the controller to SSM
Tampa Hillsborough Expressway Authority (THEA) Connected Vehicle Pilot

System Architecture

Priority by Controller

1211 Priority
1211 Status

Traffic Signal Controller receives green extension, sends green extended

RSU 19 - 32
TSP app receives priority request, sends to Master Server, receives priority granted, send green extension to signal controller, sends priority granted to Bus

Priority request
Priority Denied
Priority Granted

TMC
Master Server
TSP app receives priority request, determines schedule, if behind sends priority request

Priority request
Priority Granted
Priority Denied

Bus A
Makes a priority request
Receives priority

Priority Granted Notification

Priority Denied/Timeout Notification

SRM
SSM

Source: https://www.its.dot.gov/pilots/pilots_thea.htm
Introduction

• Utah DOT (UDOT) – deployed DSRC
  • Redwood Road - 27 signalized intersections
  • Utah Valley Express (UVX) Bus Rapid Transit in Provo, Utah – 47 signalized intersections

• Opportunity to gain experience with connected vehicles

• Goal of the TSP project is to improve schedule reliability and meet the SPaT Challenge

• Modified Arizona MMITSS to integrate the buses’ current on-time performance and passenger loading in the priority decision
System Architecture

Source: Utah DOT
Lessons Learned

• Same equipped intersections provide signal preemption to UDOT snowplow vehicles in addition to other signalized intersections
  • 46 snow plows

• Evaluation study underway for the UVX BRT Project and the Snow Plow Pre-emption Project

• More TSP and Snow Plow Pre-emption Corridors being added.
SANDAG Bus On Shoulders

Introduction

- Pilot project to **explore technologies** to support buses traveling in transit-only lanes of a freeway
  - SANDAG, in partnership with San Diego Metropolitan Transit System (MTS), the California Department of Transportation (Caltrans), and the US Department of Transportation (USDOT)
  
  - The transit-only lanes are in the shoulder lanes so where the shoulder lanes and the on-ramp lanes merge is a conflict area.
  
  - Using CV technology with **ramp meters** to hold vehicles on the on-ramps as transit vehicles approach the conflict (merge) area
SANDAG Bus On Shoulders

Concept

Source: SANDAG
System Architecture

- OBUs are installed on the transit vehicles and RSUs are installed at the ramp meters
  - Using V2I communications and WSMs
- Transit vehicles broadcast BSMs
- Ramp meters broadcast SSMs
ACTIVITY
Which of the following is an important consideration when deploying TSP in a CV environment?

Answer Choices

a) Security
b) Physical architecture
c) Criteria for granting priority requests
d) All of the above
Review of Answers

a) Security

Incorrect. Security is an important consideration for CV.

b) Physical architecture

Incorrect. The physical architecture is an important consideration for TSP system.

c) Criteria for granting priority requests

Incorrect. The criteria for granting priority requests is an important consideration for a TSP system.

d) All of the above

Correct! All of the above are important considerations for a TSP system in a CV environment.
Module Summary

Describe how transit signal priority may be provided in a connected vehicle environment

Describe TSP Standards in a Connected Vehicle Environment

Describe what agencies need to do to prepare for CV TSP implementation

Implementation Considerations
We Have Now Completed the TSP Curriculum


**Module 20**: Application of Arterial Management/Transit Signal Priority Standards
Modules of Interest

**Module 11**: Transit and the Connected Vehicle Environment/Emerging Technologies, Applications and Future Platforms

**Module 23**: Leveraging Communications Technologies for Transit On-Board Integration

**CV273**: Introduction of SPaT / MAP Messages

**CSE201**: Introduction to Security Credential Management System

**CV265**: Introduction to IEEE 1609 Family of Standards for Wireless Access in Vehicular Environments (WAVE)
Thank you for completing this module.

Feedback
Please use the Feedback link below to provide us with your thoughts and comments about the value of the training.

Thank you!