APPENDIX

B NEW AND MODIFIED U.S. ELEMENTS

B-1 *NEW PHYSICAL OBJECTS*

Appendix B1 – New U.S. Physical Objects

Physical Object Name	Description
Authorizing Center	The 'Authorizing Center' provides the functionality needed to enable data exchange between and among mobile and fixed transportation users. Its primary mission is to enable safety, mobility and environmental communications-based applications for both mobile and non-mobile users. The Authorizing Center has some jurisdiction over limited access resources; typically this includes roadside application access and radio spectrum licensing. It may be implemented as an autonomous center or as a set of supporting services that are co-located within another center.
Basic Emergency Vehicle	The 'Basic Emergency Vehicle' represents the interfaces with on-board equipment on a public safety vehicle. It includes a specialized databus that may be subject to different vehicle databus standards and hosts a broad range of components that are specific to emergency vehicles including the lightbar/siren and on-board apparatus that supports law enforcement, firefighting, emergency medical services, and towing/recovery.
Center	This general physical object is used to model core capabilities that are common to any center.
Center Personnel	'Center Personnel' represent system operators and other personnel that work within a transportation center. This interface supports modeling of general human interactions that are common to any center.
Certification System	The 'Certification System' verifies that devices and applications meet standards for participation in the ITS environment. Particular requirements vary depending on the type of certification; applications may be certified for performance and adherence to standards or specifications; devices may be similarly certified, and will also typically be subject to security-related interrogation.
Certification System Operator	The 'Certification System Operator' represents the human operator who monitors and manages ITS device and application certification.
Commercial Vehicle Administrator	The 'Commercial Vehicle Administrator' represents the people who provide overall management, administration, review, and enforcement duties for the Commercial Vehicle Administration Center.
Cooperative ITS Credentials Management System	The 'Cooperative ITS Credentials Management System' (CCMS) is a high-level aggregate representation of the interconnected systems that enable trusted communications between mobile devices and other mobile devices, roadside devices, and centers and protect data they handle from unauthorized access. Representing the different interconnected systems that make up a Public Key Infrastructure (PKI), this physical object represents an end user view of the credentials management system with focus on the exchanges between the CCMS and user devices that support the secure distribution, use, and revocation of trust credentials.
Credentials Management System Operator	The 'Credentials Management System Operator' represents the person or people that monitor and manage the Cooperative ITS Credentials Management System. These personnel monitor and manage the secure distribution, use, and revocation of trust credentials.
Data Distribution System	The 'Data Distribution System' collects, processes, and distributes ITS data, connecting data producers with data consumers and facilitating data exchange.
Data Distribution System Operator	The 'Data Distribution System Operator' represents the person or people that monitor and manage the data services provided by the Data Distribution System (DDS). These personnel manage and monitor the systems that support the publish/subscribe services of the DDS.
Electric Charging Station	The 'Electric Charging Station' provides access to electric vehicle supply equipment that is used to charge hybrid and all-electric vehicles. This includes public charging stations that support consumers, workplace charging stations, and fleet charging stations.
Field	This general physical object is used to model core capabilities that are common to any piece of field equipment.

Appendix B1 – New U.S. Physical Objects

Physical Object Name	Description
Field Maintenance Equipment	'Field Maintenance Equipment' represents the portable equipment used by field personnel to locally troubleshoot, initialize, reprogram, and test infrastructure equipment. It may include a laptop, specialized diagnostics tools, or any other general purpose or specialized equipment that is interfaced locally to infrastructure equipment to support maintenance and repair.
Field System Operator	'Field System Operator' represents the operators of field equipment such as parking management systems, intermodal terminals, and other field equipment that is supported by a local operator. The interface supports modeling of general human interface interactions that are common to all staffed field equipment.
Freight Consolidation Station	The 'Freight Consolidation Station' is an intermediate point (usually an intermodal terminal located at a port) prior to (or after) container-based shipping, where less-than-container load or less-than-truckload cargoes are consolidated into full container loads (or full containers are disbursed), for cost-effective intermodal shipping.
Freight Distribution and Logistics Center	The 'Freight Distribution and Logistics Center' provides intermodal logistics support and support for the efficient distribution of freight across transport systems and modes. This can include consolidation arrangements, warehousing, and consignor-to-consignee intermodal shipping arrangements. These capabilities may be provided as part of intermodal fleet management activities or can be provided by an independent logistics specialist.
Identifier Registry	The 'Identifier Registry' maintains identifiers that must be unique to facilitate interoperability in the connected vehicle environment.
ITS Communications Equipment	'ITS Communications Equipment' includes the communications hardware and software that supports secure, reliable communications. It provides the layered protocols and communications services and includes the physical network plant and network hardware that supports ITS communications. It also encompasses security services that protect communications and the management services that support network management. This physical object allows transportation stakeholders that are implementing their own communications solution to represent this implementation in their ITS architecture. The communications capabilities provided by this physical object are frequently purchased from a third party provider. When communications is a purchased service, the hardware and software included in this physical object are largely transparent to transportation stakeholders and may be transparent to the ITS architecture.
ITS Object	The general 'ITS Object' includes core capabilities common to any class of object.
MAP GIS Operator	The 'Map GIS Operator' represents the person or people that manage GIS updates, supporting import and translation of source data, preparing the base map and information layers, and providing oversight and management for incremental releases of updated map data.
Network Time Source	The 'Network Time Source' represents the external time source the Connected Vehicle Service Monitor System uses as the basis for time. This is likely implemented as a Stratum-2 Network Time Server that is 2 steps removed from a basic time source (e.g., atomic clock).
Object Registration and Discovery System	The 'Object Registration and Discovery System' represents one or more center-based applications that provide registration and lookup services necessary to allow objects to locate (for communications purposes) other objects operating within the Connected Vehicle Environment. These registration and discovery services are support services that enable other applications.
ORDS Operator	The 'Object Registration and Discovery System Operator' represents the person or people that monitor and manage the Object Registration and Discovery System.
Other Authorizing Centers	'Other Authorizing Centers' provides a source and destination for information flows between multiple authorizing centers that manage permissions for the Connected Vehicle Environment. The interface represented by this object enables coordination of permissions between centers in different regions, jurisdictions, or application areas.

Appendix B1 – New U.S. Physical Objects

Physical Object Name	Description
Other Connected Vehicle Roadside Equipment	Representing another Connected Vehicle Roadside Equipment, 'Other Connected Vehicle Roadside Equipment' supports peer to peer communication and direct coordination between RSEs. It provides a source and destination for information that may be exchanged between RSEs.
Other Credentials Management Systems	Representing another Cooperative ITS Credentials Management System (CCMS), 'Other Credentials Management Systems' is intended to provide a source and destination for information exchange between peer credentials management systems. It supports modeling of projects or regions that include multiple interconnected CCMS that manage credentials distribution and management in the connected vehicle environment.
Other Data Distribution Systems	Representing another Data Distribution System, 'Other Data Distribution Systems' is intended to provide a source and destination for information exchange between peer (e.g. inter-regional) data distribution systems. It supports modeling of projects or regions that include multiple interconnected data distribution systems that together manage data distribution in the connected vehicle environment.
Other EV OBEs	This represents on-board equipment on other emergency (e.g., law enforcement, fire, EMS, towing and recovery) vehicles. It provides a source and destination for ITS information transfers between emergency vehicles. These information transfers allow information to be shared between emergency vehicles arriving, or involved at, an incident. Vehicle to vehicle communications at incident locations facilitates incident coordination and personal safety.
Other Freight Distribution and Logistics Centers	Representing another Freight Distribution and Logistics Center, 'Other Freight Distribution and Logistics Center ' provides a source and destination for information exchange between peer centers. It enables sharing of intermodal logistics support information between centers.
Other Identifier Registries	'Other Identifier Registries' provides a source and destination for information flows between registries, supporting coordination between registries.
Other ITS Objects	Representing other ITS Objects, 'Other ITS Objects' provides a source and destination for information exchange between ITS Objects.
Other Map Update Systems	Representing other distinct Map Update Systems, this object is intended to provide a source and destination for ITS information flows between peer map update providers. It enables cooperative information sharing between base map and specialized map providers and any other exchange of geographic information between map data providers.
Personnel Device	'Personnel Device' represents devices used by emergency personnel or maintenance and construction personnel in the field. In the case of emergency personnel, the devices would include body cameras or smartphones (and their peripherals) that can be used by emergency personnel to provide images or video as well as send or receive data regarding the incident. The devices could also be used for incident scene safety messages to the personnel. In the case of maintenance and construction field personnel, the devices could be cellular phones or specialized safety devices that would be used for work zone safety messages to the personnel.
Population and Housing Data System	'Population and Housing Data System' provides U.S. Census data and other local, county, and state population and housing surveys that can be used to support evacuation planning.
Position Corrections Source	The 'Position Corrections Source' represents the external source of land-based position corrections that augment satellite-provided (e.g., GPS) positioning data.
Service Monitor System	The 'Service Monitor System' represents one or more center-based systems that provide monitoring, management and control services necessary to other applications and/or devices operating within the Connected Vehicle Environment. These support services enable other applications to provide transportation services.
Service Monitor System Operator	The 'Service Monitor System Operator' represents the person or people that monitor and manage the Service Monitor System.

Appendix B1 – New U.S. Physical Objects

Physical Object Name	Description
Social Media	'Social Media' provides forums for social interaction and opportunities for gathering and distributing traveler information. These sites provide crowd sourced information and the opportunity to provide traveler information to specific communities of interest. Examples include Facebook, Twitter, and LinkedIn. Each social media platform offers its own tools and API that allow integration of web content into a shared social media experience.
Special Needs Registry	The 'Special Needs Registry' allows residents with medical needs and organizations assisting those with social needs to register special needs populations so that agencies can communicate emergency preparedness, response and recovery resources to vulnerable, at risk, and hard-to-reach residents.
Support Maintenance Equipment	'Support Maintenance Equipment' represents the equipment used by IT personnel and technicians to locally or remotely troubleshoot, initialize, reprogram, and test IT assets that support ITS operations. It may include a laptop, specialized diagnostics tools, or any other general purpose or specialized equipment that is interfaced remotely or locally to support maintenance, repair, and upgrade.
Support Maintenance Personnel	'Support Maintenance Personnel' represents technicians and IT personnel that support maintenance of information technology assets that support ITS.
Traffic Regulatory Authority Center	The 'Traffic Regulatory Authority Center' is the authoritative source for traffic rules, regulations, ordinances and statutes that have official status and must be understood by all motor vehicle operators and intelligent vehicles that operate at higher automation levels. This center may represent multiple authorities that operate at local, regional, state, and national levels and represents organizations that establish, manage, and enact the traffic code.
Vehicle Service Center	'Vehicle Service Center' represents vehicle service centers that collect vehicle diagnostic information from vehicles and provide service options for drivers of these vehicles. The physical object also includes centers operated by vehicle manufacturers that can coordinate with connected vehicles to obtain vehicle operating data and provide software or data updates to connected vehicles that they have manufactured.
Wide Area Information Disseminator System	The 'Wide Area Information Disseminator System' represents the center based systems and communications equipment that is used to send messages to equipped vehicles using wide-area wireless communications such as satellite radio, terrestrial FM broadcast subcarrier, or cellular data networks.

B-2 NEW INFORMATION FLOWS

Appendix B2 – New U.S. Information Flows

Information Flow Name	Description
access violation notification	Notification to an individual vehicle that it has committed a lane violation. The flow identifies the nature of the violation and the time and location where the violation was recorded.
application test response	Response to an application stimulus, typically used to verify the application's performance and behavior.
application test stimulus	Input provided to verify the performance of an application. Typically will prompt (stimulate) the target under examination in order to measure the response.
authorization coordination	Sharing of pseudonym certificate policies and end entity enrollments and revocations to support authorization of end entities that are enrolled with another trusted CCMS.
available loads	Request from a shipper (consignor) for services to handle shipping of a container or freight load. Aggregated, this information represents the available loads to be shipped from intermodal customer locations in the region.
available truck capacity	An indication of available truck (power), equipment (chassis), and container capacity for use in load matching.
border card data	Personal identification data from ID cards used by travelers at border crossings.
border security input	Information regarding security related events occurring at the border.
border wait times data	Measure of current, actual, or predicted wait time at border. Measurement provided by vehicle type, lane, and type of lane (e.g., NEXUS vs. regular).
carrier participation report	Report that summarizes motor carrier participation in CVO programs. Used to identify the level of active participation and to report which enrolled carriers are not participating as expected.
center equipment commands	System-level control commands issued to center equipment such as reset and remote diagnostics.
center equipment configuration settings	Control settings and parameters that are used to configure center equipment.
center equipment software install/upgrade	This flow supports installation and update of software residing in centers. It supports download and installation of center software, including executable code and associated support files.
center equipment status	Reports from center equipment (computers, networks, video walls, etc.) which indicate current operational status.
center fault data	Fault information that can be used to identify centers that require initialization, reconfiguration, or repair. This flow identifies the center, the nature of the fault, and associated error codes and diagnostic data.
center operator data	Data presented to a center operator. This flow represents general status output and other data that broadly applies to transportation centers.
center operator input	Input from a center operator. This flow represents operator input that broadly applies to transportation centers.
center status	Represents the interactive monitoring of system operations by the Service Monitor. It includes device housekeeping/heartbeat monitoring and network monitoring information, the status of installed applications, and the configuration of managed devices.
certification operator input	User input from certification personnel that support monitoring, management, and documentation of the certification process and results.
certification operator presentation	Presentation of certification information to personnel that supports monitoring, management, and documentation of the certification process and results.
certification results	Identification of device (type) and certification tests that it passed and failed.
commercial vehicle driver updates	General advisories and information provided to the commercial driver regarding current traffic and road conditions and service availability.
commercial vehicle incident response information	This flow provides data containing an acknowledgement of the commercial vehicle incident notification and provides post-incident instructions.
commercial vehicle permit information	Information about commercial vehicle permits for oversize, overweight, or for dangerous goods.

Appendix B2 – New U.S. Information Flows

Information Flow Name	Description
commercial vehicle status	Current status of the commercial vehicle and associated freight equipment. This includes temperature, humidity, power, battery levels, brake wear data, door open/closed status, chassis bare/covered status)
commercial vehicle trip information	Information about vehicle trips including load information, location, speed, and routing. The information would be sanitized for distribution outside of the commercial vehicle company.
communications signature	Communications from devices on-board a vehicle, including personal devices that are carried into the vehicle, that can be monitored by ITS field equipment to uniquely identify the vehicle. This flow represents communications from Bluetooth device(s) on-board a vehicle that may be monitored by ITS field equipment or any other passive or active communications from the vehicle that can be used to identify a vehicle to support traffic monitoring. This flow specifically covers passive monitoring of vehicle communications. Other information flows cover active communications between ITS equipment on-board a vehicle and ITS field equipment.
conflict monitor status	A control flow that supports failsafe operation in the event that a conflict is detected that requires the RSE to enter a failsafe operating mode.
connection protection instructions	A request to hold at a specific stop for a specified time period to protect connections. This flow would also include subsequent adjustments to, or cancellation of, a hold request.
consolidated agency response	Electronic manifest data as well as commercial vehicle screening results.
container availability request	Request for information on the availability of a container at an Intermodal Terminal.
container availability status	Information regarding the availability of a container at an Intermodal Terminal.
container delivery confirmation	Notice confirming the arrival and transfer of control of a container at a container handling facility, for example an intermodal terminal.
container delivery request	Request for permission to deliver a container to an intermodal facility.
container identification	A unique identification of a container that can be used to associate the container with a manifest and other important data.
container identification request	Request to a container to provide its identification information; may require the requestor to authenticate their identity.
container location	The location of a container, to sufficient accuracy to allow efficient container management.
container manifest	Official statement of the cargo held in a container.
container pickup confirmation	Notice confirming that a container has been picked up at an intermodal facility and that control has been transferred to a shipping or drayage agency.
container pickup request	Request for permission to pickup a container at an intermodal transfer facility.
container seal interrogation	Customs inspection of the electronic seal on a container to verify the container has not been opened or tampered with; requires proper authentication.
container seal status	The status of an electronic seal on a container, indicating sealing time, location, and authority, and any openings or tampering.
container transfer location	Location within an intermodal facility that a container is to be received at or delivered to; may include guidance as well as location.
container transfer location request	Request for the location within an intermodal facility for the transfer of a container.
container transport assignment	Instructions to a commercial vehicle for the transportation of a container.
current charging status	Current charging status including current charge rate, estimated time to completion, and cost associated with the charge.
cv driver safety alert	Driver alerts based on operator safety sensors, including driver alertness.
cv driver safety status	Information from on-board sensors regarding the commercial vehicle driver's ability to operate the vehicle safely, including information on driver alertness.

Information Flow Name	Description
data provision	Data provision provides the source material for a publish-subscribe or query-retrieval data distribution scheme. This is the 1 of the 1:N data distribution architecture. This flow is a super-flow; it does not define data elements but is inclusive of any flow implemented using publish-subscribe or query-retrieval methods.
data publication	Data publication includes those dialogs necessary to satisfy the publication portion of a data distribution architecture. The information content varies widely based on available content and the subscription, but it generally includes information on the state of transportation system operations including traffic and road conditions, advisories, incidents, transit service information, weather information, parking information, and other related data.
data query	Data query includes those dialogs necessary to determine what data is available for and also submit a query for near-term response.
data query publication	Data query publication includes those dialogs necessary to satisfy the response portion of a query-response action using the data distribution architecture. The information content varies widely based on available content and the query, but it generally includes information on the state of transportation system operations including traffic and road conditions, advisories, incidents, transit service information, weather information, parking information, and other related data.
data subscription	Data subscription includes those dialogs necessary to determine what data is available for subscription/query, and also the dialogs necessary to create or modify data subscriptions/queries.
device control request	Request for device control action
device data	Data from detectors, environmental sensor stations, roadside equipment, and traffic control devices, including device inventory information.
device enrollment information	Information provided by an end entity to support enrollment and authorization for the Connected Vehicle environment. This includes device identification, requested permissions and restrictions, and security credentials used to establish the current level of trust and eligibility for enrollment and authorization.
device identification	An identifier and device type designation that is used to uniquely identify a device in the Connected Vehicle Environment.
device status	Status information from devices
device test response	Response to a device stimulus, typically used to verify the device's performance and behavior.
device test stimulus	Input provided to verify the performance of a device. Typically will prompt (stimulate) the target under examination in order to measure the response.
driver environmental input	Current road (e.g., surface conditions, icing, snow depths) and surface weather conditions (e.g., visibility, precipitation) as reported by the driver.
electric charging services inventory	Aggregate information provided for electric charging stations identifying the location, operating hours, current availability, charging capacity and standards supported, access restrictions, and rates/fee structure for each station.
electric charging station information	Information provided for electric charging stations identifying the location, operating hours, current availability, charging capacity and standards supported, access restrictions, and rates/fee structure.
emergency traffic coordination	Coordination supporting disaster response including evacuation and reentry. Includes coordination of special traffic control strategies that support efficient evacuation and reentry while protecting and optimizing movement of response vehicles and other resources responding to the emergency.
emissions situation data	Emissions-related data as measured and reported by connected vehicles. This flow carries aggregated and filtered data including average and current emissions reported by vehicles as well as associated data (vehicle profiles and speeds) that can be used to estimate aggregate emissions.

Information Flow Name	Description
enrollment coordination	Sharing of enrollment policies, certification mechanisms, registration and deregistration identifier types, registered and deregistered end entities, and other information that supports enrollment process coordination with another CCMS.
enrollment credentials	Long-term security credentials such as 'enrollment certificates' that demonstrate the trust-worthiness of the source device or application.
environmental monitoring application info	Environmental monitoring application parameters and thresholds that control the filtering, aggregation, and range of measures that are collected, derived, and reported. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
equipment control commands	System-level control commands issued to the RSE such as reset and remote diagnostics.
evacuation assistance information	Information on evacuation resources including self-evacuation options, anticipated pickup time and location if a transportation asset is to be deployed, destination shelter, and supporting information on what to bring, estimated reentry date/time.
evacuation assistance request	A request for evacuation assistance, which may be registered in advance or issued during an evacuation. It specifies the location, number of people that need to be evacuated, and any special needs/requirements.
evacuee match information	Shelter recommendations and assignments that were made to evacuees. This information can be used to forecast evacuee arrivals and shelter availability.
event transit service plans	Transit service plans to support the special event. This may include additional runs, tighter headways, stop changes, and other changes to standard operations to accommodate the special event.
field device coordination	Coordination between operating centers that share control of the same field devices. This flow supports coordination to prevent conflicts and allow cooperative management of shared devices.
field equipment commands	System-level control commands issued to field equipment such as reset and remote diagnostics.
field equipment configuration settings	Control settings and parameters that are used to configure field equipment.
field equipment fault data	Field equipment fault information that can be used to identify field equipment that requires initialization, reconfiguration, repair or replacement. This flow identifies the device, the nature of the fault, and associated error codes and diagnostic data.
field equipment software install/upgrade	This flow supports installation and update of software residing in ITS roadway equipment. It supports download of the software installation files, including executable code and associated support files.
freight traveler information preferences	Traveler information preferences from fleet and freight management systems or commercial vehicle drivers including: area covered by fleet/driver, types of freight managed (including special restrictions), preferred routes, other travel preferences pertaining to trip costs or tolls.
freight-specific traveler information	Traveler information customized for freight users to indicate truck routes, permit information, truck stops, inspection stations, steep grades, high-profile vehicle advisories, etc. Information provided includes freight-related road and weather conditions, parking information, and route plans.
identifier coordination	Coordination of identifiers between registries to help ensure no duplication of identifier assignments.
incident scene images	Real time images or video of an incident scene. This flow includes the images or video and meta data that describes the images.
incident scene safety application info	Incident scene safety application configuration data and warning parameters and thresholds. This includes incident scene configuration including geofenced safe areas and travel lanes that provide a safety boundary between public safety responders and passing vehicles. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.

Information Flow Name	Description
incident scene status	Information sent from a personnel device at the incident scene that more completely characterizes the incident and provides current incident response status.
infrastructure restriction warning	Vehicle size (height, width, length) and weight as measured by infrastructure sensors and the infrastructure restriction warning message currently displayed on roadside signs.
infrastructure restriction warning notification	Notification to vehicle on-board equipment (OBE) that includes vehicle size (height, width, length) and weight as measured by infrastructure sensors, current infrastructure size and weight restrictions, and infrastructure restriction warning message(s) currently displayed on roadside signs.
intermodal dispatch info	Directions for dispatch for pickup or delivery of an intermodal load.
intermodal terminal status	Current status of the intermodal terminal including the current queue length/delay, current access requirements and restrictions (e.g., access restricted to appointments only).
intersection control status	Status data provided by the traffic signal controller including phase information, alarm status, and priority/preempt status.
intersection geometry	The physical geometry of an intersection covering the location and width of each approaching lane, egress lane, and valid paths between approaches and egresses. This flow also defines the location of stop lines, cross walks, specific traffic law restrictions for the intersection (e.g., turning movement restrictions), and other elements that support calculation of a safe and legal vehicle path through the intersection.
intersection infringement info	Vehicle path information sent by a vehicle that is violating the stop bar at an intersection. This flow includes the vehicle's position, heading, speed, acceleration, transmission, steering-wheel angle, braking status, size information and trajectory.
intersection management application info	Intersection and device configuration data, including intersection geometry, and warning parameters and thresholds. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
intersection safety application info	Intersection and device configuration data, including intersection geometry, and warning parameters and thresholds. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
intersection safety warning	A warning of an imminent unsafe vehicle infringement at an intersection that may endanger other vehicles or pedestrians. This allows vehicles approaching the intersection to be warned in the event of an imminent red light or stop sign violation or potential infringement on an occupied crosswalk. All connected vehicles at the intersection receive the warning, including both the infringing vehicle and other vehicles at or near the intersection.
intersection status monitoring	Current signal phase and timing information for all lanes at a signalized intersection. This flow represents monitoring of communications by a receiver at the intersection to support monitoring for conflicts between actual signal states and RSE communications about those states.
ITS information	Information exchanged by ITS systems or devices. This flow is a super-flow; it does not define specific content since it represents any information flow exchange between physical objects defined in ARC-IT. This information flow represents any of those information flows and inherits the data content and attributes defined in the more detailed information flows.
lane closure information	Lane closure information provided to passing vehicles. This flow provides information about roadway configuration changes such as lane closures and shifts.
lane management control	Information used to configure and control dynamic lane management systems.
lane management information	System status of managed lanes including current operational state, violations, and logged information. This includes lane usage information including both traditional traffic flow measures and special information associated with managed lanes such as measured passenger occupancies. It also includes the operational status of the lane management equipment.
lighting management application info	Application parameters and thresholds. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.

Information Flow Name	Description
load appointment status	Information about the status of load appointments made through the drayage appointment system including any exceptions or changes that are needed by the freight company.
load matching info	Identification of available loads that match available truck capacity.
load matching systems coordination	Coordination of intermodal load-matching information between peer systems.
loading zone application info	Loading zone application information including loading zone parking configuration and associated parameters and thresholds that control the algorithms that monitor loading zone occupancy and the loading zone information that is delivered. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
loading zone application status	Loading zone application status reported by the RSE. This includes current operational state and status of the RSE and current, aggregate loading zone data collected from connected vehicles that can be used to monitor loading zone space usage and availability.
loading zone information	Information about a loading zone including static information (operating hours, rules, restrictions, and fee schedule as applicable) and real time information about current occupancy.
loading zone parking information	Information provided for a loading zone and associated holding areas. It includes parking reservation(s), confirmation (or non-confirmation) information, alternative options, and detailed information on the holding parking areas, and the loading zone, including guidance within and between the holding and loading zone areas.
loading zone reservation confirmation	Loading zone reservation confirmation and associated instructions.
loading zone reservation request	Request for a loading zone space that identifies the requestor and vehicle, the requested date/time, the vehicle type, the estimated duration, and associated identification and payment information.
loading zone use request	Request, booking, and confirmation that supports reservation for use of a loading or unloading area.
local border wait times	Current border wait time calculated by the RSE based on data collected from passing connected vehicles.
local situation data	This general flow represents the traffic, environmental, and emissions situation data that is collected from connected vehicles by an RSE, aggregated, filtered, and provided to a back-office center. It also includes data collected from ITS roadway equipment that provides current intersection and road network status for the area proximate to the RSE.
local traveler information	Traveler information including traffic, road, and weather conditions for a particular locality. This flow includes the location-specific traveler information and time effectivity of the information.
location correction	"Information provided to improve positional accuracy. These corrections allow a mobile GPS receiver, such as a GPS system in a connected vehicle, to achieve a
greater absolute positional accuracy, compensating for errors that exist in satellite positioning."	
low emissions zone application info	Low emissions zone application parameters and thresholds. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
low emissions zone coordination	Coordination of geographic boundaries, time period, fee structure, and restrictions for a low emissions zone. This flow supports negotiation between centers that establishes low emissions zone parameters based on air quality and transportation needs, as constrained by infrastructure and transportation services that are available to manage the defined zone and applicable laws and regulations.
low emissions zone parameters	The geographic boundaries, time period, and fee structure for a low emissions zone. This flow also provides the specific restrictions that are in place for the zone including admittance requirements and rules and restrictions for driving within the zone.

Information Flow Name	Description
map operator input	The range of GIS operator inputs that support creation and update of navigable maps and management and distribution of the map data to end users.
map operator updates	Interactive display of base map and information layers and associated information that supports map development, management, and dissemination.
map update coordination	Exchange of geographic information between map update systems.
map update notification	Notification of maintenance, construction, and other activities that will result in medium to long term changes to road location and configuration that may impact navigable maps. This flow includes the timing of the changes and precise enumeration of the location and configuration changes.
medical records	Electronic medical records accessed to support incident response.
medical records request	Request for electronic medical records to support incident response.
misbehavior analysis coordination	Sharing of misbehavior policy, reports, and analysis results, including suspected and convicted end entities and other information that coordinates misbehavior detection, analysis, and resolution with another CCMS.
misbehavior report	Notification of potential security issues encountered in processing messages, including message authentication or integrity failures, plausibility failures, or other issues appropriate to the CCMS' misbehavior policies.
mixed use crossing status	Current pedestrian and other mixed use crossing information including an indication of whether the call button has been activated, the current state of the mixed use crossing signal, and information indicating whether non-motorized users are currently occupying the cross walk.
mixed use safety warning control	Configuration and control of equipment that monitors and manages mixed use crossings and provides visual displays and warnings to drivers when non-motorized users are occupying a cross walk or other mixed use path crossing.
mixed use safety warning status	Current operational status and state of pedestrian crossings and other mixed use path crossing warning systems.
mobile source emissions data	Measured and/or estimated emissions at point locations from mobile sources including cars and light trucks, heavy trucks and buses. Where applicable, this flow may also include emissions measures or estimates from non-road engines and portable equipment at the location.
OBE fault data	OBE fault information that can be used to identify OBEs that require initialization, reconfiguration, repair or replacement. This flow identifies the device, the nature of the fault, and associated error codes and diagnostic data.
OBE status	Monitoring of OBE device status including current mode, operational status, and configuration settings. It includes device housekeeping/heartbeat monitoring and includes network information, the status of installed applications, and the configuration of managed devices.
object discovery	Represents the interactive discovery of network communications related information by any end entity, querying the ORDS. Information exchange could be as simple as a Domain Name Service (DNS) query, or it could include service and service metric information.
object registration	Represents the provision of information related to communications, service and service metric information from a service provider end entity to the ORDS.
occupant information	Identification of significant medical conditions of each occupant that would influence critical care decisions made by emergency responders
parking arrival information	Detailed parking information to support park and ride operations. This includes information on entrances available to transit and detailed arrival information indicating where vehicles are currently arriving in the lot for park and ride service.
parking availability	Information on available parking. This flow identifies available spaces with associated information about parking restrictions and location for each available space.
parking facility geometry	Precise spatial description of a parking facility that locates each parking space and the ingress and egress routes that are used to travel to and from the spaces.

Information Flow Name	Description
parking management application info	Parking management application information including parking lot configuration and status and associated parameters and thresholds that control the algorithms that monitor parking occupancy and the parking information that is delivered. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
parking management application status	Parking management application status reported by the RSE. This includes current operational state and status of the RSE and current, aggregate parking data collected from connected vehicles that can be used to monitor parking space usage and availability.
parking plan	A tailored parking plan for a particular trip and traveler's vehicle. The plan identifies the parking facility and parking space information for the trip and includes the cost for parking.
passive vehicle monitoring control	Control commands used to control detection systems that rely on infrastructure-based identification of individual vehicles to measure travel times and other related measures by identifying the same vehicle at different points in the network. Related technologies include Bluetooth readers and license plate recognition systems.
passive vehicle monitoring data	Time stamped identifiers that identify the vehicles that have passed through a detection zone.
payment application information	Application configuration data and messaging parameters for electronic payment applications for tolls, road use, and other user-pay transportation applications. This flow provides information on services provided, user information, rates and rate criteria, including variable pricing based on calendar, time of day, vehicle type and passenger occupancy. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
payment application status	Application status for electronic payment applications for tolls, road use, and other user-pay transportation applications. This includes current operational state and status of the RSE and a record of payments collected with identification that can be used to identify the payment account or source and related vehicle and service information that were used to calculate the payment. The flow also includes a record of detected violations.
payment coordination	"
permission application	A request for permission to access a Connected Vehicle service by an end-user that requires enrollment. This may include services granted to drivers of low emissions vehicles or pedestrians with special needs that require extended crossing times for example.
permission application receipt	An acknowledgment that an end-user application for a Connected Vehicle service was received and processed.
permission request	A request for permission to access or use connected vehicle applications or services. The request identifies the users that require permission, the applications or services that are requested, and the geographic coverage where the permission is required. In this context, the 'users' may be a center, infrastructure equipment (e.g., RSEs), or vehicles that are owned and operated by the requestor. This request is for an initial set of permissions. See also permission update request.
permission request coordination	Coordination of permission requests between jurisdictions or regions that allow permissions to be managed that may span more than one jurisdiction.
permission request received	An acknowledgement that the permission request or permission update request was received.
permission update request	A request for an update to current permission to access or use connected vehicle applications or services. The request identifies the users that require updated permissions, the applications or services that are requested, and the geographic coverage where the permission is required. In this context, the 'users' may be a center, infrastructure equipment (e.g., RSEs), or vehicles that are owned and operated by the requestor. This request is for an update to existing permissions. See also permission request.
personal crossing safety information	Current crossing status including permission to cross, crossing time remaining, and warnings in the event that a vehicle reports an imminent intersection infringement that may impact non-motorized users including pedestrians and cyclists.
personal device commands	System-level control commands issued to field equipment such as reset and remote diagnostics.

Appendix B2 – New U.S. Information Flows

Information Flow Name	Description
personal device configuration settings	Control settings and parameters that are used to configure personal devices that are used by transportation professionals.
personal device fault data	Personal device fault information that can be used to identify PIDs that require initialization, reconfiguration, repair or replacement. This flow identifies the device, the nature of the fault, and associated error codes and diagnostic data.
personal device software install/upgrade	This flow supports installation and update of software residing in ITS roadway equipment. It supports download of the software installation files, including executable code and associated support files.
personal device status	Reports from personal devices (smart phones, tablets, laptops, etc.) that are used by transportation professionals. The flow provides current operational status.
personal location	The current location (latitude, longitude, and elevation) reported by the personal information device
personal location information	Pedestrian, bicyclist, and other non-motorized user locations at an intersection as detected and reported by an RSE.
personal signal service request	A request for right of way from a personal device that indicates the type of traveler (pedestrian, special needs pedestrian, bicyclist, etc.), anticipated time of arrival, travel path, and crossing duration.
personal updates	Personal information, alerts, and warnings provided to pedestrians, work crew members, and other individuals in a mixed use area. This includes visual, audio, and haptic outputs that may be customized to support individual needs.
personnel input	Field personnel input to a Personnel Device. This flow may provide input to applications operating on the Personnel Devices. This flow also establishes the settings that tailor each application to suit the user's needs.
personnel location	The current location (latitude, longitude, and elevation) reported by the personnel device.
personnel safety warning	Safety alerts and warnings provided to a personnel device. The provided information would identify safety threats (e.g., vehicle encroachment into a work area, personnel infringement into a travel lane)
personnel updates	Alerts and warnings provided to emergency personnel or work crew members. This includes visual, audio, and haptic outputs that may be customized to support individual needs.
PID status	Monitoring of Personal Information Device status including current mode, operational status, and configuration settings. It includes device housekeeping/heartbeat monitoring and includes network information, the status of installed applications, and the configuration of managed devices.
population and housing data	Information on the population of an area, including addresses, types of facility (residence, multi-family dwelling, commercial retail, commercial office, etc.), and special considerations (storage of flammable liquids, special needs residents).
position corrections	Ground based reference station positioning corrections
proxied ITS information	Information exchanged by ITS systems or devices where the sender is isolated from the receiver by an intermediary that acts as a proxy for the sender. This flow is a super-flow; it does not define specific content since it represents any information flow exchange between physical objects defined in ARC-IT. This information flow represents any of those information flows and inherits the data content and attributes defined in the more detailed information flows.
proxied personal location	Relay of pedestrian, bicyclist, and other non-motorized user locations at an intersection. This relay or rebroadcast of personal locations supports coordination between motorized and non-motorized users that do not have interoperable communications capability.

Appendix B2 – New U.S. Information Flows

Information Flow Name	Description
queue warning application information	Information regarding formed or impending queues (location of the end of queue, estimated duration of the queue, and other descriptions of the queue condition) and recommendations for upstream vehicles including speed reduction, lane change, or diversion recommendations. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
queue warning information	Information regarding formed or impending queues (location of the end of queue, estimated duration of the queue, and other descriptions of the queue condition) and recommendations for upstream vehicles including speed reduction, lane change, or diversion recommendations.
rail crossing application info	Rail crossing and device configuration data and warning parameters and thresholds. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
rail crossing warning	A warning of a train approaching or already in a highway rail intersection.
reduced speed warning info	Real time notification of vehicle detections, measured vehicle characteristics (e.g., vehicle height), speed measurements, and warnings issued by roadway infrastructure. This flow can also include roadway configuration data, current speed limits, and warning parameters and thresholds enabling local speed management application configuration and management.
regional situation data	This general flow represents the traffic, environmental, and emissions situation data that is collected from connected vehicles and aggregated, filtered, and distributed to other centers as a regional information product for use in operations, performance monitoring, and analysis.
request for data review	Request that data reported about a motor carrier or driver be reviewed for potential mis-assignment or other error.
request for permit	Request by fleet management for oversize, overweight, or hazmat permit.
restricted lanes application info	Restricted lane application configuration data and messaging parameters. This flow defines the location, duration, and operating parameters for lanes that are reserved for the exclusive use of certain types of vehicles (e.g., transit vehicles) or vehicles that meet other qualifications (e.g., number of occupants, low emissions criteria). It identifies the lane(s), the start and stop locations, start and end times, vehicle restrictions, speed limits and platooning parameters. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
restricted lanes information	This flow defines the location, duration, and operating parameters for lanes that are reserved for the exclusive use of certain types of vehicles (e.g., transit vehicles) or vehicles that meet other qualifications (e.g., number of occupants, low emissions criteria). It identifies the lane(s), the start and stop locations, start and end times, vehicle restrictions, speed limits and platooning parameters.
restricted lanes parameters	The location, duration, and operating parameters for lanes that are reserved for the exclusive use of certain types of vehicles (e.g., transit vehicles) or vehicles that meet other qualifications (e.g., number of occupants, low emissions criteria). It identifies the lane(s), the start and stop locations, start and end times, vehicle restrictions, speed limits and platooning parameters.
revocation coordination	Sharing of revocation policies, Certificate Revocation Lists (CRLs), and internal blacklists, and other information that supports revocation process coordination with another CCMS.
road closure application info	Road closure signing application configuration data and messaging parameters. This flow identifies the vehicles that may initiate the road closure. This flow also provides access lists, groups, or classifications where selected vehicles are to be allowed access to the closed area.
road closure information	Road closure information provided to passing vehicles. This flow provides information about the road closure with diversion information.
road closure notification	Notification that agency personnel have closed a road due to adverse weather, major incident, or other reason.

Appendix B2 – New U.S. Information Flows

Information Flow Name	Description
road pricing equipment fault	Provides fault status of the road pricing data collection equipment in a vehicle and vehicle image and other characteristics to allow independent identification of the vehicle and its owner.
road pricing equipment status	Provides an indication of the operational status of the road pricing data collection equipment in a vehicle. Also indicates vehicle ID (VIN) so that the registration of the equipment to a specific vehicle can be verified and confirmed by comparison with vehicle characteristics.
road use charge info	Road use charge rate policies for distribution to travelers.
road use charges	Road use charges per link.
road use history	A vehicle's road use history that records where the vehicle has traveled over time. Optionally includes vehicle speeds as well as distance traveled for some applications. Information is accurate enough to distinguish between adjacent roads, adjacent lanes, and identify direction of travel on the roads.
road weather advisories	Segment-specific weather and road conditions including real-time advisories of deteriorating road and weather conditions, medium-term advisories for the next 2–12 hours, and long-term advisories more than 12 hours into the future. The advisories may include advisories that are issued by the RSE based on locally collected environmental data (e.g., an ice on bridge advisory).
road weather advisories for emergency response	Segment-specific weather and road conditions including real-time advisories of deteriorating road and weather conditions, medium-term advisories for the next 2–12 hours, and long-term advisories more than 12 hours into the future. This flow is filtered, tailored, and augmented to support emergency responders.
road weather advisory info	Road weather advisories and associated configuration and control information that are used to manage the RSE. Advisories include segment-specific weather and road conditions including real-time advisories of deteriorating road and weather conditions, medium-term advisories for the next 2–12 hours, and long-term advisories more than 12 hours into the future. This flow includes a schedule for issuing the included advisories.
roadside data message	Data set collected by roadside sensors to identify and characterize a vehicle, carrier, and (potentially) driver.
roadway advisory radio data	Information used to initialize, configure, and control roadside highway advisory radio. This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these systems.
roadway advisory radio status	Current operating status of highway advisory radios.
roadway geometry	The physical geometry of a road segment that specifies the location and width of each lane, including normal lanes as well as special lanes for pedestrians and bicycles, transit vehicles, and trains. This flow also may include the curvature, grade, and superelevation or banking of the road segment.
roadway warning system control	Information used to configure and control roadway warning systems.
roadway warning system status	Current operating status of roadway warning systems.
RSE application information	RSE application configuration data and parameters that are used to control applications and configure the application for a specific local use. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
RSE application install/upgrade	This flow supports remote installation and update of software applications residing in the RSE. It supports transmission of the secure software installation files, including executable application code and associated support files.
RSE application status	Monitoring of RSE application status including current mode, operational status, and configuration settings. It includes the status of installed applications and the application-specific data provided by the RSE.
RSE configuration settings	Control settings and parameters that are used to configure roadside equipment.

Appendix B2 – New U.S. Information Flows

Information Flow Name	Description
RSE fault data	RSE fault information that can be used to identify RSEs that require initialization, reconfiguration, repair or replacement. This flow identifies the device, the nature of the fault, and associated error codes and diagnostic data.
RSE status	Monitoring of RSE device status including current mode, operational status, and configuration settings. It includes device housekeeping/heartbeat monitoring and includes network information, the status of installed applications, the configuration of managed devices, cybersecurity and physical security status of the RSE.
security credential revocations	Certificate Revocation List; lists the certificates whose trust has been revoked by the CCMS.
security credentials	The material used by an end-entity (vehicle, personal device, field device, center system etc.) to ensure privacy, integrity and authenticability of its data transmissions. This includes certificates with associated public and private verifying/signing and decrypting/encrypting keys.
security policy and networking information	Security policy information describing the CCMS' enrollment, authorization, misbehavior and revocation policies, and communications information related to CCMS components; including contact information and public credentials of those components.
service advertisement	An advertisement of available services and identification of how those services may be accessed (e.g., RF parameters, identifiers, etc.). Services include network services such as IPv6 routing, public roadside services such as intersection safety, back office services including situation data services and security credentials, or private services.
service identifiers	Identifiers assigned to particular services, and the context necessary when and how to use these identifiers.
service information request	Request to multimodal (possibly non-roadway) transit provider for general services information and specific trip information or reservation.
service information response	Multimodal (possibly non-roadway) transit provider services information and trip reservation confirmations.
shared use confirmation	Confirmation that traveler is going to use the shared use asset now or at a future time.
shared use request	Request for shared use asset (e.g., car or bicycle) now or as a reservation for future use.
shared use response	Response from shared use provider regarding availability of the shared use asset now or in the future. Includes any payment requirements.
shared use status	Status of usage by shared use providers. Includes asset inventory and status. Could also include information on specific travelers to support multimodal trip planning.
shelter recommendations	Recommendation identifying the shelter or shelters best suited to the requestor. Hotels/motels may also be included as potential sheltering options. This flow may also include shelter assignments/reservations.
shelter request	A request for shelter information, recommendations, or assignment/reservation. Information provided my include name, current location, number of people in the group, additional requirements (e.g., evacuating with pets, needed medical support).
shoulder management control	Information used to configure and control systems that allow use of a shoulder as a lane for vehicular traffic.
shoulder management information	System status including current operational state, violations and logged information.
signal control data	Information used to configure local traffic signal controllers.
signal control device configuration	Data used to configure traffic signal control equipment including local controllers and system masters.
signal control plans	Traffic signal timing parameters including minimum green time and interval durations for basic operation and cycle length, splits, offset, phase sequence, etc. for coordinated systems.
signal fault data	Faults reported by traffic signal control equipment.

Appendix B2 – New U.S. Information Flows

Information Flow Name	Description
signal preemption request	Direct request for preemption to a traffic signal controller that results in preemption of the current control plan and grants right-of-way to the requesting vehicle. This flow identifies the required phase and timing of the preemption. This flow may also cancel the preemption request (e.g., when the requesting vehicle clears the intersection).
signal priority service request	A service request for vehicle priority issued to a traffic signal controller that results in green extension or other accommodation for the priority vehicle, within the current signal timing plan. The request includes the priority level, the desired time and duration of service, and the intended travel path through the intersection. This flow also allows the RSE to cancel a previously issued request for priority.
signal priority status	In response to a request for signal priority, this flow indicates the status of the priority or preemption request.
signal service request	A call for service or extension for a signal control phase that is issued by the RSE for connected vehicles approaching an intersection and/or pedestrians at a crosswalk. This flow identifies the desired phase and service time.
signal system configuration	Data used to configure traffic signal systems including configuring control sections and mode of operation (time based or traffic responsive).
situation data collection parameters	The parameters that are used to control the flow of situation data from the RSE. This flow identifies the type of data/snapshots that are requested from passing vehicles and reporting parameters such as snapshot frequency, filtering criteria (data thresholds for reporting), and reporting interval that control the type and volume of data reported to the back office center.
social media presence	Each social media platform offers its own tools and API that allow integration of web content into a social media experience. This interface establishes a social media presence for traveler information sites, providing current traveler information to subscribers.
special needs data	Information on special needs populations used to support evacuation planning and resource delivery when an evacuation is required. This flow includes names, contact information (address and phone #), type of disability or impairment, and type of transportation or assistance that is required.
special vehicle alert	Notification that a vehicle is in the vicinity that requires special attention from drivers. In this context, 'special vehicle' refers to any type of vehicle that uses lights or placards to alert drivers including public safety vehicles, oversize vehicles, slow vehicles, and service vehicles that stop and back up frequently.
speed management application information	Current speed targets, advisories, and limits including time of day, week, or season speed limits as necessary, and application parameters and thresholds. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
speed management information	Target speeds, speed advisories, and/or speed limit information provided to a vehicle. The information includes the current speed value(s), the route segment(s) and lane(s) where the speeds apply, and an indication of whether the speeds are suggested target speeds, posted advisory speeds, or enforceable speed limit values. This flow may also include information about the reason for reduced speeds and provide target lane information if lane changes are required.
speed warning application info	Roadway configuration data, current speed limits including time of day, week, or season speed limits as necessary, and warning parameters and thresholds. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
stop sign gap assist control	Configuration and control of detectors that monitor traffic on the major road and signs that provide stop sign gap assist alerts and warnings to vehicles on the minor road.
stop sign gap assist info	Intersection and device configuration data and warning parameters and thresholds for the stop sign gap assist application. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.

Appendix B2 – New U.S. Information Flows

Information Flow Name	Description
support equipment status presentation	Presentation of operational status of support system equipment (computers, networks, etc.) to maintenance personnel.
system status	Monitoring of system device status including current mode, operational status, and configuration settings. It includes device housekeeping/heartbeat monitoring and includes network information, the status of installed applications, and the configuration of managed devices.
targeted list	List of carriers, drivers, and/or vehicles of interest for enforcement purposes.
terminal reservation	A reservation for container pick-up/drop-off at an intermodal terminal.
terminal reservation request	Request for a reservation to pick-up/drop-off containers. The request would define the pick-up/drop-off and identify an acceptable time window
time	Current time expressed in Universal Time Coordinated (UTC) format from a Stratum-2 time server.
time local form	Time local form includes UTC time synchronized with the external source in a format usable by connected vehicle center functions.
traffic control information	Represents the flow of traffic control and status information from a TMC to a third party TIC. This is reporting only, not actual control.
traffic gap information	Measured gap to the next approaching vehicle per lane and direction of travel
traffic information for media	Report of traffic conditions including traffic incident reports for public dissemination through the media. The reports may also include information on diversions and alternate routes, closures, and special traffic restrictions in effect.
traffic metering application info	Application parameters and thresholds. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
traffic monitoring application info	Traffic monitoring application parameters and thresholds that control the filtering, aggregation, and range of measures that are collected, derived, and reported. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
traffic regulation information	Traffic rules, regulations, ordinances and statutes that have official status and must be understood by all motor vehicle operators and intelligent vehicles that operate at higher automation levels. The flow includes the regulations and the associated locations, effective date and time periods, and applicable vehicle classes. This flow supports targeted transfer of regulations to end user systems and may be initiated based on a query or pushed so that vehicles have access to relevant regulations for their vehicle classification at the current location, date, and timeframe.
traffic situation data	Current, aggregate traffic data collected from connected vehicles that can be used to supplement or replace information collected by roadside traffic detectors. It includes raw and/or processed reported vehicle speeds, counts, and other derived measures. Raw and/or filtered vehicle control events may also be included to support incident detection.
traffic-related regulations	Traffic rules, regulations, ordinances and statutes that have official status and must be understood by all motor vehicle operators and intelligent vehicles that operate at higher automation levels. The flow includes the regulations and the associated locations, effective date and time periods, and applicable vehicle classes. This flow supports bulk transfer of regulations, rules, statutes, and related attributes between back office systems.
transfer request	A traveler request for a transfer between transit routes, services, or modes. The request may also include preferences such as a need for extra connection time or connection protection in the event of a delay.
transfer status	Information indicating whether a requested transfer can be confirmed including specific information about the connection including fare payment information. Real-time updates are provided if the transfer status changes up to and including a reminder just prior to the transfer. In the event that a requested transfer is not feasible, alternatives including other transit, rideshare, and taxi options are provided.

Appendix B2 – New U.S. Information Flows

Information Flow Name	Description
transit emissions data	Aggregate and/or summarized transit emissions data, including greenhouse gas (GHG) and criteria air pollutant emissions for one or more vehicles in the transit fleet.
transit fare request	Request for fare information and transit fare payment.
transit park and ride information	Detailed transit information to support parking and ride operations. This includes transit scheduled and actual arrival times at the park and ride facility and services offered by arriving transit vehicles.
transit service information	Transit service information including routes, schedules, and fare information as well as dynamic transit schedule adherence and transit vehicle location information.
transit stop guidance	Information sent from bus stop infrastructure to portable devices that includes stop-specific bus schedules and routes.
transit stop locations	The current geographic location and dimensions of transit stops. This flow may also include the road geometry in the vicinity of the stops as needed to support transit vehicle safety applications when arriving at or departing from stops.
transit stop request	Notification that a transit stop has been requested by a transit user at a roadside stop. This flow identifies the route, stop, and the time of the request.
transit trip plan	An origin-destination transit trip that may involve multiple modes and connections.
transit trip request	Request for a transit trip plan that is responsive to traveler requirements such as schedule, cost, or duration.
transit user guidance application info	Transit user guidance application information including current transit traveler information and associated parameters and thresholds that control the delivery of this information. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
transit user information	Information about individual transit users boarding a transit vehicle, used to track a user's progress on a scheduled transit trip.
transit vehicle emissions	Greenhouse Gas (GHG) and criteria air pollutant emissions reported by a transit vehicle.
transit vehicle information	Information about the transit vehicle route and stops, including current location along the route and next stop.
transportation operational strategies	Operational strategies for each operating agency in a transportation corridor, downtown area, or other travel-impacted area, providing an integrated operations strategy for the freeways, tollways, arterials, transit services, parking facilities, and other transportation-related facilities in the area. These strategies can include dynamic adjustments to transit fares and tolls, parking fees and restrictions, dynamic lane restriction changes, and other active demand management strategies.
traveler border clearance status	Information indicating whether border clearance has been granted and instructions if additional processing is required.
traveler credentials	Traveler identification, including trusted traveler program information, if applicable.
traveler information application info	Traveler information and associated parameters, filters, and thresholds that control the RSE's distribution of the traveler information to passing vehicles. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
traveler payment information	Information provided for payment of road use charges, tolls or parking fees including identification that can be used to identify the payment account or source and related vehicle and service information that are used to determine the type and price of service requested. The information exchange normally supports an account debit to pay fees, but an account credit may be initiated where pricing strategies include incentives.
traveler payment request	Request for information supporting payments. For fee structures that include incentives, the request may support either an account debit or an account credit or reimbursement.
traveler personal information	This flow includes biometric and other data to allow recognition of travelers.

Appendix B2 – New U.S. Information Flows

Information Flow Name	Description
traveler sourced updates	Traveler posts on traffic and road conditions, parking availability, transit services, traveler services, shelter information and other real-time crowd-sourced data that may be shared with other travelers.
traveler support equipment fault data	Traveler Support Equipment fault information that can be used to identify TSEs that require initialization, reconfiguration, repair or replacement. This flow identifies the device, the nature of the fault, and associated error codes and diagnostic data.
trigger area	A geographic area a commercial motor vehicle crosses into, which initiates a request to compile and transmit a safety data message. May be associated with a time period.
trigger area definition	Information that defines the desired trigger area for wireless roadside inspection safety data message submission.
trigger area notification	Notification to activate wireless roadside inspection safety data message collection.
trigger control	Controls to enable or disable a particular trigger.
trip feedback	Information provided at the conclusion of a trip that supports performance monitoring and system optimization. Information provided may include a record of the trip including HOV/HOT lane usage and user provided feedback at the conclusion of the trip.
user account reports	Reports on charges
user account setup	Billing information, vehicle information (or registration information), and requests for reports.
user permission sets	This flow identifies users, user groups, and associated user permission sets for a geographic area or jurisdiction and set of connected vehicle applications or services.
variable speed limit control	Information used to configure and control variable speed limit systems including the equipment used to provide current speed limits and other information to drivers and the equipment used to monitor traffic and environmental conditions along the roadway.
variable speed limit status	Current operating status of the variable speed limit systems including the state of the equipment.
vehicle charging profile	Vehicle information provided to an electric charging station including the operational status of the electrical system, the charging capacity and charging rate for the vehicle, and % charge complete.
vehicle collision information	The current status of the vehicle systems following a collision including air bag deployment, number of passengers, seat belt usage, sensor data that indicates crash severity (e.g., Delta V speed profile during the crash, vehicle damage, number of impacts), and vehicle type/make/model.
vehicle commands	System-level control commands issued to vehicle equipment such as reset and remote diagnostics.
vehicle configuration settings	Control settings and parameters that are used to configure vehicle equipment.
vehicle control event	Notification that the vehicle has performed an emergency action that could impact the safety of surrounding vehicles. This includes hard braking and activation of traction/stability control systems or other actions that warrant immediate notification of surrounding vehicles. The information flow conveys the vehicle's position, heading, speed, acceleration, transmission, steering wheel angle, braking status, size information, and trajectory.
vehicle diagnostic data	Information about the vehicle and its current operational status that supports vehicle performance monitoring, service, and repair. The flow identifies the vehicle and vehicle type and provides information about the vehicle's current operational status, the current performance of engine-related and other components, and notification of any identified malfunctions.
vehicle entries and exits	Information exchanged between an RSE and ITS Roadway Equipment that supports detection of non-equipped vehicles in an automated lane, low emissions zone, or other facility where V2I communications is used to monitor vehicles at entry or exit points. This exchange also supports identification of non-equipped vehicles where an RSE is used for payment collection. This generic exchange can be implemented by any approach that compares vehicle detections with V2I communications by the RSE to identify vehicles that are not equipped or are otherwise unable to communicate with the RSE.

Information Flow Name	Description
vehicle hazard event	Notification of a potential hazard that is detected by the vehicle, including hazards posed by the vehicle itself. Self-reported hazards include notification that the vehicle is being operated in an unsafe manner or is stopped in the travel lanes or on the shoulder. Detected hazards include unequipped vehicles operating unsafely, traffic queues, and foreign objects (people, animals, debris, other obstacles) in the travel lanes. It includes vehicle location and status, path, current control actions, and additional information on the detected hazard, if applicable.
vehicle location and motion	Data describing the vehicle's position, heading, speed, acceleration, transmission, steering wheel angle, braking status, size information, and trajectory.
vehicle location and motion for mapping	Vehicles may provide location and motion data independently using wide-area wireless communications to application/service providers who use the provided data to update their maps and maintain real-time traffic and road conditions information sourced from their client-base.
vehicle location and motion for surveillance	Data describing the vehicle's position, heading, speed, acceleration, transmission, steering wheel angle, braking status, size information, and trajectory. This flow represents monitoring of basic safety data ('vehicle location and motion') broadcast by passing connected vehicles for use in vehicle detection and traffic monitoring applications.
vehicle location data for mapping	Aggregate vehicle location data collected to support map data creation and refinement.
vehicle path prediction	The predicted future vehicle path of travel. This flow includes an indication of the future positions of the transmitting vehicle that can be used by receiving vehicles to support coordinated driving maneuvers and enhance in-lane and out-of-lane threat classification.
vehicle profile	Information about a vehicle such as vehicle make and model, fuel type, engine type, size and weight, vehicle performance and level of control automation, average emissions, average fuel consumption, passenger occupancy, or other data that can be used to classify vehicle eligibility for access to specific lanes, road segments, or regions or participation in cooperative vehicle control applications.
vehicle reported emissions	Current and average vehicle emissions data as measured by vehicle diagnostics systems and reported by the vehicle.
vehicle service information	Vehicle problem diagnosis information and available vehicle service options, along with information about how to make a service reservation.
vehicle service request	Request for a service reservation from a connected vehicle.
vehicle service response	Response to a request for service reservation.
vehicle signage application info	In-vehicle signing application configuration data and messaging parameters. This flow provides a list of regulatory, warning, and information messages to be displayed and parameters that support scheduling and prioritizing messages to be issued to passing vehicles. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
vehicle situation data	This flow represents vehicle snapshots that may be provided by the vehicle to support traffic and environmental conditions monitoring. Snapshots are collected by the vehicle for specific events (e.g., when a sensor exceeds a threshold) or periodically and reported based on control parameters when communications is available. Traffic-related data includes snapshots of measured speed and heading and events including starts and stops, speed changes, and other vehicle control events. Environmental data may include measured air temperature, exterior light status, wiper status, sun sensor status, rain sensor status, traction control status, anti-lock brake status, and other collected vehicle system status and sensor information. The collected data is reported along with the location, heading, and time that the data was collected.
vehicle situation data parameters	A request for vehicle situation data that includes parameters used to control the data that is reported and the flow of data reported by the vehicle. This flow identifies the type of data/snapshots that are requested and reporting parameters such as snapshot frequency, filtering criteria (data thresholds for reporting), and reporting interval.

Appendix B2 – New U.S. Information Flows

Information Flow Name	Description
vehicle software install/upgrade	This flow supports installation and update of software residing in vehicle on-board equipment. It supports download of the software installation files, including executable code and associated support files.
weigh-in-motion information	Information from commercial vehicle virtual weigh-in-motion systems including vehicle weight, vehicle dimensions, vehicle identification and driver identification.
work zone safety application info	Work zone safety application configuration data and warning parameters and thresholds. This includes work zone configuration including geofenced crew areas and travel lanes that provide a safety boundary between work zone personnel and passing vehicles. This flow also supports remote control of the application so the application can be taken offline, reset, or restarted.
wrong way vehicle detected	Notification that a vehicle has been detected traveling in the wrong direction. This can be a direct report by an equipped vehicle that is being driven in the wrong direction or a report of a non-equipped vehicle that has been detected traveling in the wrong direction. It includes the current location, speed, acceleration, and heading of the wrong way vehicle.

APPENDIX

B-3 NEW TRIPLETS

Note: New Physical Objects and Information Flows are indicated with an *.

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Asset Management System	asset damage assessment	Emergency Management Center
Basic Vehicle	driver input information	Vehicle OBE
Border Inspection Administration Center	manifest data	Border Inspection System
Border Inspection Administration Center	clearance notification	Intermodal Customer System
Border Inspection System	inspection results	Border Inspection Administration Center
Border Inspection System	request tag data	Commercial Vehicle OBE
Border Inspection System	border pass/pull-in	Connected Vehicle Roadside Equipment
Border Inspection System	clearance notification	Connected Vehicle Roadside Equipment
Border Inspection System	vehicle signage local data	Connected Vehicle Roadside Equipment
Border Inspection System	request tag data	Freight Equipment
Commercial Vehicle Administration Center	border clearance status	Border Inspection Administration Center
Commercial Vehicle Administration Center	safety inspection record	Commercial Vehicle OBE
Commercial Vehicle Administration Center	credentials status information	Enforcement Center
Commercial Vehicle Administration Center	daily site activity data	Enforcement Center
Commercial Vehicle Administration Center	safety inspection report	Enforcement Center
Commercial Vehicle Administration Center	safety status information	Enforcement Center
Commercial Vehicle Check Equipment	driver log	Commercial Vehicle Administration Center
Commercial Vehicle Check Equipment	on-board safety data	Commercial Vehicle Administration Center
Commercial Vehicle Check Equipment	border clearance event	Connected Vehicle Roadside Equipment
Commercial Vehicle Check Equipment	electronic screening request	Connected Vehicle Roadside Equipment
Commercial Vehicle Check Equipment	pass/pull-in	Connected Vehicle Roadside Equipment
Commercial Vehicle Check Equipment	safety inspection record	Connected Vehicle Roadside Equipment
Commercial Vehicle Check Equipment	safety inspection request	Connected Vehicle Roadside Equipment
Commercial Vehicle Check Equipment	screening event record	Connected Vehicle Roadside Equipment
Commercial Vehicle Check Equipment	commercial vehicle violation notification	Enforcement Center
Commercial Vehicle Check Equipment	request tag data	Freight Equipment
Commercial Vehicle OBE	driver update information	Basic Commercial Vehicle
Commercial Vehicle OBE	driver log	Commercial Vehicle Administration Center
Commercial Vehicle OBE	on-board safety data	Commercial Vehicle Administration Center
Commercial Vehicle OBE	unique identifiers	Commercial Vehicle Administration Center
Commercial Vehicle OBE	cv driver information presentation	Commercial Vehicle Driver
Commercial Vehicle OBE	border clearance data	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	commercial vehicle disable status	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	commercial vehicle identities	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	driver log	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	electronic lock data	Connected Vehicle Roadside Equipment

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Commercial Vehicle OBE	expected driver identity characteristics	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	freight equipment information	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	local signal priority request	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	on-board safety data	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	safety inspection record	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	screening event record	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	unique identifiers	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	commercial vehicle location data	Emergency Management Center
Commercial Vehicle OBE	hazmat notification	Emergency Vehicle OBE
Commercial Vehicle OBE	commercial vehicle location data	Fleet and Freight Management Center
Commercial Vehicle OBE	driver log	Fleet and Freight Management Center
Commercial Vehicle OBE	hazmat notification	Fleet and Freight Management Center
Commercial Vehicle OBE	vehicle environmental data	Fleet and Freight Management Center
Connected Vehicle Roadside Equipment	driver log	Commercial Vehicle Administration Center
Connected Vehicle Roadside Equipment	on-board safety data	Commercial Vehicle Administration Center
Connected Vehicle Roadside Equipment	border clearance data	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	commercial vehicle disable status	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	commercial vehicle identities	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	driver log	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	electronic lock data	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	expected driver identity characteristics	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	freight equipment information	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	on-board safety data	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	safety inspection record	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	screening event record	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	unique identifiers	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	border clearance data request	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	border clearance event	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	border pass/pull-in	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	clearance notification	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	electronic lock data request	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	electronic screening request	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	intersection status	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	pass/pull-in	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	safety inspection record	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	safety inspection request	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	screening event record	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	incident scene safety application status	Emergency Management Center
Connected Vehicle Roadside Equipment	incident scene warning notification	Emergency Vehicle OBE
Connected Vehicle Roadside Equipment	intersection status	Emergency Vehicle OBE
Connected Vehicle Roadside Equipment	emissions monitoring application status	Emissions Management Center
Connected Vehicle Roadside Equipment	low emissions zone application status	Emissions Management Center
Connected Vehicle Roadside Equipment	barrier system control	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	environmental sensor data	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	environmental sensors control	ITS Roadway Equipment

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Connected Vehicle Roadside Equipment	environmental situation data	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	incident scene warning notification	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	infrastructure monitoring sensor control	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	restricted lanes application status	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	roadway dynamic signage data	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	vehicle occupancy	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	work zone warning notification	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	payment transactions	ITS Roadway Payment Equipment
Connected Vehicle Roadside Equipment	speed warning application status	Maint and Constr Management Center
Connected Vehicle Roadside Equipment	vehicle signage application status	Maint and Constr Management Center
Connected Vehicle Roadside Equipment	work zone safety application status	Maint and Constr Management Center
Connected Vehicle Roadside Equipment	payment transactions	Parking Management System
Connected Vehicle Roadside Equipment	vehicle payment information	Payment Administration Center
Connected Vehicle Roadside Equipment	arriving train information	Personal Information Device
Connected Vehicle Roadside Equipment	intersection status	Personal Information Device
Connected Vehicle Roadside Equipment	environmental situation data	Traffic Management Center
Connected Vehicle Roadside Equipment	infrastructure restriction warning status	Traffic Management Center
Connected Vehicle Roadside Equipment	transit user guidance application status	Transit Management Center
Connected Vehicle Roadside Equipment	intersection status	Transit Vehicle OBE
Connected Vehicle Roadside Equipment	vehicle signage data	Transit Vehicle OBE
Connected Vehicle Roadside Equipment	arriving train information	Vehicle OBE
Connected Vehicle Roadside Equipment	map updates	Vehicle OBE
Connected Vehicle Roadside Equipment	vehicle cluster coordination	Vehicle OBE
Connected Vehicle Roadside Equipment	vehicle payment request	Vehicle OBE
Connected Vehicle Roadside Equipment	vehicle payment update	Vehicle OBE
Cyclist	personal input	Personal Information Device
DMV	registration	Commercial Vehicle Administration Center
ITS Roadway Equipment	driver information	Transit Vehicle Operator
ITS Roadway Payment Equipment	payment instructions	Connected Vehicle Roadside Equipment
Location and Time Data Source	location and time	Connected Vehicle Roadside Equipment
Location and Time Data Source	location and time	ITS Roadway Equipment
Maint and Constr Management Center	current infrastructure restrictions	Map Update System
Maint and Constr Management Center	environmental conditions data	Traffic Management Center
Maint and Constr Vehicle OBE	work zone warning notification	Connected Vehicle Roadside Equipment
Map Update System	map updates	Connected Vehicle Roadside Equipment
Multimodal Crossing Equipment	lane management inputs	Traffic Management Center
Other Traffic Management Centers	incident information	Traffic Management Center
Other Traffic Management Centers	road network conditions	Traffic Management Center
Other Traffic Management Centers	traffic images	Traffic Management Center
Other Transportation Information Centers	alternate mode information	Transportation Information Center
Other Transportation Information Centers	emergency traveler information	Transportation Information Center
Other Transportation Information Centers	incident information for public	Transportation Information Center
Other Transportation Information Centers	parking information	Transportation Information Center
Other Transportation Information Centers	road network conditions	Transportation Information Center
Other Transportation Information Centers	traffic images	Transportation Information Center
Other Vehicle OBEs	emergency acknowledge	Vehicle OBE

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Other Vehicle OBEs	emergency notification	Vehicle OBE
Other Vehicle OBEs	emergency notification relay	Vehicle OBE
Other Vehicle OBEs	vehicle environmental data	Vehicle OBE
Parking Management System	payment instructions	Connected Vehicle Roadside Equipment
Emergency Management Center	incident scene warning device control	Emergency Vehicle OBE
Emergency Management Center	incident scene warning device control	ITS Roadway Equipment
Emergency Management Center	incident information for public	Transportation Information Center
Emergency Personnel	personnel monitoring	Emergency Vehicle OBE
Emergency Personnel	personnel monitoring	ITS Roadway Equipment
Emergency Vehicle OBE	incident scene warning notification	Connected Vehicle Roadside Equipment
Emergency Vehicle OBE	driver information	Driver
Emergency Vehicle OBE	incident scene warning status	Emergency Management Center
Emergency Vehicle OBE	incident scene warning	Emergency Personnel
Emergency Vehicle OBE	emergency vehicle tracking data	Traffic Management Center
Emergency Vehicle OBE	service patrol dispatch response	Traffic Management Center
Emergency Vehicle OBE	service patrol incident status	Traffic Management Center
Emissions Management Center	low emissions zone operations information	Event Promoter System
Emissions Management Center	low emissions zone operations information	Payment Administration Center
Emissions Management Center	air quality information	Traffic Management Center
Emissions Management Center	low emissions zone operations information	Traffic Management Center
Emissions Management Center	low emissions zone operations information	Transit Management Center
Emissions Management Center	wide area air quality data	Transit Management Center
Emissions Management Center	low emissions zone operations information for public	Transportation Information Center
Event Promoter System	event plans	Emissions Management Center
Event Promoter System	event plans	Parking Management System
Fleet and Freight Management Center	driver log	Commercial Vehicle Administration Center
Fleet and Freight Management Center	on-board safety data	Commercial Vehicle Administration Center
Fleet and Freight Management Center	unique identifiers	Commercial Vehicle Administration Center
Fleet and Freight Management Center	driver log	Commercial Vehicle OBE
Fleet and Freight Management Center	safety inspection record	Commercial Vehicle OBE
Fleet and Freight Management Center	commercial vehicle location data	Emergency Management Center
Fleet and Freight Management Center	hazmat notification	Emergency Management Center
Freight Equipment	tag data	Border Inspection System
Freight Equipment	tag data	Commercial Vehicle Check Equipment
Freight Equipment	freight equipment information	Connected Vehicle Roadside Equipment
Intermodal Customer System	manifest data	Border Inspection Administration Center
ITS Roadway Equipment	driver information	Commercial Vehicle Driver
ITS Roadway Equipment	arriving train information	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	barrier system status	Connected Vehicle Roadside Equipment

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
ITS Roadway Equipment	environmental sensor data	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	incident scene warning notification	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	infrastructure monitoring sensor data	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	roadway dynamic signage status	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	track status	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	vehicle signage local data	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	work zone warning notification	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	incident scene warning status	Emergency Management Center
ITS Roadway Equipment	driver information	Emergency Personnel
ITS Roadway Equipment	incident scene warning	Emergency Personnel
ITS Roadway Equipment	infrastructure restriction warning status	Traffic Management Center
Parking Management System	vehicle signage local data	Connected Vehicle Roadside Equipment
Parking Management System	payment transactions	Payment Administration Center
Parking Management System	vehicle payment information	Payment Administration Center
Parking Management System	payment device update	Payment Device
Payment Administration Center	vehicle payment request	Connected Vehicle Roadside Equipment
Payment Administration Center	payment instructions	Parking Management System
Payment Administration Center	vehicle payment request	Parking Management System
Payment Administration Center	toll data	Traffic Management Center
Payment Administration Center	transaction status	Transit Management Center
Payment Administration Center	vehicle payment request	Vehicle OBE
Payment Device	payment device information	Parking Management System
Payment Device	payment device information	Transit Vehicle OBE
Payment Device	payment device information	Vehicle OBE
Pedestrian	personal input	Personal Information Device
Personal Information Device	trip confirmation	Transit Management Center
Rail Operations Center	railroad schedules	Emergency Management Center
Rail Operations Center	railroad advisories	Transportation Information Center
Rail Operations Center	railroad schedules	Transportation Information Center
Surface Transportation Weather Service	environmental conditions data status	Maint and Constr Management Center
Surface Transportation Weather Service	qualified environmental conditions data	Maint and Constr Management Center
Surface Transportation Weather Service	environmental conditions data status	Traffic Management Center
Surface Transportation Weather Service	qualified environmental conditions data	Traffic Management Center
Traffic Management Center	infrastructure restriction warning info	Connected Vehicle Roadside Equipment
Traffic Management Center	service patrol dispatch request	Emergency Vehicle OBE
Traffic Management Center	road network conditions	Emissions Management Center
Traffic Management Center	current lane restrictions	Enforcement Center
Traffic Management Center	road network conditions	Fleet and Freight Management Center
Traffic Management Center	infrastructure restriction warning control	ITS Roadway Equipment
Traffic Management Center	environmental conditions data	Maint and Constr Management Center
Traffic Management Center	traffic images	Maint and Constr Management Center
Traffic Management Center	traffic images	Media
Traffic Management Center	incident information	Other Traffic Management Centers
Traffic Management Center	road network conditions	Other Traffic Management Centers
Traffic Management Center	traffic images	Other Traffic Management Centers
Traffic Management Center	road network environmental situation data	Surface Transportation Weather Service

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Traffic Management Center	traffic images	Transit Management Center
Traffic Management Center	incident information for public	Transportation Information Center
Traffic Management Center	traffic images	Transportation Information Center
Traffic Management Center	road network environmental situation data	Weather Service System
Transit Management Center	transit and fare schedules	Emissions Management Center
Transit Management Center	transit schedule adherence information	Parking Management System
Transit Management Center	payment request	Payment Administration Center
Transit Management Center	trip plan	Personal Information Device
Transit Management Center	transit fare information	Transportation Information Center
Transit Management Center	fare management information	Traveler Support Equipment
Transit Vehicle OBE	collision warning information	Basic Transit Vehicle
Transit Vehicle OBE	payment device update	Payment Device
Transit Vehicle Operator	transit vehicle operator information	Transit Vehicle OBE
Transportation Information Center	road network environmental situation data	Emergency Management Center
Transportation Information Center	incident information for public	Fleet and Freight Management Center
Transportation Information Center	road network environmental situation data	Fleet and Freight Management Center
Transportation Information Center	alternate mode information	Other Transportation Information Centers
Transportation Information Center	emergency traveler information	Other Transportation Information Centers
Transportation Information Center	incident information for public	Other Transportation Information Centers
Transportation Information Center	parking information	Other Transportation Information Centers
Transportation Information Center	road network conditions	Other Transportation Information Centers
Transportation Information Center	traffic images	Other Transportation Information Centers
Transportation Information Center	road network environmental situation data	Traffic Management Center
Transportation Information Center	trip confirmation	Transit Management Center
Traveler Support Equipment	transit traveler information	Connected Vehicle Roadside Equipment
Traveler Support Equipment	fare collection data	Transit Management Center
Traveler Support Equipment	transit traveler request	Transit Management Center
Vehicle OBE	vehicle cluster coordination	Connected Vehicle Roadside Equipment
Vehicle OBE	vehicle payment information	Connected Vehicle Roadside Equipment
Vehicle OBE	vehicle platoon coordination	Connected Vehicle Roadside Equipment
Vehicle OBE	emergency acknowledge	Other Vehicle OBEs
Vehicle OBE	emergency notification	Other Vehicle OBEs
Vehicle OBE	emergency notification relay	Other Vehicle OBEs
Vehicle OBE	vehicle environmental data	Other Vehicle OBEs
Vehicle OBE	vehicle payment information	Payment Administration Center
Vehicle OBE	payment device update	Payment Device
Alternate Mode Transportation Center	service information response*	Transit Management Center
Alternate Mode Transportation Center	service information response*	Transportation Information Center
Archived Data System	archive requests	Center*
Archived Data System	archive status	Center*
Authorizing Center*	permission request received*	Center*
Authorizing Center*	user permission sets*	Cooperative ITS Credentials Management System*

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Authorizing Center*	permission request coordination*	Other Authorizing Centers*
Basic Emergency Vehicle*	host emergency vehicle status	Emergency Vehicle OBE
Basic Vehicle	communications signature*	ITS Roadway Equipment
Border Inspection Administration Center	consolidated agency response*	Border Inspection System
Border Inspection Administration Center	traveler personal information*	Border Inspection System
Border Inspection Administration Center	clearance notification	Freight Distribution and Logistics Center*
Border Inspection System	border security input*	Border Inspection Administration Center
Border Inspection System	traveler border clearance status*	Connected Vehicle Roadside Equipment
Border Inspection System	border wait times data*	Traffic Management Center
Care Facility	medical records*	Emergency Management Center
Care Facility	medical records*	Emergency Vehicle OBE
Center Personnel*	center operator input*	Center*
Center*	center archive data	Archived Data System
Center*	permission request*	Authorizing Center*
Center*	permission update request*	Authorizing Center*
Center*	center operator data*	Center Personnel*
Center*	equipment control commands*	Connected Vehicle Roadside Equipment
Center*	RSE application information*	Connected Vehicle Roadside Equipment
Center*	RSE application install/upgrade*	Connected Vehicle Roadside Equipment
Center*	data provision*	Data Distribution System*
Center*	data query*	Data Distribution System*
Center*	data subscription*	Data Distribution System*
Center*	field equipment commands*	Field*
Center*	field equipment configuration settings*	Field*
Center*	field equipment software install/upgrade*	Field*
Center*	permission application receipt*	ITS Object*
Center*	equipment maintenance request	Maint and Constr Management Center
Center*	map update notification*	Map Update System
Center*	personal device commands*	Personal Information Device
Center*	personal device configuration settings*	Personal Information Device
Center*	personal device software install/upgrade*	Personal Information Device
Center*	center status*	Service Monitor System*
Center*	center equipment status*	Support Maintenance Equipment*
Certification System Operator*	certification operator input*	Certification System*
Certification System*	certification operator presentation*	Certification System Operator*
Certification System*	certification results*	Cooperative ITS Credentials Management System*
Certification System*	application test stimulus*	ITS Object*
Certification System*	device test stimulus*	ITS Object*
Commercial Vehicle Administration Center	commercial vehicle administration information presentation	Commercial Vehicle Administrator*
Commercial Vehicle Administration Center	carrier participation report*	Commercial Vehicle Check Equipment
Commercial Vehicle Administration Center	commercial vehicle permit information*	Commercial Vehicle Check Equipment

Source Physical Object	Information Flows	Destination Physical Object
Commercial Vehicle Administration Center	roadside data message*	Commercial Vehicle Check Equipment
Commercial Vehicle Administration Center	targeted list*	Commercial Vehicle Check Equipment
Commercial Vehicle Administration Center	trigger area notification*	Connected Vehicle Roadside Equipment
Commercial Vehicle Administration Center	trigger control*	Connected Vehicle Roadside Equipment
Commercial Vehicle Administration Center	carrier participation report*	CVO Information Requestor Center
Commercial Vehicle Administration Center	carrier participation report*	Enforcement Center
Commercial Vehicle Administration Center	commercial vehicle permit information*	Enforcement Center
Commercial Vehicle Administration Center	trigger area*	Fleet and Freight Management Center
Commercial Vehicle Administration Center	trigger area notification*	Fleet and Freight Management Center
Commercial Vehicle Administration Center	commercial vehicle permit information*	Other CV Administration Centers
Commercial Vehicle Administration Center	commercial vehicle permit information*	Transportation Information Center
Commercial Vehicle Administrator*	commercial vehicle administrative request	Commercial Vehicle Administration Center
Commercial Vehicle Check Equipment	weigh-in-motion information*	Commercial Vehicle Administration Center
Commercial Vehicle OBE	commercial vehicle driver updates*	Commercial Vehicle Driver
Commercial Vehicle OBE	commercial vehicle status*	Commercial Vehicle Driver
Commercial Vehicle OBE	cv driver safety alert*	Commercial Vehicle Driver
Commercial Vehicle OBE	intermodal dispatch info*	Commercial Vehicle Driver
Commercial Vehicle OBE	container seal status*	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	container transfer location request*	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	vehicle location and motion*	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	vehicle profile*	Connected Vehicle Roadside Equipment
Commercial Vehicle OBE	cv driver safety status*	Fleet and Freight Management Center
Commercial Vehicle OBE	freight traveler information preferences*	Transportation Information Center
Commercial Vehicle OBE	special vehicle alert*	Vehicle OBE
Connected Vehicle Roadside Equipment	local situation data*	Archived Data System
Connected Vehicle Roadside Equipment	container manifest*	Border Inspection System
Connected Vehicle Roadside Equipment	container seal status*	Border Inspection System
Connected Vehicle Roadside Equipment	local border wait times*	Border Inspection System
Connected Vehicle Roadside Equipment	traveler credentials*	Border Inspection System
Connected Vehicle Roadside Equipment	RSE application status*	Center*
Connected Vehicle Roadside Equipment	container manifest*	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	container seal status*	Commercial Vehicle Check Equipment
Connected Vehicle Roadside Equipment	container transfer location*	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	infrastructure restriction warning notification*	Commercial Vehicle OBE

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Source Physical Object	Information Flows	Destination Physical Object
Connected Vehicle Roadside Equipment	intersection geometry*	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	signal priority status*	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	trigger area notification*	Commercial Vehicle OBE
Connected Vehicle Roadside Equipment	data provision*	Data Distribution System*
Connected Vehicle Roadside Equipment	data query*	Data Distribution System*
Connected Vehicle Roadside Equipment	data subscription*	Data Distribution System*
Connected Vehicle Roadside Equipment	local situation data*	Data Distribution System*
Connected Vehicle Roadside Equipment	vehicle charging profile*	Electric Charging Station*
Connected Vehicle Roadside Equipment	intersection geometry*	Emergency Vehicle OBE
Connected Vehicle Roadside Equipment	signal priority status*	Emergency Vehicle OBE
Connected Vehicle Roadside Equipment	emissions situation data*	Emissions Management Center
Connected Vehicle Roadside Equipment	RSE status*	Field Maintenance Equipment*
Connected Vehicle Roadside Equipment	container identification request*	Freight Equipment
Connected Vehicle Roadside Equipment	container seal interrogation*	Freight Equipment
Connected Vehicle Roadside Equipment	container identification*	Intermodal Terminal
Connected Vehicle Roadside Equipment	container location*	Intermodal Terminal
Connected Vehicle Roadside Equipment	container transfer location request*	Intermodal Terminal
Connected Vehicle Roadside Equipment	intersection infringement info*	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	intersection status monitoring*	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	personal location information*	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	signal preemption request*	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	signal priority service request*	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	signal service request*	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	traffic situation data*	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	vehicle entries and exits*	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	vehicle reported emissions*	ITS Roadway Equipment
Connected Vehicle Roadside Equipment	vehicle entries and exits*	ITS Roadway Payment Equipment
Connected Vehicle Roadside Equipment	vehicle location data for mapping*	Map Update System
Connected Vehicle Roadside Equipment	RSE application information*	Other Connected Vehicle Roadside Equipment*
Connected Vehicle Roadside Equipment	wrong way vehicle detected*	Other Connected Vehicle Roadside Equipment*
Connected Vehicle Roadside Equipment	loading zone application status*	Parking Management System
Connected Vehicle Roadside Equipment	parking management application status*	Parking Management System
Connected Vehicle Roadside Equipment	payment application status*	Payment Administration Center
Connected Vehicle Roadside Equipment	road use history*	Payment Administration Center
Connected Vehicle Roadside Equipment	intersection geometry*	Personal Information Device
Connected Vehicle Roadside Equipment	local traveler information*	Personal Information Device
Connected Vehicle Roadside Equipment	location correction*	Personal Information Device
Connected Vehicle Roadside Equipment	personal crossing safety information*	Personal Information Device
Connected Vehicle Roadside Equipment	rail crossing warning*	Personal Information Device
Connected Vehicle Roadside Equipment	transit stop guidance*	Personal Information Device
Connected Vehicle Roadside Equipment	personnel safety warning*	Personnel Device*
Connected Vehicle Roadside Equipment	RSE status*	Service Monitor System*
Connected Vehicle Roadside Equipment	local border wait times*	Traffic Management Center
Connected Vehicle Roadside Equipment	traffic situation data*	Traffic Management Center
Connected Vehicle Roadside Equipment	intersection geometry*	Transit Vehicle OBE

Source Physical Object	Information Flows	Destination Physical Object
Connected Vehicle Roadside Equipment	restricted lanes information*	Transit Vehicle OBE
Connected Vehicle Roadside Equipment	signal priority status*	Transit Vehicle OBE
Connected Vehicle Roadside Equipment	transit stop request*	Transit Vehicle OBE
Connected Vehicle Roadside Equipment	electric charging station information*	Transportation Information Center
Connected Vehicle Roadside Equipment	traffic situation data*	Transportation Information Center
Connected Vehicle Roadside Equipment	transit vehicle information*	Traveler Support Equipment
Connected Vehicle Roadside Equipment	access violation notification*	Vehicle OBE
Connected Vehicle Roadside Equipment	current charging status*	Vehicle OBE
Connected Vehicle Roadside Equipment	electric charging services inventory*	Vehicle OBE
Connected Vehicle Roadside Equipment	intersection geometry*	Vehicle OBE
Connected Vehicle Roadside Equipment	intersection safety warning*	Vehicle OBE
Connected Vehicle Roadside Equipment	lane closure information*	Vehicle OBE
Connected Vehicle Roadside Equipment	loading zone parking information*	Vehicle OBE
Connected Vehicle Roadside Equipment	local traveler information*	Vehicle OBE
Connected Vehicle Roadside Equipment	location correction*	Vehicle OBE
Connected Vehicle Roadside Equipment	low emissions zone parameters*	Vehicle OBE
Connected Vehicle Roadside Equipment	parking availability*	Vehicle OBE
Connected Vehicle Roadside Equipment	parking facility geometry*	Vehicle OBE
Connected Vehicle Roadside Equipment	proxied personal location*	Vehicle OBE
Connected Vehicle Roadside Equipment	queue warning information*	Vehicle OBE
Connected Vehicle Roadside Equipment	rail crossing warning*	Vehicle OBE
Connected Vehicle Roadside Equipment	restricted lanes application info*	Vehicle OBE
Connected Vehicle Roadside Equipment	restricted lanes information*	Vehicle OBE
Connected Vehicle Roadside Equipment	restricted lanes parameters*	Vehicle OBE
Connected Vehicle Roadside Equipment	road closure information*	Vehicle OBE
Connected Vehicle Roadside Equipment	road use charges*	Vehicle OBE
Connected Vehicle Roadside Equipment	road weather advisories*	Vehicle OBE
Connected Vehicle Roadside Equipment	roadway geometry*	Vehicle OBE
Connected Vehicle Roadside Equipment	speed management information*	Vehicle OBE
Connected Vehicle Roadside Equipment	traffic gap information*	Vehicle OBE
Connected Vehicle Roadside Equipment	traveler border clearance status*	Vehicle OBE
Connected Vehicle Roadside Equipment	vehicle situation data parameters*	Vehicle OBE
Connected Vehicle Roadside Equipment	wrong way vehicle detected*	Vehicle OBE
Cooperative ITS Credentials Management System*	credentials management operator presentation	Credentials Management System Operator*
Cooperative ITS Credentials Management System*	enrollment credentials*	ITS Object*
Cooperative ITS Credentials Management System*	security credential revocations*	ITS Object*
Cooperative ITS Credentials Management System*	security credentials*	ITS Object*
Cooperative ITS Credentials Management System*	security policy and networking information*	ITS Object*
Cooperative ITS Credentials Management System*	authorization coordination*	Other Credentials Management Systems*
Cooperative ITS Credentials Management System*	enrollment coordination*	Other Credentials Management Systems*

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Source Physical Object	Information Flows	Destination Physical Object
Cooperative ITS Credentials Management System*	misbehavior analysis coordination*	Other Credentials Management Systems*
Cooperative ITS Credentials Management System*	revocation coordination*	Other Credentials Management Systems*
Credentials Management System Operator*	credentials management operator input	Cooperative ITS Credentials Management System*
CVO Information Requestor Center	request for data review*	Commercial Vehicle Administration Center
Data Distribution System Operator*	DDS operator input	Data Distribution System*
Data Distribution System*	regional situation data*	Archived Data System
Data Distribution System*	data publication*	Center*
Data Distribution System*	data query publication*	Center*
Data Distribution System*	data publication*	Connected Vehicle Roadside Equipment
Data Distribution System*	data query publication*	Connected Vehicle Roadside Equipment
Data Distribution System*	DDS operations information presentation	Data Distribution System Operator*
Data Distribution System*	data provision*	Other Data Distribution Systems*
Data Distribution System*	data publication*	Other Data Distribution Systems*
Data Distribution System*	data query*	Other Data Distribution Systems*
Data Distribution System*	data query publication*	Other Data Distribution Systems*
Data Distribution System*	data subscription*	Other Data Distribution Systems*
Data Distribution System*	data publication*	Personal Information Device
Data Distribution System*	data query publication*	Personal Information Device
Data Distribution System*	data publication*	Vehicle OBE
Data Distribution System*	data query publication*	Vehicle OBE
Electric Charging Station*	current charging status*	Connected Vehicle Roadside Equipment
Electric Charging Station*	driver information	Driver
Electric Charging Station*	electric charging station information*	Transportation Information Center
Emergency Management Center	medical records request*	Care Facility
Emergency Management Center	incident scene safety application info*	Connected Vehicle Roadside Equipment
Emergency Management Center	occupant information*	Emergency Vehicle OBE
Emergency Management Center	road weather advisories for emergency response*	Emergency Vehicle OBE
Emergency Management Center	commercial vehicle incident response information*	Fleet and Freight Management Center
Emergency Management Center	decision support information	Personnel Device*
Emergency Management Center	incident command information	Personnel Device*
Emergency Management Center	alert notification	Social Media*
Emergency Management Center	road closure notification*	Traffic Management Center
Emergency Personnel	personnel input*	Personnel Device*
Emergency Vehicle OBE	medical records request*	Care Facility
Emergency Vehicle OBE	vehicle location and motion*	Connected Vehicle Roadside Equipment
Emergency Vehicle OBE	incident scene images*	Emergency Management Center
Emergency Vehicle OBE	road closure notification*	Emergency Management Center
Emergency Vehicle OBE	container seal interrogation*	Freight Equipment
Emergency Vehicle OBE	decision support information	Other EV OBEs*
Emergency Vehicle OBE	incident scene warning notification	Other EV OBEs*
Emergency Vehicle OBE	personnel safety warning*	Personnel Device*

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Emergency Vehicle OBE	special vehicle alert*	Vehicle OBE
Emissions Management Center	low emissions zone application info*	Connected Vehicle Roadside Equipment
Emissions Management Center	low emissions zone coordination*	Payment Administration Center
Emissions Management Center	low emissions zone coordination*	Traffic Management Center
Emissions Management Center	mobile source emissions data*	Traffic Management Center
Emissions Management Center	low emissions zone coordination*	Transit Management Center
Enforcement Center	targeted list*	Commercial Vehicle Administration Center
Enforcement Center	trigger area definition*	Commercial Vehicle Administration Center
Enforcement Center	trigger control*	Commercial Vehicle Administration Center
Field Maintenance Equipment*	equipment control commands*	Connected Vehicle Roadside Equipment
Field Maintenance Equipment*	RSE application install/upgrade*	Connected Vehicle Roadside Equipment
Field Maintenance Equipment*	RSE configuration settings*	Connected Vehicle Roadside Equipment
Field Maintenance Equipment*	field equipment commands*	Field*
Field Maintenance Equipment*	field equipment configuration settings*	Field*
Field Maintenance Equipment*	field equipment software install/upgrade*	Field*
Field Maintenance Equipment*	field equipment commands*	ITS Roadway Equipment
Field Maintenance Equipment*	field equipment configuration settings*	ITS Roadway Equipment
Field Maintenance Equipment*	field equipment software install/upgrade*	ITS Roadway Equipment
Field Maintenance Equipment*	equipment status presentation	Maint and Constr Field Personnel
Field Maintenance Equipment*	field equipment status presentation	Maint and Constr Field Personnel
Field System Operator*	field personnel equipment input	Field*
Field*	field equipment status	Center*
Field*	field equipment status	Field Maintenance Equipment*
Field*	field equipment status presentation	Field System Operator*
Field*	field equipment status presentation	Maint and Constr Field Personnel
Field*	field equipment status	Maint and Constr Management Center
Field*	field equipment status	Service Monitor System*
Fleet and Freight Management Center	request for permit*	Commercial Vehicle Administration Center
Fleet and Freight Management Center	container transport assignment*	Commercial Vehicle OBE
Fleet and Freight Management Center	road weather advisories*	Commercial Vehicle OBE
Fleet and Freight Management Center	trigger area*	Commercial Vehicle OBE
Fleet and Freight Management Center	trigger area notification*	Commercial Vehicle OBE
Fleet and Freight Management Center	available truck capacity*	Freight Distribution and Logistics Center*
Fleet and Freight Management Center	booking status	Freight Distribution and Logistics Center*
Fleet and Freight Management Center	load appointment status*	Freight Distribution and Logistics Center*
Fleet and Freight Management Center	container delivery request*	Intermodal Terminal
Fleet and Freight Management Center	container pickup confirmation*	Intermodal Terminal
Fleet and Freight Management Center	terminal reservation request*	Intermodal Terminal
Fleet and Freight Management Center	commercial vehicle trip information*	Transportation Information Center
Fleet and Freight Management Center	freight traveler information preferences*	Transportation Information Center

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Freight Consolidation Station*	container pickup request*	Fleet and Freight Management Center
Freight Distribution and Logistics Center*	manifest data	Border Inspection Administration Center
Freight Distribution and Logistics Center*	load matching info*	Fleet and Freight Management Center
Freight Distribution and Logistics Center*	booking status	Intermodal Customer System
Freight Distribution and Logistics Center*	container availability request*	Intermodal Terminal
Freight Distribution and Logistics Center*	load matching systems coordination*	Other Freight Distribution and Logistics Centers*
Freight Distribution and Logistics Center*	freight traveler information preferences*	Transportation Information Center
Freight Equipment	container seal status*	Commercial Vehicle OBE
Freight Equipment	container identification*	Connected Vehicle Roadside Equipment
Freight Equipment	container location*	Connected Vehicle Roadside Equipment
Freight Equipment	container manifest*	Connected Vehicle Roadside Equipment
Freight Equipment	container seal status*	Connected Vehicle Roadside Equipment
Freight Equipment	container manifest*	Emergency Vehicle OBE
Freight Equipment	container seal status*	Emergency Vehicle OBE
Freight Equipment	container seal status*	Fleet and Freight Management Center
Identifier Registry*	service identifiers*	Cooperative ITS Credentials Management System*
Identifier Registry*	identifier coordination*	Other Identifier Registries*
Intermodal Customer System	available loads*	Freight Distribution and Logistics Center*
Intermodal Customer System	freight traveler information preferences*	Transportation Information Center
Intermodal Terminal	container transfer location*	Connected Vehicle Roadside Equipment
Intermodal Terminal	container delivery confirmation*	Fleet and Freight Management Center
Intermodal Terminal	container pickup request*	Fleet and Freight Management Center
Intermodal Terminal	intermodal terminal status*	Fleet and Freight Management Center
Intermodal Terminal	terminal reservation*	Fleet and Freight Management Center
Intermodal Terminal	container availability status*	Freight Distribution and Logistics Center*
Intermodal Terminal	intermodal terminal status*	Freight Distribution and Logistics Center*
Intermodal Terminal	intermodal terminal status*	Transportation Information Center
ITS Communications Equipment*	ITS information*	ITS Object*
ITS Communications Equipment*	proxied ITS information*	ITS Object*
ITS Communications Equipment*	ITS information*	Other ITS Objects*
ITS Communications Equipment*	proxied ITS information*	Other ITS Objects*
ITS Object*	device identification*	Center*
ITS Object*	permission application*	Center*
ITS Object*	application test response*	Certification System*
ITS Object*	device test response*	Certification System*
ITS Object*	device enrollment information*	Cooperative ITS Credentials Management System*

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
ITS Object*	misbehavior report*	Cooperative ITS Credentials Management System*
ITS Object*	ITS information*	ITS Communications Equipment*
ITS Object*	object registration*	Object Registration and Discovery System*
ITS Object*	ITS information*	Other ITS Objects*
ITS Object*	system status*	Service Monitor System*
ITS Object*	service advertisement*	Vehicle OBE
ITS Roadway Equipment	conflict monitor status*	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	infrastructure restriction warning*	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	intersection control status*	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	mixed use crossing status*	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	reduced speed warning info*	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	traffic gap information*	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	vehicle entries and exits*	Connected Vehicle Roadside Equipment
ITS Roadway Equipment	field equipment status	Field Maintenance Equipment*
ITS Roadway Equipment	roadway advisory radio status*	Maint and Constr Management Center
ITS Roadway Equipment	signal control data*	Other ITS Roadway Equipment
ITS Roadway Equipment	lane management information*	Traffic Management Center
ITS Roadway Equipment	mixed use safety warning status*	Traffic Management Center
ITS Roadway Equipment	passive vehicle monitoring data*	Traffic Management Center
ITS Roadway Equipment	roadway advisory radio status*	Traffic Management Center
ITS Roadway Equipment	roadway warning system status*	Traffic Management Center
ITS Roadway Equipment	shoulder management information*	Traffic Management Center
ITS Roadway Equipment	signal fault data*	Traffic Management Center
ITS Roadway Equipment	variable speed limit status*	Traffic Management Center
ITS Roadway Payment Equipment	vehicle entries and exits*	Connected Vehicle Roadside Equipment
ITS Roadway Payment Equipment	road pricing equipment fault*	Payment Administration Center
Location and Time Data Source	location and time	Center*
Maint and Constr Field Personnel	field personnel equipment input	Field Maintenance Equipment*
Maint and Constr Field Personnel	field personnel equipment input	Field*
Maint and Constr Management Center	equipment maintenance status	Center*
Maint and Constr Management Center	speed warning application info*	Connected Vehicle Roadside Equipment
Maint and Constr Management Center	vehicle signage application info*	Connected Vehicle Roadside Equipment
Maint and Constr Management Center	work zone safety application info*	Connected Vehicle Roadside Equipment
Maint and Constr Management Center	field equipment commands*	Field*
Maint and Constr Management Center	field equipment configuration settings*	Field*
Maint and Constr Management Center	field equipment software install/upgrade*	Field*
Maint and Constr Management Center	roadway advisory radio data*	ITS Roadway Equipment
Maint and Constr Management Center	field device coordination*	Traffic Management Center
Maint and Constr Vehicle OBE	personnel safety warning*	Personnel Device*
Maint and Constr Vehicle OBE	special vehicle alert*	Vehicle OBE
Maint and Constr Vehicle Operator	driver environmental input*	Maint and Constr Vehicle OBE
MAP GIS Operator*	map operator input*	Map Update System
Map Update System	intersection geometry*	Center*
Map Update System	map updates	Center*
Map Update System	intersection geometry*	Connected Vehicle Roadside Equipment

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Map Update System	parking facility geometry*	Connected Vehicle Roadside Equipment
Map Update System	roadway geometry*	Connected Vehicle Roadside Equipment
Map Update System	map operator updates*	MAP GIS Operator*
Map Update System	map update coordination*	Other Map Update Systems*
Map Update System	parking facility geometry*	Parking Management System
Map Update System	intersection geometry*	Personal Information Device
Map Update System	intersection geometry*	Vehicle OBE
Map Update System	parking facility geometry*	Vehicle OBE
Map Update System	roadway geometry*	Vehicle OBE
Network Time Source*	time*	Center*
Network Time Source*	time*	Connected Vehicle Roadside Equipment
Network Time Source*	time*	Data Distribution System*
Network Time Source*	time*	ITS Roadway Equipment
Network Time Source*	time*	Service Monitor System*
Object Registration and Discovery System*	object discovery*	ITS Object*
Object Registration and Discovery System*	ORDS operations information presentation	ORDS Operator*
ORDS Operator*	ORDS operator input	Object Registration and Discovery System*
Other Authorizing Centers*	permission request coordination*	Authorizing Center*
Other Connected Vehicle Roadside Equipment*	RSE application information*	Connected Vehicle Roadside Equipment
Other Connected Vehicle Roadside Equipment*	wrong way vehicle detected*	Connected Vehicle Roadside Equipment
Other Credentials Management Systems*	authorization coordination*	Cooperative ITS Credentials Management System*
Other Credentials Management Systems*	enrollment coordination*	Cooperative ITS Credentials Management System*
Other Credentials Management Systems*	misbehavior analysis coordination*	Cooperative ITS Credentials Management System*
Other Credentials Management Systems*	revocation coordination*	Cooperative ITS Credentials Management System*
Other CV Administration Centers	commercial vehicle permit information*	Commercial Vehicle Administration Center
Other Data Distribution Systems*	data provision*	Data Distribution System*
Other Data Distribution Systems*	data publication*	Data Distribution System*
Other Data Distribution Systems*	data query*	Data Distribution System*
Other Data Distribution Systems*	data query publication*	Data Distribution System*
Other Data Distribution Systems*	data subscription*	Data Distribution System*
Other EV OBEs*	decision support information	Emergency Vehicle OBE
Other EV OBEs*	incident scene warning notification	Emergency Vehicle OBE
Other Freight Distribution and Logistics Centers*	load matching systems coordination*	Freight Distribution and Logistics Center*
Other Identifier Registries*	identifier coordination*	Identifier Registry*
Other ITS Objects*	ITS information*	ITS Communications Equipment*
Other ITS Objects*	ITS information*	ITS Object*

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Other ITS Roadway Equipment	signal control data*	ITS Roadway Equipment
Other Map Update Systems*	map update coordination*	Map Update System
Other Payment Administration Centers	payment coordination*	Payment Administration Center
Other Traffic Management Centers	device control request*	Traffic Management Center
Other Traffic Management Centers	device data*	Traffic Management Center
Other Traffic Management Centers	device status*	Traffic Management Center
Other Traffic Management Centers	emergency traffic coordination*	Traffic Management Center
Other Traffic Management Centers	transportation operational strategies*	Traffic Management Center
Other Transportation Information Centers	traffic-related regulations*	Transportation Information Center
Other Transportation Information Centers	transit service information*	Transportation Information Center
Other Vehicle OBEs	vehicle location and motion*	Connected Vehicle Roadside Equipment
Other Vehicle OBEs	intersection infringement info*	Vehicle OBE
Other Vehicle OBEs	vehicle control event*	Vehicle OBE
Other Vehicle OBEs	vehicle hazard event*	Vehicle OBE
Other Vehicle OBEs	vehicle location and motion*	Vehicle OBE
Other Vehicle OBEs	vehicle path prediction*	Vehicle OBE
Other Vehicle OBEs	vehicle profile*	Vehicle OBE
Other Vehicle OBEs	wrong way vehicle detected*	Vehicle OBE
Parking Management System	loading zone application info*	Connected Vehicle Roadside Equipment
Parking Management System	parking management application info*	Connected Vehicle Roadside Equipment
Parking Management System	parking facility geometry*	Map Update System
Parking Management System	parking arrival information*	Transit Management Center
Parking Management System	loading zone information*	Transportation Information Center
Parking Management System	loading zone reservation confirmation*	Transportation Information Center
Payment Administration Center	payment application information*	Connected Vehicle Roadside Equipment
Payment Administration Center	road use charges*	Connected Vehicle Roadside Equipment
Payment Administration Center	low emissions zone coordination*	Emissions Management Center
Payment Administration Center	payment coordination*	Other Payment Administration Centers
Payment Administration Center	traveler payment request*	Personal Information Device
Payment Administration Center	user account reports*	Personal Information Device
Payment Administration Center	road use charge info*	Transportation Information Center
Payment Administration Center	traveler payment request*	Traveler Support Equipment
Payment Administration Center	user account reports*	Traveler Support Equipment
Payment Administration Center	road use charges*	Vehicle OBE
Personal Information Device	personal device status*	Center*
Personal Information Device	personal location*	Connected Vehicle Roadside Equipment
Personal Information Device	personal signal service request*	Connected Vehicle Roadside Equipment
Personal Information Device	transit user information*	Connected Vehicle Roadside Equipment
Personal Information Device	personal updates*	Cyclist
Personal Information Device	data provision*	Data Distribution System*
Personal Information Device	data query*	Data Distribution System*
Personal Information Device	data subscription*	Data Distribution System*
Personal Information Device	traveler payment information*	Payment Administration Center
Personal Information Device	user account setup*	Payment Administration Center
Personal Information Device	personal updates*	Pedestrian
Personal Information Device	PID status*	Service Monitor System*
Personal Information Device	traveler request	Social Media*

Source Physical Object	Information Flows	Destination Physical Object
Personal Information Device	traveler sourced updates*	Social Media*
Personal Information Device	transfer request*	Transit Management Center
Personal Information Device	transit stop request*	Transit Management Center
Personal Information Device	personal location*	Transit Vehicle OBE
Personal Information Device	transfer request*	Transit Vehicle OBE
Personal Information Device	transit stop request*	Transit Vehicle OBE
Personal Information Device	transit user information*	Transit Vehicle OBE
Personal Information Device	evacuation assistance request*	Transportation Information Center
Personal Information Device	freight traveler information preferences*	Transportation Information Center
Personal Information Device	shared use confirmation*	Transportation Information Center
Personal Information Device	shared use request*	Transportation Information Center
Personal Information Device	shelter request*	Transportation Information Center
Personal Information Device	traveler sourced updates*	Transportation Information Center
Personal Information Device	trip feedback*	Transportation Information Center
Personal Information Device	personal location*	Vehicle OBE
Personnel Device*	personnel location*	Connected Vehicle Roadside Equipment
Personnel Device*	incident command input	Emergency Management Center
Personnel Device*	incident scene images*	Emergency Management Center
Personnel Device*	incident scene status*	Emergency Management Center
Personnel Device*	personnel location*	Emergency Management Center
Personnel Device*	personnel updates*	Emergency Personnel
Personnel Device*	incident scene images*	Emergency Vehicle OBE
Personnel Device*	personnel location*	Emergency Vehicle OBE
Personnel Device*	personnel updates*	Maint and Constr Field Personnel
Personnel Device*	personnel location*	Maint and Constr Vehicle OBE
Population and Housing Data System*	population and housing data*	Emergency Management Center
Position Corrections Source*	position corrections*	Connected Vehicle Roadside Equipment
Service Monitor System Operator*	service monitor operator input	Service Monitor System*
Service Monitor System*	center fault data*	Center*
Service Monitor System*	field equipment fault data*	Center*
Service Monitor System*	personal device fault data*	Center*
Service Monitor System*	RSE fault data*	Center*
Service Monitor System*	time local form*	Center*
Service Monitor System*	time local form*	Connected Vehicle Roadside Equipment
Service Monitor System*	time local form*	Data Distribution System*
Service Monitor System*	time local form*	ITS Roadway Equipment
Service Monitor System*	RSE fault data*	Maint and Constr Management Center
Service Monitor System*	service monitor information presentation	Service Monitor System Operator*
Service Monitor System*	OBE fault data*	Vehicle Service Center*
Social Media*	traveler sourced updates*	Emergency Management Center
Social Media*	interactive traveler information	Personal Information Device
Social Media*	traveler sourced updates*	Transportation Information Center
Special Needs Registry*	special needs data*	Emergency Management Center
Support Maintenance Equipment*	center equipment commands*	Center*
Support Maintenance Equipment*	center equipment configuration settings*	Center*
Support Maintenance Equipment*	center equipment software install/upgrade*	Center*

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Support Maintenance Equipment*	support equipment status presentation*	Support Maintenance Personnel*
Support Maintenance Personnel*	support personnel equipment input	Support Maintenance Equipment*
Traffic Management Center	environmental monitoring application info*	Connected Vehicle Roadside Equipment
Traffic Management Center	intersection management application info*	Connected Vehicle Roadside Equipment
Traffic Management Center	intersection safety application info*	Connected Vehicle Roadside Equipment
Traffic Management Center	lighting management application info*	Connected Vehicle Roadside Equipment
Traffic Management Center	queue warning application information*	Connected Vehicle Roadside Equipment
Traffic Management Center	rail crossing application info*	Connected Vehicle Roadside Equipment
Traffic Management Center	restricted lanes application info*	Connected Vehicle Roadside Equipment
Traffic Management Center	road closure application info*	Connected Vehicle Roadside Equipment
Traffic Management Center	road weather advisory info*	Connected Vehicle Roadside Equipment
Traffic Management Center	situation data collection parameters*	Connected Vehicle Roadside Equipment
Traffic Management Center	speed management application information*	Connected Vehicle Roadside Equipment
Traffic Management Center	speed warning application info*	Connected Vehicle Roadside Equipment
Traffic Management Center	stop sign gap assist info*	Connected Vehicle Roadside Equipment
Traffic Management Center	traffic metering application info*	Connected Vehicle Roadside Equipment
Traffic Management Center	traffic monitoring application info*	Connected Vehicle Roadside Equipment
Traffic Management Center	vehicle signage application info*	Connected Vehicle Roadside Equipment
Traffic Management Center	transportation operational strategies*	Emergency Management Center
Traffic Management Center	low emissions zone coordination*	Emissions Management Center
Traffic Management Center	transportation operational strategies*	Emissions Management Center
Traffic Management Center	transportation operational strategies*	Event Promoter System
Traffic Management Center	lane management control*	ITS Roadway Equipment
Traffic Management Center	mixed use safety warning control*	ITS Roadway Equipment
Traffic Management Center	passive vehicle monitoring control*	ITS Roadway Equipment
Traffic Management Center	roadway advisory radio data*	ITS Roadway Equipment
Traffic Management Center	roadway warning system control*	ITS Roadway Equipment
Traffic Management Center	shoulder management control*	ITS Roadway Equipment
Traffic Management Center	signal control device configuration*	ITS Roadway Equipment
Traffic Management Center	signal control plans*	ITS Roadway Equipment
Traffic Management Center	signal system configuration*	ITS Roadway Equipment
Traffic Management Center	stop sign gap assist control*	ITS Roadway Equipment
Traffic Management Center	variable speed limit control*	ITS Roadway Equipment
Traffic Management Center	field device coordination*	Maint and Constr Management Center
Traffic Management Center	transportation operational strategies*	Maint and Constr Management Center
Traffic Management Center	traffic information for media*	Media
Traffic Management Center	device control request*	Other Traffic Management Centers
Traffic Management Center	device data*	Other Traffic Management Centers
Traffic Management Center	device status*	Other Traffic Management Centers
Traffic Management Center	emergency traffic coordination*	Other Traffic Management Centers
Traffic Management Center	transportation operational strategies*	Other Traffic Management Centers
Traffic Management Center	transportation operational strategies*	Parking Management System
Traffic Management Center	transportation operational strategies*	Payment Administration Center
Traffic Management Center	transportation operational strategies*	Transit Management Center

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Traffic Management Center	traffic control information*	Transportation Information Center
Traffic Management Center	traffic-related regulations*	Transportation Information Center
Traffic Management Center	transportation operational strategies*	Transportation Information Center
Traffic Regulatory Authority Center*	traffic-related regulations*	Map Update System
Traffic Regulatory Authority Center*	traffic-related regulations*	Traffic Management Center
Traffic Regulatory Authority Center*	traffic-related regulations*	Transportation Information Center
Transit Management Center	service information request*	Alternate Mode Transportation Center
Transit Management Center	transit user guidance application info*	Connected Vehicle Roadside Equipment
Transit Management Center	low emissions zone coordination*	Emissions Management Center
Transit Management Center	transit emissions data*	Emissions Management Center
Transit Management Center	event transit service plans*	Event Promoter System
Transit Management Center	transit park and ride information*	Parking Management System
Transit Management Center	transfer status*	Personal Information Device
Transit Management Center	connection protection instructions*	Transit Vehicle OBE
Transit Management Center	transfer status*	Transit Vehicle OBE
Transit Management Center	transit stop locations*	Transit Vehicle OBE
Transit Management Center	transit stop request*	Transit Vehicle OBE
Transit Management Center	transit trip plan*	Transportation Information Center
Transit Vehicle OBE	transit vehicle information*	Connected Vehicle Roadside Equipment
Transit Vehicle OBE	vehicle location and motion*	Connected Vehicle Roadside Equipment
Transit Vehicle OBE	vehicle path prediction*	Connected Vehicle Roadside Equipment
Transit Vehicle OBE	vehicle profile*	Connected Vehicle Roadside Equipment
Transit Vehicle OBE	transfer status*	Personal Information Device
Transit Vehicle OBE	transit vehicle information*	Personal Information Device
Transit Vehicle OBE	vehicle location and motion*	Personal Information Device
Transit Vehicle OBE	vehicle path prediction*	Personal Information Device
Transit Vehicle OBE	transfer request*	Transit Management Center
Transit Vehicle OBE	transit user information*	Transit Management Center
Transit Vehicle OBE	transit vehicle emissions*	Transit Management Center
Transit Vehicle OBE	special vehicle alert*	Vehicle OBE
Transit Vehicle OBE	vehicle location and motion*	Vehicle OBE
Transit Vehicle OBE	vehicle path prediction*	Vehicle OBE
Transportation Information Center	service information request*	Alternate Mode Transportation Center
Transportation Information Center	freight-specific traveler information*	Commercial Vehicle OBE
Transportation Information Center	electric charging services inventory*	Connected Vehicle Roadside Equipment
Transportation Information Center	road weather advisory info*	Connected Vehicle Roadside Equipment
Transportation Information Center	traveler information application info*	Connected Vehicle Roadside Equipment
Transportation Information Center	road weather advisories*	Emergency Management Center
Transportation Information Center	freight-specific traveler information*	Fleet and Freight Management Center
Transportation Information Center	road weather advisories*	Fleet and Freight Management Center
Transportation Information Center	freight-specific traveler information*	Freight Distribution and Logistics Center*
Transportation Information Center	freight-specific traveler information*	Intermodal Customer System
Transportation Information Center	traffic-related regulations*	Other Transportation Information Centers
Transportation Information Center	transit service information*	Other Transportation Information Centers
Transportation Information Center	loading zone reservation request*	Parking Management System
Transportation Information Center	evacuation assistance information*	Personal Information Device

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Transportation Information Center	freight-specific traveler information*	Personal Information Device
Transportation Information Center	parking plan*	Personal Information Device
Transportation Information Center	shared use response*	Personal Information Device
Transportation Information Center	shelter recommendations*	Personal Information Device
Transportation Information Center	traffic regulation information*	Personal Information Device
Transportation Information Center	evacuee match information*	Shelter Provider Center
Transportation Information Center	social media presence*	Social Media*
Transportation Information Center	shared use status*	Transit Management Center
Transportation Information Center	transit fare request*	Transit Management Center
Transportation Information Center	transit trip request*	Transit Management Center
Transportation Information Center	evacuation assistance information*	Traveler Support Equipment
Transportation Information Center	parking plan*	Traveler Support Equipment
Transportation Information Center	shared use response*	Traveler Support Equipment
Transportation Information Center	shelter recommendations*	Traveler Support Equipment
Transportation Information Center	electric charging services inventory*	Vehicle OBE
Transportation Information Center	evacuation assistance information*	Vehicle OBE
Transportation Information Center	parking plan*	Vehicle OBE
Transportation Information Center	road weather advisories*	Vehicle OBE
Transportation Information Center	shelter recommendations*	Vehicle OBE
Transportation Information Center	traffic regulation information*	Vehicle OBE
Transportation Information Center	vehicle situation data parameters*	Vehicle OBE
Transportation Information Center	broadcast traveler information	Wide Area Information Disseminator System*
Traveler Card	border card data*	Border Inspection System
Traveler Card	border card data*	Vehicle OBE
Traveler Support Equipment	transit stop request*	Connected Vehicle Roadside Equipment
Traveler Support Equipment	traveler payment information*	Payment Administration Center
Traveler Support Equipment	user account setup*	Payment Administration Center
Traveler Support Equipment	transit stop request*	Transit Management Center
Traveler Support Equipment	evacuation assistance request*	Transportation Information Center
Traveler Support Equipment	shared use confirmation*	Transportation Information Center
Traveler Support Equipment	shared use request*	Transportation Information Center
Traveler Support Equipment	shelter request*	Transportation Information Center
Traveler Support Equipment	traveler sourced updates*	Transportation Information Center
Vehicle OBE	intersection infringement info*	Connected Vehicle Roadside Equipment
Vehicle OBE	loading zone use request*	Connected Vehicle Roadside Equipment
Vehicle OBE	road pricing equipment status*	Connected Vehicle Roadside Equipment
Vehicle OBE	road use history*	Connected Vehicle Roadside Equipment
Vehicle OBE	traveler credentials*	Connected Vehicle Roadside Equipment
Vehicle OBE	vehicle charging profile*	Connected Vehicle Roadside Equipment
Vehicle OBE	vehicle control event*	Connected Vehicle Roadside Equipment
Vehicle OBE	vehicle location and motion*	Connected Vehicle Roadside Equipment
Vehicle OBE	vehicle location and motion for surveillance*	Connected Vehicle Roadside Equipment
Vehicle OBE	vehicle profile*	Connected Vehicle Roadside Equipment
Vehicle OBE	vehicle reported emissions*	Connected Vehicle Roadside Equipment
Vehicle OBE	vehicle situation data*	Connected Vehicle Roadside Equipment

Appendix B3 – New U.S. Triplets

Source Physical Object	Information Flows	Destination Physical Object
Vehicle OBE	wrong way vehicle detected*	Connected Vehicle Roadside Equipment
Vehicle OBE	data provision*	Data Distribution System*
Vehicle OBE	data query*	Data Distribution System*
Vehicle OBE	data subscription*	Data Distribution System*
Vehicle OBE	vehicle collision information*	Emergency Vehicle OBE
Vehicle OBE	vehicle location and motion*	Emergency Vehicle OBE
Vehicle OBE	vehicle location and motion*	Maint and Constr Vehicle OBE
Vehicle OBE	vehicle location and motion for mapping*	Map Update System
Vehicle OBE	intersection infringement info*	Other Vehicle OBEs
Vehicle OBE	vehicle control event*	Other Vehicle OBEs
Vehicle OBE	vehicle hazard event*	Other Vehicle OBEs
Vehicle OBE	vehicle location and motion*	Other Vehicle OBEs
Vehicle OBE	vehicle path prediction*	Other Vehicle OBEs
Vehicle OBE	vehicle profile*	Other Vehicle OBEs
Vehicle OBE	wrong way vehicle detected*	Other Vehicle OBEs
Vehicle OBE	road use history*	Payment Administration Center
Vehicle OBE	vehicle location and motion*	Personal Information Device
Vehicle OBE	OBE status*	Service Monitor System*
Vehicle OBE	vehicle location and motion*	Transit Vehicle OBE
Vehicle OBE	evacuation assistance request*	Transportation Information Center
Vehicle OBE	shelter request*	Transportation Information Center
Vehicle OBE	traveler sourced updates*	Transportation Information Center
Vehicle OBE	trip feedback*	Transportation Information Center
Vehicle OBE	vehicle situation data*	Transportation Information Center
Vehicle OBE	vehicle diagnostic data*	Vehicle Service Center*
Vehicle OBE	vehicle service request*	Vehicle Service Center*
Vehicle Service Center*	vehicle commands*	Vehicle OBE
Vehicle Service Center*	vehicle configuration settings*	Vehicle OBE
Vehicle Service Center*	vehicle service information*	Vehicle OBE
Vehicle Service Center*	vehicle service response*	Vehicle OBE
Vehicle Service Center*	vehicle software install/upgrade*	Vehicle OBE
Wide Area Information Disseminator System*	wide area broadcast traveler information	Personal Information Device
Wide Area Information Disseminator System*	wide area broadcast traveler information	Traveler Support Equipment
Wide Area Information Disseminator System*	wide area broadcast traveler information	Vehicle OBE

B-4 *NEW FUNCTION OBJECTS*

Note: New Physical Objects are indicated with an *.

Appendix B4 – New U.S Functional Objects

Functional Object	Description	In Physical Object
Border Inspection	'Border Inspection' manages and supports primary and secondary inspections at the border crossing.	Border Inspection System
Border Inspection Administration	'Border Inspection Administration' performs administrative functions relating to the inspection of goods and vehicles at the border.	Border Inspection Administration Center
CCMS Authorization	'CCMS Authorization' components provide authorization credentials (e.g., pseudonym certificates) to end entities. The end entity applies for and obtains authorization credentials, enabling the end entity to enter the "Operational" state. This function requires an interactive dialog, including at minimum a Certificate Request from the end entity desiring certificates. This request will be checked for validity, with the embedded enrollment certificate checked against an internal blacklist. If all checks are passed, this function will distribute a bundle of linked pseudonym certificates suitable for use by the requesting end entity, with the characteristics and usage rules of those certificates dependent on the operational policies of the CCMS. It also provides the secure provisioning of a given object's Decryption Key in response to an authorized request from that object. The retrieved Decryption Key will be used by the receiving object to decrypt the "next valid" batch within the set of previously retrieved Security Credential batches.	Cooperative ITS Credentials Management System*
CCMS Enrollment	'CCMS Enrollment' components provide enrollment credentials to end entities. The end entity applies for and obtains enrollment credentials that can be used to communicate with other CCMS components, entering the "Unauthorized" state. CCMS Enrollment components also participate in de-registration processes through interaction with CCMS Revocation components.	Cooperative ITS Credentials Management System*
CCMS Misbehavior Reporting and Action	'CCMS Misbehavior Reporting and Action' components process misbehavior reports from end entities. Misbehavior reports are analyzed and investigated if warranted. Investigated misbehavior reports are correlated with end entities and systemic issues are identified. If revocation is warranted, this component provides information to Authorization or Revocation components to initiate revocation and/or blacklisting, as appropriate.	Cooperative ITS Credentials Management System*
CCMS Provisioning	'CCMS Provisioning' components provide the end entity with material that allows it to enter the 'Unenrolled' state. This consists of root certificates and the crypto material that allows it to communicate securely with the Enrollment components. This function ensures the requesting entity meets requirements for provisioning and provides the certificates and relevant policy information to entities that meet the requirements.	Cooperative ITS Credentials Management System*
CCMS Revocation	'CCMS Revocation' components generate the internal blacklist and Certificate Revocation List (CRL) and distribute them to other CCMS components and end entities. Once placed on the CRL, an end entity is in the Unauthorized state. Once placed on the blacklist, an end entity is in the Unenrolled state.	Cooperative ITS Credentials Management System*

Appendix B4 – New U.S Functional Objects

Functional Object	Description	In Physical Object
Center Connected Vehicle Infrastructure Management	'Center Connected Vehicle Infrastructure Management' is the back office application that supports monitoring and maintenance of the Connected Vehicle infrastructure (RSEs, support systems, and associated communications links). It monitors the performance and configuration of the infrastructure portion of the Connected Vehicle Environment. This includes tracking and management of the infrastructure configuration as well as detection, isolation, and correction of infrastructure service problems. The application also includes monitoring of performance of the infrastructure equipment, including RSEs and communications links.	Center*
Center Data Subscription Management	'Center Data Subscription Management' manages data subscriptions for an end user. It provides access to a catalog of available data, manages the necessary user information and rules that govern the data subscriptions, supports communications with data providers to collect data per the subscription rules, and makes the data available to the end user. It provides the local user interface through which a user can specify and manage subscriptions. It supports different mechanisms for collecting subscribed data for the end-user including one-time query-response as well as publish-subscribe services.	Center*
Center Field Equipment Management	'Center Field Equipment Management' is the back office application that supports monitoring and maintenance of field equipment. It monitors the performance and configuration of the field equipment. This includes management of the infrastructure configuration as well as detection, isolation, and correction of field equipment problems. The application also includes monitoring of performance of the field equipment, including communications links.	Center*
Center Map Management	'Center Map Management' provides the map functionality necessary to support map updates and use within an operational center. It manages map data for the center and provides map data to center applications that use a map.	Center*
Center Permission Management	'Center Permission Management' enables Connected Vehicle system users to request permission to access connected vehicle services. A center may request permission for the center or the infrastructure devices and vehicles associated with the center.	Center*
Center Personal Information Device Management	'Center Personal Information Device Management' is the back office application that supports monitoring and maintenance of Personal Information Devices. Most Personal Information Device management is the province of device manufacturers, service providers, and their clients, which is beyond the scope of an ITS architecture. For roadside safety applications, particularly those that are operated by field personnel working on or close to the right of way, the operating center may manage the devices and the hosted safety applications. For these devices and applications, this functional object monitors the performance and configuration of the devices and installed applications, and the communications links.	Center*

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Functional Object	Description	In Physical Object
Center Support Services	'Center Support Services' provides foundational functions that support data collection, management, location reference, timing, and data distribution. It maintains precise location and time information to support other services.	Center*
Center System Executive	'Center System Executive' provides the operating system and executive functions that manage computer resources, user accounts, and installed applications. It provides security features and manages software installation and upgrade.	Center*
Center System Monitoring and Diagnostics	'Center System Monitoring and Diagnostics' includes background self-tests, diagnostics, watchdog timers, and other hardware and software that monitors the operating condition of the center. The status of the center equipment and diagnostic information is provided to center operations personnel and maintenance personnel that may be operating remotely from the center.	Center*
Certification of Applications	'Certification of Applications' verifies the performance and integrity of software for use in the ITS environment. It interacts with and monitors software in device configurations and verifies that the software is able to operate as specified; it may also certify that the software meets the requirements associated with particular services and should be entitled to application-specific credentials.	Certification System*
Certification of Devices	'Certification of Devices' verifies the performance, integrity and functionality of devices, including necessary firmware, for use in the ITS environment. It monitors software and hardware including radios, processors and tamper-related sensors to verify that the device and its operating software is able to operate as specified; it may also certify that the hardware and firmware meet the requirements associated with particular services and should be entitled to device-specific credentials.	Certification System*
Core Authorization	'Core Authorization' manages authorization mechanisms to define permissions for System Users. This enables the Core System to establish operational environments where different System Users may have different capabilities in terms of accessing Core services and interacting with one another. For instance, some Mobile elements may be authorized to request signal priority, or some Centers may be permitted to use the geographic broadcast service, while those without those permissions would not.	Authorizing Center*
CV On-Board Drayage Support	'CV On-Board Drayage Support' communicates with the Intermodal Terminal, Fleet and Freight Management (dispatch), and third party services to support efficient drayage operations. This application provides information to the commercial vehicle driver identifying loads and efficient schedules and routes for transport to avoid terminal congestion and minimize bobtail/dry runs. It provides information to dispatch on current truck/equipment/load status.	Commercial Vehicle OBE
CV On-Board Signal Priority	'CV On-board Signal Priority' provides the capability for commercial vehicles to determine eligibility for priority and request signal priority at signalized intersections, ramps, and interchanges through short range communication with traffic control equipment at the roadside.	Commercial Vehicle OBE

Appendix B4 – New U.S Functional Objects

Functional Object	Description	In Physical Object
CV On-Board Special Vehicle Safety	'CV On-Board Special Vehicle Safety' alerts vehicles in the vicinity of a commercial vehicle that is oversized, slow, or performs maneuvers that may impact surrounding vehicles.	Commercial Vehicle OBE
DDS Data Access Management	'"DDS	Data Access Management' defines the access mechanisms, structures and restrictions for inbound (from providers) and outbound (to consumers) data."
DDS Data Collection and Aggregation	'DDS Data Collection and Aggregation' collects data 'deposits' from producers including meta data such as the generation location and time. It authenticates and validates the data deposits and logs all associated meta data. Authenticated, valid data is bundled based on information type and location and made available as data products to consumers who are interested in the data. It establishes delivery parameters for data consumers that subscribe based on parameters including content type and geographic region of interest and delivers data to consumers based on these parameters.	Data Distribution System*
DDS Support Services	'DDS Support Services' provides foundational functions that support data collection, management, timing, and data distribution. It coordinates with Support subsystems to maintain necessary registrations with respect to location and scope.	Data Distribution System*
Drayage Operations Optimization Service	The 'Drayage Operations Optimization Service' provides a portal for shippers and receivers to post their loads in need of transport and provide an opportunity for commercial vehicles to find a load to haul on their trip back to/from an intermodal facility. It connects load matching services with container and chassis/equipment availability information and appointment/reservations services from the intermodal terminals to provide an optimized, regionally integrated view of intermodal container transport for drayage operators.	Freight Distribution and Logistics Center*
Electric Charging Station Management	'Electric Charging Station Management' manages vehicle charging. It communicates with the vehicle during charging and provides charge status information to the driver. A connection with Connected Vehicle Roadside Equipment provides the capability to integrate charging station coordination and communication into the broader Connected Vehicle Environment.	Electric Charging Station*
Emissions Connected Vehicle Monitoring	'Emissions Connected Vehicle Monitoring' collects emissions data reported by passing vehicles and uses this data to support air quality management and planning. Coordination with traffic management supports air quality-responsive management of traffic.	Emissions Management Center
Emissions Zone Management	'Emissions Zone Management' identifies existing and potential emissions hot spots and coordinates with transportation agencies and their systems to establish low emissions zones to manage air quality in these areas. Through this coordination, the geographic boundary, restrictions, and pricing for the low emissions zone are established and adjusted.	Emissions Management Center

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Functional Object	Description	In Physical Object
Field System Executive	'Field System Executive' includes the operating system kernel and executive functions that manage the overall device software configuration and operation and support configuration management, computer resource management, and govern software installation and upgrade.	Field*
Field System Monitoring and Diagnostics	'Field System Monitoring and Diagnostics' includes background self-tests, diagnostics, watchdog timers, and other hardware and software that monitors the operating condition of field equipment. The status of the equipment and diagnostic information is provided to local maintenance personnel and the operating center.	Field*
FME On-Site Maintenance	'FME On-Site Maintenance' provides field personnel with diagnostic information from field equipment and provides the capability for field personnel to locally control and configure this equipment to support on-site installation, repair, and maintenance.	Field Maintenance Equipment*
Freight Equipment Monitoring	'Freight Equipment Monitoring' includes the on-board devices used to monitor intermodal freight equipment. These devices provide freight equipment location and status of the freight, container, or chassis equipment.	Freight Equipment
ITS Communications Privacy Protection	'ITS Communications Privacy Protection' operates as a proxy, obscuring the originator's network address, and tagging the message so that it can return replies to the originator.	ITS Communications Equipment*
ITS Communications Services	'ITS Communications Services' supports secure, reliable data communications between connected devices. It includes the network devices as well as any required physical cabling and supporting hardware that represent the communications infrastructure that originate, route, and terminate data communications between a source and a destination. Applications specific protocols are layered over more general communications protocols to support the communications. Network management keeps the network configured and working reliably. Security services ensure the data received is correct and from an authentic source.	ITS Communications Equipment*
ITS Communications Support	'ITS Communications Support' provides means to send and receive messages to and from other ITS Objects. It provides mechanisms for scheduling and prioritizing communications traffic. It may also provide relay functions.	ITS Object*
ITS Management Support	'ITS Management Support' provides management of the ITS Object. This includes management of regulatory information and policies, management of application processes, management of communication system configuration and update management, communications interfaces, protocol-specific techniques to ensure interoperability such as service advertisements, communications congestion management and interference management, local device states and communications information, billing management, fault management, service level and performance monitoring.	ITS Object*

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Functional Object	Description	In Physical Object
ITS Security Support	'ITS Security Support' provides communications and system security functions to the ITS Object, including privacy protection functions. It may include firewall, intrusion management, authentication, authorization, profile management, identity management, cryptographic key management. It may include a hardware security module and security management information base.	ITS Object*
Loading Zone Management	'Loading Zone Management' manages loading zones. It monitors loading zone space occupancy and makes this information available to arriving vehicles and other applications. It monitors the time each vehicle spends in the loading zone and provides this information to drivers in the zone and other applications. Day and time specific management is supported for loading zones that revert to normal vehicle parking spaces in off hours and other day/time specific management strategies. In advanced implementations, reservations are accepted so that a loading zone spot can be reserved with an optional accompanying payment. Vehicles associated with the reservation are identified on arrival and directed to the reserved spot.	Parking Management System
Map Management	'Map Management' provides the GIS functionality necessary to support map data creation and management. It provides an operator interface that supports management of the map data and rendering of the maps under operator control and interfaces to external data sources, including the connected vehicle environment.	Map Update System
MCM Field Equipment Maintenance	'MCM Field Equipment Maintenance' provides overall management and support for maintenance of field equipment on a roadway system, right-of-way, parking area, transit stop, or other areas where field equipment exists. Services include repair and maintenance of ITS field equipment in these areas (e.g., detectors and other sensors, cameras, dynamic message signs, electronic toll collection equipment, electronic clearance equipment, weigh-in-motion sensors, etc.).	Maint and Constr Management Center
MCM Reduced Speed Zone Warning	'MCM Reduced Speed Zone Warning' supports remote control and monitoring of reduced speed zone warning roadside equipment. It provides posted speed limits and associated schedules and information about associated road configuration changes including lane merges and shifts. It monitors field equipment operation and reports current status to the operator.	Maint and Constr Management Center
Object Registration and Discovery	'Object Registration and Discovery' facilitates the registration of services by the respective service providers and the subsequent query-based discovery of these registered services. Many of the services offered by roadside or center-based service providers operating within the project geographic boundary will require an advertisement of their existence and cyber location to potential users; which consist primarily of PIDs and vehicles, but could include roadside or other center based services.	Object Registration and Discovery System*

Functional Object	Description	In Physical Object
PAC Road Pricing Administration	'PAC Road Pricing Administration' enables payment for road use based on VMT, vehicle type, vehicle emissions, or other parameters. It establishes a price schedule based on these parameters that may vary by time, location or zone, vehicle type, and/or vehicle behavior. Pricing strategies may also include incentives that allow reimbursement of fees previously paid for good behavior (e.g., VMT reductions, economical driving behavior, avoidance of peak periods or congested zones). It receives vehicle data (e.g., time stamped roadways used by the vehicle since the last transmission) and computes the total cost to the vehicle owner for payment. Based on owner preference, this cost is either billed to the owner or requested from an in-vehicle payment instrument. Payment for use of roadways not operated by the specific instance of the VMT Payment Administration that the vehicle is registered with, will be reconciled. Payment violations can be reported to Enforcement Agencies when appropriate. Finally, vehicle owners can interact with this object using personal devices or public terminals to setup and edit account preferences for owned vehicles, get account reports, and make payments.	Payment Administration Center
Personal Data Subscription Management	'Personal Data Subscription Management' manages data subscriptions for an end user. It provides access to a catalog of available data, manages the necessary user information and rules that govern the data subscriptions, supports communications with data providers to collect data per the subscription rules, and makes the data available to the end user. It provides the local user interface through which a user can specify and manage subscriptions. It supports different mechanisms for collecting data for the end-user including one-time query-response as well as publish-subscribe services.	Personal Information Device
Personal Device System Executive	'Personal Device System Executive' provides the operating system kernel and executive functions that manage the hardware and software configuration and settings, manages installed applications, and manages device resources. It provides device security and governs software installation and upgrade.	Personal Information Device
Personal Device System Monitoring and Diagnostics	'Personal Device Monitoring and Diagnostics' includes background self-tests, diagnostic software, and other hardware and software that monitors the operating condition of a personal information device. The status of the device and diagnostic information is provided to the user and the associated center.	Personal Information Device
Personal Intersection Safety	'Personal Intersection Safety' improves pedestrian, cyclist, and other non-motorized user safety by providing personal location information to the infrastructure that can be used to avoid collisions involving non-motorized travelers. It may also alert the non-motorized user of unsafe conditions, augmenting or extending information provided by signals and signs. The information provided and the user interface delivery mechanism (visual, audible, or haptic) can also be tailored to the needs of the user that is carrying or wearing the device that hosts the application.	Personal Information Device

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Functional Object	Description	In Physical Object
Personal Map Management	'Personal Map Management' supports map updates and makes current map and geometry data available to other applications. It manages map data for the device and provides map data to end-user applications that provide location-based services.	Personal Information Device
Personal Shared Use Planning	'Personal Shared Use Planning' provides a personalized connection to shared use mobility including vehicle shared use and arranging person trips. The shared use plan is calculated based on preferences and constraints supplied by the traveler and provided to the traveler for confirmation. Many equipment configurations are possible including systems that provide a basic trip plan to the traveler as well as more sophisticated systems that can provide transition by transition guidance to the traveler along a multi-modal route with transfers. Devices represented by this functional object include desktop computers at home, work, or at major trip generation sites, plus personal devices such as tablets and smart phones.	Personal Information Device
Personnel Incident Scene Communications	'Personnel Incident Scene Communications' provides images, video and information from an incident scene captured by or input to an emergency personnel device. The information provided and the user interface delivery mechanism (visual, audible, or haptic) can also be tailored to the needs of the user that is carrying or wearing the device that generates the information.	Personnel Device*
Personnel Incident Scene Safety	'Personnel Incident Scene Safety' improves public safety responder safety by providing responder location information to the infrastructure that can be used to avoid collisions involving the public safety responders. The application may also alert responders if they travel beyond the designated safe zone. The information provided and the user interface delivery mechanism (visual, audible, or haptic) can also be tailored to the needs of the user that is carrying or wearing the device that hosts the application.	Personnel Device*
Personnel Work Zone Safety	'Personnel Work Zone Safety' improves maintenance and construction crew safety by providing crew location information to the infrastructure that can be used to avoid collisions involving the work crew. The application may also alert workers if they travel beyond the designated safe zone. The information provided and the user interface delivery mechanism (visual, audible, or haptic) can also be tailored to the needs of the user that is carrying or wearing the device that hosts the application.	Personnel Device*
Registry Management	'Registry Management' maintains unique identifiers associated with cooperative and connected transportation services. It coordinates between registries and ensures that duplicate assignments are not made.	Identifier Registry*

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Functional Object	Description	In Physical Object
Roadway Dynamic Lane Management and Shoulder Use	'Roadway Dynamic Lane Management and Shoulder Use' 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 centrally controlled by a Traffic Management Center or it can be autonomous and monitor traffic conditions and demand along the roadway and determine how to change the lane controls to respond to current conditions. Lane controls can be used to change the lane configuration of the roadway, reconfigure intersections and/or interchanges, allow use of shoulders as temporary travel lanes, designate lanes for use by special vehicles only, such as buses, high occupancy vehicles (HOVs), vehicles attending a special event, etc. and/or prohibit or restrict types of vehicles from using particular lanes. Guidance and information for drivers can be posted on dynamic message signs.	ITS Roadway Equipment
Roadway Field Management Station Operation	'Roadway Field Management Station Operation' supports direct communications between field management stations and the local field equipment under their control.	ITS Roadway Equipment
Roadway Mixed Use Crossing Safety	'Roadway Mixed Use Crossing Safety' is an advanced infrastructure application that detects pedestrians, cyclists, and other non-motorized users and provides active safety warnings to drivers when cross walks or other intersecting mixed use paths are occupied.	ITS Roadway Equipment
Roadway Passive Monitoring	'Roadway Passive Monitoring' monitors passing vehicles for a signature that can be used to recognize the same vehicle at different points in the network and measure travel times. Depending on the implementation and the penetration rate of the technology that is monitored, other point traffic measures may also be inferred by monitoring the number of vehicles within range over time. Today this approach is implemented most commonly using a Bluetooth receiver that passively monitors Bluetooth devices on-board passing vehicles and license plate readers that record the vehicle license plate number, but any widely deployed vehicle communications technology or feature that can be passively monitored to uniquely identify a vehicle could be used.	ITS Roadway Equipment
Roadway Restriction Monitoring and Warning	'Roadway Restriction Monitoring and Warning' measures the size and weight of passing vehicles and displays warnings to vehicles if the size exceeds the current infrastructure restrictions. The measured vehicle dimensions are also made available to other applications.	ITS Roadway Equipment
Roadway Signal Preemption	'Roadway Signal Preemption' includes the field elements that receive signal preemption requests from emergency vehicles approaching a signalized intersection and overrides the current operation of the traffic signals to stop conflicting traffic and grant right-of-way to the approaching vehicle.	ITS Roadway Equipment
Roadway Time Management	'Roadway Time Management' provides foundational time keeping functionality that supports an accurate, synchronized time reference in ITS field equipment. It receives accurate time information from an external source and maintains a local time reference using an internal clock in between time synchronizations.	ITS Roadway Equipment

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Functional Object	Description	In Physical Object
Roadway Traffic Gap Assist	'Roadway Traffic Gap Assist' measures the headway to the next approaching vehicle. Based on programmed thresholds, unsafe gaps are identified and reported via roadside signs. Traffic gaps and associated advisories and warnings are also provided to the RSE for communication to connected vehicles.	ITS Roadway Equipment
Roadway Variable Speed Limits	'Roadway Variable Speed Limits' includes the field equipment, physical overhead lane signs and associated control electronics that are used to manage and control variable speed limits systems. This equipment monitors traffic and environmental conditions along the roadway. The system can be centrally monitored and controlled by a Traffic Management Center or it can be autonomous, calculating and setting suitable speed limits, usually by lane. This application displays the speed limits and additional information such as basic safety rules and current traffic information to drivers.	ITS Roadway Equipment
Roadway Warning	'Roadway Warning' includes the field equipment used to warn drivers approaching hazards on a roadway. Warnings may be generated in response to roadway weather conditions, road surface conditions, traffic conditions including queues, obstacles or animals in the roadway, and any other transient events that can be sensed. The equipment monitors traffic and roadway conditions and may send data to a Traffic Management Center for processing or may process it to determine when a warning should be issued. When it is determined that a warning should be issued, the equipment is used to alert approaching drivers via dynamic warning signs, flashing lights, in-vehicle messages, etc.	ITS Roadway Equipment
RSE Border Management	'RSE Border Management' supports border operations, providing functions that measure border wait times and provide wait times and other traveler information to approaching vehicles. Short range communications with vehicles and associated equipment supports collection of traveler, vehicle, and cargo information and credentials.	Connected Vehicle Roadside Equipment
RSE Commercial Vehicle Services	'RSE Commercial Vehicle Services' provides two-way communication with approaching properly equipped commercial vehicles at mainline speeds for automated vehicle identification, credential checking, and freight security verification.	Connected Vehicle Roadside Equipment
RSE Communications Relay	'RSE Communications Relay' provides message relay services that extend effective communications range to improve communications systems performance and robustness. It also supports safety applications such as wrong way vehicle detection and other applications where roadside communication of warnings beyond DSRC range are needed to compensate for high speeds or line of site/RF interference challenges.	Connected Vehicle Roadside Equipment
RSE Data Subscription Management	'RSE Data Subscription Management' manages data subscriptions for an RSE. It provides access to a catalog of available data, manages the necessary identification information and rules that govern the data subscriptions, supports communications with data providers to collect data per the subscription rules, and makes the data available to other RSE applications. It supports different mechanisms for collecting data including one-time query-response as well as publish-subscribe services.	Connected Vehicle Roadside Equipment

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Functional Object	Description	In Physical Object
RSE Electric Charging Support	'RSE Electric Charging Support' uses short range communications to coordinate with a vehicle that is being charged, receiving information about the operational state of the electrical system, the maximum charge rate, and the percentage-complete of the charge from the vehicle.	Connected Vehicle Roadside Equipment
RSE Incident Scene Safety	'RSE Incident Scene Safety' communicates with Connected Vehicles and Personal Information Devices carried or worn by public safety responders to detect vehicle intrusions in designated work areas at an incident scene and warn responders and drivers of imminent encroachment. Public safety responder movements are also monitored so that the responders can be warned of movement beyond the designated safe zone.	Connected Vehicle Roadside Equipment
RSE Infrastructure Restriction Warning	'RSE Infrastructure Restriction Warning' uses short range communications to warn vehicles of infrastructure dimensional and weight restrictions.	Connected Vehicle Roadside Equipment
RSE Intermodal Terminal Management	'RSE Intermodal Terminal Management' manages communications with commercial vehicles on behalf of an Intermodal Terminal. This functional object manages entry to and exit from the facility and supports identification of entering vehicles and associated freight equipment, including containers. It also supports identification and tracking of containers within the terminal and identifies container pickup and drop-off locations, including optional routing instructions within the terminal.	Connected Vehicle Roadside Equipment
RSE Intersection Management	'RSE Intersection Management' uses short range communications to support connected vehicle applications that manage signalized intersections. It communicates with approaching vehicles and ITS infrastructure (e.g., the traffic signal controller) to enhance traffic signal operations. Coordination with the ITS infrastructure also supports conflict monitoring to ensure the RSE output and traffic signal control output are consistent and degrade in a fail safe manner.	Connected Vehicle Roadside Equipment
RSE Intersection Safety	'RSE Intersection Safety' uses short range communications to support connected vehicle applications that improve intersection safety. It communicates with approaching vehicles and ITS infrastructure to alert and warn drivers of potential stop sign, red light, and non-motorized user crossing conflicts or violations.	Connected Vehicle Roadside Equipment
RSE Lighting System Support	'RSE Lighting System Support' uses V2I communications to monitor vehicle presence and collect environmental information from passing connected vehicles. The collected data is processed and filtered and provided as an input to support adjustment of roadside lighting systems.	Connected Vehicle Roadside Equipment
RSE Loading Zone Management	'RSE Loading Zone Management' uses I2V communications to monitor and communicate with equipped vehicles approaching and/or in the loading zone. It monitors loading zone space occupancy by equipped vehicles and makes this information available to arriving vehicles and other applications. It monitors the time each vehicle spends in the loading zone and provides this information to drivers in the zone and other applications. Vehicles that have a reservation are identified on arrival and directed to the reserved spot.	Connected Vehicle Roadside Equipment

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Functional Object	Description	In Physical Object
RSE Low Emissions Zone Application	'RSE Low Emissions Zone Application' provides information to vehicles regarding low emissions zones and checks vehicle profiles on entry to a designated low emissions zone to verify they are in compliance with the parameters established for the zone.	Connected Vehicle Roadside Equipment
RSE Map Management	'RSE Map Management' provides the map functionality necessary to support map data updates to passing vehicles. It collects current map and geometry data and provides current map and geometry data to connected vehicles.	Connected Vehicle Roadside Equipment
RSE Parking Management	'RSE Parking Management' monitors the basic safety messages generated by connected vehicles to detect vehicles parking and maintain and report spaces that are occupied by connected vehicles. It also uses short range communications to provide parking information to vehicles.	Connected Vehicle Roadside Equipment
RSE Payment Support	'RSE Payment Support' manages vehicle payments for road use, parking, and other fee-based services like vehicle charging. Road use payments are based on fee structures and payment strategies based on vehicle-reported data including VMT, emissions, vehicle class or type. Fees may vary by time or location and may include incentives or credits to reward desirable driving behavior. To support payment, it receives vehicle data (e.g., time stamped roadways used by the vehicle since the last transmission) and forwards this to the Payment Administration Center. It also receives equipment status from the vehicle and vehicle characteristics sensed from the vehicle (number of axles, weight, vehicle tag image/ID). Faults are identified and forwarded to the Payment Administration Center. Finally, it requests, receives, processes, and reports vehicle payment information.	Connected Vehicle Roadside Equipment
RSE Position Correction Support	'RSE Position Correction Support' broadcasts differential positioning data to enable precise locations to be determined by passing vehicles, supporting Connected Vehicle applications that require highly accurate positioning. The differential positioning data may be calculated directly by a precisely located RSE that is operating as a reference station or received from an external reference station and relayed to passing vehicles.	Connected Vehicle Roadside Equipment
RSE Queue Warning	'RSE Queue Warning' provides V2I communications to support queue warning systems. It monitors connected vehicles to identify and monitor queues in real-time and provides information to vehicles about upcoming queues, including downstream queues that are reported by the Traffic Management Center.	Connected Vehicle Roadside Equipment
RSE Rail Crossing Warning	'RSE Rail Crossing Warning' is a connected vehicle application that improves safety at rail crossings. It communicates with wayside equipment that detects or communicates with approaching trains. It provides rail crossing warnings and train arrival information to approaching vehicles and monitors connected vehicles that may intrude on the crossing.	Connected Vehicle Roadside Equipment

Functional Object	Description	In Physical Object
RSE Restricted Lanes Application	The 'RSE Restricted Lanes Application' uses short range communications to monitor and manage dynamic and static restricted lanes. It collects vehicle profile information from vehicles entering the lanes and monitors vehicles within the lanes, providing aggregate data to the back office center. It provides lane restriction information and signage data to the vehicles and optionally identifies vehicles that violate the current lane restrictions. These functions are performed based on operating parameters provided by the back office managing center(s).	Connected Vehicle Roadside Equipment
RSE Road Closure Management	'RSE Road Closure Management' communicates with qualified Connected Vehicles and barrier control systems to support local road closure management. It validates and requests implementation of road closure requests. During a closure, it can also support selective access to the closed area, only granting entry permission to allowed vehicles.	Connected Vehicle Roadside Equipment
RSE Situation Monitoring	'RSE Situation Monitoring' is a general functional object that supports collection of traffic, environmental, and emissions data from passing vehicles. The data is collected, filtered, and forwarded based on parameters provided by the back office. Parameters are provided to passing vehicles that are equipped to collect and send situation data to the infrastructure in snapshots. In addition, this object collects current status information from local field devices including intersection status, sensor data, and signage data, providing complete, configurable monitoring of the situation for the local transportation system in the vicinity of the RSE.	Connected Vehicle Roadside Equipment
RSE Speed Management	'RSE Speed Management' provides infrastructure information including road grade, roadway geometry, road weather information, and current speed limits to assist vehicles in maintaining safe speeds and headways. It also provides speed recommendations to vehicles based on current conditions and overall speed limits and strategies established by the back office.	Connected Vehicle Roadside Equipment
RSE Speed Warning	'RSE Speed Warning' notifies connected vehicles that are approaching a reduced speed zone, providing: (1) the zone's current posted speed limit and (2) any roadway configuration changes associated with the reduced speed zone (e.g., lane closures, lane shifts) if applicable, and (3) associated warning information (i.e., the reason for the reduced speed warning). Configuration parameters that define the applicable speed limit(s), geographic location and extent of the reduced speed zone, and roadway configuration information are received from a center or provided through a local interface. The characteristics of individual vehicles may also be monitored and used to warn vehicles with specific limitations that reduce safe operating speeds, (e.g., rollover risk for tall vehicles). This functional object works in conjunction with the 'Roadway Speed Monitoring and Warning' functional object, which uses traditional ITS field equipment to warn non-equipped vehicles.	Connected Vehicle Roadside Equipment
RSE Support Services	'RSE Support Services' provides foundational functions that support data collection, management, location reference, timing, and data distribution. It coordinates with Support subsystems to maintain necessary registrations with respect to location and scope. It maintains precise location and time information to support other services.	Connected Vehicle Roadside Equipment

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Functional Object	Description	In Physical Object
RSE Toll Collection	'RSE Toll Collection' collects electronic tolls using V2I communications in toll plazas and other designated toll collection locations. The RSE is connected with other field equipment that detects vehicles, identifies violators, and provides other toll plaza functionality.	Connected Vehicle Roadside Equipment
RSE Traffic Gap Assist	'RSE Traffic Gap Assist' provides advisory information to minor road drivers at a stop-sign controlled intersection to facilitate gap selection to proceed through the intersection. The application can be configured depending on the intersection geometry. It monitors Connected Vehicle traffic on the major road, augmenting infrastructure traffic detectors, to identify and measure traffic gaps. The intersection geometry, measured traffic gaps, and current gap assist sign displays are communicated to the connected vehicle that is navigating the intersection for use in driver advisories and warnings. The application may also collect vehicle size and performance profile from the connected vehicle to optimize the alerts and warnings to the capabilities of the vehicle and driver preferences.	Connected Vehicle Roadside Equipment
RSE Traffic Metering	'RSE Traffic Metering' uses V2I communications to support ramp metering and other traffic metering applications. Data is collected from connected vehicles on both the mainline and approach to the traffic meters. The collected data is processed and filtered and provided to the metering controller. Status and current signal indications from the ramp meter are also collected and provided to approaching and queued connected vehicles.	Connected Vehicle Roadside Equipment
RSE Traffic Monitoring	'RSE Traffic Monitoring' monitors the basic safety messages that are shared between connected vehicles and distills this data into traffic flow measures that can be used to manage the network in combination with or in lieu of traffic data collected by infrastructure-based sensors. As connected vehicle penetration rates increase, the measures provided by this application can expand beyond vehicle speeds that are directly reported by vehicles to include estimated volume, occupancy, and other measures. This object also supports incident detection by monitoring for changes in speed and vehicle control events that indicate a potential incident.	Connected Vehicle Roadside Equipment
RSE Work Zone Safety	'RSE Work Zone Safety' communicates with Connected Vehicles and Personal Information Devices carried or worn by the work crew to detect vehicle intrusions in work zones and warn crew workers and drivers of imminent encroachment. Crew movements are also monitored so that the crew can be warned of movement beyond the designated safe zone.	Connected Vehicle Roadside Equipment
SM Device Management	'SM Device Management' provides the functions necessary to manage devices, including network management, operational status monitoring, and application performance monitoring.	Service Monitor System*
SM Time Synchronization	'SM Time Synchronization' provides the functions necessary to receive accurate time from an external Network Time Server and provide that Coordinated Universal Time (UTC) as Time Local Form to other center systems and field devices.	Service Monitor System*

Functional Object	Description	In Physical Object
SME IT Maintenance	'SME IT Maintenance' provides diagnostics and troubleshooting capabilities for information technology equipment that supports back office operations for intelligent transportation systems. It also provides the capability to control and configure this equipment to support on-site installation, repair, and maintenance and remote software configuration and upgrade.	Support Maintenance Equipment*
Terminal Management	'Terminal Management' supports the operation of the roadway aspects of an intermodal terminal. The key capabilities include the ability to identify and control vehicle traffic entering and departing the facility, guide vehicles to loading and unloading points, maintain site security and monitor container integrity, provide an interface to Customs as appropriate, and acknowledge container pickup and drop-off. Other capabilities include the ability to track container locations within the facility, manage any other required assets, like truck chassis, and provide reservation services to manage congestion at busy terminals. This application also provides information to support load matching services for drayage operators.	Intermodal Terminal
TIC Freight-Specific Travel Planning	'TIC Freight-Specific Travel Planning' provides traveler information and trip planning services for freight routes from source to destination, customized for freight users to indicate truck routes, truck stops, inspection stations, steep grades, etc.	Transportation Information Center
TIC Shared Use	'TIC Shared Use' provides shared use services for eligible travelers, connecting with travelers for specific trips or vehicle usage based on preferences. Reservations and advanced payment are also supported so that each segment of the shared use/ trip may be confirmed.	Transportation Information Center
TIC Situation Data Management	'TIC Situation Data Management' manages connected vehicle situation data collection, quality controls, filtering, aggregation, and storage. Through this process, raw data reported by connected vehicles are transformed into information products that can be accessed and used to support transportation operations and traveler information. The distribution of the connected vehicle-derived information products is handled by other functional objects.	Transportation Information Center
TIC Traffic Regulation Dissemination	'TIC Traffic Regulation Dissemination' disseminates rules, regulations, and statutes that govern motor vehicle operation. It aggregates regulations from regulatory authorities and then disseminates the relevant regulations to vehicles and other mobile devices.	Transportation Information Center

Appendix B4 – New U.S Functional Objects

Functional Object	Description	In Physical Object
TMC Dynamic Lane Management and Shoulder Use	'TMC Dynamic Lane Management and Shoulder Use' remotely monitors and controls the system that is used to dynamically manage travel lanes, including temporary use of shoulders as travel lanes. It monitors traffic conditions and demand measured in the field and determines when the lane configuration of the roadway should be changed, when intersections and/or interchanges should be reconfigured, when the shoulders should be used for travel (as a lane), when lanes should be designated for use by special vehicles only, such as buses, high occupancy vehicles (HOVs), vehicles attending a special event, etc. and/or when types of vehicles should be prohibited or restricted from using particular lanes. It controls the field equipment used to manage and control specific lanes and the shoulders. It also can automatically notify the enforcement agency of lane control violations.	Traffic Management Center
TMC Infrastructure Restriction Warning	'TMC Infrastructure Restriction Warning' controls and monitors RSEs that support Infrastructure Restriction Warnings. It configures the RSEs to define tunnel/bridge geometry and design and temporary size and weight restrictions. Information that is currently being communicated to passing vehicles and the operational status of the field equipment is monitored by this application. The operational status of the field equipment is reported to operations personnel.	Traffic Management Center
TMC Intersection Safety	'TMC Intersection Safety' controls and monitors RSEs that support stop sign, red light, and mixed use crossing violations. It configures the RSEs for the current intersection geometry and traffic signal control equipment at the intersection. Information that is currently being communicated to passing vehicles and the operational status of the field equipment is monitored by this application. The operational status of the field equipment is reported to operations personnel.	Traffic Management Center
TMC Passive Surveillance	'TMC Passive Surveillance' collects time stamped vehicle identities from different detection zones, correlates the identities, and calculates link travel times and derives other traffic measures.	Traffic Management Center
TMC Restricted Lanes CV Application	'TMC Restricted Lanes CV Application' manages dynamic lanes for connected vehicles. The application provides the back office functions and supports the TMC operator in establishing and managing dynamic lanes using communications to manage lane use for connected vehicles.	Traffic Management Center
TMC Roadway Warning	'TMC Roadway Warning' remotely monitors and controls the systems used to warn drivers approaching hazards on a roadway. It monitors data on roadway conditions from sensors in the field and generates warnings in response to roadway weather conditions, road surface conditions, traffic conditions including queues, obstacles or animals in the roadway, and any other transient events that can be sensed.	Traffic Management Center
TMC Speed Warning	'TMC Speed Warning' supports remote control and monitoring of reduced speed zone warning roadside equipment. It provides the location and extent of the reduced speed zone, the posted speed limit(s) with information about the applicability of the speed limit(s) (e.g., time of day, day of week, seasonality, relevant vehicle types) and information about associated road configuration changes including lane merges and shifts. It monitors field equipment operation and reports current status to the operator.	Traffic Management Center

Functional Object	Description	In Physical Object
TMC Traffic Gap Assist	'TMC Traffic Gap Assist' supports remote control and monitoring of traffic gap assist infrastructure equipment. It provides configuration information for the equipped intersection and the operating parameters for the traffic detection system that measures traffic gaps on the major road and the signs and Connected Vehicle communications that provide advisories and warnings to vehicles on the minor road attempting to navigate the intersection. It monitors field equipment operation and reports current status to the operator.	Traffic Management Center
TMC Variable Speed Limits	'TMC Variable Speed Limits' provides center monitoring and control of variable speed limits systems. It monitors data on traffic and environmental conditions collected from sensors along the roadway. Based on the measured data, it calculates and sets suitable speed limits usually by lane. It controls equipment that posts the current speed limits and displays additional information such as basic safety rules and current traffic information to drivers.	Traffic Management Center
Transit Center Connection Protection	'Transit Center Connection Protection' manages the coordination of transit transfers between routes within a single transit agency, between routes of different transit agencies, or between different modes (e.g. a bus transit route and a ferry route). This functional object also supports the capability for an individual traveler to obtain connection protection throughout a specific transit trip. This application may be implemented through peer-to-peer sharing between agencies control systems or as a central transit transfer request brokerage that facilitates the management and coordination of transfers across multiple agencies and control systems.	Transit Management Center
Transit Center Park and Ride Operations	'Transit Park and Ride Operations' supports additional coordination required for park and ride operations. It monitors park and ride customer arrivals in the parking facility and manages the transit services for those park and ride customers.	Transit Management Center
Transit Vehicle Emissions Monitoring	'Transit Vehicle Emissions Monitoring' directly measures or estimates vehicle emissions and provides current and average emissions measures to the Transit Management Center.	Transit Vehicle OBE
Transit Vehicle On-Board Connection Protection	'Transit Vehicle On-Board Connection Protection' monitors vehicle schedule performance and provides it to the transit center for connection protection processing. It receives operator instructions relating to managing connection protection and recognizes individual travelers who have arranged for connection protection and provides connection protection information to the transit center.	Transit Vehicle OBE
Transit Vehicle Pedestrian Safety	'Transit Vehicle Pedestrian Safety' exchanges current location and motion information with pedestrian-carried devices in the vicinity and uses that information to warn the driver of pedestrians in the vehicle's path. Information from on-board sensors (e.g., radars and image processing) are used to augment the short range communications, if available. In addition to notifying the driver, control information can also be provided to support automated control functions that can avoid the collision.	Transit Vehicle OBE

Functional Object	Description	In Physical Object
Transit Vehicle V2V Safety	'Transit Vehicle V2V Safety' exchanges current vehicle location and motion information with other vehicles in the vicinity, uses that information to predict vehicle paths, and notifies the driver when the potential for an impending collision is detected. Information from on-board sensors (e.g., radars and image processing) are used to augment the V2V communications, if available. In addition to notifying the driver, control information can also be provided to support automated control functions that can avoid the collision. This object is similar to the 'Vehicle Basic V2V Safety', but it accounts for crash scenarios that are unique to transit vehicles (e.g., Vehicle Turning Right in Front of Bus). It is also stop-aware since stop locations pose specific crash threats for transit vehicles. Finally, the detection and control algorithms, filters, and timing account for bus performance and risk profiles associated with remote vehicles that are unique to transit.	Transit Vehicle OBE
Traveler Trip Planning	'Traveler Trip Planning' provides a personalized trip plan to the traveler. The trip plan is calculated based on preferences and constraints supplied by the traveler and provided to the traveler for confirmation. It represents kiosks and other fixed public interactive displays that may be used by travelers in public areas.	Traveler Support Equipment
Vehicle Basic Safety Communication	'Vehicle Basic Safety Communication' exchanges current vehicle location and motion information with other vehicles in the vicinity, uses that information to calculate vehicle paths, and warns the driver when the potential for an impending collision is detected. If available, map data is used to filter and interpret the relative location and motion of vehicles in the vicinity. Information from on-board sensors (e.g., radars and image processing) are also used, if available, in combination with the V2V communications to detect non-equipped vehicles and corroborate connected vehicle data. Vehicle location and motion broadcasts are also received by the infrastructure and used by the infrastructure to support a wide range of roadside safety and mobility applications. This object represents a broad range of implementations ranging from basic Vehicle Awareness Devices that only broadcast vehicle location and motion and provide no driver warnings to advanced integrated safety systems that may, in addition to warning the driver, provide collision warning information to support automated control functions that can support control intervention.	Vehicle OBE
Vehicle Border Crossing Support	'Vehicle Border Crossing Support' uses connected vehicle technology to exchange traveler credentials with border systems to support expedited clearance through international borders.	Vehicle OBE
Vehicle Data Subscription Management	'Vehicle Data Subscription Management' manages data subscriptions for an end user. It provides access to a catalog of available data, manages the necessary user information and rules that govern the data subscriptions, supports communications with data providers to collect data per the subscription rules, and makes the data available to the end user. It provides the local user interface through which a user can specify and manage subscriptions. It supports different mechanisms for collecting data for the end-user including one-time query-response as well as publish-subscribe services.	Vehicle OBE

Functional Object	Description	In Physical Object
Vehicle Eco-Driving Assist	'Vehicle Eco-Driving Assist' provides customized real-time driving advice to drivers, allowing them to adjust behaviors to save fuel and reduce emissions. This advice includes recommended driving speeds, optimal acceleration and deceleration profiles based on prevailing traffic conditions, and local interactions with nearby vehicles, i.e., processing Basic Safety Messages (BSMs) to determine position and speed of vehicles that are between the host vehicle and the intersection. When approaching and departing signalized intersections, it uses intersection geometry information, the relative position and speed of vehicles ahead of it, and signal phase movement information to provide speed advice to the driver so that the driver can adapt the vehicle's speed to pass the next traffic signal on green, decelerate to a stop in the most eco-friendly manner, or manage acceleration as the vehicle departs from a signalized intersection. It also provides feedback to drivers on their driving behavior to encourage them to drive in a more environmentally efficient manner. It may also support vehicle-assisted strategies, where the vehicle automatically implements the eco-driving strategy (e.g., changes gears, switches power sources, or reduces its speed in an eco-friendly manner as the vehicle approaches a traffic signal or queue).	Vehicle OBE
Vehicle Electric Charging Assist	'Vehicle Electric Charging Assist' uses short range communications to coordinate with electric charging stations, providing information about the operational state of the electrical system, the maximum charge rate, and the percentage-complete of the charge. This application also receives current information about electric charging systems in the region and makes this information available to the driver on request.	Vehicle OBE
Vehicle Emissions Monitoring	'Vehicle Emissions Monitoring' directly measures or estimates current and average vehicle emissions and makes this data available to the driver and connected vehicle infrastructure systems.	Vehicle OBE
Vehicle Gap Assist	'Vehicle Gap Assist' uses V2I communications to collect traffic gap information and associated alerts and warnings that are displayed to the driver who is navigating a stop-sign controlled intersection with a major road.	Vehicle OBE
Vehicle Intersection Warning	'Vehicle Intersection Warning' uses V2V and V2I communications to monitor other connected vehicles at intersections and support the safe movement of the vehicle through the intersection. Driver warnings are provided and the application may also optionally take control of the vehicle to avoid collisions. The application will also notify the infrastructure and other vehicles if it detects an unsafe infringement on the intersection.	Vehicle OBE
Vehicle Map Management	'Vehicle Map Management' supports map updates and makes current map and geometry data available to other applications. It manages map data on-board and provides map data to end-user applications that provide location-based services.	Vehicle OBE

Appendix B4 – New U.S Functional Objects

Functional Object	Description	In Physical Object
Vehicle Payment Service	'Vehicle Payment Service' supports vehicle payments including VMT- and zone-based payments and payments for other services including fuel/charging services, tolls, and parking. To support VMT-based payment, this application tracks the location of the vehicle at specific times and reports this VMT data along with vehicle identification. A variety of pricing strategies are supported, including strategies that include credits or incentives that reward desired driving patterns and behavior. The onboard equipment supports secure short range communications with connected vehicle roadside equipment to support secure payments.	Vehicle OBE
Vehicle Queue Warning	'Vehicle Queue Warning' detects vehicle queues and reports queues to other vehicles using V2V communications and to the infrastructure using V2I communications. Vehicle-based queue warning builds on the exchange of vehicle location and motion and maneuvers that supports connected vehicle safety applications. This application also receives information about downstream queues using I2V communications. Individualized queue warnings and queue characteristics relevant to the vehicle are provided to the driver.	Vehicle OBE
Vehicle Rail Crossing Warning	'Vehicle Rail Crossing Warning ' uses I2V communications to receive alerts of trains entering HRIs and to provide warnings to drivers regarding the trains. The warning can include second train warning (meaning the HRI gates are about to lower, or remain lowered due to the arrival of a second train). The application can also provide vehicle infringement warnings by using the alert information along with vehicle trajectory information to determine that the vehicle will infringe upon a crossing that is (or will be) occupied by a train.	Vehicle OBE
Vehicle Restricted Lanes Application	The 'Vehicle Restricted Lanes Application' monitors and reports its own operating parameters and communicates with roadside equipment to safely enter, operate within, and exit eco-lanes and other controlled-access lanes.	Vehicle OBE
Vehicle Situation Data Monitoring	'Vehicle Situation Data Monitoring' is the highest-level representation of the functionality required to collect traffic and environmental situation data by monitoring and storing the experience of the vehicle as it travels through the road network. Collected data is aggregated into snapshots that are reported when communications is available and with flow control based on parameters provided by the infrastructure. Note that this functional object supports collection of data for areas remote from RSEs or other communications infrastructure.	Vehicle OBE
Vehicle Speed Management Assist	'Vehicle Speed Management Assist' assists the driver in operating the vehicle within the current speed limit. It monitors current vehicle speed and communicates with the infrastructure to receive current speed limits and associated road configuration change notifications. Driver warnings are issued when unsafe or excessive speeds are detected based on the provided speed limits and current conditions.	Vehicle OBE
Vehicle Support Services	'Vehicle Support Services' provides foundational functions that support data collection, management, and distribution. It coordinates with Support subsystems to maintain necessary registrations with respect to location and scope.	Vehicle OBE

Functional Object	Description	In Physical Object
Vehicle System Executive	'Vehicle System Executive' provides the operating system kernel and executive functions that manage the software configuration and operation and support computer resource management, security, and software installation and upgrade.	Vehicle OBE
WAID Broadcast Services	'WAID Broadcast Services' provides wide-area digital broadcast of traveler information to transportation users across a region. It collects traveler information of interest to clientele (either subscribers or the general public) and distributes the traveler information using broadcast data services that are offered in context with entertainment and other data services.	Wide Area Information Disseminator System*

B-5 MODIFIED SERVICE PACKAGES

Note: New Physical Objects are indicated with an *.

Appendix B5 – Modified U.S. Service Packages

SP	Name	Description	Description of Modifications
CVO01	Carrier Operations and Fleet Management	This service package 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 is 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. This service package also supports maintenance of fleet vehicles with on-board monitoring equipment. Records of vehicle mileage, preventative maintenance and repairs are maintained.	New Triplets (Source - Flow - Destination) • Commercial Vehicle OBE - commercial vehicle location data - Fleet and Freight Management Center • Commercial Vehicle OBE - cv driver safety alert - Commercial Vehicle Driver • Commercial Vehicle OBE - cv driver safety status - Fleet and Freight Management Center • Transportation Information Center - incident information for public - Fleet and Freight Management Center
CVO02	Freight Administration	This service package tracks the movement of cargo and monitors the cargo condition. Interconnections are provided to intermodal freight shippers and intermodal freight depots for tracking of cargo from origin to destination. In addition to exceptions that are reported, on-going indications of the state of the various freight equipment are reported to the Fleet and Freight Management Center.	New Functional Objects • Freight Equipment Monitoring (Freight Equipment) New Triplets (Source - Flow - Destination) • Commercial Vehicle OBE - commercial vehicle status - Commercial Vehicle Driver

Appendix B5 – Modified U.S. Service Packages

SP	Name	Description	Description of Modifications
CVO03	Electronic Clearance	This service package provides for automated clearance at roadside check facilities. The roadside check facility communicates with the Commercial Vehicle Administration Center to retrieve infrastructure snapshots of critical carrier, vehicle, and driver data to be used to sort passing vehicles. This allows a good driver/vehicle/carrier to pass roadside facilities at highway speeds using vehicle to infrastructure (V2I) Communications. Results of roadside clearance activities will be passed on to the Commercial Vehicle Administration Center. The roadside check facility may be equipped with Automated Vehicle Identification (AVI), weighing sensors, communications equipment, and computer workstations. Communications may be implemented using a range of technologies from transponder data readers through connected vehicle short range communications.	<u>New Functional Objects</u> • RSE Commercial Vehicle Services (Connected Vehicle Roadside Equipment) <u>New Triplets (Source - Flow - Destination)</u> • Commercial Vehicle Administration Center - commercial vehicle permit information - Commercial Vehicle Check Equipment • Commercial Vehicle Administration Center - targeted list - Commercial Vehicle Check Equipment • Commercial Vehicle Check Equipment - commercial vehicle violation notification - Enforcement Center • Commercial Vehicle Check Equipment - electronic screening request - Connected Vehicle Roadside Equipment • Commercial Vehicle Check Equipment - pass/pull-in - Connected Vehicle Roadside Equipment • Commercial Vehicle Check Equipment - screening event record - Connected Vehicle Roadside Equipment • Commercial Vehicle Check Equipment - weigh-in-motion information - Commercial Vehicle Administration Center • Commercial Vehicle OBE - freight equipment information - Connected Vehicle Roadside Equipment • Commercial Vehicle OBE - on-board safety data - Connected Vehicle Roadside Equipment • Commercial Vehicle OBE - screening event record - Connected Vehicle Roadside Equipment • Connected Vehicle Roadside Equipment - electronic screening request - Commercial Vehicle OBE • Connected Vehicle Roadside Equipment - freight equipment information - Commercial Vehicle Check Equipment • Connected Vehicle Roadside Equipment - on-board safety data - Commercial Vehicle Check Equipment • Connected Vehicle Roadside Equipment - pass/pull-in - Commercial Vehicle OBE • Connected Vehicle Roadside Equipment - screening event record - Commercial Vehicle Check Equipment • Connected Vehicle Roadside Equipment - screening event record - Commercial Vehicle OBE • Enforcement Center - targeted list - Commercial Vehicle Administration Center • Freight Equipment - freight equipment information - Connected Vehicle Roadside Equipment

SP	Name	Description	Description of Modifications
CVO04	CV 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.	New Triplets (Source - Flow - Destination) • Commercial Vehicle Administration Center - carrier participation report - Commercial Vehicle Check Equipment • Commercial Vehicle Administration Center - carrier participation report - CVO Information Requestor Center • Commercial Vehicle Administration Center - carrier participation report - Enforcement Center • Commercial Vehicle Administration Center - commercial vehicle administration information presentation - Commercial Vehicle Administrator • Commercial Vehicle Administration Center - commercial vehicle permit - Fleet and Freight Management Center • Commercial Vehicle Administration Center - commercial vehicle permit information - Other CV Administration Centers • Commercial Vehicle Administrator - commercial vehicle administrative request - Commercial Vehicle Administration Center • CVO Information Requestor Center - request for data review - Commercial Vehicle Administration Center • DMV - registration - Commercial Vehicle Administration Center • Fleet and Freight Management Center - request for permit - Commercial Vehicle Administration Center • Other CV Administration Centers - commercial vehicle permit information - Commercial Vehicle Administration Center

CVO05	International Border Electronic Clearance	This service package provides for automated clearance at international border crossings. It augments the Electronic Clearance service package by allowing interface with border administration and border inspection related functions. This service package processes the entry documentation for vehicle, cargo, and driver, checks compliance with import/export and immigration regulations, handles duty fee processing, and reports the results of the crossing event to manage release of commercial vehicle, cargo, and driver across an international border. It interfaces with administrative systems used by customs and border protection, immigration, carriers, and service providers (e.g., brokers) and inspection systems at international border crossings to generate, process, and store entry documentation.	New Functional Objects • Border Inspection (Border Inspection System) • Border Inspection Administration (Border Inspection Administration Center) • Drayage Operations Optimization Service (Freight Distribution and Logistics Center) • Freight Equipment Monitoring (Freight Equipment) • RSE Border Management (Connected Vehicle Roadside Equipment) • RSE Commercial Vehicle Services (Connected Vehicle Roadside Equipment) New Triplets (Source - Flow - Destination) New Triplets (Source - Flow - Destination) • Border Inspection Administration Center - clearance notification - Freight Distribution and Logistics Center • Border Inspection Administration Center - clearance notification - Intermodal Customer System • Border Inspection Administration Center - consolidated agency response - Border Inspection System • Border Inspection Administration Center - manifest data - Border Inspection System • Border Inspection System - border pass/pull-in - Connected Vehicle Roadside Equipment • Border Inspection System - border security input - Border Inspection Administration Center • Border Inspection System - clearance notification - Connected Vehicle Roadside Equipment • Border Inspection System - inspection results - Border Inspection Administration Center • Border Inspection System - request tag data - Commercial Vehicle OBE • Border Inspection System - request tag data - Freight Equipment • Commercial Vehicle Administration Center - border clearance status - Border Inspection Administration Center • Commercial Vehicle Check Equipment - border clearance event - Connected Vehicle Roadside Equipment • Commercial Vehicle Check Equipment - pass/pull-in - Connected Vehicle Roadside Equipment • Commercial Vehicle Check Equipment - request tag data - Freight Equipment • Commercial Vehicle OBE - border clearance data - Connected Vehicle Roadside Equipment • Commercial Vehicle OBE - electronic lock data - Connected Vehicle Roadside Equipment • Connected Vehicle Roadside Equipment - border clearance data - Commercial Vehicle Check Equipment • Connected Vehicle Roadside Equipment - border clearance data request - Commercial Vehicle OBE

Appendix B5 – Modified U.S. Service Packages

SP	Name	Description	Description of Modifications
			- Connected Vehicle Roadside Equipment - border clearance event - Commercial Vehicle OBE - Connected Vehicle Roadside Equipment - border pass/pull-in - Commercial Vehicle OBE - Connected Vehicle Roadside Equipment - clearance notification - Commercial Vehicle OBE - Connected Vehicle Roadside Equipment - container manifest - Border Inspection System - Connected Vehicle Roadside Equipment - container seal interrogation - Freight Equipment - Connected Vehicle Roadside Equipment - container seal status - Border Inspection System - Connected Vehicle Roadside Equipment - electronic lock data - Commercial Vehicle Check Equipment - Connected Vehicle Roadside Equipment - electronic lock data request - Commercial Vehicle OBE - Freight Distribution and Logistics Center - manifest data - Border Inspection Administration Center - Freight Equipment - container manifest - Connected Vehicle Roadside Equipment - Freight Equipment - container seal status - Connected Vehicle Roadside Equipment - Freight Equipment - tag data - Border Inspection System - Freight Equipment - tag data - Commercial Vehicle Check Equipment - Intermodal Customer System - manifest data - Border Inspection Administration Center

| CVO07 | 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. | New Functional Objects

• RSE Commercial Vehicle Services (Connected Vehicle Roadside Equipment)

New Triplets (Source - Flow - Destination)

• Commercial Vehicle Administration Center - carrier participation report - Commercial Vehicle Check Equipment
• Commercial Vehicle Administration Center - commercial vehicle permit information - Enforcement Center
• Commercial Vehicle Administration Center - credentials status information - Enforcement Center
• Commercial Vehicle Administration Center - daily site activity data - Enforcement Center
• Commercial Vehicle Administration Center - safety inspection report - Enforcement Center
• Commercial Vehicle Administration Center - safety status information - Enforcement Center
• Commercial Vehicle Check Equipment - commercial vehicle violation notification - Enforcement Center
• Commercial Vehicle Check Equipment - pass/pull-in - Connected Vehicle Roadside Equipment
• Commercial Vehicle Check Equipment - safety inspection record - Connected Vehicle Roadside Equipment
• Commercial Vehicle Check Equipment - safety inspection request - Connected Vehicle Roadside Equipment
• Commercial Vehicle OBE - electronic lock data - Connected Vehicle Roadside Equipment
• Commercial Vehicle OBE - on-board safety data - Connected Vehicle Roadside Equipment
• Commercial Vehicle OBE - safety inspection record - Connected Vehicle Roadside Equipment
• Connected Vehicle Roadside Equipment - electronic lock data - Commercial Vehicle Check Equipment
• Connected Vehicle Roadside Equipment - electronic lock data request - Commercial Vehicle OBE
• Connected Vehicle Roadside Equipment - on-board safety data - Commercial Vehicle Check Equipment
• Connected Vehicle Roadside Equipment - pass/pull-in - Commercial Vehicle OBE
• Connected Vehicle Roadside Equipment - safety inspection record - Commercial Vehicle Check Equipment
• Connected Vehicle Roadside Equipment - safety inspection record - Commercial Vehicle OBE |

SP	Name	Description	Description of Modifications
			• Connected Vehicle Roadside Equipment - safety inspection request - Commercial Vehicle OBE

CVO08	Smart Roadside and Virtual WIM	This service package 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 service package 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 service package can also be used to verify that the commercial vehicle meets vehicle weight (via weigh in motion capability) or dimension requirements.	New Functional Objects • RSE Commercial Vehicle Services (Connected Vehicle Roadside Equipment) New Triplets (Source - Flow - Destination) • Commercial Vehicle Administration Center - commercial vehicle permit information - Commercial Vehicle Check Equipment • Commercial Vehicle Administration Center - commercial vehicle permit information - Other CV Administration Centers • Commercial Vehicle Administration Center - roadside data message - Commercial Vehicle Check Equipment • Commercial Vehicle Administration Center - safety inspection record - Commercial Vehicle OBE • Commercial Vehicle Administration Center - targeted list - Commercial Vehicle Check Equipment • Commercial Vehicle Administration Center - trigger area - Fleet and Freight Management Center • Commercial Vehicle Administration Center - trigger area notification - Connected Vehicle Roadside Equipment • Commercial Vehicle Administration Center - trigger area notification - Fleet and Freight Management Center • Commercial Vehicle Administration Center - trigger control - Connected Vehicle Roadside Equipment • Commercial Vehicle Check Equipment - commercial vehicle violation notification - Enforcement Center • Commercial Vehicle Check Equipment - driver log - Commercial Vehicle Administration Center • Commercial Vehicle Check Equipment - electronic screening request - Connected Vehicle Roadside Equipment • Commercial Vehicle Check Equipment - on-board safety data - Commercial Vehicle Administration Center • Commercial Vehicle Check Equipment - pass/pull-in - Connected Vehicle Roadside Equipment • Commercial Vehicle Check Equipment - screening event record - Connected Vehicle Roadside Equipment • Commercial Vehicle Check Equipment - weigh-in-motion information - Commercial Vehicle Administration Center • Commercial Vehicle OBE - driver log - Commercial Vehicle Administration Center • Commercial Vehicle OBE - driver log - Connected Vehicle Roadside Equipment • Commercial Vehicle OBE - driver log - Fleet and Freight Management Center • Commercial Vehicle OBE - freight equipment information - Connected Vehicle Roadside Equipment • Commercial Vehicle OBE - on-board safety data - Commercial Vehicle Administration Center

			- Commercial Vehicle OBE - on-board safety data - Connected Vehicle Roadside Equipment - Commercial Vehicle OBE - screening event record - Connected Vehicle Roadside Equipment - Commercial Vehicle OBE - unique identifiers - Commercial Vehicle Administration Center - Commercial Vehicle OBE - unique identifiers - Connected Vehicle Roadside Equipment - Connected Vehicle Roadside Equipment - driver log - Commercial Vehicle Administration Center - Connected Vehicle Roadside Equipment - driver log - Commercial Vehicle Check Equipment - Connected Vehicle Roadside Equipment - electronic screening request - Commercial Vehicle OBE - Connected Vehicle Roadside Equipment - freight equipment information - Commercial Vehicle Check Equipment - Connected Vehicle Roadside Equipment - on-board safety data - Commercial Vehicle Administration Center - Connected Vehicle Roadside Equipment - on-board safety data - Commercial Vehicle Check Equipment - Connected Vehicle Roadside Equipment - pass/pull-in - Commercial Vehicle OBE - Connected Vehicle Roadside Equipment - screening event record - Commercial Vehicle Check Equipment - Connected Vehicle Roadside Equipment - screening event record - Commercial Vehicle OBE - Connected Vehicle Roadside Equipment - trigger area notification - Commercial Vehicle OBE - Connected Vehicle Roadside Equipment - unique identifiers - Commercial Vehicle Check Equipment - Enforcement Center - targeted list - Commercial Vehicle Administration Center - Enforcement Center - trigger area definition - Commercial Vehicle Administration Center - Enforcement Center - trigger control - Commercial Vehicle Administration Center - Fleet and Freight Management Center - driver log - Commercial Vehicle Administration Center - Fleet and Freight Management Center - driver log - Commercial Vehicle OBE - Fleet and Freight Management Center - on-board safety data - Commercial Vehicle Administration Center - Fleet and Freight Management Center - safety inspection record - Commercial Vehicle OBE - Fleet and Freight Management Center - trigger area - Commercial Vehicle OBE - Fleet and Freight Management Center - trigger area notification - Commercial Vehicle OBE

SP	Name	Description	Description of Modifications
			• Fleet and Freight Management Center - unique identifiers - Commercial Vehicle Administration Center • Freight Equipment - freight equipment information - Connected Vehicle Roadside Equipment • Other CV Administration Centers - commercial vehicle permit information - Commercial Vehicle Administration Center
CVO12	HAZMAT Management	This service package integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material transport, including response to incidents. HAZMAT tracking is performed by the Fleet and Freight Management Center. The Emergency Management Center is notified by the Commercial Vehicle and the Fleet and Freight Management Center of the HAZMAT vehicle location and information about the HAZMAT load. If an incident occurs, the Emergency Management Center can use the information to coordinate 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, during the trip, or gathered following the incident depending on the selected policy and implementation.	<u>New Functional Objects</u> • Freight Equipment Monitoring (Freight Equipment) <u>New Triplets (Source - Flow - Destination)</u> • Commercial Vehicle OBE - commercial vehicle location data - Emergency Management Center • Commercial Vehicle OBE - commercial vehicle location data - Fleet and Freight Management Center • Commercial Vehicle OBE - hazmat notification - Fleet and Freight Management Center • Fleet and Freight Management Center - commercial vehicle location data - Emergency Management Center • Fleet and Freight Management Center - hazmat notification - Emergency Management Center
CVO13	Roadside HAZMAT Security Detection and Mitigation	This service package 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.	<u>New Functional Objects</u> • RSE Commercial Vehicle Services (Connected Vehicle Roadside Equipment) <u>New Triplets (Source - Flow - Destination)</u> • Commercial Vehicle Check Equipment - pass/pull-in - Connected Vehicle Roadside Equipment • Connected Vehicle Roadside Equipment - pass/pull-in - Commercial Vehicle OBE

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SP	Name	Description	Description of Modifications
CVO14	CV Driver Security Authentication	This service package provides the ability for Fleet and Freight Management to detect when an unauthorized commercial vehicle driver attempts to drive their vehicle based on stored driver identity information. If an unauthorized driver has been detected, Fleet and Freight Management can activate commands to safely disable the commercial vehicle. Alarms can also be sent to emergency management to inform them of a potential commercial vehicle hijacking or theft and potential hazardous situation. In addition, Emergency Management can request Fleet and Freight Management to disable a specific vehicle in their fleet.	New Functional Objects • RSE Commercial Vehicle Services (Connected Vehicle Roadside Equipment) New Triplets (Source - Flow - Destination) • Commercial Vehicle OBE - commercial vehicle disable status - Connected Vehicle Roadside Equipment • Commercial Vehicle OBE - commercial vehicle identities - Connected Vehicle Roadside Equipment • Commercial Vehicle OBE - expected driver identity characteristics - Connected Vehicle Roadside Equipment • Connected Vehicle Roadside Equipment - commercial vehicle disable status - Commercial Vehicle Check Equipment • Connected Vehicle Roadside Equipment - commercial vehicle identities - Commercial Vehicle Check Equipment • Connected Vehicle Roadside Equipment - expected driver identity characteristics - Commercial Vehicle Check Equipment • Emergency Management Center - commercial vehicle incident response information - Fleet and Freight Management Center

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SP	Name	Description	Description of Modifications
CVO15	Fleet and Freight Security	This service package provides enhanced security for commercial vehicle fleets and freight. Internal and external alerts and advisories are monitored to identify potential threats to the safety and security of the fleet and freight. It provides for the planning and tracking of three aspects of commercial vehicle shipments. For each shipment, the commercial vehicle, the freight equipment, and the commercial vehicle driver are monitored for consistency with the planned assignment. Any unauthorized changes are determined by the Fleet and Freight Management Center and then the appropriate people and Centers are notified. As the freight is shipped and tracked, security and public safety agencies may also interrogate the freight container to determine if it has been breached and to identify container contents. Once a route has been assigned, changes must be coordinated. Commercial Vehicle Drivers are alerted to any changes in route from the planned route and given an opportunity to justify a rerouting. Any unauthorized or unexpected route changes by the Commercial Vehicle will register a route deviation alert with the Fleet and Freight Management Center, which can notify local public safety agencies of the route deviation when appropriate (e.g., if there is safety sensitive HAZMAT being carried). Freight managers may decide to take further action on the alerts and/or provide responses that explain that the alerts are false alarms. If no explanation is received, the Fleet and Freight Management Center may notify the Emergency Management Center.	New Functional Objects • Freight Equipment Monitoring (Freight Equipment) • RSE Commercial Vehicle Services (Connected Vehicle Roadside Equipment) New Triplets (Source - Flow - Destination) • Commercial Vehicle OBE - container seal status - Connected Vehicle Roadside Equipment • Commercial Vehicle OBE - freight equipment information - Connected Vehicle Roadside Equipment • Connected Vehicle Roadside Equipment - container manifest - Commercial Vehicle Check Equipment • Connected Vehicle Roadside Equipment - container seal interrogation - Freight Equipment • Connected Vehicle Roadside Equipment - container seal status - Commercial Vehicle Check Equipment • Connected Vehicle Roadside Equipment - freight equipment information - Commercial Vehicle Check Equipment • Emergency Vehicle OBE - container seal interrogation - Freight Equipment • Fleet and Freight Management Center - booking status - Freight Distribution and Logistics Center • Freight Equipment - container manifest - Connected Vehicle Roadside Equipment • Freight Equipment - container manifest - Emergency Vehicle OBE • Freight Equipment - container seal status - Commercial Vehicle OBE • Freight Equipment - container seal status - Connected Vehicle Roadside Equipment • Freight Equipment - container seal status - Emergency Vehicle OBE • Freight Equipment - container seal status - Fleet and Freight Management Center • Freight Equipment - freight equipment information - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
DM01	ITS Data Warehouse	This service package provides access to transportation data to support transportation planning, condition and performance monitoring, safety analysis, and research. Configurations range from focused repositories that house data collected and owned by a single agency, district, private sector provider, or research institution to broad repositories that contain multimodal, multidimensional data from varied data sources covering a broader region. Both central repositories and physical distributed ITS data repositories are supported. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse service package may be parsed by the local repository and dynamically translated to requests to other repositories that relay the data necessary to satisfy the request. The repositories could include a data registry capability that allows registration of data identifiers or data definitions for interoperable use throughout a region.	New Functional Objects • DDS Data Access Management (Data Distribution System) • DDS Data Collection and Aggregation (Data Distribution System) • RSE Situation Monitoring (Connected Vehicle Roadside Equipment) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - local situation data - Archived Data System • Connected Vehicle Roadside Equipment - local situation data - Data Distribution System • Data Distribution System - regional situation data - Archived Data System
MC04	Winter Maintenance	This service package supports winter road maintenance including snow plow operations, roadway treatments (e.g., salt spraying and other anti-icing material applications), and other snow and ice control activities. This package monitors environmental conditions and weather forecasts and uses the information to schedule winter maintenance activities, determine the appropriate snow and ice control response, and track and manage response operations.	New Triplets (Source - Flow - Destination) • Maint and Constr Vehicle Operator - driver environmental input - Maint and Constr Vehicle OBE • Traffic Management Center - traffic images - Maint and Constr Management Center

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SP	Name	Description	Description of Modifications
MC05	Roadway Maintenance and Construction	This service package 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.	<u>New Functional Objects</u> • FME On-Site Maintenance (Field Maintenance Equipment) • MCM Field Equipment Maintenance (Maint and Constr Management Center) <u>New Triplets (Source - Flow - Destination)</u> • Field Maintenance Equipment - field equipment commands - ITS Roadway Equipment • Field Maintenance Equipment - field equipment configuration settings - ITS Roadway Equipment • Field Maintenance Equipment - field equipment software install/upgrade - ITS Roadway Equipment • Field Maintenance Equipment - field equipment status presentation - Maint and Constr Field Personnel • ITS Roadway Equipment - field equipment status - Field Maintenance Equipment • Maint and Constr Field Personnel - field personnel equipment input - Field Maintenance Equipment
MC06	Work Zone Management	This service package 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 service package 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.	<u>New Triplets (Source - Flow - Destination)</u> • Connected Vehicle Roadside Equipment - roadway dynamic signage data - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - vehicle signage application status - Maint and Constr Management Center • ITS Roadway Equipment - roadway advisory radio status - Maint and Constr Management Center • ITS Roadway Equipment - roadway advisory radio status - Traffic Management Center • ITS Roadway Equipment - roadway dynamic signage status - Connected Vehicle Roadside Equipment • ITS Roadway Equipment - vehicle signage local data - Connected Vehicle Roadside Equipment • Maint and Constr Management Center - roadway advisory radio data - ITS Roadway Equipment • Maint and Constr Management Center - vehicle signage application info - Connected Vehicle Roadside Equipment • Traffic Management Center - roadway advisory radio data - ITS Roadway Equipment • Traffic Management Center - vehicle signage application info - Connected Vehicle Roadside Equipment

SP	Name	Description	Description of Modifications
MC07	Work Zone Safety Monitoring	This service package 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).	New Functional Objects • Personnel Work Zone Safety (Personnel Device) • RSE Work Zone Safety (Connected Vehicle Roadside Equipment) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - personnel safety warning - Personnel Device • Connected Vehicle Roadside Equipment - traffic situation data - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - work zone safety application status - Maint and Constr Management Center • Connected Vehicle Roadside Equipment - work zone warning notification - ITS Roadway Equipment • ITS Roadway Equipment - work zone warning notification - Connected Vehicle Roadside Equipment • Maint and Constr Management Center - work zone safety application info - Connected Vehicle Roadside Equipment • Maint and Constr Vehicle OBE - personnel safety warning - Personnel Device • Maint and Constr Vehicle OBE - work zone warning notification - Connected Vehicle Roadside Equipment • Personnel Device - personnel location - Connected Vehicle Roadside Equipment • Personnel Device - personnel location - Maint and Constr Vehicle OBE • Personnel Device - personnel updates - Maint and Constr Field Personnel • Vehicle OBE - vehicle location and motion - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle location and motion - Maint and Constr Vehicle OBE
MC09	Infrastructure Monitoring	This service package monitors the condition of pavement, bridges, tunnels, associated hardware, and other transportation-related infrastructure (e.g., culverts) using both fixed and vehicle-based infrastructure monitoring sensors. Fixed sensors monitor vibration, stress, temperature, continuity, and other parameters and mobile sensors and data logging devices collect information on current infrastructure condition. This service package also monitors vehicle probes for vertical acceleration data and other probe data that may be used to determine current pavement condition.	New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - infrastructure monitoring sensor control - ITS Roadway Equipment • ITS Roadway Equipment - infrastructure monitoring sensor data - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
PM01	Parking Space Management	This service package 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 service package shares collected parking information with local drivers and information providers for broader distribution.	New Functional Objects • RSE Parking Management (Connected Vehicle Roadside Equipment) • Vehicle Basic Safety Communication (Vehicle OBE) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - parking availability - Vehicle OBE • Connected Vehicle Roadside Equipment - parking management application status - Parking Management System • Parking Management System - parking management application info - Connected Vehicle Roadside Equipment • Parking Management System - vehicle signage local data - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle location and motion for surveillance - Connected Vehicle Roadside Equipment

SP	Name	Description	Description of Modifications
PM03	Parking Electronic Payment	This service package supports electronic collection of parking fees. It collects parking fees from in-vehicle equipment, contact or proximity cards, or any smart payment device. User accounts may be established to enhance services offered to frequent customers.	New Functional Objects • RSE Parking Management (Connected Vehicle Roadside Equipment) • RSE Payment Support (Connected Vehicle Roadside Equipment) • Vehicle Payment Service (Vehicle OBE) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - parking management application status - Parking Management System • Connected Vehicle Roadside Equipment - payment transactions - Parking Management System • Connected Vehicle Roadside Equipment - vehicle payment request - Vehicle OBE • Connected Vehicle Roadside Equipment - vehicle payment update - Vehicle OBE • Parking Management System - parking management application info - Connected Vehicle Roadside Equipment • Parking Management System - payment device update - Payment Device • Parking Management System - payment instructions - Connected Vehicle Roadside Equipment • Parking Management System - payment transactions - Payment Administration Center • Payment Administration Center - payment instructions - Parking Management System • Payment Administration Center - traveler payment request - Personal Information Device • Payment Administration Center - user account reports - Personal Information Device • Payment Device - payment device information - Parking Management System • Payment Device - payment device information - Vehicle OBE • Personal Information Device - traveler payment information - Payment Administration Center • Personal Information Device - user account setup - Payment Administration Center • Vehicle OBE - payment device update - Payment Device • Vehicle OBE - vehicle payment information - Connected Vehicle Roadside Equipment
PM04	Regional Parking Management	This service package supports communication and coordination between equipped parking facilities and also supports regional coordination between parking facilities and traffic and transit management systems. This service package also shares information with transit management centers and transportation information centers to support multimodal travel planning. Information including current parking availability, system status, and operating strategies are shared to enable local parking facility management that supports regional transportation strategies.	New Triplets (Source - Flow - Destination) • Event Promoter System - event plans - Parking Management System • Other Transportation Information Centers - parking information - Transportation Information Center • Traffic Management Center - transportation operational strategies - Parking Management System • Transit Management Center - transit schedule adherence information - Parking Management System • Transportation Information Center - parking information - Other Transportation Information Centers

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SP	Name	Description	Description of Modifications
PM05	Parking Reservations	This service package manages parking reservations, allowing a traveler to reserve parking as part of the trip planning process. Parking reservations may be part of a trip plan provided by a Transportation Information Center (TIC) based on parking information provided by one or more parking facilities. This parking plan is provided to the traveler/driver, which includes the option to make a reservation if available. If the parking reservation is selected by the traveler/driver, then the TIC will negotiate the parking reservation with the parking facility and provide a confirmation to the traveler/driver.	New Functional Objects • Traveler Trip Planning (Traveler Support Equipment) New Triplets (Source - Flow - Destination) • Personal Information Device - traveler sourced updates - Transportation Information Center • Transportation Information Center - parking plan - Personal Information Device • Transportation Information Center - parking plan - Traveler Support Equipment • Transportation Information Center - parking plan - Vehicle OBE • Vehicle OBE - traveler sourced updates - Transportation Information Center
PS01	Emergency Call-Taking and Dispatch	This service package 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. This service package also 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.	New Triplets (Source - Flow - Destination) • Emergency Management Center - road weather advisories for emergency response - Emergency Vehicle OBE • Rail Operations Center - railroad schedules - Emergency Management Center • Transportation Information Center - road network environmental situation data - Emergency Management Center • Transportation Information Center - road weather advisories - Emergency Management Center

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SP	Name	Description	Description of Modifications
PS02	Emergency Response	This service package supports emergency/incident response by personnel in the field. It includes emergency vehicle equipment used to provide response status as well as video or images from either the vehicle or from emergency personnel in the field. Wide area wireless communications between the Emergency Management Center, Emergency Personnel and Emergency Vehicles supports a sharing of emergency response information. The service package also includes tactical decision support, resource coordination, and communications integration for Incident Commands that are established by first responders at or near the incident scene to support local management of an incident, including the functions and interfaces commonly supported by a mobile command center.	New Functional Objects • Personnel Incident Scene Communications (Personnel Device) New Triplets (Source - Flow - Destination) • Emergency Management Center - decision support information - Personnel Device • Emergency Management Center - incident command information - Personnel Device • Emergency Personnel - personnel input - Personnel Device • Emergency Vehicle OBE - decision support information - Other EV OBEs • Emergency Vehicle OBE - incident scene images - Emergency Management Center • Other EV OBEs - decision support information - Emergency Vehicle OBE • Personnel Device - incident command input - Emergency Management Center • Personnel Device - incident scene images - Emergency Management Center • Personnel Device - incident scene images - Emergency Vehicle OBE • Personnel Device - incident scene status - Emergency Management Center • Personnel Device - personnel location - Emergency Management Center • Personnel Device - personnel location - Emergency Vehicle OBE • Personnel Device - personnel updates - Emergency Personnel
PS03	Emergency Vehicle Preemption	This service package 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.	New Functional Objects • Roadway Signal Preemption (ITS Roadway Equipment) • RSE Intersection Management (Connected Vehicle Roadside Equipment) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - intersection geometry - Emergency Vehicle OBE • Connected Vehicle Roadside Equipment - intersection status - Emergency Vehicle OBE • Connected Vehicle Roadside Equipment - signal preemption request - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - signal priority status - Emergency Vehicle OBE • Emergency Vehicle OBE - vehicle location and motion - Connected Vehicle Roadside Equipment • ITS Roadway Equipment - driver information - Emergency Personnel • ITS Roadway Equipment - intersection control status - Connected Vehicle Roadside Equipment • Traffic Management Center - intersection management application info - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
PS04	Mayday Notification	This service package 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 service package allows passing vehicles to receive and forward mayday requests in areas where no communications infrastructure exists. Emergency notifications from personal devices are also supported.	New Triplets (Source - Flow - Destination) • Basic Vehicle - driver input information - Vehicle OBE • Other Vehicle OBEs - emergency acknowledge - Vehicle OBE • Other Vehicle OBEs - emergency notification - Vehicle OBE • Other Vehicle OBEs - emergency notification relay - Vehicle OBE • Vehicle OBE - emergency acknowledge - Other Vehicle OBEs • Vehicle OBE - emergency notification - Other Vehicle OBEs • Vehicle OBE - emergency notification relay - Other Vehicle OBEs
PS05	Vehicle Emergency Response	The Vehicle Emergency Response service package 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.	New Triplets (Source - Flow - Destination) • Basic Vehicle - driver input information - Vehicle OBE • Commercial Vehicle OBE - hazmat notification - Emergency Vehicle OBE • Vehicle OBE - vehicle collision information - Emergency Vehicle OBE

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SP	Name	Description	Description of Modifications
PS08	Roadway Service Patrols	This service package 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 service package 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.	New Triplets (Source - Flow - Destination) • Emergency Vehicle OBE - emergency vehicle tracking data - Traffic Management Center • Emergency Vehicle OBE - service patrol dispatch response - Traffic Management Center • Emergency Vehicle OBE - service patrol incident status - Traffic Management Center • Traffic Management Center - incident information for public - Transportation Information Center • Traffic Management Center - service patrol dispatch request - Emergency Vehicle OBE

SP	Name	Description	Description of Modifications
PS09	Transportation Infrastructure Protection	This service package 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.	New Functional Objects • RSE Road Closure Management (Connected Vehicle Roadside Equipment) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - barrier system control - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - road closure information - Vehicle OBE • Emergency Vehicle OBE - road closure notification - Emergency Management Center • ITS Roadway Equipment - barrier system status - Connected Vehicle Roadside Equipment • Traffic Management Center - road closure application info - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
PS10	Wide-Area Alert	This service package 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.	New Triplets (Source - Flow - Destination) • Emergency Management Center - alert notification - Social Media • ITS Roadway Equipment - roadway advisory radio status - Traffic Management Center • Other Transportation Information Centers - emergency traveler information - Transportation Information Center • Traffic Management Center - roadway advisory radio data - ITS Roadway Equipment • Transportation Information Center - emergency traveler information - Other Transportation Information Centers
PS11	Early Warning System	This service package 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 service package 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.	New Triplets (Source - Flow - Destination) • Social Media - traveler sourced updates - Emergency Management Center

PS12	Disaster Response and Recovery	This service package 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 service package 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 service package 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 service package tracks and coordinates the transportation resources - the transportation professionals, equipment, and materials - that constitute a portion of the disaster response. The service package 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 service package, 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	Underline New Triplets (Source - Flow - Destination) • Asset Management System - asset damage assessment - Emergency Management Center • Other Traffic Management Centers - emergency traffic coordination - Traffic Management Center • Traffic Management Center - emergency traffic coordination - Other Traffic Management Centers

SP	Name	Description	Description of Modifications
		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 service package 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.	
		This service package builds on the basic traffic incident response service that is provided by TM08, the Traffic Incident Management service package. This service package addresses the additional complexities and coordination requirements that are associated with the most severe incidents that warrant an extraordinary response from outside the local jurisdictions and require special measures such as the activation of one or more emergency operations centers. Many users of ARC-IT will want to consider both TM08 and this service package since every region is concerned with both day-to-day management of traffic-related incidents and occasional management of disasters that require extraordinary response.	
		Disaster Response and Recovery is also supported by PS14, the "Disaster Traveler Information" service package that keeps the public informed during a disaster response. See that service package for more information.	

SP	Name	Description	Description of Modifications
PS13	Evacuation and Reentry Management	This service package supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. The service package 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 service package 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. Evacuations are also supported by PS14, the "Disaster Traveler Information" service package, which keeps the public informed during evacuations. See that service package for more information.	New Triplets (Source - Flow - Destination) • Other Traffic Management Centers - emergency traffic coordination - Traffic Management Center • Population and Housing Data System - population and housing data - Emergency Management Center • Special Needs Registry - special needs data - Emergency Management Center • Traffic Management Center - emergency traffic coordination - Other Traffic Management Centers

PS14	Disaster Traveler Information	This service package uses ITS to provide disaster-related traveler information to the general public, including evacuation and reentry information and other information concerning the operation of the transportation system during a disaster. This service package collects information from multiple sources including traffic, transit, public safety, emergency management, shelter provider, and travel service provider organizations. The collected information is processed and the public is provided with real-time disaster and evacuation information using ITS traveler information systems. A disaster will stress the surface transportation system since it may damage transportation facilities at the same time that it places unique demands on these facilities to support public evacuation and provide access for emergency responders. Similarly, a disaster may interrupt or degrade the operation of many traveler information systems at the same time that safety-critical information must be provided to the traveling public. This service package keeps the public informed in these scenarios, using all available means to provide information about the disaster area including damage to the transportation system, detours and closures in effect, special traffic restrictions and allowances, special transit schedules, and real-time information on traffic conditions and transit system performance in and around the disaster. This service package also provides emergency information to assist the public with evacuations when necessary. Information on mandatory and voluntary evacuation zones, evacuation times, and instructions are provided. Available evacuation routes and destinations and current and anticipated travel conditions along those routes are provided so evacuees are prepared and know their destination and preferred evacuation route. Information on available	New Triplets (Source - Flow - Destination) • Emergency Management Center - incident information for public - Transportation Information Center • Other Transportation Information Centers - emergency traveler information - Transportation Information Center • Personal Information Device - evacuation assistance request - Transportation Information Center • Personal Information Device - shelter request - Transportation Information Center • Personal Information Device - traveler sourced updates - Transportation Information Center • Traffic Management Center - incident information for public - Transportation Information Center • Traffic Management Center - traffic images - Transportation Information Center • Transportation Information Center - emergency traveler information - Other Transportation Information Centers • Transportation Information Center - evacuation assistance information - Personal Information Device • Transportation Information Center - evacuation assistance information - Traveler Support Equipment • Transportation Information Center - evacuation assistance information - Vehicle OBE • Transportation Information Center - evacuee match information - Shelter Provider Center • Transportation Information Center - shelter recommendations - Personal Information Device • Transportation Information Center - shelter recommendations - Traveler Support Equipment • Transportation Information Center - shelter recommendations - Vehicle OBE • Traveler Support Equipment - evacuation assistance request - Transportation Information Center • Traveler Support Equipment - shelter request - Transportation Information Center • Traveler Support Equipment - traveler sourced updates - Transportation Information Center • Vehicle OBE - evacuation assistance request - Transportation Information Center • Vehicle OBE - shelter request - Transportation Information Center • Vehicle OBE - traveler sourced updates - Transportation Information Center

SP	Name	Description	Description of Modifications
		transit services and traveler services (shelters, medical services, hotels, restaurants, gas stations, etc.) is also provided. In addition to general evacuation information, this service package provides specific evacuation trip planning information that is tailored for the evacuee based on origin, selected destination, and evacuee-specified evacuation requirements and route parameters. This service package augments the Traveler Information (TI) service packages that provide traveler information on a day-to-day basis for the surface transportation system. This service package provides focus on the special requirements for traveler information dissemination in disaster situations.	
PT02	Transit Fixed-Route Operations	This service package 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.	<u>New Triplets (Source - Flow - Destination)</u> • Traffic Management Center - traffic images - Transit Management Center
PT03	Dynamic Transit Operations	The Dynamic Transit Operations service package 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 service package 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.	<u>New Triplets (Source - Flow - Destination)</u> • Personal Information Device - trip feedback - Transportation Information Center • Traffic Management Center - traffic images - Transit Management Center • Transportation Information Center - trip confirmation - Transit Management Center

SP	Name	Description	Description of Modifications
PT04	Transit Fare Collection Management	This service package manages transit fare collection on-board transit vehicles and at transit stops using electronic means. It allows transit users to use a traveler card or other electronic payment device such as a smart phone. Readers located either in the infrastructure or on-board the transit vehicles enable electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Center.	New Triplets (Source - Flow - Destination) • Payment Device - payment device information - Transit Vehicle OBE • Transit Management Center - fare management information - Traveler Support Equipment • Transit Management Center - transit fare information - Transportation Information Center • Transit Vehicle OBE - payment device update - Payment Device • Transportation Information Center - transit fare request - Transit Management Center • Traveler Support Equipment - fare collection data - Transit Management Center
PT08	Transit Traveler Information	This service package 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 service package.	New Triplets (Source - Flow - Destination) • Other Transportation Information Centers - transit service information - Transportation Information Center • Transportation Information Center - transit service information - Other Transportation Information Centers • Traveler Support Equipment - transit traveler request - Transit Management Center
PT09	Transit Signal Priority	The Transit Signal Priority service package uses transit vehicle to infrastructure communications to allow a transit vehicle to request priority at one or a series of intersections. The service package provides feedback to the transit driver indicating whether the signal priority has been granted or not. This service package can contribute to improved operating performance of the transit vehicles by reducing the time spent stopped at a red light.	New Functional Objects • RSE Intersection Management (Connected Vehicle Roadside Equipment) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - intersection geometry - Transit Vehicle OBE • Connected Vehicle Roadside Equipment - intersection status - Transit Vehicle OBE • Connected Vehicle Roadside Equipment - signal priority service request - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - signal priority status - Transit Vehicle OBE • ITS Roadway Equipment - driver information - Transit Vehicle Operator • ITS Roadway Equipment - intersection control status - Connected Vehicle Roadside Equipment • Traffic Management Center - intersection management application info - Connected Vehicle Roadside Equipment • Transit Vehicle OBE - vehicle location and motion - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
PT14	Multi-modal Coordination	This service package 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.	New Triplets (Source - Flow - Destination) • Alternate Mode Transportation Center - service information response - Transit Management Center • Transit Management Center - event transit service plans - Event Promoter System • Transit Management Center - service information request - Alternate Mode Transportation Center

PT18	Integrated Multi-Modal Electronic Payment	The Integrated Multi-Modal Electronic Payment service package provides electronic payment capability for transit fares, tolls, road use, parking, and other areas requiring electronic payments.	New Functional Objects • RSE Payment Support (Connected Vehicle Roadside Equipment) • Vehicle Payment Service (Vehicle OBE) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - payment application status - Payment Administration Center • Connected Vehicle Roadside Equipment - vehicle payment information - Payment Administration Center • Connected Vehicle Roadside Equipment - vehicle payment request - Vehicle OBE • Other Payment Administration Centers - payment coordination - Payment Administration Center • Parking Management System - vehicle payment information - Payment Administration Center • Payment Administration Center - payment application information - Connected Vehicle Roadside Equipment • Payment Administration Center - payment coordination - Other Payment Administration Centers • Payment Administration Center - transaction status - Transit Management Center • Payment Administration Center - traveler payment request - Personal Information Device • Payment Administration Center - traveler payment request - Traveler Support Equipment • Payment Administration Center - user account reports - Personal Information Device • Payment Administration Center - user account reports - Traveler Support Equipment • Payment Administration Center - vehicle payment request - Connected Vehicle Roadside Equipment • Payment Administration Center - vehicle payment request - Parking Management System • Payment Administration Center - vehicle payment request - Vehicle OBE • Payment Device - payment device information - Transit Vehicle OBE • Payment Device - payment device information - Vehicle OBE • Personal Information Device - traveler payment information - Payment Administration Center • Personal Information Device - user account setup - Payment Administration Center • Transit Management Center - fare management information - Traveler Support Equipment • Transit Management Center - payment request - Payment Administration Center • Transit Vehicle OBE - payment device update - Payment Device • Traveler Support Equipment - fare collection data - Transit Management Center • Traveler Support Equipment - traveler payment information - Payment Administration Center

SP	Name	Description	Description of Modifications
			• Traveler Support Equipment - user account setup - Payment Administration Center • Vehicle OBE - payment device update - Payment Device • Vehicle OBE - vehicle payment information - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle payment information - Payment Administration Center
ST01	Emissions Monitoring	This service package monitors individual vehicle emissions and provides general air quality monitoring using distributed sensors to collect the data. The collected information is transmitted to the Emissions Management Center for processing. Both area wide air quality monitoring and point emissions monitoring are supported by this service package. For area wide monitoring, this service package measures air quality, identifies sectors that are non-compliant with air quality standards, and collects, stores and reports supporting statistical data. For point emissions monitoring, this service package collects data from on-board diagnostic systems and measures tail pipe emissions to identify vehicles that exceed emissions standards and/or clean vehicles that could be released from standard emissions tests, depending on policy and regulations. Summary emissions information or warnings can also be displayed to drivers. The gathered information can be used to implement environmentally sensitive travel demand management (TDM) programs, policies, and regulations.	New Functional Objects • Emissions Connected Vehicle Monitoring (Emissions Management Center) • Transit Vehicle Emissions Monitoring (Transit Vehicle OBE) • Vehicle Emissions Monitoring (Vehicle OBE) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - emissions monitoring application status - Emissions Management Center • Connected Vehicle Roadside Equipment - emissions situation data - Emissions Management Center • Connected Vehicle Roadside Equipment - vehicle reported emissions - ITS Roadway Equipment • Emissions Management Center - mobile source emissions data - Traffic Management Center • Emissions Management Center - wide area air quality data - Transit Management Center • Transit Management Center - transit emissions data - Emissions Management Center • Transit Vehicle OBE - transit vehicle emissions - Transit Management Center • Vehicle OBE - vehicle reported emissions - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
ST04	Roadside Lighting	The Roadside Lighting service package is a connected vehicle version of the automated roadside lighting systems that uses the presence of vehicles based on V2I communications as an input to control of roadside lighting systems. The service package can use the presence of vehicles to alter roadside lighting levels, and can use environmental data obtained from the vehicles as an input to support adjustment of the lighting based on adverse weather conditions such as fog, rain, or snow.	New Functional Objects • RSE Lighting System Support (Connected Vehicle Roadside Equipment) • RSE Traffic Monitoring (Connected Vehicle Roadside Equipment) • Vehicle Basic Safety Communication (Vehicle OBE) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - environmental situation data - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - environmental situation data - Traffic Management Center • Connected Vehicle Roadside Equipment - traffic situation data - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - traffic situation data - Traffic Management Center • Traffic Management Center - lighting management application info - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle location and motion for surveillance - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
ST06	HOV/HOT Lane Management	This service package manages high-occupancy vehicle (HOV) and high-occupancy toll (HOT) lanes by coordinating freeway ramp meters and connector signals with HOV lane usage signals. Preferential treatment is given to HOV lanes using special bypasses, reserved lanes, and exclusive rights-of-way that may vary by time of day. Vehicle occupancy can be detected to verify HOV compliance and to notify enforcement agencies of violations. For HOT lane configurations, tolls are collected for vehicles that do not meet the high-occupancy criteria for the lane.	<u>New Functional Objects</u> • RSE Restricted Lanes Application (Connected Vehicle Roadside Equipment) • RSE Toll Collection (Connected Vehicle Roadside Equipment) • TMC Restricted Lanes CV Application (Traffic Management Center) • Vehicle Payment Service (Vehicle OBE) • Vehicle Restricted Lanes Application (Vehicle OBE) <u>New Triplets (Source - Flow - Destination)</u> • Connected Vehicle Roadside Equipment - access violation notification - Vehicle OBE • Connected Vehicle Roadside Equipment - payment application status - Payment Administration Center • Connected Vehicle Roadside Equipment - payment transactions - ITS Roadway Payment Equipment • Connected Vehicle Roadside Equipment - vehicle entries and exits - ITS Roadway Payment Equipment • Connected Vehicle Roadside Equipment - vehicle occupancy - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - vehicle payment request - Vehicle OBE • Connected Vehicle Roadside Equipment - vehicle payment update - Vehicle OBE • ITS Roadway Equipment - lane management information - Traffic Management Center • ITS Roadway Equipment - vehicle signage local data - Connected Vehicle Roadside Equipment • ITS Roadway Payment Equipment - payment instructions - Connected Vehicle Roadside Equipment • ITS Roadway Payment Equipment - vehicle entries and exits - Connected Vehicle Roadside Equipment • Payment Administration Center - payment application information - Connected Vehicle Roadside Equipment • Payment Administration Center - user account reports - Personal Information Device • Payment Device - payment device information - Vehicle OBE • Personal Information Device - user account setup - Payment Administration Center • Traffic Management Center - lane management control - ITS Roadway Equipment • Traffic Management Center - restricted lanes application info - Connected Vehicle Roadside Equipment • Traffic Management Center - vehicle signage application info - Connected Vehicle Roadside Equipment • Vehicle OBE - payment device update - Payment Device • Vehicle OBE - vehicle payment information - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle profile - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
ST07	Eco-Lanes Management	The Eco-Lanes Management service package supports the operations of eco-lanes – dedicated lanes similar to high-occupancy vehicle (HOV) or high-occupancy toll (HOT) lanes, but optimized for the environment. The service package employs communication technology to gather traffic and environmental information from multiple sources including infrastructure, vehicles, and other systems. The service package then processes these data and determines whether an eco-lane should be created or decommissioned along a roadway. These decisions would be in response to real-time traffic and environmental conditions. While the eco-lanes would have the capability to be flexible and more dynamic, it is envisioned that these parameters would change only as needed to ensure that travelers do not become confused by a system that is too dynamic in nature. Travelers would need to assume some level of consistency with their trip and should not be surprised by constant changing of the eco-lane's parameters. The Eco-Lanes Management service package establishes parameters and defines or geo-fences the eco-lanes boundaries. Eco-lanes parameters may include the types of vehicles allowed in the eco-lanes, emissions parameters for entering the eco-lanes, the number of lanes, and the start and end of the eco-lanes. The service package also conveys this information about eco-lanes to traveler information centers so those centers can provide the information to travelers.	New Functional Objects • Emissions Connected Vehicle Monitoring (Emissions Management Center) • Roadway Dynamic Lane Management and Shoulder Use (ITS Roadway Equipment) • RSE Restricted Lanes Application (Connected Vehicle Roadside Equipment) • RSE Traffic Monitoring (Connected Vehicle Roadside Equipment) • TMC Dynamic Lane Management and Shoulder Use (Traffic Management Center) • TMC Restricted Lanes CV Application (Traffic Management Center) • Vehicle Basic Safety Communication (Vehicle OBE) • Vehicle Emissions Monitoring (Vehicle OBE) • Vehicle Restricted Lanes Application (Vehicle OBE) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - access violation notification - Vehicle OBE • Connected Vehicle Roadside Equipment - emissions situation data - Emissions Management Center • Connected Vehicle Roadside Equipment - restricted lanes application info - Vehicle OBE • Connected Vehicle Roadside Equipment - vehicle entries and exits - ITS Roadway Equipment • ITS Roadway Equipment - lane management information - Traffic Management Center • ITS Roadway Equipment - vehicle entries and exits - Connected Vehicle Roadside Equipment • ITS Roadway Equipment - vehicle signage local data - Connected Vehicle Roadside Equipment • Other Traffic Management Centers - road network conditions - Traffic Management Center • Traffic Management Center - current lane restrictions - Enforcement Center • Traffic Management Center - lane management control - ITS Roadway Equipment • Traffic Management Center - restricted lanes application info - Connected Vehicle Roadside Equipment • Traffic Management Center - road network conditions - Other Traffic Management Centers • Traffic Management Center - vehicle signage application info - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle location and motion for surveillance - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle profile - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle reported emissions - Connected Vehicle Roadside Equipment

SU03	Data Distribution	This service package manages the distribution of data from data providers to data consumers and protects those data from unauthorized access. It informs data providers of how to provide data, manages data subscriptions, and provides data forwarding capabilities. The service package also maintains a directory of System Users that want data and supports multiple distribution mechanisms including publish-subscribe and directly from data provider to data consumer. It allows data consumers to specify (and change the specification of) data they wish to receive.	New Functional Objects • Center Data Subscription Management (Center) • DDS Data Access Management (Data Distribution System) • DDS Data Collection and Aggregation (Data Distribution System) • Personal Data Subscription Management (Personal Information Device) • RSE Data Subscription Management (Connected Vehicle Roadside Equipment) • Vehicle Data Subscription Management (Vehicle OBE) New Triplets (Source - Flow - Destination) • Center - data provision - Data Distribution System • Center - data query - Data Distribution System • Center - data subscription - Data Distribution System • Connected Vehicle Roadside Equipment - data provision - Data Distribution System • Connected Vehicle Roadside Equipment - data query - Data Distribution System • Connected Vehicle Roadside Equipment - data subscription - Data Distribution System • Data Distribution System - data provision - Other Data Distribution Systems • Data Distribution System - data publication - Center • Data Distribution System - data publication - Connected Vehicle Roadside Equipment • Data Distribution System - data publication - Other Data Distribution Systems • Data Distribution System - data publication - Personal Information Device • Data Distribution System - data publication - Vehicle OBE • Data Distribution System - data query - Other Data Distribution Systems • Data Distribution System - data query publication - Center • Data Distribution System - data query publication - Connected Vehicle Roadside Equipment • Data Distribution System - data query publication - Other Data Distribution Systems • Data Distribution System - data query publication - Personal Information Device • Data Distribution System - data query publication - Vehicle OBE • Data Distribution System - data subscription - Other Data Distribution Systems • Data Distribution System - DDS operations information presentation - Data Distribution System Operator • Data Distribution System Operator - DDS operator input - Data Distribution System • Other Data Distribution Systems - data provision - Data Distribution System • Other Data Distribution Systems - data publication - Data Distribution System • Other Data Distribution Systems - data query - Data Distribution System • Other Data Distribution Systems - data query publication - Data Distribution System • Other Data Distribution Systems - data subscription - Data Distribution System • Personal Information Device - data provision - Data Distribution System • Personal Information Device - data query - Data Distribution System • Personal Information Device - data subscription - Data Distribution System • Vehicle OBE - data provision - Data Distribution System • Vehicle OBE - data query - Data Distribution System

SP	Name	Description	Description of Modifications
			• Vehicle OBE - data subscription - Data Distribution System

TI01	Broadcast Traveler Information	This service package 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. This service package also provides location-specific or situation-relevant information to travelers in vehicles using Dedicated Short Range Communications (DSRC) infrastructure supporting mobility service packages for connected vehicles. DSRC is used to deliver real-time traveler information including travel times, incident information, road conditions, and emergency traveler information to vehicles as they pass connected vehicle roadside equipment along their route. This service package provides public information that is available to all equipped vehicles in the vicinity of the roadside equipment.	New Functional Objects • WAID Broadcast Services (Wide Area Information Disseminator System) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - local traveler information - Personal Information Device • Connected Vehicle Roadside Equipment - local traveler information - Vehicle OBE • Emergency Management Center - incident information for public - Transportation Information Center • Other Transportation Information Centers - alternate mode information - Transportation Information Center • Other Transportation Information Centers - incident information for public - Transportation Information Center • Other Transportation Information Centers - parking information - Transportation Information Center • Other Transportation Information Centers - road network conditions - Transportation Information Center • Other Transportation Information Centers - traffic images - Transportation Information Center • Other Transportation Information Centers - transit service information - Transportation Information Center • Traffic Management Center - incident information for public - Transportation Information Center • Traffic Management Center - traffic control information - Transportation Information Center • Traffic Management Center - traffic images - Transportation Information Center • Transportation Information Center - alternate mode information - Other Transportation Information Centers • Transportation Information Center - broadcast traveler information - Wide Area Information Disseminator System • Transportation Information Center - incident information for public - Other Transportation Information Centers • Transportation Information Center - parking information - Other Transportation Information Centers • Transportation Information Center - road network conditions - Other Transportation Information Centers • Transportation Information Center - traffic images - Other Transportation Information Centers • Transportation Information Center - transit service information - Other Transportation Information Centers • Transportation Information Center - traveler information application info - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
			• Wide Area Information Disseminator System - wide area broadcast traveler information - Personal Information Device • Wide Area Information Disseminator System - wide area broadcast traveler information - Traveler Support Equipment • Wide Area Information Disseminator System - wide area broadcast traveler information - Vehicle OBE

SP	Name	Description	Description of Modifications
TI02	Personalized Traveler Information	This service package 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 en route including phone via a 511-like portal and web pages via smart phone, tablet, personal computer, and a variety of in-vehicle devices."	New Triplets (Source - Flow - Destination) • Emergency Management Center - incident information for public - Transportation Information Center • Other Transportation Information Centers - alternate mode information - Transportation Information Center • Other Transportation Information Centers - incident information for public - Transportation Information Center • Other Transportation Information Centers - parking information - Transportation Information Center • Other Transportation Information Centers - road network conditions - Transportation Information Center • Other Transportation Information Centers - traffic images - Transportation Information Center • Other Transportation Information Centers - transit service information - Transportation Information Center • Personal Information Device - traveler request - Social Media • Personal Information Device - traveler sourced updates - Social Media • Social Media - interactive traveler information - Personal Information Device • Social Media - traveler sourced updates - Transportation Information Center • Traffic Management Center - incident information for public - Transportation Information Center • Traffic Management Center - traffic control information - Transportation Information Center • Traffic Management Center - traffic images - Transportation Information Center • Transportation Information Center - alternate mode information - Other Transportation Information Centers • Transportation Information Center - incident information for public - Other Transportation Information Centers • Transportation Information Center - parking information - Other Transportation Information Centers • Transportation Information Center - road network conditions - Other Transportation Information Centers • Transportation Information Center - social media presence - Social Media • Transportation Information Center - traffic images - Other Transportation Information Centers • Transportation Information Center - transit service information - Other Transportation Information Centers

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SP	Name	Description	Description of Modifications
TI03	Dynamic Route Guidance	This service package 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.	New Triplets (Source - Flow - Destination) • Traffic Management Center - incident information for public - Transportation Information Center • Traffic Management Center - traffic images - Transportation Information Center

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SP	Name	Description	Description of Modifications
TI04	Infrastructure-Provided Trip Planning and Route Guidance	This service package offers the user trip planning and en route guidance services. It generates a trip plan, including a multimodal route and associated service information (e.g., parking information), based on traveler preferences and constraints. Routes may be based on static information or reflect real time network conditions. Unlike TI03, where the user equipment determines the route, the route determination functions are performed by the center in this service package. The trip plan may be confirmed by the traveler and advanced payment and reservations for transit and alternate mode (e.g., airline, rail, and ferry) trip segments, and ancillary services are accepted and processed. The confirmed trip plan may include specific routing information that can be supplied to the traveler as general directions or as turn-by-turn route guidance depending on the level of user equipment.	<u>New Functional Objects</u> • Transit Center Connection Protection (Transit Management Center) • Traveler Trip Planning (Traveler Support Equipment) <u>New Triplets (Source - Flow - Destination)</u> • Other Transportation Information Centers - alternate mode information - Transportation Information Center • Other Transportation Information Centers - incident information for public - Transportation Information Center • Other Transportation Information Centers - parking information - Transportation Information Center • Other Transportation Information Centers - road network conditions - Transportation Information Center • Other Transportation Information Centers - traffic images - Transportation Information Center • Other Transportation Information Centers - transit service information - Transportation Information Center • Personal Information Device - trip feedback - Transportation Information Center • Traffic Management Center - incident information for public - Transportation Information Center • Traffic Management Center - traffic images - Transportation Information Center • Transit Management Center - transit trip plan - Transportation Information Center • Transportation Information Center - alternate mode information - Other Transportation Information Centers • Transportation Information Center - incident information for public - Other Transportation Information Centers • Transportation Information Center - parking information - Other Transportation Information Centers • Transportation Information Center - road network conditions - Other Transportation Information Centers • Transportation Information Center - traffic images - Other Transportation Information Centers • Transportation Information Center - transit service information - Other Transportation Information Centers • Transportation Information Center - transit trip request - Transit Management Center • Transportation Information Center - trip confirmation - Transit Management Center • Vehicle OBE - trip feedback - Transportation Information Center

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SP	Name	Description	Description of Modifications
TI05	Travel Services Information and Reservation	This service package provides travel service information and reservation services to the traveler pre-trip and while en route. This includes information for tourist attractions, lodging, dining, service stations, parking, emergency services, and other services and businesses of interest to the traveler.	New Triplets (Source - Flow - Destination) • Alternate Mode Transportation Center - service information response - Transportation Information Center • Transportation Information Center - service information request - Alternate Mode Transportation Center
TI06	Dynamic Ridesharing and Shared Use Transportation	This service package 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 service package to improve the user's experience for future trips. The shared use aspect of the service package 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.	New Functional Objects • Personal Shared Use Planning (Personal Information Device) • TIC Shared Use (Transportation Information Center) • Traveler Trip Planning (Traveler Support Equipment) New Triplets (Source - Flow - Destination) • Personal Information Device - shared use confirmation - Transportation Information Center • Personal Information Device - shared use request - Transportation Information Center • Personal Information Device - trip feedback - Transportation Information Center • Transportation Information Center - shared use response - Personal Information Device • Transportation Information Center - shared use response - Traveler Support Equipment • Transportation Information Center - shared use status - Transit Management Center • Traveler Support Equipment - shared use confirmation - Transportation Information Center • Traveler Support Equipment - shared use request - Transportation Information Center • Vehicle OBE - trip feedback - Transportation Information Center

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SP	Name	Description	Description of Modifications
TI07	In-Vehicle Signage	This service package augments regulatory, warning, and informational signs and signals by providing information directly to drivers through in-vehicle devices. The information provided would include static sign information (e.g., stop, curve warning, guide signs, service signs, and directional signs) and dynamic information (e.g., current signal states including highway intersection and highway-rail intersection status and local conditions warnings identified by local environmental sensors). This service package also includes the capability for maintenance and construction, emergency, and transit vehicles to transmit sign information to vehicles in the vicinity so that in vehicle signing can be used without fixed infrastructure in areas such as work zones, around incidents, and at bus stops.	New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - roadway dynamic signage data - ITS Roadway Equipment • ITS Roadway Equipment - roadway dynamic signage status - Connected Vehicle Roadside Equipment • ITS Roadway Equipment - vehicle signage local data - Connected Vehicle Roadside Equipment • Traffic Management Center - vehicle signage application info - Connected Vehicle Roadside Equipment
TM01	Infrastructure-Based Traffic Surveillance	This service package 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 service package 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.	New Functional Objects • Roadway Passive Monitoring (ITS Roadway Equipment) • TMC Passive Surveillance (Traffic Management Center) New Triplets (Source - Flow - Destination) • Basic Vehicle - communications signature - ITS Roadway Equipment • ITS Roadway Equipment - passive vehicle monitoring data - Traffic Management Center • Traffic Management Center - passive vehicle monitoring control - ITS Roadway Equipment • Traffic Management Center - traffic images - Transportation Information Center

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SP	Name	Description	Description of Modifications
TM02	Vehicle-Based Traffic Surveillance	"This service package 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 service package 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)."	New Functional Objects • RSE Situation Monitoring (Connected Vehicle Roadside Equipment) • RSE Traffic Monitoring (Connected Vehicle Roadside Equipment) • TIC Situation Data Management (Transportation Information Center) • Vehicle Basic Safety Communication (Vehicle OBE) • Vehicle Situation Data Monitoring (Vehicle OBE) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - traffic situation data - Traffic Management Center • Connected Vehicle Roadside Equipment - traffic situation data - Transportation Information Center • Connected Vehicle Roadside Equipment - vehicle situation data parameters - Vehicle OBE • Traffic Management Center - situation data collection parameters - Connected Vehicle Roadside Equipment • Traffic Management Center - traffic monitoring application info - Connected Vehicle Roadside Equipment • Transportation Information Center - vehicle situation data parameters - Vehicle OBE • Vehicle OBE - vehicle location and motion for surveillance - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle situation data - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle situation data - Transportation Information Center

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SP	Name	Description	Description of Modifications
TM03	Traffic Signal Control	This service package 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 service package 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 service package is generally an intra-jurisdictional 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 TM07-Regional Traffic Management service package. This service package is consistent with typical traffic signal control systems.	New Functional Objects • Roadway Field Management Station Operation (ITS Roadway Equipment) New Triplets (Source - Flow - Destination) • ITS Roadway Equipment - signal control data - Other ITS Roadway Equipment • ITS Roadway Equipment - signal fault data - Traffic Management Center • Other ITS Roadway Equipment - signal control data - ITS Roadway Equipment • Traffic Management Center - signal control device configuration - ITS Roadway Equipment • Traffic Management Center - signal control plans - ITS Roadway Equipment • Traffic Management Center - signal system configuration - ITS Roadway Equipment

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SP	Name	Description	Description of Modifications
TM06	Traffic Information Dissemination	This service package 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.	New Triplets (Source - Flow - Destination) • ITS Roadway Equipment - roadway advisory radio status - Traffic Management Center • Traffic Management Center - roadway advisory radio data - ITS Roadway Equipment • Traffic Management Center - traffic control information - Transportation Information Center • Traffic Management Center - traffic images - Maint and Constr Management Center • Traffic Management Center - traffic images - Media • Traffic Management Center - traffic images - Transit Management Center • Traffic Management Center - traffic images - Transportation Information Center • Traffic Management Center - traffic information for media - Media

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SP	Name	Description	Description of Modifications
TM07	Regional Traffic Management	This service package 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 service package advances the TM03-Traffic Signal Control and TM05-Traffic Metering service packages 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 service packages 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.	New Triplets (Source - Flow - Destination) • Other Traffic Management Centers - device control request - Traffic Management Center • Other Traffic Management Centers - device data - Traffic Management Center • Other Traffic Management Centers - device status - Traffic Management Center • Other Traffic Management Centers - incident information - Traffic Management Center • Other Traffic Management Centers - road network conditions - Traffic Management Center • Other Traffic Management Centers - traffic images - Traffic Management Center • Traffic Management Center - device control request - Other Traffic Management Centers • Traffic Management Center - device data - Other Traffic Management Centers • Traffic Management Center - device status - Other Traffic Management Centers • Traffic Management Center - incident information - Other Traffic Management Centers • Traffic Management Center - road network conditions - Other Traffic Management Centers • Traffic Management Center - traffic images - Other Traffic Management Centers

SP	Name	Description	Description of Modifications
TM08	Traffic Incident Management System	This service package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The service package 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 service package to detect and verify incidents and implement an appropriate response. This service package 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 service package and dissemination of incident information to travelers through the Broadcast Traveler Information or Interactive Traveler Information service packages. 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 personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel. This service package is closely related with the Public Safety service packages, which focus on services that support first responders. In particular, local management of the incident using an incident command system is covered by PS02.	New Functional Objects • Border Inspection (Border Inspection System) New Triplets (Source - Flow - Destination) • Emergency Management Center - incident information for public - Transportation Information Center • Other Traffic Management Centers - incident information - Traffic Management Center • Other Traffic Management Centers - road network conditions - Traffic Management Center • Other Traffic Management Centers - traffic images - Traffic Management Center • Traffic Management Center - incident information - Other Traffic Management Centers • Traffic Management Center - incident information for public - Transportation Information Center • Traffic Management Center - road network conditions - Other Traffic Management Centers • Traffic Management Center - traffic images - Other Traffic Management Centers • Traffic Management Center - traffic images - Transportation Information Center • Traffic Management Center - traffic information for media - Media

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SP	Name	Description	Description of Modifications
TM09	Integrated Decision Support and Demand Management	This service package recommends courses of action to transportation operators in a corridor, downtown area, or other heavily traveled area. Recommendations are based on an assessment of current and forecast transportation network performance and environmental conditions. Multi-modal transportation operational strategies are created that consider all modes and all roads in the travel area to correct network imbalances and effectively manage available capacity. As part of the operational strategies, this service package may also recommend lane restrictions, transit, parking, and toll strategies to influence traveler route and mode choices to support active demand management programs and policies managing both traffic and the environment. Operational strategies, including demand management recommendations, are coordinated to support operational decisions by each transportation operator that are consistent with the recommended strategy. All recommended operational strategies are based on historical evaluation, real-time assessment, and forecast of the roadway network performance based on predicted travel demand patterns. This service package also collects air quality, parking availability, transit usage, and vehicle occupancy data to support operational strategies that manage and balance capacity and demand.	New Functional Objects • Emissions Zone Management (Emissions Management Center) New Triplets (Source - Flow - Destination) • Emissions Management Center - air quality information - Traffic Management Center • Other Traffic Management Centers - incident information - Traffic Management Center • Other Traffic Management Centers - road network conditions - Traffic Management Center • Other Traffic Management Centers - transportation operational strategies - Traffic Management Center • Payment Administration Center - toll data - Traffic Management Center • Traffic Management Center - incident information - Other Traffic Management Centers • Traffic Management Center - road network conditions - Other Traffic Management Centers • Traffic Management Center - transportation operational strategies - Emergency Management Center • Traffic Management Center - transportation operational strategies - Emissions Management Center • Traffic Management Center - transportation operational strategies - Event Promoter System • Traffic Management Center - transportation operational strategies - Maint and Constr Management Center • Traffic Management Center - transportation operational strategies - Other Traffic Management Centers • Traffic Management Center - transportation operational strategies - Parking Management System • Traffic Management Center - transportation operational strategies - Payment Administration Center • Traffic Management Center - transportation operational strategies - Transit Management Center • Traffic Management Center - transportation operational strategies - Transportation Information Center

SP	Name	Description	Description of Modifications
TM10	Electronic Toll Collection	The Electronic Toll Collection service package provides toll operators with the ability to collect tolls electronically and detect and process violations. The fees that are collected may be adjusted to implement demand management strategies. Field-Vehicle Communication between the roadway equipment and the vehicle is required as well as Fixed Point-Fixed Point interfaces between the toll collection equipment and transportation authorities and the financial infrastructure that supports fee collection. Toll violations are identified and electronically posted to vehicle owners. Standards, inter-agency coordination, and financial clearinghouse capabilities enable broad interoperability for these services.	New Functional Objects • RSE Toll Collection (Connected Vehicle Roadside Equipment) • Vehicle Payment Service (Vehicle OBE) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - payment application status - Payment Administration Center • Connected Vehicle Roadside Equipment - payment transactions - ITS Roadway Payment Equipment • Connected Vehicle Roadside Equipment - vehicle entries and exits - ITS Roadway Payment Equipment • Connected Vehicle Roadside Equipment - vehicle payment request - Vehicle OBE • Connected Vehicle Roadside Equipment - vehicle payment update - Vehicle OBE • ITS Roadway Payment Equipment - payment instructions - Connected Vehicle Roadside Equipment • ITS Roadway Payment Equipment - vehicle entries and exits - Connected Vehicle Roadside Equipment • Payment Administration Center - payment application information - Connected Vehicle Roadside Equipment • Payment Administration Center - user account reports - Personal Information Device • Payment Device - payment device information - Vehicle OBE • Personal Information Device - user account setup - Payment Administration Center • Vehicle OBE - payment device update - Payment Device • Vehicle OBE - vehicle payment information - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
TM14	Advanced Railroad Grade Crossing	This service package 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 service package includes all capabilities from the Standard Railroad Grade Crossing service package 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 service package 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 service package, 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 service package 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 service package 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.	**New Functional Objects** • Personal Intersection Safety (Personal Information Device) • RSE Rail Crossing Warning (Connected Vehicle Roadside Equipment) • Vehicle Rail Crossing Warning (Vehicle OBE) **New Triplets (Source - Flow - Destination)** • Connected Vehicle Roadside Equipment - arriving train information - Personal Information Device • Connected Vehicle Roadside Equipment - arriving train information - Vehicle OBE • Connected Vehicle Roadside Equipment - intersection infringement info - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - rail crossing warning - Personal Information Device • Connected Vehicle Roadside Equipment - rail crossing warning - Vehicle OBE • ITS Roadway Equipment - arriving train information - Connected Vehicle Roadside Equipment • ITS Roadway Equipment - track status - Connected Vehicle Roadside Equipment • Personal Information Device - personal location - Connected Vehicle Roadside Equipment • Personal Information Device - personal updates - Cyclist • Personal Information Device - personal updates - Pedestrian • Traffic Management Center - rail crossing application info - Connected Vehicle Roadside Equipment • Vehicle OBE - intersection infringement info - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle location and motion - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
TM15	Railroad Operations Coordination	This service package 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.	New Triplets (Source - Flow - Destination) • Rail Operations Center - railroad advisories - Transportation Information Center • Rail Operations Center - railroad schedules - Transportation Information Center
TM16	Reversible Lane Management	This service package provides for the management of reversible lane facilities. In addition to standard surveillance capabilities, this service package includes sensory functions that detect wrong-way vehicles and other special surveillance capabilities that mitigate safety hazards associated with reversible lanes. The package includes the field equipment, physical lane access controls, and associated control electronics that manage and control these special lanes. This service package also includes the equipment used to electronically reconfigure intersections and manage right-of-way to address dynamic demand changes and special events.	New Triplets (Source - Flow - Destination) • ITS Roadway Equipment - lane management information - Traffic Management Center • ITS Roadway Equipment - signal fault data - Traffic Management Center • ITS Roadway Equipment - vehicle signage local data - Connected Vehicle Roadside Equipment • Traffic Management Center - lane management control - ITS Roadway Equipment • Traffic Management Center - signal control device configuration - ITS Roadway Equipment • Traffic Management Center - signal control plans - ITS Roadway Equipment • Traffic Management Center - signal system configuration - ITS Roadway Equipment

SP	Name	Description	Description of Modifications
TM17	Speed Warning and Enforcement	This service package 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 (covered in TM20-Variable Speed Limits service package) 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.	New Functional Objects • MCM Reduced Speed Zone Warning (Maint and Constr Management Center) • TMC Speed Warning (Traffic Management Center) New Triplets (Source - Flow - Destination) • ITS Roadway Equipment - vehicle signage local data - Connected Vehicle Roadside Equipment
TM18	Drawbridge Management	This service package supports systems that manage drawbridges at rivers and canals and other multimodal crossings (other than railroad grade crossings which are specifically covered by other service packages). The equipment managed by this service package includes control devices (e.g., gates, warning lights, dynamic message signs) at the drawbridge as well as the information systems that are used to keep travelers apprised of current and forecasted drawbridge status.	New Triplets (Source - Flow - Destination) • ITS Roadway Equipment - signal fault data - Traffic Management Center

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SP	Name	Description	Description of Modifications
TM19	Roadway Closure Management	This service package 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 service package 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 service package 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 service package 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 service packages.	New Functional Objects • RSE Road Closure Management (Connected Vehicle Roadside Equipment) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - barrier system control - ITS Roadway Equipment • Emergency Management Center - road closure notification - Traffic Management Center • Emergency Vehicle OBE - road closure notification - Emergency Management Center • ITS Roadway Equipment - barrier system status - Connected Vehicle Roadside Equipment • ITS Roadway Equipment - roadway advisory radio status - Maint and Constr Management Center • ITS Roadway Equipment - roadway advisory radio status - Traffic Management Center • Maint and Constr Management Center - roadway advisory radio data - ITS Roadway Equipment • Traffic Management Center - road closure application info - Connected Vehicle Roadside Equipment • Traffic Management Center - roadway advisory radio data - ITS Roadway Equipment

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SP	Name	Description	Description of Modifications
VS01	Autonomous Vehicle Safety Systems	This service package improves vehicle safety using on-board sensors that monitor the driving environment surrounding the vehicle. All levels of driving automation are supported ranging from basic warning systems that warn the driver through full automation where the vehicle controls the steering and acceleration/deceleration in all scenarios and environments, without driver intervention. Unlike other Vehicle Safety service packages, this service package includes autonomous capabilities that rely only on on-board systems without communication with other vehicles or the infrastructure.	<u>New Triplets (Source - Flow - Destination)</u> • Basic Vehicle - driver input information - Vehicle OBE
VS02	V2V Basic Safety	This service package exchanges basic safety messages with surrounding Connected Vehicles to support and augment the safety warning and control automation features identified in VS01. These exchanges support Connected Vehicle safety applications defined in SAE J2945/1: Emergency Electronic Brake Lights, Forward Crash Warning, Blind Spot Warning/Lane Change Warning, Intersection Movement Assist, Left Turn Assist, and Control Loss Warning. It also supports Do Not Pass Warning, Motorcycle Approaching indication, Tailgating Advisory, Stationary Vehicle, and Pre-Crash Actions applications from CVRIA.	<u>New Functional Objects</u> • Vehicle Basic Safety Communication (Vehicle OBE) <u>New Triplets (Source - Flow - Destination)</u> • Basic Vehicle - driver input information - Vehicle OBE • Other Vehicle OBEs - vehicle control event - Vehicle OBE • Other Vehicle OBEs - vehicle location and motion - Vehicle OBE • Vehicle OBE - vehicle control event - Other Vehicle OBEs • Vehicle OBE - vehicle location and motion - Other Vehicle OBEs

SP	Name	Description	Description of Modifications
VS03	Situational Awareness	This service package shares information about potentially hazardous road conditions or road hazards with other vehicles to support enhanced driver warnings and control automation. Vehicles broadcast relevant road condition information that is collected by the vehicle, such as fog or icy roads. This service package supports the capability for connected vehicles to share situational awareness information even in areas where no roadside communications infrastructure exists. It can be useful to vehicles that are not fully equipped with sensors, or vehicles entering an area with hazardous conditions. Roadside communications infrastructure, if available, can extend the situational awareness range to cover wrong way vehicles where closing rates can require notification beyond DSRC communications range.	New Functional Objects • RSE Communications Relay (Connected Vehicle Roadside Equipment) • Vehicle Basic Safety Communication (Vehicle OBE) New Triplets (Source - Flow - Destination) • Basic Vehicle - driver input information - Vehicle OBE • Connected Vehicle Roadside Equipment - wrong way vehicle detected - Other Connected Vehicle Roadside Equipment • Connected Vehicle Roadside Equipment - wrong way vehicle detected - Vehicle OBE • Other Connected Vehicle Roadside Equipment - wrong way vehicle detected - Connected Vehicle Roadside Equipment • Other Vehicle OBEs - vehicle control event - Vehicle OBE • Other Vehicle OBEs - vehicle environmental data - Vehicle OBE • Other Vehicle OBEs - vehicle hazard event - Vehicle OBE • Other Vehicle OBEs - vehicle location and motion - Vehicle OBE • Other Vehicle OBEs - vehicle path prediction - Vehicle OBE • Other Vehicle OBEs - wrong way vehicle detected - Vehicle OBE • Vehicle OBE - vehicle control event - Other Vehicle OBEs • Vehicle OBE - vehicle environmental data - Other Vehicle OBEs • Vehicle OBE - vehicle hazard event - Other Vehicle OBEs • Vehicle OBE - vehicle location and motion - Other Vehicle OBEs • Vehicle OBE - vehicle path prediction - Other Vehicle OBEs • Vehicle OBE - wrong way vehicle detected - Connected Vehicle Roadside Equipment • Vehicle OBE - wrong way vehicle detected - Other Vehicle OBEs
VS04	V2V Special Vehicle Alert	This service package alerts the driver about the location of and the movement of public safety vehicles responding to an incident, slow moving vehicles, oversized vehicles, and other special vehicles that may require special attention from the driver. These public safety, commercial, and maintenance vehicles share their current status and location with surrounding vehicles so that other drivers in the vicinity can avoid interfering with their actions and avoid collisions.	New Functional Objects • CV On-Board Special Vehicle Safety (Commercial Vehicle OBE) • Transit Vehicle V2V Safety (Transit Vehicle OBE) • Vehicle Basic Safety Communication (Vehicle OBE) New Triplets (Source - Flow - Destination) • Basic Vehicle - driver input information - Vehicle OBE • Commercial Vehicle OBE - cv driver information presentation - Commercial Vehicle Driver • Commercial Vehicle OBE - special vehicle alert - Vehicle OBE • Emergency Vehicle OBE - special vehicle alert - Vehicle OBE • Maint and Constr Vehicle OBE - special vehicle alert - Vehicle OBE • Transit Vehicle OBE - special vehicle alert - Vehicle OBE • Transit Vehicle Operator - transit vehicle operator information - Transit Vehicle OBE

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SP	Name	Description	Description of Modifications
VS05	Curve Speed Warning	This service package 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.	New Functional Objects • RSE Speed Warning (Connected Vehicle Roadside Equipment) • TMC Speed Warning (Traffic Management Center) • Vehicle Speed Management Assist (Vehicle OBE)) New Triplets (Source - Flow - Destination) • Basic Vehicle - driver input information - Vehicle OBE • ITS Roadway Equipment - environmental sensor data - Connected Vehicle Roadside Equipment • ITS Roadway Equipment - reduced speed warning info - Connected Vehicle Roadside Equipment • Traffic Management Center - speed warning application info - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle location and motion for surveillance - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle profile - Connected Vehicle Roadside Equipment
VS06	Stop Sign Gap Assist	This service package is intended to improve safety at non-signalized intersections where only the minor road has posted stop signs. It includes both onboard (for connected vehicles) and roadside signage warning systems (for non-equipped vehicles). The service package helps drivers on a minor road stopped at an intersection understand the state of activities associated with that intersection by providing a warning of unsafe gaps on the major road. The SSGA service package collects all available sensor information (major road, minor road, and median sensors) data and computes the dynamic state of the intersection in order to issue appropriate warnings and alerts.	New Functional Objects • Roadway Traffic Gap Assist (ITS Roadway Equipment) • RSE Traffic Gap Assist (Connected Vehicle Roadside Equipment) • TMC Traffic Gap Assist (Traffic Management Center) • Vehicle Gap Assist (Vehicle OBE) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - traffic gap information - Vehicle OBE • Connected Vehicle Roadside Equipment - traffic situation data - ITS Roadway Equipment • ITS Roadway Equipment - traffic gap information - Connected Vehicle Roadside Equipment • ITS Roadway Equipment - vehicle signage local data - Connected Vehicle Roadside Equipment • Other Vehicle OBEs - vehicle location and motion - Connected Vehicle Roadside Equipment • Other Vehicle OBEs - vehicle location and motion - Vehicle OBE • Traffic Management Center - stop sign gap assist control - ITS Roadway Equipment • Traffic Management Center - stop sign gap assist info - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle location and motion - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle location and motion - Other Vehicle OBEs • Vehicle OBE - vehicle profile - Connected Vehicle Roadside Equipment

SP	Name	Description	Description of Modifications
VS09	Reduced Speed Zone Warning / Lane Closure	This service package provides connected vehicles that are approaching a reduced speed zone with information on the zone's posted speed limit and/or if the configuration of the roadway is altered (e.g., lane closures, lane shifts). Reduced speed zones include (but are not be limited to) construction/work zones, school zones, pedestrian crossing areas, and incorporated zones (e.g., rural towns). The connected vehicle uses the revised speed limit along with any applicable changed roadside configuration information to determine whether to provide an alert or warning to the driver. Additionally, to provide warnings to non-equipped vehicles, infrastructure equipment measures the speed of the approaching vehicles and if greater than the reduced speed zone posted speed limit will provide warning signage. It will provide an alert to drivers in advance when aggressive braking is required to reduce to the posted speed limit.	New Functional Objects • MCM Reduced Speed Zone Warning (Maint and Constr Management Center) • RSE Speed Warning (Connected Vehicle Roadside Equipment) • TMC Speed Warning (Traffic Management Center) • Vehicle Speed Management Assist (Vehicle OBE) New Triplets (Source - Flow - Destination) • Basic Vehicle - driver input information - Vehicle OBE • Connected Vehicle Roadside Equipment - lane closure information - Vehicle OBE • Connected Vehicle Roadside Equipment - speed warning application status - Maint and Constr Management Center • ITS Roadway Equipment - reduced speed warning info - Connected Vehicle Roadside Equipment • Maint and Constr Management Center - field device coordination - Traffic Management Center • Maint and Constr Management Center - speed warning application info - Connected Vehicle Roadside Equipment • Traffic Management Center - field device coordination - Maint and Constr Management Center • Traffic Management Center - speed warning application info - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle location and motion for surveillance - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
VS10	Restricted Lane Warnings	This service package provides the connected vehicle with restriction information about the travel lanes, such as if the lane is restricted to high occupancy vehicles (HOV), transit, or public safety vehicles only or has defined eco-lane criteria. A connected vehicle can use this information to determine if the vehicle is in a lane that has lane restrictions.	New Functional Objects • Roadway Dynamic Lane Management and Shoulder Use (ITS Roadway Equipment) • RSE Restricted Lanes Application (Connected Vehicle Roadside Equipment) • TMC Dynamic Lane Management and Shoulder Use (Traffic Management Center) • TMC Restricted Lanes CV Application (Traffic Management Center) • Vehicle Basic Safety Communication (Vehicle OBE) • Vehicle Restricted Lanes Application (Vehicle OBE) New Triplets (Source - Flow - Destination) • Basic Vehicle - driver input information - Vehicle OBE • Connected Vehicle Roadside Equipment - restricted lanes application status - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - restricted lanes parameters - Vehicle OBE • ITS Roadway Equipment - lane management information - Traffic Management Center • ITS Roadway Equipment - vehicle signage local data - Connected Vehicle Roadside Equipment • Traffic Management Center - lane management control - ITS Roadway Equipment • Traffic Management Center - restricted lanes application info - Connected Vehicle Roadside Equipment • Traffic Management Center - vehicle signage application info - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle location and motion for surveillance - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle profile - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
VS11	Oversize Vehicle Warning	This service package 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 service package 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 service package can be expanded to consider weight as well as height and width.	New Functional Objects • Roadway Restriction Monitoring and Warning (ITS Roadway Equipment) • RSE Infrastructure Restriction Warning (Connected Vehicle Roadside Equipment) • TMC Infrastructure Restriction Warning (Traffic Management Center) New Triplets (Source - Flow - Destination) • Commercial Vehicle OBE - commercial vehicle driver updates - Commercial Vehicle Driver • Commercial Vehicle OBE - driver update information - Basic Commercial Vehicle • Commercial Vehicle OBE - vehicle profile - Connected Vehicle Roadside Equipment • Connected Vehicle Roadside Equipment - infrastructure restriction warning notification - Commercial Vehicle OBE • Connected Vehicle Roadside Equipment - infrastructure restriction warning status - Traffic Management Center • ITS Roadway Equipment - driver information - Commercial Vehicle Driver • ITS Roadway Equipment - infrastructure restriction warning - Connected Vehicle Roadside Equipment • ITS Roadway Equipment - infrastructure restriction warning status - Traffic Management Center • Traffic Management Center - infrastructure restriction warning control - ITS Roadway Equipment • Traffic Management Center - infrastructure restriction warning info - Connected Vehicle Roadside Equipment

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SP	Name	Description	Description of Modifications
VS13	Intersection Safety Warning and Collision Avoidance	This service package enables a connected vehicle approaching an instrumented signalized intersection to receive information from the infrastructure regarding the signal timing and the geometry of the intersection. The vehicle uses its speed and acceleration profile, along with the signal timing and geometry information to determine if it appears likely that the vehicle will be able to pass safely through the intersection without violating the signal or colliding with other vehicles. If the vehicle determines that proceeding through the intersection is unsafe, a warning is provided to the driver and/or collision avoidance actions are taken, depending on the automation level of the vehicle.	New Functional Objects • RSE Intersection Safety (Connected Vehicle Roadside Equipment) • TMC Intersection Safety (Traffic Management Center) • Vehicle Intersection Warning (Vehicle OBE) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - intersection geometry - Vehicle OBE • Connected Vehicle Roadside Equipment - intersection infringement info - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - intersection safety warning - Vehicle OBE • Connected Vehicle Roadside Equipment - intersection status monitoring - ITS Roadway Equipment • ITS Roadway Equipment - conflict monitor status - Connected Vehicle Roadside Equipment • ITS Roadway Equipment - intersection control status - Connected Vehicle Roadside Equipment • Other Vehicle OBEs - intersection infringement info - Vehicle OBE • Other Vehicle OBEs - vehicle location and motion - Vehicle OBE • Traffic Management Center - intersection safety application info - Connected Vehicle Roadside Equipment • Vehicle OBE - intersection infringement info - Connected Vehicle Roadside Equipment • Vehicle OBE - intersection infringement info - Other Vehicle OBEs • Vehicle OBE - vehicle location and motion - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle location and motion - Other Vehicle OBEs
VS14	Cooperative Adaptive Cruise Control	This service package adds vehicle to vehicle (V2V) communications to adaptive cruise control (ACC) systems, which provides enhanced information so that groups or 'strings' of CACC-equipped vehicles can follow a lead vehicle with better accuracy, quicker response, and shorter time gaps, enhancing traffic flow stability. In ACC systems, sensors (e.g., radar or lidar) and longitudinal control automation are used to measure and maintain a safe distance from the lead vehicle. V2V communications enables direct communication between the vehicles so that acceleration and deceleration can be more directly coordinated between vehicles in the string.	New Functional Objects • Vehicle Basic Safety Communication (Vehicle OBE) New Triplets (Source - Flow - Destination) • Basic Vehicle - driver input information - Vehicle OBE • Other Vehicle OBEs - vehicle environmental data - Vehicle OBE • Other Vehicle OBEs - vehicle location and motion - Vehicle OBE • Other Vehicle OBEs - vehicle path prediction - Vehicle OBE • Other Vehicle OBEs - vehicle profile - Vehicle OBE • Vehicle OBE - vehicle environmental data - Other Vehicle OBEs • Vehicle OBE - vehicle location and motion - Other Vehicle OBEs • Vehicle OBE - vehicle path prediction - Other Vehicle OBEs • Vehicle OBE - vehicle profile - Other Vehicle OBEs

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SP	Name	Description	Description of Modifications
VS15	Infrastructure Enhanced Cooperative Adaptive Cruise Control	This service package adds Infrastructure to Vehicle (I2V) communications to Cooperative Adaptive Cruise Control systems so that strings of compatible CACC-equipped vehicles can be more efficiently formed and cooperating vehicles gain access to speed recommendations and traffic control status from the infrastructure, further enhancing traffic flow stability and improving highway capacity and throughput. Speed recommendations provided by the infrastructure can be used to stabilize traffic flow, reducing speed differentials and enhancing throughput along a route that includes a bottleneck. Access to traffic control information such as signal phase and timing enables synchronized starts by adjacent CACC-equipped strings of vehicles, increasing intersection throughput. The infrastructure can also assist with broader coordination between CACC-equipped vehicles, enabling strings of vehicles to be more efficiently formed that share performance parameters and destinations.	<u>New Functional Objects</u> • RSE Intersection Management (Connected Vehicle Roadside Equipment) • RSE Traffic Monitoring (Connected Vehicle Roadside Equipment) • Vehicle Basic Safety Communication (Vehicle OBE) • Vehicle Intersection Warning (Vehicle OBE) <u>New Triplets (Source - Flow - Destination)</u> • Basic Vehicle - driver input information - Vehicle OBE • Connected Vehicle Roadside Equipment - environmental situation data - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - environmental situation data - Traffic Management Center • Connected Vehicle Roadside Equipment - intersection geometry - Vehicle OBE • Connected Vehicle Roadside Equipment - traffic situation data - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - traffic situation data - Traffic Management Center • Connected Vehicle Roadside Equipment - vehicle cluster coordination - Vehicle OBE • ITS Roadway Equipment - intersection control status - Connected Vehicle Roadside Equipment • Other Vehicle OBEs - vehicle environmental data - Vehicle OBE • Other Vehicle OBEs - vehicle location and motion - Vehicle OBE • Other Vehicle OBEs - vehicle path prediction - Vehicle OBE • Other Vehicle OBEs - vehicle profile - Vehicle OBE • Traffic Management Center - intersection management application info - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle cluster coordination - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle environmental data - Other Vehicle OBEs • Vehicle OBE - vehicle location and motion - Other Vehicle OBEs • Vehicle OBE - vehicle location and motion for surveillance - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle path prediction - Other Vehicle OBEs • Vehicle OBE - vehicle profile - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle profile - Other Vehicle OBEs

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SP	Name	Description	Description of Modifications
VS16	Automated Vehicle Operations	This service package provides full vehicle automation, controlling both the steering and acceleration/deceleration on areas of the highway system that support full automation. Communications between vehicles and between the vehicles and supporting infrastructure equipment supports cooperative check-in to the automated portion of the system and transition to automated mode, coordination of maneuvers between vehicles in automated mode, and checkout from the automated system. This service package is distinguished from the most advanced CACC systems in that full longitudinal and lateral control automation are supported, enabling closely spaced, tightly coupled platoons of vehicles to operate with short fixed gaps, providing greatly enhanced highway capacity and throughput with enhanced efficiency since aerodynamic drag is reduced.	<u>New Functional Objects</u> • RSE Traffic Monitoring (Connected Vehicle Roadside Equipment) • Vehicle Basic Safety Communication (Vehicle OBE) <u>New Triplets (Source - Flow - Destination)</u> • Basic Vehicle - driver input information - Vehicle OBE • Connected Vehicle Roadside Equipment - environmental situation data - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - environmental situation data - Traffic Management Center • Connected Vehicle Roadside Equipment - traffic situation data - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - traffic situation data - Traffic Management Center • Connected Vehicle Roadside Equipment - vehicle entries and exits - ITS Roadway Equipment • ITS Roadway Equipment - vehicle entries and exits - Connected Vehicle Roadside Equipment • Other Vehicle OBEs - vehicle environmental data - Vehicle OBE • Other Vehicle OBEs - vehicle location and motion - Vehicle OBE • Vehicle OBE - vehicle environmental data - Other Vehicle OBEs • Vehicle OBE - vehicle location and motion - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle location and motion - Other Vehicle OBEs • Vehicle OBE - vehicle platoon coordination - Connected Vehicle Roadside Equipment • Vehicle OBE - vehicle profile - Connected Vehicle Roadside Equipment

Appendix B5 – Modified U.S. Service Packages

SP	Name	Description	Description of Modifications
WX01	Weather Data Collection	This service package 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 service package 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 service package may also request and receive qualified data sets from meteorological systems.	New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - environmental sensor data - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - environmental sensors control - ITS Roadway Equipment • Connected Vehicle Roadside Equipment - environmental situation data - Traffic Management Center • Connected Vehicle Roadside Equipment - vehicle situation data parameters - Vehicle OBE • ITS Roadway Equipment - environmental sensor data - Connected Vehicle Roadside Equipment • Maint and Constr Management Center - environmental conditions data - Traffic Management Center • Surface Transportation Weather Service - environmental conditions data status - Maint and Constr Management Center • Surface Transportation Weather Service - environmental conditions data status - Traffic Management Center • Surface Transportation Weather Service - qualified environmental conditions data - Maint and Constr Management Center • Surface Transportation Weather Service - qualified environmental conditions data - Traffic Management Center • Traffic Management Center - environmental conditions data - Maint and Constr Management Center • Traffic Management Center - environmental monitoring application info - Connected Vehicle Roadside Equipment

SP	Name	Description	Description of Modifications
WX03	Spot Weather Impact Warning	This service package 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 service packages 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.	New Functional Objects • Roadway Variable Speed Limits (ITS Roadway Equipment) • RSE Speed Warning (Connected Vehicle Roadside Equipment) • TMC Variable Speed Limits (Traffic Management Center) New Triplets (Source - Flow - Destination) • Connected Vehicle Roadside Equipment - environmental situation data - Traffic Management Center • Connected Vehicle Roadside Equipment - lane closure information - Vehicle OBE • Connected Vehicle Roadside Equipment - road closure information - Vehicle OBE • Connected Vehicle Roadside Equipment - road weather advisories - Vehicle OBE • ITS Roadway Equipment - environmental sensor data - Connected Vehicle Roadside Equipment • ITS Roadway Equipment - variable speed limit status - Traffic Management Center • Traffic Management Center - speed warning application info - Connected Vehicle Roadside Equipment • Traffic Management Center - variable speed limit control - ITS Roadway Equipment • Transportation Information Center - road network environmental situation data - Traffic Management Center • Transportation Information Center - road weather advisories - Vehicle OBE • Transportation Information Center - road weather advisory info - Connected Vehicle Roadside Equipment

B-6 *MODIFIED PHYSICAL OBJECTS*

Note: 'Modified' assessed as those Physical Objects that have new Functional Objects associated to them in ARC-IT

Appendix B6 – Modified U.S. Physical Objects

Physical Object Name	New Functional Object
Border Inspection Administration Center	Border Inspection Administration
Border Inspection System	Border Inspection
Commercial Vehicle OBE	CV On-Board Drayage Support
	CV On-Board Signal Priority
	CV On-Board Special Vehicle Safety
Connected Vehicle Roadside Equipment	RSE Border Management
	RSE Commercial Vehicle Services
	RSE Communications Relay
	RSE Data Subscription Management
	RSE Electric Charging Support
	RSE Incident Scene Safety
	RSE Infrastructure Restriction Warning
	RSE Intermodal Terminal Management
	RSE Intersection Management
	RSE Intersection Safety
	RSE Lighting System Support
	RSE Loading Zone Management
	RSE Low Emissions Zone Application
	RSE Map Management
	RSE Parking Management
	RSE Payment Support
	RSE Position Correction Support
	RSE Queue Warning
	RSE Rail Crossing Warning
	RSE Restricted Lanes Application
	RSE Road Closure Management
	RSE Situation Monitoring
	RSE Speed Management
	RSE Speed Warning
	RSE Support Services
	RSE Toll Collection
	RSE Traffic Gap Assist
	RSE Traffic Metering
	RSE Traffic Monitoring
	RSE Work Zone Safety
Emissions Management Center	Emissions Connected Vehicle Monitoring
	Emissions Zone Management
Freight Equipment	Freight Equipment Monitoring
Intermodal Terminal	Terminal Management
ITS Roadway Equipment	Roadway Dynamic Lane Management and Shoulder Use
	Roadway Field Management Station Operation
	Roadway Mixed Use Crossing Safety
	Roadway Passive Monitoring
	Roadway Restriction Monitoring and Warning
	Roadway Signal Preemption
	Roadway Time Management
	Roadway Traffic Gap Assist

	Roadway Variable Speed Limits
	Roadway Warning
Maint and Constr Management Center	MCM Field Equipment Maintenance
	MCM Reduced Speed Zone Warning
Map Update System	Map Management
Parking Management System	Loading Zone Management
Payment Administration Center	PAC Road Pricing Administration
Personal Information Device	Personal Data Subscription Management
	Personal Device System Executive
	Personal Device System Monitoring and Diagnostics
	Personal Intersection Safety
	Personal Map Management
	Personal Shared Use Planning
Traffic Management Center	TMC Dynamic Lane Management and Shoulder Use
	TMC Infrastructure Restriction Warning
	TMC Intersection Safety
	TMC Passive Surveillance
	TMC Restricted Lanes CV Application
	TMC Roadway Warning
	TMC Speed Warning
	TMC Traffic Gap Assist
	TMC Variable Speed Limits
Transit Management Center	Transit Center Connection Protection
	Transit Center Park and Ride Operations
Transit Vehicle OBE	Transit Vehicle Emissions Monitoring
	Transit Vehicle On-Board Connection Protection
	Transit Vehicle Pedestrian Safety
	Transit Vehicle V2V Safety
Transportation Information Center	TIC Freight-Specific Travel Planning
	TIC Shared Use
	TIC Situation Data Management
	TIC Traffic Regulation Dissemination
Traveler Support Equipment	Traveler Trip Planning
Vehicle OBE	Vehicle Basic Safety Communication
	Vehicle Border Crossing Support
	Vehicle Data Subscription Management
	Vehicle Eco-Driving Assist
	Vehicle Electric Charging Assist
	Vehicle Emissions Monitoring
	Vehicle Gap Assist
	Vehicle Intersection Warning
	Vehicle Map Management
	Vehicle Payment Service
	Vehicle Queue Warning
	Vehicle Rail Crossing Warning
	Vehicle Restricted Lanes Application
	Vehicle Situation Data Monitoring
	Vehicle Speed Management Assist

	Vehicle Support Services	
	Vehicle System Executive	