



# INTELLIGENT TRANSPORTATION SYSTEMS (ITS) PLAN FOR THE KERN REGION

## FINAL DELIVERABLE NO. 12 REGIONAL ITS PLAN APPENDIX B: ITS STRATEGIES

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Kern Council of Governments  
1401 19<sup>th</sup> Street, Suite 300  
Bakersfield, CA 93301  
www.kerncog.org  
661-635-2900  
Fax 661-324-8215

<http://www.kerncog.org/category/docs/its/>

*Prepared by:*  
Kimley-Horn & Associates, Inc.  
765 The City Drive, Suite 200  
Orange, CA 92868

## Appendix B. ITS STRATEGIES

### **ITS STRATEGY #1: INTELLIGENT ACCESS PROGRAM – WEIGHT MONITORING**

The Intelligent Access Program - Weight Monitoring strategy enables commercial vehicle operators simplified access to permit operations in exchange for remote weight monitoring.

**Program Area:** Commercial Vehicle Operations

**ITS User Needs Addressed:**

- Reduce commercial vehicle weight, width and height violations
- Provide information on commercial vehicle operations (CVO) permit restrictions
- Deploy weigh-in-motion/mobile weigh enforcement technology

**Service Package:**

- CVO03 Electronic Clearance

### **ITS STRATEGY #2: FREIGHT-SPECIFIC DYNAMIC TRAVEL PLANNING**

This strategy provides both pretrip and enroute travel planning, routing, and commercial vehicle related traveler information, which includes information such as truck parking locations and current status. The information will be based on data collected from the commercial fleet as well as general traffic data collection capabilities. The information, both real time and static can be provided directly to fleet managers, to mobile devices used by commercial vehicle operators, or directly to in vehicle systems as commercial vehicles approach roadway exits with key facilities such as parking. The strategy can also provide oversize/ overweight permit information to commercial managers.

**Program Areas:** Commercial Vehicle Operations

**ITS User Needs Addressed:**

- Provide interstate/inter-regional traveler information for commercial vehicles
- Provide information on commercial vehicle operations (CVO) permit restrictions
- Provide better vehicle restrictions and roadway closure information to commercial vehicles

**Service Package:**

- CVO09 Freight-Specific Dynamic Travel Planning

### **ITS STRATEGY #3: ROAD WEATHER INFORMATION FOR FREIGHT CARRIERS**

This strategy provides the capability to collect road weather data from connected vehicles and using that data to develop short term warnings or advisories that can be provided to individual commercial vehicles or to commercial vehicle dispatchers. The information may come from either vehicles operated by the general public and commercial entities (including passenger cars and trucks) or specialty vehicles and public fleet vehicles (such as snowplows, maintenance

trucks, and other agency pool vehicles). The raw data will be processed in a controlling center to generate road segment-based data outputs. The processing will also include a road weather commercial vehicle alerts algorithm to generate short time horizon alerts that will be pushed to user systems and available to commercial vehicle dispatchers. In addition the information collected can be combined with observations and forecasts from other sources to provide medium (next 2-12 hours) or long term (more than 12 hours) advisories through a variety of interfaces including web based and connected vehicle based interfaces.

**Program Areas:** Commercial Vehicle Operations

**ITS User Needs Addressed:**

- Provide interstate/inter-regional traveler information for commercial vehicles

**Service Package:**

- CVO10 Road Weather Information for Freight Carriers

## **ITS STRATEGY #4: HAZMAT MANAGEMENT**

This strategy integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material and incidents. HAZMAT tracking is performed by the Fleet and Freight Management Center. The Emergency Management Center is notified by the Commercial Vehicle if an incident occurs and coordinates the response. The response is tailored based on information that is provided as part of the original incident notification or derived from supplemental information provided by the Fleet and Freight Management Center. The latter information can be provided prior to the beginning of the trip or gathered following the incident depending on the selected policy and implementation.

**Program Area:** Commercial Vehicle Operations

**ITS User Needs Addressed:**

- Provide tracking of HAZMAT vehicles
- Improve response to HAZMAT incidents

**Service Package:**

- CVO12 HAZMAT Management

## **ITS STRATEGY #5: CARRIER OPERATIONS AND FLEET MANAGEMENT**

This strategy manages a fleet of commercial vehicles. The Fleet and Freight Management Center monitors the vehicle fleet and can provide routes using either an in-house capability or an external provider. Routes generated by either approach are constrained by hazardous materials and other restrictions (such as height or weight). A route would be electronically sent to the Commercial Vehicle with any appropriate dispatch instructions. The location of the Commercial Vehicle can be monitored by the Fleet and Freight Management Center and routing changes can be made depending on current road network conditions.

**Program Area:** Commercial Vehicle Operations

**ITS User Needs Addressed:**

- Improve response to HAZMAT incidents
- Provide better vehicle restrictions and roadway closure information to commercial vehicles

**Service Package:**

- CVO01 Carrier Operations and Fleet Management

## **ITS STRATEGY #6: COMMERCIAL VEHICLE ADMINISTRATIVE PROCESSES**

This service package supports program administration and enrollment and provides for electronic application, processing, fee collection, issuance, and distribution of CVO credential and tax filing. Through this process, carriers, drivers, and vehicles may be enrolled in a variety of programs including electronic clearance and wireless inspection programs which allow commercial vehicles to be screened at mainline speeds. Through this enrollment process, current profile databases are maintained in the Commercial Vehicle Administration Center and snapshots of this data are made available to the roadside check facilities. Current program status is maintained and made available to carriers, drivers, and other authorized users of the data. Enrolled carriers are provided the option to review and challenge the collected data. Commercial Vehicle Administration Centers can share current program status and credential information with other Centers, so that it is possible for any Commercial Vehicle Administration Center to have access to all credentials, credential fees, credentials status and safety status information. In addition, it is possible for one Commercial Vehicle Administration Center to collect HAZMAT route restrictions information from other Commercial Vehicle Administration Centers and then act as a clearinghouse for this route restrictions information.

**Program Area:** Commercial Vehicle Operations

**ITS User Needs Addressed:**

- Provide information on commercial vehicle operations (CVO) permit restrictions

**Service Package:**

- CVO04 CV Administrative Processes

## **ITS STRATEGY #7: ROADSIDE CVO SAFETY**

This service package provides for automated roadside safety monitoring and reporting. It automates commercial vehicle safety inspections at roadside check locations. The basic option, directly supported by this service package, facilitates safety inspection of vehicles that have been pulled off the highway, perhaps as a result of the automated screening process provided by the Electronic Clearance (CVO03) service package. In this scenario, only basic identification data and status information is read from the electronic tag on the commercial vehicle. The identification

data from the tag enables access to additional safety data maintained in the infrastructure which is used to support the safety inspection, and may also inform the pull-in decision if system timing requirements can be met. More advanced implementations collect additional data from commercial vehicles. This service package focuses on manned inspection locations. See CVO08 for remote monitoring options using smart roadside infrastructure at unmanned, virtual inspection stations.

**Program Area:** Commercial Vehicle Operations

**ITS User Needs Addressed:**

- Provide information on commercial vehicle operations (CVO) permit restrictions

**Service Package:**

- CVO07 Roadside CVO Safety

## **ITS STRATEGY #8: ROADSIDE HAZMAT SECURITY DETECTION AND MITIGATION**

This strategy provides the capability to detect and classify security sensitive HAZMAT on commercial vehicles using roadside sensing and imaging technology. Credentials information can be accessed to verify if the commercial driver, vehicle and carrier are permitted to transport the identified HAZMAT. If the credentials analysis and sensed HAZMAT information do not agree, the vehicle can be signaled to pull off the highway, and if required, an alarm can be sent to Emergency Management to request they monitor, traffic stop or disable the vehicle.

**Program Area:** Commercial Vehicle Operations

**ITS User Needs Addressed:**

- Improve response to HAZMAT incidents

**Service Package:**

- CVO13 Roadside HAZMAT Security Detection and Mitigation

## **ITS STRATEGY #9: SMART ROADSIDE AND VIRTUAL WIM**

This strategy includes the delivery of capabilities related to wireless roadside inspections and electronic screening/virtual weigh stations. Wireless roadside inspection is defined by a safety screening capability that employs communications technologies to obtain information from a commercial vehicle that will allow safety screening of the vehicle and its driver. This capability provides for the interrogation at mainline speeds of a commercial vehicle when it has entered a control segment or geofenced area. Vehicle identification and driver information are provided to the roadside unit. The information communicated can be used to verify compliance with safety requirements, allowing a decision to be made regarding whether the vehicle should pull in to a roadside check station. A more advanced version of this strategy would download safety information measured on the vehicle including driver related information such as the driver log allowing real time evaluation that the vehicle and driver are meeting safety requirements. The electronic screening/virtual weigh stations capability employs communications technologies to

obtain information from a commercial vehicle that will allow verification of permits or credentials for the vehicle. The information communicated is used to verify compliance with safety requirements, allowing a decision to be made regarding whether the vehicle should pull in to a roadside check station. This strategy can also be used to verify that the commercial vehicle meets vehicle weight (via weigh in motion capability) or dimension requirements.

**Program Area:** Commercial Vehicle Operations

**ITS User Needs Addressed:**

- Deploy weigh-in-motion/mobile weigh enforcement technology
- Provide target enforcement at locations with history of violations

**Service Package:**

- CVO08 Smart Roadside and Virtual WIM

## **ITS STRATEGY #10: ITS DATA WAREHOUSE**

This strategy provides the same broad access to multimodal, multidimensional data from varied data sources as in the ITS Data Warehouse strategy, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse strategy are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the request.

**Program Area:** Data Management

**ITS User Needs Addressed:**

- Improve information exchange between Caltrans, local transportation agencies and transit agencies
- Improve data collection capabilities and archiving on freeways/expressways
- Implement a central information/data clearinghouse
- Use archived data for planning, modeling, analysis and traffic management strategy development

**Service Package:**

- DM01 ITS Data Warehouse

## **ITS STRATEGY #11: PERFORMANCE MONITORING**

The Performance Monitoring strategy uses information collected from connected vehicles to support performance monitoring and other uses of historical data including transportation planning, condition monitoring, safety analyses, and research. The information may be probe data information obtained from vehicles in the network to determine network performance measures such as speed and travel times, or it may be information collected from the vehicles

and processed by the infrastructure, e.g. environmental data and infrastructure conditions monitoring data.

**Program Areas:** Data Management

**ITS User Needs Addressed:**

- Monitor transportation infrastructure
- Improve data collection capabilities and archiving on freeways/expressways
- Use archived data for planning, modeling, analysis and traffic management strategy development

**Service Package:**

- DM02 Performance Monitoring

## **ITS STRATEGY #12: TRANSIT VEHICLE TRACKING**

This strategy monitors current transit vehicle location using an Automated Vehicle Location System. The location data may be used to determine real time schedule adherence and update the transit system's schedule in real-time.

**Program Area:** Public Transportation

**ITS User Needs Addressed:**

- Expand/enhance/upgrade automatic vehicle location (AVL) system
- Implement/enhance web-based trip planner
- Provide real-time transit arrival/departure information on website and at bus stops
- Receive real-time roadway congestion information

**Service Package:**

- PT01 Transit Vehicle Tracking

## **ITS STRATEGY #13: MULTI-MODAL COORDINATION**

This strategy establishes two way communications between multiple transit and traffic agencies to improve service coordination. Multimodal coordination between transit agencies can increase traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) and also improve operating efficiency.

**Program Area:** Public Transportation

**ITS User Needs Addressed:**

- Coordinate timed transfers between routes, providers and modes

**Service Package:**

- PT14 Multi-modal Coordination

## **ITS STRATEGY #14: TRANSIT CONNECTION PROTECTION**

This strategy allows travelers to initiate a request for connection protection anytime during the trip using a personal device or on-board equipment and receive a confirmation indicating whether the request is accepted. Connection protection uses real time data to examine the arrival status of a transit vehicle and to transmit a hold message to a vehicle or other mode of transportation (e.g. rail) in order for the traveler to make a successful transfer from one vehicle to another. Connection protection can be performed within a single agency, across multiple agencies, and across multiple modes. In an intermodal, multimodal or interagency environment, a transfer request brokerage system, represented by the Transit Management System, can be used to determine the feasibility of a connection protection request and support schedule coordination between agencies.

**Program Area:** Public Transportation

**ITS User Needs Addressed:**

- Coordinate timed transfers between routes, providers and modes

**Service Package:**

- PT17 Transit Connection Protection

## **ITS STRATEGY #15: TRANSIT TRAVELER INFORMATION**

This strategy provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this strategy.

**Program Area:** Public Transportation

**ITS User Needs Addressed:**

- Implement/enhance web-based trip planner
- Provide real-time transit arrival/departure information on website and at bus stops
- Provide on-board automated enunciators
- Provide transit information using social media
- Develop mobile apps to provide static and real-time transit information
- Enhance 511 to provide static and real-time transit information

**Service Package:**

- PT08 Transit Traveler Information



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## **ITS STRATEGY #16: TRANSIT FLEET MANAGEMENT**

This strategy supports automatic transit maintenance scheduling and monitoring. On-board condition sensors monitor system status and transmit critical status information to the Transit Management Center. The Transit Management Center processes this data and schedules preventative and corrective maintenance. The strategy also supports the day to day management of the transit fleet inventory, including the assignment of specific transit vehicles to blocks.

**Program Area:** Public Transportation

**ITS User Needs Addressed:**

- Implement/enhance remote monitoring of transit vehicle mechanical condition

**Service Package:**

- PT06 Transit Fleet Management

## **ITS STRATEGY #17: TRANSIT SECURITY**

This strategy provides for the physical security of transit passengers and transit vehicle operators. On-board equipment performs surveillance and sensor monitoring in order to identify potentially hazardous situations. The surveillance equipment includes video (e.g., CCTV cameras), audio systems and/or event recorder systems. The sensor equipment includes threat sensors (e.g., chemical agent, toxic industrial chemical, biological, explosives, and radiological sensors) and object detection sensors (e.g., metal detectors). Transit user or transit vehicle operator activated alarms are provided on-board. Public areas (e.g., transit stops, park and ride lots, stations) are also monitored with similar surveillance and sensor equipment and provided with transit user activated alarms. In addition this strategy provides surveillance and sensor monitoring of non-public areas of transit facilities (e.g., transit yards) and transit infrastructure such as bridges, tunnels, and transit railways or bus rapid transit (BRT) guideways. The surveillance equipment includes video and/or audio systems. The sensor equipment includes threat sensors and object detection sensors as described above as well as, intrusion or motion detection sensors and infrastructure integrity monitoring (e.g., rail track continuity checking or bridge structural integrity monitoring). Most of the surveillance and sensor data that is collected by this strategy may be monitored by either the Emergency Management Center or the Transit Management Center, providing two possible approaches to implementing this strategy. This strategy also supports remote transit vehicle disabling and transit vehicle operator authentication by the Transit Management Center.

**Program Areas:** Public Transportation

**ITS User Needs Addressed:**

- Expand security cameras on transit vehicles, at transit stations/stops and park-and-ride facilities

**Service Package:**

- PT05 Transit Security

### **ITS STRATEGY #18: ROUTE ID FOR THE VISUALLY IMPAIRED**

This strategy assists visually impaired travelers to identify the appropriate bus and route to their intended destination. It provides information from bus stop infrastructure to visually impaired travelers portable devices that can be converted to audible information regarding the appropriate bus and route. It also allows the visually impaired traveler to query the portable device to identify route options.

**Program Area:** Public Transportation

**ITS User Needs Addressed:**

- Provide on-board automated enunciators

**Service Package:**

- PT16 Route ID for the Visually Impaired

### **ITS STRATEGY #19: DYNAMIC TRANSIT OPERATIONS**

This strategy allows travelers to request trips and obtain itineraries using a personal device such as a smart phone, tablet, or personal computer. The trips and itineraries cover multiple transportation services (public transportation modes, private transportation services, shared-ride, walking and biking). This strategy builds on existing technology systems such as computer-aided dispatch/ automated vehicle location (CAD/AVL) systems and automated scheduling software, providing a coordination function within and between transit providers that would dynamically schedule and dispatch or modify the route of an in-service vehicle by matching compatible trips together. TI06 covers other shared use transportation options.

**Program Area:** Public Transportation

**ITS User Needs Addressed:**

- Provide on-line reservation system for demand-responsive transit services

**Service Package:**

- PT02 Transit Fixed-Route Operations
- PT03 Dynamic Transit Operations

### **ITS STRATEGY #20: TRANSIT SIGNAL PRIORITY**

This strategy uses transit vehicle to infrastructure communications to allow a transit vehicle to request priority at one or a series of intersections. The strategy provides feedback to the transit driver indicating whether the signal priority has been granted or not. This strategy can contribute

to improved operating performance of the transit vehicles by reducing the time spent stopped at a red light.

**Program Area:** Public Transportation

**ITS User Needs Addressed:**

- Implement transit signal priority technology

**Service Package:**

- PT09 Transit Signal Priority

## **ITS STRATEGY #21: TRANSIT PASSENGER COUNTING**

A Smart Work Zone system is comprised of computers, communications, and sensor technology to obtain, analyze, and communicate real-time traffic flow data to users. The system elements are portable, making them appropriate for use in work zones, accurate, and are fully automated.

**Program Area:** Public Transportation

**ITS User Needs Addressed:**

- Expand/upgrade automated passenger counters

**Service Packages:**

- PT07 Transit Passenger Counting

## **ITS STRATEGY #22: TRANSIT FIXED-ROUTE OPERATIONS**

This strategy performs automated dispatch and system monitoring for fixed-route and flexible-route transit services. This service performs scheduling activities including the creation of schedules, blocks and runs, as well as operator assignment. This service monitors the transit vehicle trip performance against the schedule and provides information displays at the Transit Management Center.

**Program Area:** Public Transportation

**ITS User Needs Addressed:**

- Expand/enhance/upgrade computer aided dispatch (CAD) system
- Receive real-time roadway congestion information

**Service Package:**

- PT02 Transit Fixed-Route  
Operations

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## **ITS STRATEGY #23: DYNAMIC RIDESHARING AND SHARED USE TRANSPORTATION**

This strategy addresses dynamic ridesharing/ride matching services to travelers and other forms of shared use transportation. Dynamic ridesharing allows travelers to arrange carpool trips through a personal device with a wireless connection to a ride matching system (e.g., a web-based application). It uses inputs from both passengers and drivers pre-trip, during the trip, and post-trip. These inputs are then translated into "optimal" pairings between passengers and drivers to provide both with a convenient route between their two origin and destination locations. After the trip, information is provided back to the strategy to improve the user's experience for future trips. The shared use aspect of the strategy addresses three types of shared use that may be arranged using an internet connected personal device. In the first type, a traveler arranges for the temporary use of a vehicle. In the second type of shared use, a traveler arranges for a vehicle to pick them up at a specific location and take them to another location. The second type of shared use may be implemented as a ride matching or ridesharing service, including those provided by Uber and Lyft. The third type of shared use is a bikeshare capability.

**Program Area:** Traveler Information

### **ITS User Needs Addressed:**

- Promote the use of and facilitate the use of shared mobility
- Improve ridesharing program/website

### **Service Package:**

- TI06 Dynamic Ridesharing and Shared Use Transportation

## **ITS STRATEGY #24: BROADCAST TRAVELER INFORMATION**

This strategy provides a digital broadcast service that disseminates traveler information to all equipped travelers within range. It collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, roadway maintenance and construction information, air quality and weather information, and broadcasts the information to travelers using technologies such as FM subcarrier, satellite radio, cellular data broadcasts, and Internet streaming technologies.

**Program Area:** Traveler Information

### **ITS User Needs Addressed:**

- Expand highway advisory radio (HAR) coverage on freeways/expressways
- Provide more timely incident information to travelers and improve quality, consistency and thoroughness of traveler information
- Provide/enhance congestion information to travelers
- Provide freeway/expressway travel times and Provide arterial travel times (on major arterials)
- Use social media for traveler information dissemination

- Provide roadway closure/restriction information
- Send email alerts of major incidents to major employers
- Improve 511 system/web site, enhance freeway/expressway traffic map, and enhance arterial traffic map

**Service Package:**

- TI01 Broadcast Traveler Information

**ITS STRATEGY #25: TRAFFIC INFORMATION DISSEMINATION**

This strategy provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, travel restrictions, incident information, and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), Transit Management, Emergency Management, and Transportation Information Centers. A link to the Maintenance and Construction Management Center allows real time information on road/bridge closures and restrictions due to maintenance and construction activities to be disseminated.

**Program Area:** Traveler Information, Traffic Management

**ITS User Needs Addressed:**

- Expand highway advisory radio (HAR) coverage on freeways/expressways
- Provide more timely incident information to travelers and improve quality, consistency and thoroughness of traveler information
- Provide freeway/expressway travel times and Provide arterial travel times (on major arterials)
- Share incident information with other agencies
- Share congestion information with other agencies
- Share surveillance video and data with PSAPs/emergency responders
- Share public safety/computer aided dispatch (CAD) data with transportation agencies
- Implement/expand dynamic message sign (DMS) installations on arterials and freeways
- Provide roadway flood warnings

**Service Package:**

- TM06 Traffic Information  
Dissemination

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**ITS STRATEGY #26: PERSONALIZED TRAVELER INFORMATION**

This strategy provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. The traveler can obtain current information regarding traffic conditions, roadway maintenance and construction, transit services, ride share/ride match, parking management, detours and pricing information. Although the Internet is the predominate network used for traveler information dissemination, a range of two-way wide-area wireless and fixed-point to fixed-point communications systems may be used to support the required data communications with the traveler. A variety of interactive devices may be used by the traveler to access information prior to a trip or enroute including phone via a 511-like portal and web pages via smart phone, tablet, personal computer, and a variety of in-vehicle devices.

**Program Area:** Traveler Information

**ITS User Needs Addressed:**

- Provide more timely incident information to travelers and improve quality, consistency and thoroughness of traveler information
- Provide/enhance congestion information to travelers
- Provide freeway/expressway travel times and Provide arterial travel times (on major arterials)
- Send email alerts of major incidents to major employers

**Service Package:**

- TI02 Personalized Traveler Information

**ITS STRATEGY #27: DYNAMIC ROUTE GUIDANCE**

This strategy offers advanced route planning and guidance that is responsive to current conditions. The package augments a user's navigation system equipment with a digital receiver capable of receiving real-time traffic, transit, and road condition information, which is used by the user equipment to provide real-time route guidance that factors in current conditions.

**Program Area:** Traveler Information

**ITS User Needs Addressed:**

- Provide/enhance congestion information to travelers
- Provide roadway closure/restriction information
- Provide information and routing (detour) information to travelers during incident, construction, weather events, special events, etc.

**Service Packages:**

- TI03 Dynamic Route Guidance

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## **ITS STRATEGY #28: TRAFFIC INCIDENT MANAGEMENT SYSTEM**

This strategy manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The strategy includes incident detection capabilities through roadside surveillance devices (e.g. CCTV) and through regional coordination with other traffic management, maintenance and construction management and emergency management centers as well as rail operations and event promoters. Information from these diverse sources is collected and correlated by this strategy to detect and verify incidents and implement an appropriate response. This strategy supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications or resource coordination between centers. Incident response also includes presentation of information to affected travelers using the Traffic Information Dissemination strategy and dissemination of incident information to travelers through the Broadcast Traveler Information or Interactive Traveler Information strategies. The roadside equipment used to detect and verify incidents also allows the operator to monitor incident status as the response unfolds. The coordination with emergency management might be through a CAD system or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel.

**Program Area:** Traffic Management

### **ITS User Needs Addressed:**

- Share incident information with other agencies
- Share surveillance video and data with PSAPs/emergency responders
- Share surveillance video and data with PSAPs/emergency responders
- Share public safety/computer aided dispatch (CAD) data with transportation agencies
- Coordinate arterial and freeway management strategies
- Develop/implement system-wide arterial management strategies
- Reduce traffic congestion during incidents

### **Service Package:**

- TM08 Traffic Incident Management System

## **ITS STRATEGY #29: REGIONAL TRAFFIC MANAGEMENT**

This strategy provides for the sharing of information and control among traffic management centers to support regional traffic management strategies. Regional traffic management strategies that are supported include inter-jurisdictional, real-time coordinated traffic signal control systems and coordination between freeway operations and traffic signal control within a corridor. This strategy advances the Traffic Signal Control and Traffic Metering strategies by adding the communications links and integrated control strategies that enable integrated, interjurisdictional traffic management. The nature of optimization and extent of information and control sharing is

determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Traffic Signal Control and Traffic Metering strategies and adds hardware, software, and fixed-point communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of device control between traffic management centers.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Share incident information with other agencies
- Share congestion information with other agencies
- Improve signal timing/coordination
- Coordinate arterial and freeway management strategies
- Reduce traffic congestion during incidents
- Reduce recurring traffic congestion
- Implement/improve inter-jurisdictional signal coordination
- Develop/implement system-wide arterial management strategies

**Service Package:**

- TM07 Regional Traffic Management

### **ITS STRATEGY #30: TRAFFIC SIGNAL CONTROL**

This strategy provides the central control and monitoring equipment, communication links, and the signal control equipment that support traffic control at signalized intersections. A range of traffic signal control systems are represented by this strategy ranging from fixed-schedule control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. This strategy is generally an intrajurisdictional package. Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would also be represented by this package. Coordination of traffic signal systems using real-time communications is covered in the Regional Traffic Management strategy. This strategy is consistent with typical traffic signal control systems.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Improve signal timing/coordination
- Improve/implement ability to remotely modify signal timing
- Upgrade signal hardware
- Reduce recurring traffic congestion
- Implement/improve inter-jurisdictional signal coordination

**Service Package:**

- TM03 Traffic Signal Control



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**ITS STRATEGY #31: CONNECTED VEHICLE TRAFFIC SIGNAL SYSTEM**

This strategy uses both vehicle location and movement information from connected vehicles as well as infrastructure measurement of non-equipped vehicles to improve the operations of traffic signal control systems. The strategy utilizes the vehicle information to adjust signal timing for an intersection or group of intersections in order to improve traffic flow, including allowing platoon flow through the intersection. Other strategies provide related mobility services such as Transit Signal Priority, Freight Signal Priority, Emergency Vehicle Preemption, and Pedestrian Mobility to maximize overall arterial network performance.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Improve signal timing/coordination
- Upgrade signal hardware
- Implement intersection collision warning/avoidance systems
- Develop/implement system-wide arterial management strategies

**Service Packages:**

- TM04 Connected Vehicle Traffic Signal System

**ITS STRATEGY #32: INFRASTRUCTURE-BASED TRAFFIC SURVEILLANCE**

This strategy includes traffic detectors, other surveillance equipment, the supporting field equipment, and Center to Field communications to transmit the collected data back to the Traffic Management Center. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Center). The data generated by this strategy enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Traveler Information Center physical object.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Improve/implement ability to remotely modify signal timing
- Expand CCTV camera coverage on arterials and freeways/expressways
- Improve/expand vehicle detection coverage on freeways/expressways
- Implement/improve incident detection capabilities

**Service Package:**

- TM01 Infrastructure-Based Traffic Surveillance

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**ITS STRATEGY #33: SPEED WARNING AND ENFORCEMENT**

This strategy monitors vehicle speeds and supports warning drivers when their speed is excessive. Also the service includes notifications to an enforcement agency to enforce the speed limit of the roadway. Speed monitoring can be made via spot speed or average speed measurements. Roadside equipment can display the speed of passing vehicles and/or suggest a safe driving speed. Environmental conditions and vehicle characteristics may be monitored and factored into the safe speed advisories that are provided to the motorist. For example, warnings can be generated recognizing the limitations of a given vehicle for the geometry of the roadway such as rollover risk for tall vehicles. This service focuses on monitoring of vehicle speeds and enforcement of the speed limit while the variable speed limits service focuses on varying the posted speed limits to create more uniform speeds along a roadway, to promote safer driving during adverse conditions (such as fog) and/or to reduce air pollution.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Provide/enhance speed enforcement at high risk locations

**Service Package:**

- TM17 Speed Warning and Enforcement

**ITS STRATEGY #34: TRAFFIC METERING**

This strategy provides central monitoring and control, communications, and field equipment that support metering of traffic. It supports the complete range of metering strategies including ramp, interchange, and mainline metering. This package incorporates the instrumentation included in the TM01 strategy (traffic sensors are used to measure traffic flow and queues) to support traffic monitoring so responsive and adaptive metering strategies can be implemented. Also included is configurable field equipment to provide information to drivers approaching a meter, such as advance warning of the meter, its operational status (whether it is currently on or not, how many cars per green are allowed, etc.), lane usage at the meter (including a bypass lane for HOVs) and existing queue at the meter.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Reduce recurring traffic congestion
- Improve ramp metering operations

**Service Package:**

- TM05 Traffic Metering

**ITS STRATEGY #35: SPEED HARMONIZATION**

This strategy determines speed recommendations based on traffic conditions and weather information and uses connected vehicle technologies to assist in harmonizing speeds to these recommendations. The speed recommendations can be regulatory (e.g. variable speed limits) or advisory. The purpose of speed harmonization is to change traffic speed on links that approach areas of traffic congestion, bottlenecks, incidents, special events, and other conditions that affect flow. Speed harmonization assists in maintaining flow, reducing unnecessary stops and starts, and maintaining consistent speeds. The strategy utilizes connected vehicle V2I communication to detect the precipitating roadway or congestion conditions that might necessitate speed harmonization, to generate the appropriate response plans and speed recommendation strategies for upstream traffic, and to broadcast such recommendations to the affected vehicles. The speed recommendations can be provided in-vehicle for connected vehicles, or through roadside signage for non-connected vehicles.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Reduce recurring traffic congestion
- Implement variable speed limits

**Service Package:**

- TM21 Speed Harmonization

**ITS STRATEGY #36: DYNAMIC LANE MANAGEMENT AND SHOULDER USE**

This strategy provides for active management of travel lanes along a roadway. The package includes the field equipment, physical overhead lane signs and associated control electronics that are used to manage and control specific lanes and/or the shoulders. This equipment can be used to change the lane configuration on the roadway according to traffic demand and lane destination along a typical roadway section or on approach to or access from a border crossing, multimodal crossing or intermodal freight depot. This package can be used to allow temporary or interim use of shoulders as travel lanes. The equipment can be used to electronically reconfigure intersections and interchanges and manage right-of-way dynamically including merges. Also, lanes can be designated for use by special vehicles only, such as buses, high occupancy vehicles (HOVs), vehicles attending a special event, etc. Prohibitions or restrictions of types of vehicles from using particular lanes can be implemented. The lane management system can be centrally monitored and controlled by a traffic management center or it can be autonomous. This service also can include automated enforcement equipment that notifies the enforcement agency of violators of the lane controls.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Reduce recurring traffic congestion

**Service Package:**

- TM22 Dynamic Lane Management and Shoulder Use

**ITS STRATEGY #37: RAILROAD OPERATIONS COORDINATION**

This strategy provides an additional level of strategic coordination between freight rail operations and other transportation centers. Rail operations provides train schedules, maintenance schedules, and any other forecast events that will result in highway-rail intersection (HRI) closures. This information is used to develop forecast HRI closure times and durations that may be used in advanced traffic control strategies or to enhance the quality of traveler information.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Reduce vehicle delays at rail grade crossings, Provide health monitoring of traffic signal equipment at intersections and rail crossings

**Service Package:**

- TM15 Railroad Operations Coordination

**ITS STRATEGY #38: ADVANCED RAILROAD GRADE CROSSING**

This strategy manages highway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This strategy includes all capabilities from the Standard Railroad Grade Crossing strategy and augments these with additional safety features to mitigate the risks associated with higher rail speeds and leverage Connected Vehicle technologies. The active warning systems supported by this strategy include positive barrier systems that preclude entrance into the intersection when the barriers are activated. Like the Standard package, the HRI equipment is activated on notification by wayside interface equipment which detects, or communicates with the approaching train. In this strategy, the wayside equipment provides additional information about the arriving train so that the train's direction of travel, estimated time of arrival, and estimated duration of closure may be derived. This strategy will alert and/or warn drivers who are approaching an at-grade railroad crossing if they are on a crash-imminent trajectory to collide with a crossing or approaching train. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This strategy also includes additional detection capabilities that enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Reduce vehicle delays at rail grade crossings, Provide health monitoring of traffic signal equipment at intersections and rail crossings

**Service Package:**

- TM14 Advanced Railroad Grade Crossing

**ITS STRATEGY #39: STANDARD RAILROAD GRADE CROSSING**

This strategy manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Both passive (e.g., the crossbuck sign) and active warning systems (e.g., flashing lights and gates) are supported. (Note that passive systems exercise only the single interface between the ITS Roadway Equipment and the Driver in the physical view.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification of an approaching train by interfaced wayside equipment. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported to both highway and railroad officials through wayside interfaces and interfaces to the Traffic Management Center.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Reduce vehicle delays at rail grade crossings, Provide health
- monitoring of traffic signal equipment at intersections and rail crossings

**Service Package:**

- TM13 Standard Railroad Grade Crossing

**ITS STRATEGY #40: VEHICLE-BASED TRAFFIC SURVEILLANCE**

This strategy uses probe data information obtained from vehicles in the network to support traffic operations, including incident detection and the implementation of localized operational strategies. Since traffic data is collected from vehicles, travel times and other related traffic performance measures are available. This strategy includes the capability to collect data from Connected Vehicles so that "probe" data can be collected from all equipped vehicles, providing access to a large vehicle population as penetration increases. Incident detection enables transportation agencies to determine the location of potential incidents so the agencies can respond more quickly to the incident and mitigate any negative impacts to the transportation network. Vehicle data that can be used to detect potential incidents include changes in vehicle speeds indicating the disruption of traffic flow, when a vehicle's safety systems have been

activated or deployed, or sudden vehicle turns or deceleration at a specific location (indicating a potential obstacle in the roadway).

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Improve/expand vehicle detection coverage on freeways/expressways
- Implement/improve incident detection capabilities

**Service Package:**

- TM02 Vehicle-Based Traffic Surveillance

## **ITS STRATEGY #41: ROADWAY CLOSURE MANAGEMENT**

This strategy closes roadways to vehicular traffic when driving conditions are unsafe, maintenance must be performed, and other scenarios where access to the roadway must be prohibited. The strategy includes automatic or remotely controlled gates or barriers that control access to roadway segments including ramps and traffic lanes. Remote control systems allow the gates to be controlled from a central location or from a vehicle at the gate/barrier location, improving system efficiency and reducing personnel exposure to unsafe conditions during severe weather and other situations where roads must be closed. Surveillance systems allow operating personnel to visually verify the safe activation of the closure system and driver information systems (e.g., DMS) provide closure information to motorists in the vicinity of the closure. The equipment managed by this strategy includes the control and monitoring systems, the field devices (e.g., gates, warning lights, DMS, CCTV cameras) at the closure location(s), and the information systems that notify other systems of a closure. This strategy covers general road closure applications; specific closure systems that are used at railroad grade crossings, drawbridges, reversible lanes, etc. are covered by other Traffic Management strategies.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Implement automated/remote control gate systems

**Service Package:**

- TM19 Roadway Closure Management

## **ITS STRATEGY #42: VARIABLE SPEED LIMITS**

This strategy sets variable speed limits along a roadway to create more uniform speeds, to promote safer driving during adverse conditions (such as fog), and/or to reduce air pollution. Also known as speed harmonization, this service monitors traffic and environmental conditions along the roadway. Based on the measured data, the system calculates and sets suitable speed

limits, usually by lane. Equipment over and along the roadway displays the speed limits and additional information such as basic safety rules and current traffic information. The system can be centrally monitored and controlled by a traffic management center or it can be autonomous.

**Program Area:** Traffic Management

**ITS User Needs Addressed:**

- Implement variable speed limits

**Service Package:**

- TM20 Variable Speed Limits

### **ITS STRATEGY #43: ROUTING SUPPORT FOR EMERGENCY RESPONDERS**

This strategy provides information to support dynamic routing of emergency vehicles. Traffic information, road conditions, and weather advisories are provided to enhance emergency vehicle routing. The Emergency Management Center provides routing information based on real-time conditions and has the option to request an ingress/egress route from the Traffic Management Center.

**Program Area:** Public Safety

**ITS User Needs Addressed:**

- Provide/enhance mobile data terminals for emergency vehicles
- Provide incident and real-time traffic information to emergency responders and emergency management agencies
- Improve incident response
- Reduce incident clearance time

**Service Package:**

- PS02 Routing Support for  
Emergency Responders

### **ITS STRATEGY #44: VEHICLE EMERGENCY RESPONSE**

This strategy provides arriving public safety vehicles with information from connected vehicles involved in a crash. Emergency responders need information about the vehicles involved in a crash to respond safely and effectively to the vehicle crash. Information such as HAZMAT data can assist the responders. Information about air bag activations and other measures indicating the severity of the crash can provide useful input to ambulance staff. In addition information about the power system of the vehicle (e.g. hybrid, electric, or internal combustion engine) can affect the response.

**Program Area:** Public Safety

**ITS User Needs Addressed:**

- Provide/enhance mobile data terminals for emergency vehicles
- Provide incident and real-time traffic information to emergency responders and emergency management agencies
- Improve incident response
- Reduce incident clearance time

**Service Package:**

- PS05 Vehicle Emergency Response

**ITS STRATEGY #45: EMERGENCY CALL-TAKING AND DISPATCH**

This strategy provides basic public safety call-taking and dispatch services. It includes emergency vehicle equipment, equipment used to receive and route emergency calls, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between Emergency Management Centers supports emergency notification between agencies. Wide area wireless communications between the Emergency Management Center and an Emergency Vehicle supports dispatch and provision of information to responding personnel.

**Program Area:** Public Safety

**ITS User Needs Addressed:**

- Implement/upgrade computer aided dispatch (CAD) system for freeway service patrol
- Improve incident response
- Reduce incident clearance time
- Improve a multi-agency, system-coordinated response to major incidents

**Service Package:**

- PS01 Emergency Call-Taking and Dispatch

**ITS STRATEGY #46: ROADWAY SERVICE PATROLS**

This strategy supports roadway service patrol vehicles that monitor roads and aid motorists, offering rapid response to minor incidents (flat tire, accidents, out of gas) to minimize disruption to the traffic stream. If problems are detected, the roadway service patrol vehicles will provide assistance to the motorist (e.g., push a vehicle to the shoulder or median). The strategy monitors service patrol vehicle locations and supports vehicle dispatch to identified incident locations. Incident information collected by the service patrol is shared with traffic, maintenance and construction, and traveler information systems.

**Program Area:** Public Safety

**ITS User Needs Addressed:**



- Implement/upgrade computer aided dispatch (CAD) system for freeway service patrol
- Install/upgrade automatic vehicle location (AVL) on freeway service patrol vehicles and emergency vehicles
- Reduce incident clearance time

**Service Package:**

- PS08 Roadway Service Patrols

**ITS STRATEGY #47: INCIDENT SCENE PRE-ARRIVAL STAGING GUIDANCE FOR EMERGENCY RESPONDERS**

This strategy provides situational awareness to and coordination among emergency responders - upon dispatch, while enroute to establish incident scene work zones, upon initial arrival and staging of assets, and afterward if circumstances require additional dispatch and staging. It collects a variety of data from emergency, traffic, and maintenance centers. It includes a vehicle and equipment staging function that supplies the enroute responders with additional information about the scene of an incident that they can use to determine where to stage personnel and equipment prior to their arrival on-scene. The strategy also includes a dynamic routing function which provides emergency responders with real-time navigation instructions to travel from their base to the incident scene, accounting for traffic conditions, road closures, and snowplow reports if needed. In addition it includes an emergency responder status reporting function which continuously monitors the location of the enroute responder vehicles as well as the vehicles already on-scene. The function develops and maintains the current position of the responder's vehicles and provides updates for estimated time of arrival (ETA).

**Program Area:** Public Safety

**ITS User Needs Addressed:**

- Provide incident and real-time traffic information to emergency responders and emergency management agencies
- Improve incident response
- Reduce incident clearance time

**Service Package:**

- PS06 Incident Scene Pre-Arrival Staging Guidance for Emergency Responders

**ITS STRATEGY #48: EMERGENCY VEHICLE PREEMPTION**

This strategy provides signal preemption for public safety first responder vehicles. Both traditional signal preemption systems and new systems based on connected vehicle technology are covered. In more advanced systems, movement of public safety vehicles through the intersection can be facilitated by clearing queues and holding conflicting phases. In addition, this

SP also covers the transition back to normal traffic signal operations after providing emergency vehicle preemption.

**Program Area:** Public Safety

**ITS User Needs Addressed:**

- Improve incident response
- Reduce incident clearance time
- Expand emergency vehicle preemption

**Service Package:**

- PS03 Emergency Vehicle Preemption

## **ITS STRATEGY #49: MAYDAY NOTIFICATION**

This strategy provides the capability for a vehicle to automatically transmit an emergency message when the vehicle has been involved in a crash or other distress situation. An automatic crash notification feature transmits key data on the crash recorded by sensors mounted in the vehicle (e.g. deployment of airbags) without the need for involvement of the driver. The emergency message is sent to emergency response services, which determines and carries out the appropriate response. This strategy allows passing vehicles to receive and forward mayday requests in areas where no communications infrastructure exists. Emergency notifications from personal devices are also supported.

**Program Area:** Public Safety

**ITS User Needs Addressed:**

- Improve incident response

**Service Package:**

- PS04 Mayday Notification

## **ITS STRATEGY #50: TRANSPORTATION INFRASTRUCTURE PROTECTION**

This strategy includes the monitoring of transportation infrastructure (e.g., bridges, tunnels and management centers) for potential threats using sensors and surveillance equipment and barrier and safeguard systems to control access, preclude an incident, and mitigate the impact of an incident if it occurs. Threats can result from acts of nature (e.g., hurricanes, earthquakes), terrorist attacks or other incidents causing damage to the infrastructure (e.g., stray barge hitting a bridge support). Infrastructure may be monitored with acoustic, environmental threat (such as nuclear, biological, chemical, and explosives), infrastructure condition and integrity, motion and object sensors and video and audio surveillance equipment. Data from such sensors and surveillance equipment may be processed in the field or sent to a center for processing. The data

enables operators at the center to detect and verify threats. When a threat is detected, agencies are notified. Detected threats or advisories received from other agencies result in an increased level of system preparedness. In response to threats, barrier and safeguard systems may be activated to deter an incident, control access to an area or mitigate the impact of an incident. Barrier systems include gates, barriers and other automated and remotely controlled systems that manage entry to transportation infrastructure. Safeguard systems include blast shields, exhaust systems and other automated and remotely controlled systems that mitigate impact of an incident.

**Program Area:** Public Safety

**ITS User Needs Addressed:**

- Monitor transportation infrastructure

**Service Package:**

- PS09 Transportation Infrastructure Protection

## **ITS STRATEGY #51: WIDE-AREA ALERT**

This strategy uses ITS driver and traveler information systems to alert the public in emergency situations such as child abductions, severe weather events, civil emergencies, and other situations that pose a threat to life and property. The alert includes information and instructions for transportation system operators and the traveling public, improving public safety and enlisting the public's help in some scenarios. The ITS technologies will supplement and support other emergency and homeland security alert systems such as the Emergency Alert System (EAS). When an emergency situation is reported and verified and the terms and conditions for system activation are satisfied, a designated agency broadcasts emergency information to traffic agencies, transit agencies, information service providers, toll operators, and others that operate ITS systems. The ITS systems, in turn, provide the alert information to transportation system operators and the traveling public using ITS technologies such as dynamic message signs, highway advisory radios, in-vehicle displays, transit displays, 511 traveler information systems, and traveler information websites.

**Program Area:** Public Safety

**ITS User Needs Addressed:**

- Improve communications in rural areas
- Improve incident notification to agencies and improve interagency communications

**Service Package:**

- PS10 Wide-Area Alert

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**ITS STRATEGY #52: EARLY WARNING SYSTEM**

This strategy monitors and detects potential, looming, and actual disasters including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and acts of terrorism including nuclear, chemical, biological, and radiological weapons attacks). The strategy monitors alerting and advisory systems, ITS sensors and surveillance systems, field reports, and emergency call-taking systems to identify emergencies and notifies all responding agencies of detected emergencies.

**Program Area:** Public Safety

**ITS User Needs Addressed:**

- Improve a multi-agency, system-coordinated response to major incidents
- Improve incident notification to agencies and improve interagency communications

**Service Package:**

- PS11 Early Warning System

**ITS STRATEGY #53: EVACUATION AND REENTRY MANAGEMENT**

This strategy supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. The strategy addresses evacuations for all types of disasters, including disasters like hurricanes that are anticipated and occur slowly, allowing a well-planned orderly evacuation, as well as disasters like terrorist acts that occur rapidly, without warning, and allow little or no time for preparation or public warning.

This strategy supports coordination of evacuation plans among the federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation. All affected jurisdictions (e.g., states and counties) at the evacuation origin, evacuation destination, and along the evacuation route are informed of the plan. Information is shared with traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. Reversible lanes, shoulder use, closures, special signal control strategies, and other special strategies may be implemented to maximize capacity along the evacuation routes. Transit resources play an important role in an evacuation, removing many people from an evacuated area while making efficient use of limited capacity. Additional shared transit resources may be added and managed in evacuation scenarios. Resource requirements are forecast based on the evacuation plans, and the necessary resources are located, shared between agencies if necessary, and deployed at the right locations at the appropriate times.

**Program Area:** Public Safety

**ITS User Needs Addressed:**

- Improve a multi-agency, system-coordinated response to major incidents

**Service Package:**

- PS13 Evacuation and Reentry Management

## **ITS STRATEGY #54: DISASTER RESPONSE AND RECOVERY**

This strategy enhances the ability of the surface transportation system to respond to and recover from disasters. It addresses the most severe incidents that require an extraordinary response from outside the local community. All types of disasters are addressed including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and national security emergencies such as nuclear, chemical, biological, and radiological weapons attacks). The strategy supports coordination of emergency response plans, including general plans developed before a disaster as well as specific tactical plans with short time horizon that are developed as part of a disaster response. The strategy provides enhanced access to the scene for response personnel and resources, provides better information about the transportation system in the vicinity of the disaster, and maintains situation awareness regarding the disaster itself. In addition, this strategy tracks and coordinates the transportation resources - the transportation professionals, equipment, and materials - that constitute a portion of the disaster response. The strategy identifies the key points of integration between transportation systems and the public safety, emergency management, public health, and other allied organizations that form the overall disaster response. In this strategy, the Emergency Management Center represents the federal, regional, state, and local Emergency Operations Centers and the Incident Commands that are established to respond to the disaster. The interface between the Emergency Management Center and the other centers provides situation awareness and resource coordination among transportation and other allied response agencies. In its role, traffic management implements special traffic control strategies and detours and restrictions to effectively manage traffic in and around the disaster. Maintenance and construction provides damage assessment of road network facilities and manages service restoration. Transit management provides a similar assessment of status for transit facilities and modifies transit operations to meet the special demands of the disaster. As immediate public safety concerns are addressed and disaster response transitions into recovery, this strategy supports transition back to normal transportation system operation, recovering resources, managing on-going transportation facility repair, supporting data collection and revised plan coordination, and other recovery activities.

**Program Area:** Public Safety

### **ITS User Needs Addressed:**

- Improve a multi-agency, system-coordinated response to major incidents
- Improve incident notification to agencies and improve interagency communications

### **Service Package:**

- PS12 Disaster Response and Recovery

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**ITS STRATEGY #55: MAINTENANCE AND CONSTRUCTION ACTIVITY COORDINATION**

This strategy supports the dissemination of maintenance and construction activity to centers that can utilize it as part of their operations, or to Transportation Information Centers who can provide the information to travelers. Center to center coordination of work plans supports adjustments to reduce disruption to regional transportation operations.

**Program Area:** Maintenance and Construction

**ITS User Needs Addressed:**

- Provide information on roadway construction and maintenance activities
- Coordinate construction and maintenance project schedules within and between agencies

**Service Package:**

- MC08 Maintenance and Construction Activity Coordination

**ITS STRATEGY #56: WORK ZONE MANAGEMENT**

This strategy manages work zones, controlling traffic in areas of the roadway where maintenance, construction, and utility work activities are underway. Traffic conditions are monitored using CCTV cameras and controlled using dynamic message signs (DMS), Highway Advisory Radio (HAR), gates and barriers. Work zone information is coordinated with other groups (e.g., TIC, traffic management, other maintenance and construction centers). Work zone speeds and delays are provided to the motorist prior to the work zones. This strategy provides control of field equipment in all maintenance and construction areas, including fixed, portable, and truck-mounted devices supporting both stationary and mobile work zones.

**Program Area:** Maintenance and Construction

**ITS User Needs Addressed:**

- Provide travel times/delays through work zones
- Coordinate construction and maintenance project schedules within and between agencies
- Provide/enhance enforcement in work zones
- Warn travelers about trucks entering/existing work zones

**Service Package:**

- MC06 Work Zone Management

**ITS STRATEGY #57: WORK ZONE SAFETY MONITORING**

This strategy provides warnings to maintenance personnel within a work zone about potential hazards within the work zone. It enables vehicles or the infrastructure to provide warnings to

workers in a work zone when a vehicle is moving in a manner that appears to create an unsafe condition (e.g., moving at high speed or entering the work zone).

**Program Area:** Maintenance and Construction

**ITS User Needs Addressed:**

- Implement Smart Work Zone technology
- Warn work crews of errant vehicles
- Warn travelers about trucks entering/existing work zones

**Service Package:**

- MC07 Work Zone Safety Monitoring

### **ITS STRATEGY #58: MAINTENANCE AND CONSTRUCTION VEHICLE AND EQUIPMENT TRACKING**

This strategy tracks the location of maintenance and construction vehicles and other equipment to ascertain the progress of their activities. Checks can include ensuring the correct roads are being plowed and work activity is being performed at the correct locations.

**Program Area:** Maintenance and Construction

**ITS User Needs Addressed:**

- Implement Smart Work Zone technology
- Track locations of maintenance fleet

**Service Package:**

- MC01 Maintenance and Construction Vehicle and Equipment Tracking

### **ITS STRATEGY #59: ROADWAY MAINTENANCE AND CONSTRUCTION**

This strategy supports numerous services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Maintenance services include landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting), and repair and maintenance of both ITS and non-ITS equipment on the roadway (e.g., signs, traffic controllers, traffic detectors, dynamic message signs, traffic signals, CCTV, etc.). Environmental conditions information is also received from various weather sources to aid in scheduling maintenance and construction activities.

**Program Area:** Maintenance and Construction

**ITS User Needs Addressed:**

- Coordinate construction and maintenance project schedules within and between agencies

**Service Package:**

- MC05 Roadway Maintenance and Construction

**ITS STRATEGY #60: CURVE SPEED WARNING**

This strategy allows connected vehicles to receive information that it is approaching a curve along with the recommended speed for the curve. This capability allows the vehicle to provide a warning to the driver regarding the curve and its recommended speed. In addition, the vehicle can perform additional warning actions if the actual speed through the curve exceeds the recommended speed.

**Program Area:** Vehicle Safety

**ITS User Needs Addressed:**

- Provide curve speed warning

**Service Package:**

- VS05 Curve Speed Warning

**ITS STRATEGY #61: ROAD WEATHER MOTORIST ALERT AND WARNING**

This strategy collects road weather data from connected vehicles and uses that data to develop short term warnings or advisories that can be provided to individual motorists. The information may come from either vehicles operated by the general public and commercial entities (including passenger cars and trucks) or specialty vehicles and public fleet vehicles (such as snowplows, maintenance trucks, and other agency pool vehicles). The raw data will be processed in a controlling center to generate road segment-based data outputs. The processing will also include a road weather motorist alerts algorithm to generate short time horizon alerts that will be pushed to user systems and available to commercial service providers. In addition the information collected can be combined with observations and forecasts from other sources to provide medium (next 2-12 hours) or long term (more than 12 hours) advisories through a variety of interfaces including web based and connected vehicle based interfaces.

**Program Area:** Vehicle Safety

**ITS User Needs Addressed:**

- Provide/enhance road weather conditions information to travelers

**Service Package:**

- VS07 Road Weather Motorist Alert and Warning



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**ITS STRATEGY #62: OVERSIZE VEHICLE WARNING**

The strategy uses external measurements taken by the roadside infrastructure, and transmitted to the vehicle, to support in-vehicle determination of whether an alert/warning is necessary. Specifically, the infrastructure data equipment detects and measures the approaching vehicle's height and width. The infrastructure component of the strategy transmits the vehicle measurements, along with bridge, overpass, or tunnel geometry, to the oversize vehicle. The vehicle application utilizes this data to determine whether the vehicle can clear the bridge or tunnel. If deemed necessary, the driver is alerted to the impending low height and/or narrow horizontal clearance bridge or tunnel prior to a decision point, enabling the vehicle to reroute and avoid a collision. If the driver ignores the alert and continues along the route, the vehicle will generate a warning indicating an impending collision at a point near the bridge or tunnel approach. To support unequipped vehicles the infrastructure will display warning or reroute information when the measurements indicate that a vehicle does not have adequate height or width clearance. This strategy can be expanded to consider weight as well as height and width.

**Program Area:** Vehicle Safety

**ITS User Needs Addressed:**

- Provide vehicle-over-height detection/warnings

**Service Package:**

- VS11 Oversize Vehicle Warning

**ITS STRATEGY #63: WEATHER INFORMATION PROCESSING AND DISTRIBUTION**

This strategy processes and distributes the environmental information collected from the Weather Data Collection strategy. This strategy uses the environmental data to detect environmental hazards such as icy road conditions, high winds, dense fog, etc. so operational centers and decision support systems can make decision on corrective actions to take. The continuing updates of road condition information and current temperatures can be used to more effectively deploy road maintenance resources, issue general traveler advisories, issue location specific warnings to drivers using the Traffic Information Dissemination strategy, and aid operators in scheduling work activity.

**Program Area:** Weather

**ITS User Needs Addressed:**

- Expand coverage of environmental/weather/road conditions detection/monitoring systems

**Service Packages:**

- WX02 Weather Information  
Processing and Distribution

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**ITS STRATEGY #64: WEATHER DATA COLLECTION**

This strategy collects current road and weather conditions using data collected from environmental sensors deployed on and about the roadway. It also collects data from vehicles in the road network that can be used to directly measure or infer current environmental conditions. It leverages vehicle on-board systems that measure temperature, sense current weather conditions (rain and sun sensors) and also can monitor aspects of the vehicle operational status (e.g., use of headlights, wipers, and traction control system) to gather information about local environmental conditions. In addition, environmental sensor systems located on Maintenance and Construction Vehicles are also potential data sources. The collected environmental data is used by the Weather Information Processing and Distribution strategy to process the information and make decisions on operations. The collected environmental data may be aggregated, combined with data attributes and sent to meteorological systems for data qualification and further data consolidation. The strategy may also request and receive qualified data sets from meteorological systems.

**Program Area:** Weather

**ITS User Needs Addressed:**

- Expand coverage of environmental/weather/road conditions detection/monitoring systems

**Service Packages:**

- WX01 Weather Data Collection

**ITS STRATEGY #65: SPOT WEATHER IMPACT WARNING**

This strategy will alert drivers to unsafe conditions or road closure at specific points on the downstream roadway as a result of weather-related impacts, which include, but are not limited to high winds, flood conditions, ice, or fog. The strategy is designed to use standalone weather systems to warn drivers about inclement weather conditions that may impact travel conditions. Real time weather information is collected from fixed environmental sensor stations and vehicle based sensors. The information is processed to determine the nature of the alert or warning to be delivered and then communicated to connected vehicles. If the warning includes road closure then diversion information can be provided. For non-equipped vehicles the alerts or warnings will be provided via roadway signage. In addition, the roadway equipment may calculate the appropriate speed for current weather conditions and provide this information to the connected vehicle or on roadway signage.

**Program Area:** Weather

**ITS User Needs Addressed:**

- Expand coverage of environmental/weather/road conditions detection/monitoring systems

**Service Packages:**

- WX03 Spot Weather Impact Warning

**ITS STRATEGY #66: PARKING SPACE MANAGEMENT**

This strategy monitors and manages parking spaces in lots, garages, and other parking areas and facilities. It assists in the management of parking operations by monitoring parking lot ingress and egress, parking space occupancy and availability. Infrastructure-based detectors and/or connected vehicles may be used to monitor parking occupancy. The strategy shares collected parking information with local drivers and information providers for broader distribution.

**Program Area:** Parking Management

**ITS User Needs Addressed:**

- Provide information on available truck parking facilities

**Service Packages:**

- PM01 Parking Space Management