Technical Memorandum

SOUTHERN CALIFORNIA REGIONAL ITS ARCHITECTURE
2011 UPDATE

Recommended Goods Movement Subregional ITS Architecture Elements

Prepared for:

SOUTHERN CALIFORNIA ASSOCIATION of GOVERNMENTS

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1. INTRODUCTION

The Southern California Regional ITS Architecture leverages long standing investments in Intelligent Transportation Systems (ITS) by fostering coordination and cooperation among public agency stakeholders. A Regional ITS Architecture provides a framework for ITS planning that promotes interoperability and communication across jurisdictional boundaries. Projects developed under a regional framework extend the usefulness of any single project by making information easily accessible for operators and users of the system.

In Southern California, there are several ITS architectures that may be applicable to an ITS project, depending on how far reaching the project is. Each County has developed a Regional ITS Architecture. In addition, as the Metropolitan Planning Organization (MPO), SCAG has developed a Southern California Regional ITS Architecture that addresses multi-county issues: those projects, programs, and services that require connectivity across county boundaries or are deployed at a multi-county level. A third "layer" is also in place at the state level: the California ITS Architecture and System Plan addresses those services that are rolled out or managed at a state level or are interregional in nature. Project sponsors are responsible for ensuring that their projects maintain consistency with the regional architectures, regardless of which architecture applies, as a requirement for federally funded projects.

In the time between 2005, when the Southern California Regional ITS Architecture was developed, and 2011, as it is being updated, there have been several changes. The National ITS Architecture has been updated to reflect new user services, Southern California has continued as a national leader in ITS deployment with extensive ITS investments, and new technology applications have emerged. The 2011 update to the Southern California Regional ITS Architecture will reflect changes since 2005 and position the architecture to guide future ITS deployments as new technologies emerge. Topics covered in this 2011 update include Express Lanes, Positive Train Control, technologies in support of non-motorized transport, and goods movement in addition to the updates for other cross-county services such as to address traveler information, regional data exchange and archiving of regional data. Additionally, recommendations are made to subregional (county-level) ITS Architecture champions for their consideration in the event that changes are desired to be made at the county level for the associated topic.

1.1 Background and Purpose

The SCAG region is the national gateway for goods, with the Port of Los Angeles and the Port of Long Beach (POLA/POLB) accounting for 40% of the containers entering the country and 24% of exports. The goods movement industry plays a vital role in the local economy with 1 out of every 7 jobs in Southern California involved in international trade. The SCAG region is highly competitive in goods movement with its extensive network of seaports, airports, roadways, railways and intermodal transfer facilities. Despite the recent economic downturn, international trade will continue to have a strong economic impact over the long term with container volumes expected to grow three fold by year 2035[1].

More than 75% of containers that are arrive at the ports wind up getting transported by trucks. Truck trips are expected to more than double on major freeways by 2030. The rise in container volume at the ports will also see projected increases in the number of freight trains, which is expected to double as well by 2025[2]. The movement of containers from the ports bound for local and national markets poses serious concerns about congestion and air quality, which has significant impacts for businesses and residents throughout the region.

[1] SCAG, 2008 RTP, p. 13.
[2] *Ibid*., p. 14.

SCAG and its federal, state and local partners are making investments in the transportation infrastructure to handle current and future demand. Some of these investments are being directed at improving the flow of goods from the ports to warehousing and distributions centers located inland and in neighboring states. As investments are being directed to deal with capacity constraints in the transportation system, SCAG and its partners are looking to employ Intelligent Transportation Systems (ITS) to improve the efficiency in which goods are transported using the existing infrastructure. These ITS projects deploy technology strategically to improve the flow of goods through better communications, data sharing, and coordination. The application of ITS to goods movement builds upon the successful examples of ITS delivering benefits to drivers through traveler information and trip planning, as well as active management of traffic on arterials and freeways.

This Technical Memorandum describes the ITS elements related to goods movement that are included in the update to the Southern California Regional ITS Architecture and serves as guidance for regional agencies to consider in a future update of the subregional ITS architectures.

1.2 Goods Movement ITS Infrastructure

The SCAG region maintains competiveness in the goods movement arena with an extensive network of freeways, arterial roadways, bridges, airports, sea ports, inland ports, railways and intermodal facilities. Descriptions of the regional transportation infrastructure can be found in Section 2 of the Southern California Regional ITS Architecture, Multi-County Issues report. This section focuses on the ITS applications and major plans and projects to improve freight and commercial vehicle operations (CVO) in the region.

1.2.1 Existing ITS Applications

A number of ITS technologies in the SCAG region collect and distribute real time data that is useful and relevant to logistics operations.

Freeway and Arterial Systems:

- Caltrans has existing detection on most freeways within the region, using loop detectors as the primary source of data collection on lane volumes and occupancies. Most freeway segments feature additional field elements such as ramp metering, CCTV cameras, and changeable message signs (CMS) to support traffic management operations. Caltrans staff traffic management centers to monitor freeway traffic conditions and share data with other agencies and information providers.
- Weigh-in-Motion (WIM) and inspection station systems used at truck scales and enforcement facilities on freeways reduce wait times for vehicles in conformance with legal weight requirements allowing legal trucks to bypass scales without stopping. These systems allow trucks to travel at or near full speed passing over sensors, while the weigh in motion systems record loads, speed of vehicle, direction of travel, and date and time.
- Arterial networks on which trucks operate are overseen by various agencies. The traffic signal systems in areas near the Ports are managed by a number of small cities, the County of Los Angeles, City of Los Angeles, and the City of Long Beach.
- The POLA/POLB has deployed the Advanced Transportation Management Information System (ATMIS) to monitor truck queues at terminal gates using vehicle detection devices and CCTV cameras. A traffic management center operated jointly by the Ports provides traveler information including real time traffic conditions and incidents on CMS in the vicinity of the Port area.

Port Logistics and Scheduling Systems:

- The PierPASS program was established by the POLA/POLB to manage and improve truck movements, to address congestion and improve air quality by reducing the number of idling trucks and driver's waiting time. PierPASS has an "Off-Peak" program that charges a traffic mitigation fee of $50 per twenty foot equivalent unit container for peak-hour pickups or deliveries. The fees are used to subsidize the additional shifts at the Port to be able to provide service during extended hours.
- *VoyagerTrack* is a private service that allows freight companies access to real-time information about when a container is received from the truck at the terminal, or delivered to the truck from the terminal operator, or available for pickup. *VoyagerTrack* allows customers to access their container and shipping information via Internet or by phone. In addition to the container-specific information, *VoyagerTrack* also has an appointment system for trucking companies to schedule pick-up and delivery times. Three terminals at the Port of Los Angeles and one terminal at the Port of Long Beach use this reservation system.
- *eModal* is a private service that provides several services for freight companies including an appointment system, terminal information, and fee payment service. Dispatchers access *eModal* using a website log-in. The appointment system website interface is different for each terminal based on the terminal's time schedules and container pick-up area layout. There are currently four terminals at the Port of Los Angeles and five terminals at the Port of Long Beach that use eModal as their appointment system provider.

Regional Data Exchange Systems:

- The Regional Integration of Intelligent Transportation Systems (RIITS) network is a multi-modal, web-based communications network that supports information exchange in real-time between freeway, traffic, transit and emergency service agencies. RIITS establishes system-to-system links to automate the exchange of traffic control, work zone, transit vehicle locations and schedule adherence/performance, traffic, and incident information.
- The Los Angeles County IEN Network allows arterial-based traffic management centers with Los Angeles County to share and exchange information to manage and coordinate traffic progression, improve coordination between member agency traffic control systems, track construction, and improve incident response.
- The Performance Measurement System (PeMS) is a database of real-time and historical vehicle detector data collected from Caltrans District freeway management centers around the state. PeMS also obtains WIM data, incident reports and lane closure notices from CHP and Caltrans.

Traveler Information Systems:

- Regional traveler information services are provided to the public through the Go511 and Inland511 systems. The 511 systems obtain data from RIITS, Caltrans Districts and PeMS to disseminate information from real time traffic condition and incidents to the public through a web site and phone interactive voice response (IVR) system.

1.2.2 Regional Goods Movement Planning Initiatives

Describes major planning studies and coordination efforts underway that pertain to regional goods movement:

- SCAG is developing a Comprehensive Regional Goods Movement Plan and Implementation Strategy that builds upon the goods movement element in the 2008 Regional Transportation Plan (RTP) and incorporates the findings and recommendations from the recently completed Multi-County Goods Movement Action Plan (MCGMAP) and the Port and Modal Elasticity Study Phase II. The Plan focuses on defining projects, financing and phasing.
- The Gateway Cities Council of Government (GCCOG) and Metro are preparing an ITS Implementation Plan for goods movement that builds upon the previously completed ITS Integration Plan. The focus of the current effort is to outline the conceptual design of goods movement technologies and the development of a business plan for deployment and operations.
- Metro is leading the preparation of an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the I-710 corridor. The EIS/EIR will assess the impact that future improvements may have on the environment and for communities along the corridor. Some of the alternatives being evaluated include dedicated truck lanes and a zero emission freight corridor.

2. STAKEHOLDERS

2.1 Regional Stakeholders

To accommodate data exchanges between the goods movement ITS elements in the Southern California Regional ITS Architecture stakeholders are identified. Public sector stakeholders include federal, state and local governments representing transportation agencies, the ports and various coalitions. Public sector stakeholders have traditionally been seen as the primary providers and operators of the transportation infrastructure for goods movement. If the county architecture owners choose to add goods movement related elements, the subregional architectures should include agencies and private industry participates involved in freight and logistics. **Table 1** provides a summary of the stakeholder groups to consider in an update to the subregional architectures.

Table 1 – Stakeholder Roles and Responsibilities

Description	Roles/Responsibilities as Related to Goods Movement
SCAG	▪ Programs capital improvements to goods movement infrastructure in the Regional Transportation Plan ▪ Responsible for maintaining regional transportation conformity for air quality ▪ Planning, funding and coalition building to address freight related issues in the five county SCAG region
County Transportation Commissions	▪ Comprised of Metro, RCTC, OCTA, SANBAG, VCTC and IVAG ▪ Lead role in planning and funding the construction of goods movement infrastructure ▪ Operates traveler information services ▪ Maintains countywide ITS architectures
Local jurisdictions	▪ Operates traffic signal systems that manage traffic on local arterials ▪ In the Gateway Cities, local jurisdictions hare traffic signal status and monitoring information through the Los Angeles County IEN ▪ Designates truck routes on local arterials
Regional Caltrans	▪ Comprised of Caltrans District 7, 8 and 12 ▪ Owns and operates field devices on freeways to monitor traffic conditions using vehicle detection systems ▪ Staffs traffic management centers to monitor real-time traffic conditions on county freeways ▪ Provides traveler information using a network of roadside CMS ▪ Collects real time traffic data from field devices and shares the information with RIITS and PeMS ▪ Operates weigh-in-motion (WIM) systems
Ports	▪ Comprised of the POLA and POLB ▪ Lead role in planning, financing, design, and construction of the transportation network infrastructure within the Port complexes ▪ POLA/POLB jointly operates the ATMIS to monitor traffic onsite using CCTV and vehicle detection devices

Description	Roles/Responsibilities as Related to Goods Movement
	▪ Operates the PierPass program to schedule cargo pick up during off peak periods
Rail Road Companies	▪ Comprised of the Union Pacific (UP), Burlington Northern Santa Fe (BNSF) ▪ Operates on-dock/near-dock/off-dock intermodal facilities ▪ Transports containers to domestic markets in North America
California Highway Patrol (CHP)	▪ Responsible for public safety and enforcement on freeways ▪ Records and manages accident/crash reporting data in the Statewide Integrated Reporting System (SWITRS) ▪ Performs inspections of commercial vehicles ▪ Maintains the California Commercial Vehicle Inspection System (CCVIS) ▪ Maintains CA VIEW, the Commercial Vehicle Information Exchange Window
California DMV	▪ Commercial vehicle registration
South Coast Air Quality Management District (SCAQMD)	▪ Enforces compliance with air quality regulations that govern commercial vehicle emissions
Commercial Vehicle Operators	▪ Motor carriage companies that perform drayage operations localized around the ports ▪ Motor carriage companies that perform long-haul trucking for intra/interstate deliveries
Port Terminal Operators	▪ Private companies that load and offload containers from ships at the ports

2.2 Agreements

To support the data interconnections described in the Southern California Regional ITS Architecture for the goods movement ITS elements, cooperative agreements are needed to define the roles and responsibilities of the public and private sector participants over the provision and use of truck fleet and freight operations data. Data sharing agreements are critical since the trucking companies, terminal operators and the shipping lines would be wary of sharing data that they consider as sensitive information. The following are key considerations that would shape the data sharing agreements for goods movement related data:

- Degree of data anonymity;
- Funding for technology development;
- Business rules and processes for reciprocating the exchange of data;
- Data accuracy and reliability;
- Data security;
- Performance monitoring;
- Operations and maintenance of the devices that collect the data;
- Terms in which third parties can use the data;
- Liability on the part of those who provide the data; and
- Fees and profit sharing potential if the data is monetized.

3. ITS INVENTORY

The section will describe the ITS projects for goods movement, their associated market packages, and approximate timing.

3.1 ITS Elements

Several key ITS applications are in place that public agencies and the private sector are using to better coordinate freight and commercial vehicle operations. A portion of these goods movement services are described in the previous Southern California Regional ITS Architecture. The update will focus on adding those elements that are tied to truck data collection, truck-focused traveler information and future technologies for container movement within the region.

If the county architecture owners choose to add ITS elements related to goods movement, the elements summarized in **Table 2** should be considered in the update to the subregional architectures to support information flows and data exchanges for collecting and sharing freight operations data:

Table 2 – ITS Elements

Element Name	Associated Stakeholder(s)	Description	Mapped To:
Container Scheduling Systems	ISPs Shipping Lines	Provides trucking companies with scheduling services to make appointments for container pick up	Fleet and Freight Management Subsystem
Commercial Vehicle Enforcement Stations	CHP Caltrans	Represents Weigh-In-Motions (WIM) stations, truck scales and inspections stations	Commercial Vehicle Check Subsystem
Commercial Credentialing Systems	CHP DMV FHWA	Represents information systems providing commercial vehicle registration and safety inspection data collected by regulatory and enforcement agencies	Commercial Vehicle Administration Subsystem
Truck Traveler Information Services	Commercial Vehicle Operators	Enables truck operators to obtain routing and traveler information inside their vehicles	Fleet and Freight Management Subsystem Commercial Vehicle Subsystem
Automatic Vehicle Identification System	CHP Ports	Allows trucks with participating transponders to bypass WIM stations and port of entry facilities	Commercial Vehicle Check Subsystem
Automatic Vehicle Locator System	Commercial Vehicle Operators	Gathers anonymous truck data using technologies such as commercial GPS/AVL systems or RFID tags	Vehicle Subsystem Commercial Vehicle Subsystem
Port ATMIS	Ports	Traffic management center operated by the Ports that collects and disseminates real	Traffic Management Subsystem

Element Name	Associated Stakeholder(s)	Description	Mapped To:
		time traffic data and video images from detection devices in the Port vicinity	
Port Incident Management System	Ports	Disseminates trip advisories and incident information on roadway conditions leading in and out of the Ports	Information Service Provider Subsystem
Railroad Crossing Monitoring System	Railroad companies Local Jurisdictions	Collects video images and detection data from at-grade railroad crossings to provide information on delays from queuing	Roadway Subsystem

3.2 Market Packages

User services and market packages, standard terms defined by the National ITS Architecture, are intended to be comprehensive lists of the potential ITS applications or solutions to transportation problems. Each user service or market package is generic in nature (for example the user service "Pre-trip Travel Information" is a generic description of a traveler information service provided to travelers prior to their trips such as web-based applications). They are intended to be used as a starting point for ITS planning to ensure that all potential solutions are considered. In some regional ITS architecture developments, stakeholders develop solutions that are not addressed by the available lists of user services and market packages, in which case a custom definition would be developed.

Table 3 shows the goods movement related market packages from the 2005 update and those added as part of the 2008 security update.

Table 3 – Market Packages

Market Package		Status
ATIS01	Broadcast Traveler Information	Existing/Planned
ATIS02	Interactive Traveler Information	Existing/Planned
ATMS01	Network Surveillance	Existing/Planned
ATMS06	Traffic Information Dissemination	Existing/Planned
CVO 01	Fleet Administration	Existing/Planned
CVO 02	Freight Administration	Existing/Planned
CVO 03	Electronic Clearance	Existing/Planned
CVO 04	CV Administrative Processes	Existing/Planned
CVO 06	Weigh-In-Motion	Existing/Planned
CVO 07	Roadside CVO Safety	Existing/Planned

If the county ITS architecture owners choose to add ITS elements for goods movement, the following market packages should be included in the update of the subregional architectures:

CVO 03 – Electronic Clearance: This market package provides for automated clearance at roadside check facilities. The roadside check facility communicates with the Commercial Vehicle Administration subsystem 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 transponders and Field-Vehicle Communications to the roadside. Results of roadside clearance activities will be passed on to the Commercial Vehicle Administration. The roadside check facility may be equipped with Automated Vehicle Identification (AVI), weighing sensors, transponder read/write devices and computer workstations.

CVO 06 – Weigh-In-Motion: This market package provides for high speed weigh-in-motion with or without Automated Vehicle Identification (AVI) capabilities. This market package provides the roadside equipment that could be used as a stand-alone system or to augment the Electronic Clearance (CVO03) market package.

CVO 07 – Roadside CVO Safety: This market package provides for automated roadside safety monitoring and reporting. It automates commercial vehicle safety inspections at the roadside check locations. The capabilities for performing the safety inspection are shared between this market package and the On-board CVO and Freight Safety & Security (CVO08) Market Package which enables a variety of implementation options. The basic option, directly supported by this market 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) Market 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, supported by the On-board CVO and Freight Safety & Security (CVO08) market package, utilize additional on-board vehicle safety monitoring and reporting capabilities in the commercial vehicle to augment the roadside safety check.

CVO 09 – CVO Fleet Maintenance: This market package supports maintenance of CVO fleet vehicles with on-board monitoring equipment and Automated Vehicle Location (AVL) capabilities within the Fleet and Freight Management Subsystem. Records of vehicle mileage, repairs, and safety violations are maintained to assure safe vehicles on the highway.

CVO 10 – HAZMAT Management: This market package integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material and incidents. HAZMAT tracking is performed by the Fleet and Freight Management Subsystem. The Emergency Management subsystem is notified by the Commercial Vehicle if an incident occurs and coordinates the response. The response is tailored based on information that is provided as part of the original incident notification or derived from supplemental information provided by the Fleet and Freight Management Subsystem. The latter information can be provided prior to the beginning of the trip or gathered following the incident depending on the selected policy and implementation.

3.3 Project Sequencing

The ITS elements for goods movement in this update to the Southern California Regional ITS Architecture will be implemented through a series of projects led by both public sector and private sector agencies. Key foundation systems will need to be implemented in order to support other systems and projects. Project sequencing identifies those foundation systems, projects, or

infrastructure that are required to be in place for other projects to move forward. Further discussions among stakeholders regarding these particular projects will need to be held for consensus on project priorities across regions to be achieved. In some cases, studies may be required prior to full project development and implementation and operational agreements may be necessary for interregional projects to effectively work together.

A listing of the proposed projects to consider in the update to the subregional architectures is provided in **Table 4**.

Table 4 – Project Sequencing

Project Title	Market Packages	Participating Stakeholders	Description	Timing
Disseminate Real Time CVO Information	CVO01-Fleet Administration ATIS1-Broadcast Traveler Information ATIS2-Interactive Traveler Information ATMS06-Traffic Information Dissemination	▪ Regional agencies ▪ Information Service Providers ▪ Ports	Delivers real time information from multiple data sources and ITS services that is tailored to trucks. Information such as incident and road closures and terminal queue times supports the coordination of vehicle dispatch and route guidance to make turn times more reliable and predictable.	S
Commercial Vehicle Clearance System	CVO02-Freight Administration CVO04-CV Administrative Processes	▪ Caltrans ▪ DMV ▪ CHP ▪ Ports	This project creates a data clearinghouse that provides vehicle carrier, vehicle safety and credentialing information from federal and state agency databases to fixed and mobile roadside inspection stations and other 3rd party users	M
Container Tracking System	CVO02-Freight Administration	▪ Shipping lines ▪ Terminal operators ▪ Trucking companies ▪ Railroads	This project establishes a centralized and standardized system for scheduling the pickup and delivery of containers.	M
Truck Fleet Communications Program	CVO01-Fleet Administration CVO09-CVO Fleet Maintenance	▪ Trucking companies ▪ Information Service Providers ▪ Regional agencies	This project outfits truck fleets with two-way communications and mobile data terminals to collect and disseminate truck specific data to enhance commercial vehicle operations and provide public agencies with data for performance monitoring and incident management.	S/M

Project Title	Market Packages	Participating Stakeholders	Description	Timing
Truck Fleet Data Integration	CVO09-CVO Fleet Maintenance	▪ Information Service Providers ▪ Regional agencies	As part of the truck fleet communications program, this project integrates various data sources and companies providing technology to monitor truck location, speed and other valuable truck specific data.	S/M
Truck Inspection Stations (physical and virtual)	CVO03-Electronic Clearance CVO06-Weigh-In-Motion CVO07-Roadside CVO Safety	▪ CHP ▪ Caltrans	Deployment of truck inspection stations in the SCAG region. These may include physical and/or virtual stations, over time.	S/M/L

4. OPERATIONAL CONCEPTS

The operational concepts in this update to the Southern California Regional ITS Architecture outline the roles and responsibilities of participating stakeholders that are currently or will be involved with in the provision of interregional services related to goods movement.

A concept of operations, though similar in nature to an operational concept, defines in more detail the specifics of how a particular project or system operates in different scenarios. A concept of operations is part of a project-oriented systems engineering approach. Evolving from a project development environment, a concept of operations describes in detail not only the roles and responsibilities, but the information flows among stakeholders, scenarios for how a system operates, and required interactions and data sharing for a project. It enables later validation of the concept of what the system was meant to do (in addition to system testing to ensure that the system meets the specific requirements that were laid out). Concepts of operations for future projects of this ITS Architecture can be developed from the corresponding portion of this operational concept.

If the county architecture owners choose to include good movement related elements, operational concepts for the recommended market packages should be considered for the subregional architecture update(s). Operational concepts for the recommended market packages are provided in **Table 5**.

Table 5 – Operational Concepts

Market Package(s)	Description
CVO03-Electronic Clearance **CVO06-Weigh-In-Motion** **CVO07-Roadside CVO Safety**	Caltrans: ▪ Establish statewide design standards for weigh stations, inspection stations, and borders. ▪ Operate WIM stations; operate PrePass, California's automated pre-clearance system. ▪ Maintain and disseminate data regarding the state highway network and vehicle restrictions on various highways. ▪ Promote the ability to use a standard transponder technology for any activity that uses Automatic Vehicle Identification. ▪ Promote inter-agency communications for Commercial Vehicle automated roadside safety inspection on a local level. DMV: ▪ Review and adopt federal regulations pertaining to registration, permits and licenses. CHP: ▪ Enforce regulations adopted at the state level pertaining to loading, load securement and size. ▪ Facilitate electronic collection of inspection data and electronically forward to a CHP headquarters database and then to SAFETYNET, a federal commercial vehicle information system database.
CVO09-CVO Fleet Maintenance	Commercial Vehicle Operators: ▪ Implement on-board monitoring systems that provide the sensory, processing, storage, and communications functions necessary to support safe and efficient commercial vehicle operations. Such systems will also provide two-way

Market Package(s)	Description
	communications between the commercial vehicle drivers, their fleet managers and roadside officials; and provide HAZMAT response teams with timely and accurate cargo content information after incidents. ▪ Disseminate data through private information providers or public agencies. <u>Regional Agencies:</u> ▪ Work cooperatively with trucking companies and information service providers on developing technology and data sharing agreements.

5. ITS STANDARDS

The Southern California Regional ITS Architecture provides recommended current, relevant standards for each information exchange between ITS projects. Their use is not mandatory. However, in some instances, there may be funding requirements or regional policies that mandate project-specific standards such as for real-time transit information.

Table 6 identifies the ITS standards that are possible for goods movement based upon the identified interfaces and information flows.

Table 6 – Applicable ITS Standards for Goods Movement

Group	SDO	Document ID	Standard Title	Standard Type
No	AASHTO/ITE	ITE TMDD	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)	Message/Data
No	AASHTO/ITE/NEMA	NTCIP 1201	Global Object Definitions	Message/Data
No	AASHTO/ITE/NEMA	NTCIP 1203	Object Definitions for Dynamic Message Signs (DMS)	Message/Data
No	AASHTO/ITE/NEMA	NTCIP 1205	Object Definitions for Closed Circuit Television (CCTV) Camera Control	Message/Data
No	AASHTO/ITE/NEMA	NTCIP 1208	Object Definitions for Closed Circuit Television (CCTV) Switching	Message/Data
No	AASHTO/ITE/NEMA	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems (TSS)	Message/Data
No	ANSI	ANSI TS813	Electronic Filing of Tax Return Data	Message/Data
No	IEEE	IEEE 1455-1999	Standard for Message Sets for Vehicle/Roadside Communications	Message/Data
Yes	AASHTO/ITE/NEMA	NTCIP C2C	NTCIP Center-to-Center Standards Group	Group
Yes	AASHTO/ITE/NEMA	NTCIP C2F	NTCIP Center-to-Field Standards Group	Group
Yes	ASTM	DSRC 915MHz	Dedicated Short Range Communication at 915 MHz Standards Group	Group
Yes	IEEE	IEEE IM	Incident Management Standards Group	Group
Yes	SAE	ATIS General Use	Advanced Traveler Information Systems (ATIS) General Use Standards Group	Group
Yes	SAE	ATIS Low Bandwidth	Advanced Traveler Information Systems (ATIS) Bandwidth Limited Standards Group	Group

6. FUNCTIONAL REQUIREMENTS

Functional requirements described in this update of the Southern California Regional ITS Architecture are high-level descriptions of the functions or activities of the ITS element related to goods movement. They are developed for two reasons:

- To provide input to the identification of interfaces and information flows of the architecture; and
- To provide a resource for project deployers in defining activities and functional relationships of the systems that may be developed or upgraded to provide interregional ITS services.

A list of requirements that describe the functions covered by the architecture is a requisite component of the architecture according to the FHWA Final Rule for Architecture and Standards. This list of requirements describes the functionality of the existing and planned elements of the architecture for providing interregional services for Express Lanes. **The architecture does not prescribe that future projects meet any or all of the requirements.**

For all projects that are funded with Highway Trust Funds the Final Rule states that the project should be based on a system engineering analysis, and specifically states that the analysis shall include requirements definition. The intent of the functional requirements is to provide a set of requirements that can be used to assist project implementers in the development of functional requirements definition as required by the Final Rule. This does not preclude future projects from identifying different or additional functions, but rather, provides requirements for implementation of the regional architecture.

Future projects may choose to utilize the lists of requirements as a reference or tool to develop specific requirements that address each individual project's needs. If a project is developed that has additional functions not documented in the current list, future updates of the Regional ITS Architecture can add those requirements. This update to the architecture would assist in identifying the interconnects and information flows that may also be changed, added, or implemented as a result of future technological developments. The interconnects should also be revised in the process of updating the architecture.

A list of functional requirements defined for the goods movement ITS elements is provided in **Table 7**.

Table 7 – Functional Requirements

Functional Areas	Function (Equipment Package)	Requirement
Commercial Vehicle Administration	CV Data Collection	The center shall receive operational data from the roadside check systems as well as administration and credentials data.
Commercial Vehicle Administration	CV Information Exchange	The center shall exchange information with roadside check facilities, including credentials and credentials status information, safety status information, daily site activity data, driver records, and citations.
Commercial Vehicle Administration	CV Information Exchange	The center shall provide reports to the commercial vehicle fleet manager regarding fleet activity through roadside facilities including accident reports, citations, credentials status information, driver records, and safety status information.
Commercial Vehicle Administration	CV Safety and Security Administration	The center shall provide commercial vehicle safety and security data to roadside check facilities.
Commercial Vehicle	CV Safety and	The center shall collect and review safety inspection reports and

Functional Areas	Function (Equipment Package)	Requirement
Administration	Security Administration	violations from the roadside check facilities and pass on appropriate portions to other commercial vehicle administrative centers and commercial vehicle fleet operators.
Commercial Vehicle Administration	CV Safety and Security Administration	The center shall monitor alerting and advisory systems for security alerts and advisories.
Commercial Vehicle Administration	CV Safety and Security Administration	The center shall provide commercial vehicle accident reports to enforcement agencies.
Commercial Vehicle Administration	CV Safety and Security Administration	The center shall receive citation records from roadside check facilities.
Commercial Vehicle Check	Roadside Electronic Screening	The roadside check facility equipment shall detect the presence of commercial vehicles and freight equipment approaching a facility. Sensors can differentiate between different types of vehicles and determine the number of axles, gross vehicle weight, and the identification of the vehicle and its cargo.
Commercial Vehicle Check	Roadside Electronic Screening	The roadside check facility equipment shall receive the credential and credentials status information (e.g. snapshots) from the commercial vehicle administration center to maintain an up to date list of which vehicles have been cleared (enrolled) to potentially pass through without stopping.
Commercial Vehicle Check	Roadside Electronic Screening	The roadside check facility equipment shall receive violation records from appropriate law enforcement agencies pertaining to commercial vehicles.
Commercial Vehicle Check	Roadside Electronic Screening	The roadside check facility equipment shall provide an interface to inspectors in the field to allow them to monitor and if necessary override the pull-in decisions made by the system.
Commercial Vehicle Check	Roadside Electronic Screening	The roadside check facility equipment shall request and input electronic screening data from the commercial vehicle's electronic tag data.
Commercial Vehicle Check	Roadside Electronic Screening	The roadside check facility equipment shall collect safety data from the commercial vehicle and its freight equipment.
Commercial Vehicle Check	Roadside Electronic Screening	The roadside check facility equipment shall send a pass/pull-in notification to the commercial vehicle and its driver based on the information received from the vehicle, the administration center, enforcement agencies, and the inspector. The message may be sent to the on-board equipment in the commercial vehicle or transmitted to the driver using equipment such as dynamic message signs, red-green lights, flashing signs, etc.
Commercial Vehicle Check	Roadside Electronic Screening	The roadside check facility equipment shall verify that pull-in requests are heeded by drivers, notifying the facility operator if a vehicle fails to pull in as requested.

Functional Areas	Function (Equipment Package)	Requirement
Commercial Vehicle Check	Roadside Electronic Screening	The roadside check facility equipment shall monitor alerting and advisory systems for security alerts and advisories.
Commercial Vehicle Check	Roadside Electronic Screening	The roadside check facility equipment shall send a record of daily activities at the facility including summaries of screening events and inspections to the commercial vehicle administration center.
Commercial Vehicle Check	Roadside HAZMAT Detection	The roadside check facility equipment shall detect the presence of commercial vehicles and freight equipment approaching a facility. Sensors can differentiate between different types of vehicles and determine the number of axles, gross vehicle weight, presence of security sensitive hazardous materials, and the identification of the vehicle and its cargo.
Commercial Vehicle Check	Roadside HAZMAT Detection	The roadside check facility equipment shall detect the presence of security sensitive substance, e.g. detection of radiation or ammonia compounds, carried on-board commercial vehicles and freight equipment approaching a facility. This data is acquired by roadside sensors from the freight equipment electronically, optically, or manually.
Commercial Vehicle Check	Roadside HAZMAT Detection	The roadside check facility equipment shall receive the credential information (e.g. snapshots) from the commercial vehicle administration center to maintain an up to date list of which vehicles with hazardous materials shipments have been cleared (enrolled).
Commercial Vehicle Check	Roadside HAZMAT Detection	The roadside check facility equipment shall send a pass/pull-in notification to the commercial vehicle and its driver based on the hazmat information received from the vehicle, the freight equipment, or the administration center. The message may be sent to the on-board equipment in the commercial vehicle or transmitted to the driver using equipment such as dynamic message signs, red-green lights, flashing signs, etc.
Commercial Vehicle Check	Roadside HAZMAT Detection	The roadside check facility equipment shall raise and forward an alarm to the appropriate emergency management center if the hazmat-carrying commercial vehicle does not stop, or in the case of a positive identification of an unpermitted security sensitive hazmat cargo, to coordinate a traffic stop or some other action with respect to the offending commercial vehicle. The alarm will include information concerning the security sensitive hazmat detected at the roadside including the location, appropriate identifiers, route deviation, or assignment mismatches between the driver, commercial vehicle, or the freight equipment.
Commercial Vehicle Check	Roadside Safety and Security Inspection	The roadside check facility equipment shall receive information concerning commercial vehicles and freight equipment approaching a facility that are being pulled in for safety and security inspections.

Functional Areas	Function (Equipment Package)	Requirement
Commercial Vehicle Check	Roadside Safety and Security Inspection	The roadside check facility equipment shall receive the safety and security inspection and status information from the commercial vehicle administration center to include information such as safety ratings, inspection summaries, and violation summaries. Corresponds to the safety portion of CVISN "snapshots."
Commercial Vehicle Check	Roadside Safety and Security Inspection	The roadside check facility equipment shall provide an interface to inspectors in the field to allow them to safety inspection data including overrides to the pull-in decisions made by the system.
Commercial Vehicle Check	Roadside Safety and Security Inspection	The roadside check facility equipment shall request and input electronic safety data from the commercial vehicle's electronic tag data. This includes driver logs, on-board safety data, safety inspection records, commercial vehicle breach information, as well as freight equipment information.
Commercial Vehicle Check	Roadside Safety and Security Inspection	The roadside check facility equipment shall send a pass/pull-in notification to the commercial vehicle and its driver based on the information received from the vehicle, the administration center, and the inspector. The message may be sent to the on-board equipment in the commercial vehicle or transmitted to the driver using equipment such as dynamic message signs, red-green lights, flashing signs, etc.
Commercial Vehicle Check	Roadside Safety and Security Inspection	The roadside check facility equipment shall receive information about a breach or tamper event on a commercial vehicle or its attached freight equipment which includes identity, type of breach, location, and time.
Commercial Vehicle Check	Roadside Safety and Security Inspection	The roadside check facility equipment shall receive driver records, accident reports, and citation records from the commercial vehicle administration center to support driver identification and access to driver credentials and history information.
Commercial Vehicle Check	Roadside Safety and Security Inspection	The roadside check facility equipment shall read expected driver identity characteristics (e.g., PIN codes and biometric data) from the commercial vehicle equipment to support safety and security checking.
Commercial Vehicle Check	Roadside Safety and Security Inspection	The roadside check facility equipment shall read the driver identification card provided by the commercial vehicle driver and support cross-check of the identification data with driver records.
Commercial Vehicle Check	Roadside Safety and Security Inspection	The roadside check facility equipment shall forward results of the roadside safety inspections to the commercial vehicle administration center.
Commercial Vehicle Check	Roadside WIM	The roadside check facility equipment shall detect the presence of commercial vehicles and freight equipment approaching a facility. Sensors can differentiate between different types of vehicles and determine the number of axles, gross vehicle weight,

Functional Areas	Function (Equipment Package)	Requirement
		weight per axle, and the identification of the vehicle and its cargo.
Commercial Vehicle Check	Roadside WIM	The roadside check facility equipment shall request and input electronic screening data from the commercial vehicle's electronic tag data.
Commercial Vehicle Check	Roadside WIM	The roadside check facility equipment shall send a pass/pull-in notification to the commercial vehicle and its driver based on the information received from the vehicle and the measurements taken. The message may be sent to the on-board equipment in the commercial vehicle or transmitted to the driver using equipment such as dynamic message signs, red-green lights, flashing signs, etc.
Commercial Vehicle Subsystem	On-board Cargo Monitoring	The commercial vehicle shall compute the location of the commercial vehicle and its freight equipment.
Commercial Vehicle Subsystem	On-board Cargo Monitoring	The commercial vehicle shall monitor on-board systems and record measures such as weight, vehicle security status, vehicle safety status, vehicle identity, driver status, driver safety status, distance traveled, and brake condition.
Commercial Vehicle Subsystem	On-board Cargo Monitoring	The commercial vehicle shall monitor information concerning the freight equipment including cargo type, HAZMAT designation (if any) for the cargo, cargo weight, the type of container in which the cargo is held, safety condition of the cargo, etc.
Commercial Vehicle Subsystem	On-board Cargo Monitoring	The commercial vehicle shall forward information concerning the freight equipment on to its fleet and freight management center as well as the roadside check facility.
Commercial Vehicle Subsystem	On-board Cargo Monitoring	The commercial vehicle shall send notification of a hazmat spill to appropriate emergency management center in case of an incident including the information from cargo sensors, vehicle location, and the carrier identification.
Commercial Vehicle Subsystem	On-board CV Electronic Data	The commercial vehicle shall receive pass/pull-in messages from the roadside check facilities and present them to the driver in either audible or visual forms.
Commercial Vehicle Subsystem	On-board CV Electronic Data	The commercial vehicle shall respond to requests to provide data accumulated on-board the vehicle to roadside check facilities for inspection including driver logs, electronic identifiers, credentials, border clearance data, and other screening data such as cargo status, hazmat identifiers, out of service status, vehicle axle weight, vehicle weight, and time.
Commercial Vehicle Subsystem	On-board CV Electronic Data	The commercial vehicle shall respond to requests to provide the identity, status and other information from the electronic cargo lock tag, if so equipped, to roadside check facilities, including border crossings.

Functional Areas	Function (Equipment Package)	Requirement
Commercial Vehicle Subsystem	On-board CV Electronic Data	The commercial vehicle shall support an interface to a commercial vehicle driver that is also acting in the role of a commercial vehicle fleet manager to set up routes, pay necessary taxes, obtain proper credentials, and write the identifiers to the electronic tag for the driver, vehicle, and carrier.
Commercial Vehicle Subsystem	On-board CV Safety and Security	The commercial vehicle shall receive pass/pull-in messages from the roadside check facilities and present them to the driver in either audible or visual forms.
Commercial Vehicle Subsystem	On-board CV Safety and Security	The commercial vehicle shall respond to requests to provide on-board safety inspection data to roadside check facilities including vehicle identification, driver logs, and characteristics data for initiating safety and security checking. Results of the inspection are read back into the on-board equipment.
Commercial Vehicle Subsystem	On-board CV Safety and Security	The commercial vehicle shall monitor on-board systems pertaining to the safety and security of the vehicle, its driver, and its cargo/freight equipment; and provide the information to the driver, roadside check facilities, and commercial fleet management centers.
Commercial Vehicle Subsystem	On-board CV Safety and Security	The commercial vehicle shall provide interface with the driver to be presented with and respond to alerts, either visual or audible, concerning the safety and security of the vehicle and its cargo. Alerts and messages specific to commercial vehicles include trucks not advised on a route, trucks over 10 tons not allowed on bridge, route details, detected route deviations and warning indications detected by on-board sensors (e.g., safety) and freight equipment sensors (e.g., breach, cargo).
Commercial Vehicle Subsystem	On-board CV Safety and Security	The commercial vehicle shall provide information concerning a breach or tamper event on a commercial vehicle or its attached freight equipment to roadside check facilities and to the commercial fleet management center, the information includes identity, type of breach, location, and time.
Commercial Vehicle Subsystem	On-board CV Safety and Security	The commercial vehicle shall provide expected driver identity characteristics (e.g., PIN codes and biometric data) to roadside check facilities to support safety and security checking.
Commercial Vehicle Subsystem	On-board CV Safety and Security	The commercial vehicle shall provide information about previous attempts to disable the commercial vehicle to roadside check facilities.
Fleet and Freight Management	Commercial Vehicle and Freight Security	The center shall coordinate the response to security incidents and the sharing of security threat information involving commercial vehicles and freight equipment with other agencies including emergency management centers, intermodal freight shippers, and alerting/advisory systems.

Functional Areas	Function (Equipment Package)	Requirement
Fleet and Freight Management	Fleet Administration	The center shall obtain and manage commercial vehicle routes for its fleet of vehicles, taking into account route restrictions, advance payment of tolls, HAZMAT restrictions, current traffic and road conditions, and incident information provided by traveler information systems.
Fleet and Freight Management	Fleet Administration	The center shall support an interface with a map update provider, or other appropriate data sources, through which updates of digitized map data can be obtained and used as the background for commercial vehicle fleet administration - includes commercial vehicle specific data such as route or HAZMAT restrictions.
Fleet and Freight Management	Fleet Administration	The center shall coordinate the response to security incidents and the sharing of security threat information involving commercial vehicles with other agencies including emergency management centers and alerting/advisory systems.
Fleet and Freight Management	Fleet HAZMAT Management	The center shall provide information concerning commercial vehicles carrying hazardous materials (HAZMAT) upon request from an emergency management center. The information includes the nature of the cargo being carried, identity of the vehicle and unloading instructions.
Fleet and Freight Management	Freight Administration and Management	The center shall provide the interface with intermodal freight shippers to setup transportation for freight equipment. Inputs to this include information about the shipper, consignee, commodities, pick-up and drop-off locations for freight equipment. Outputs include information about the driver and commercial vehicle that will be transporting the freight.
Fleet and Freight Management	Freight Administration and Management	The center shall coordinate the response to security incidents and the sharing of security threat information involving freight equipment with other agencies including emergency management centers, intermodal freight shippers, and alerting/advisory systems.

7. INTERFACES

One of the key components of the Southern California Regional ITS Architecture is the definition of interfaces and information flows that define the connections between ITS systems to support the desired operational concepts and services for goods movement. The interfaces are a detailed view of system interconnections. These interconnections are described in diagram, table, and database formats. The information can be generated from a Turbo Architecture database that defines the entire Southern California Regional ITS Architecture.

While the various systems and stakeholders are identified as part of the Southern California Regional ITS Architecture, a primary purpose of the architecture is to identify the *connectivity* between transportation systems. The customized market packages from the previous section represent services that can be deployed, and the market package diagrams show the information flows between the systems. High-level views of the interconnections and data flows for the customized goods movement market packages are provided in **Figures 1** through **11**.

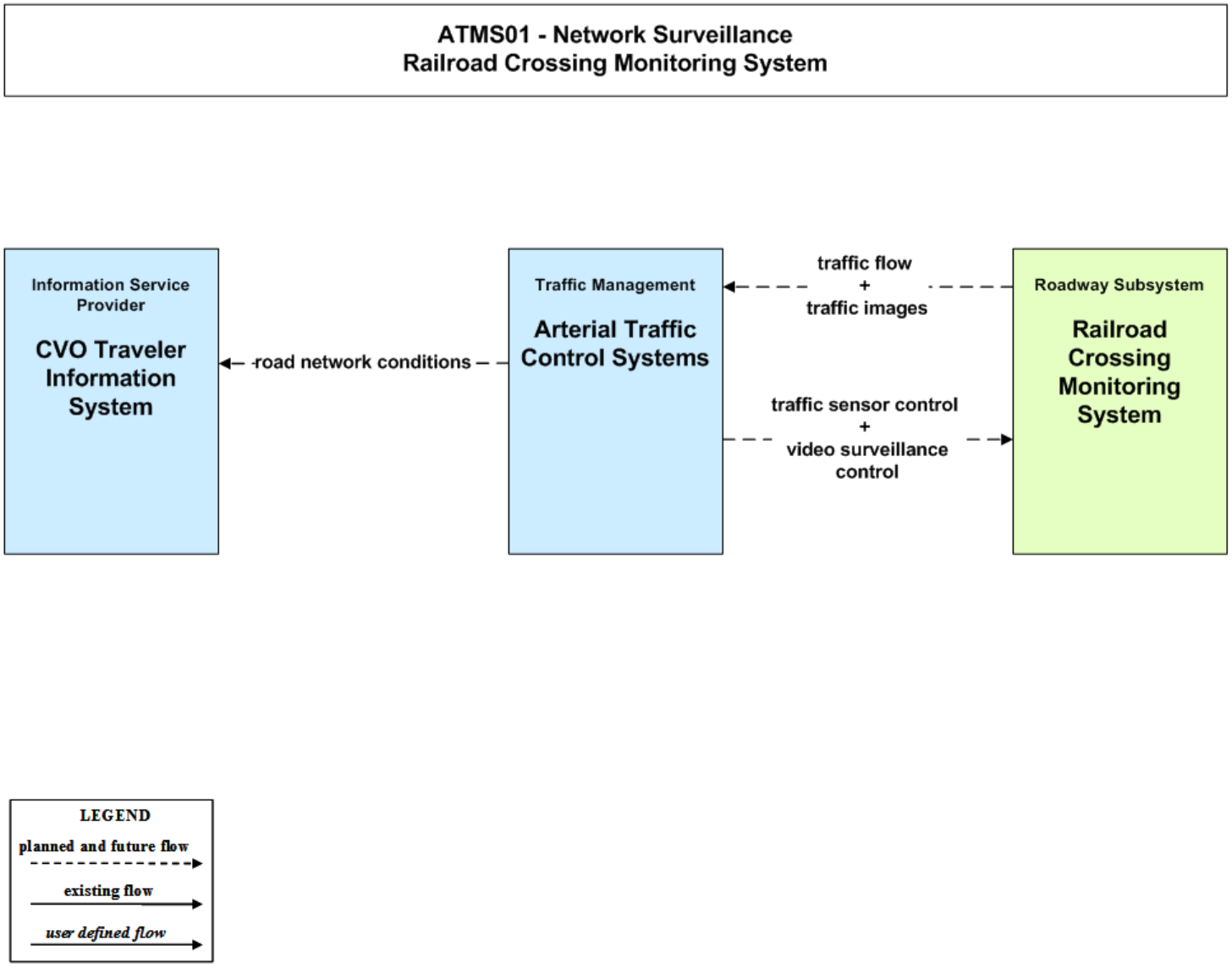

Figure 1 – Railroad Crossing Monitoring System

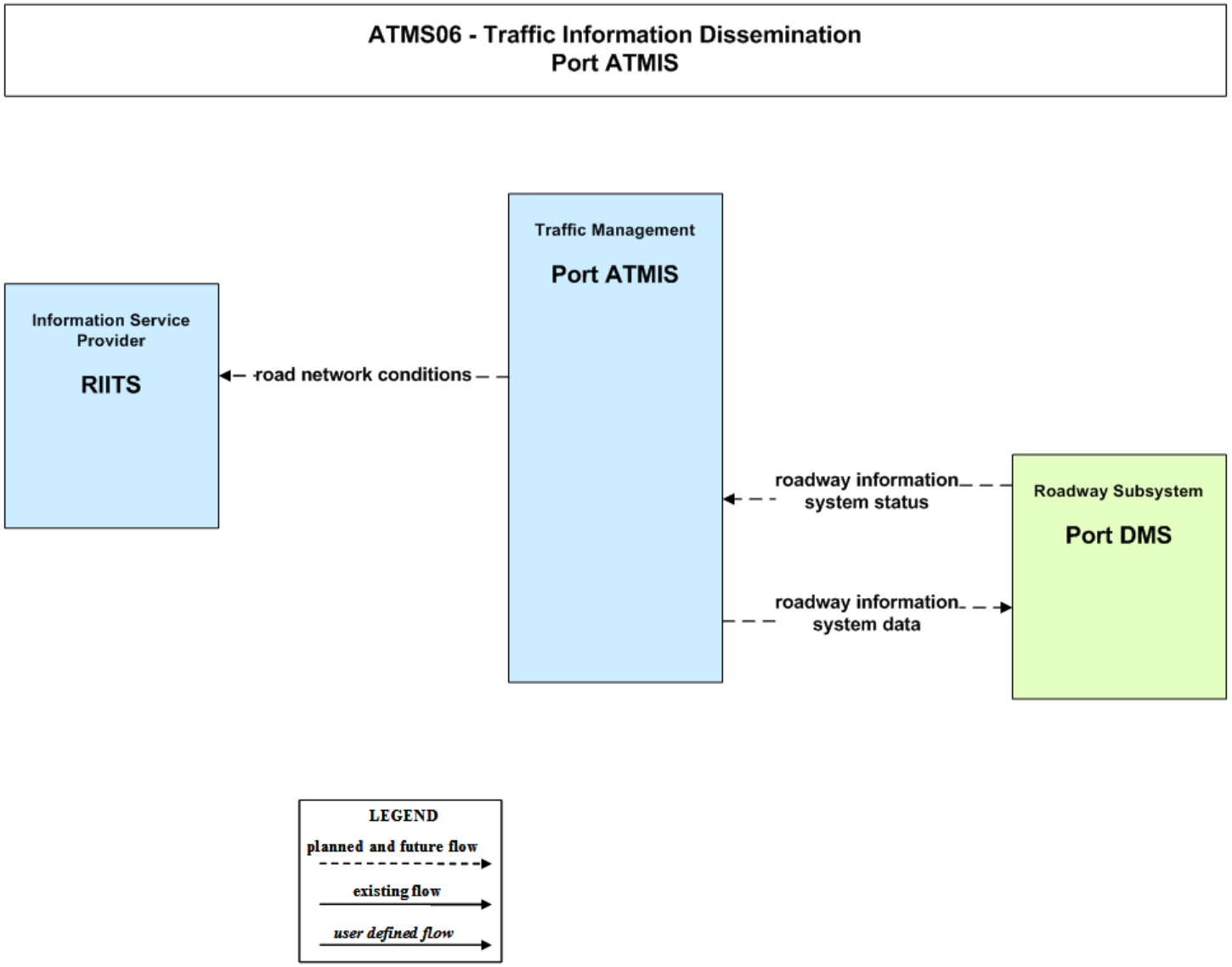

Figure 2 – Port ATMIS

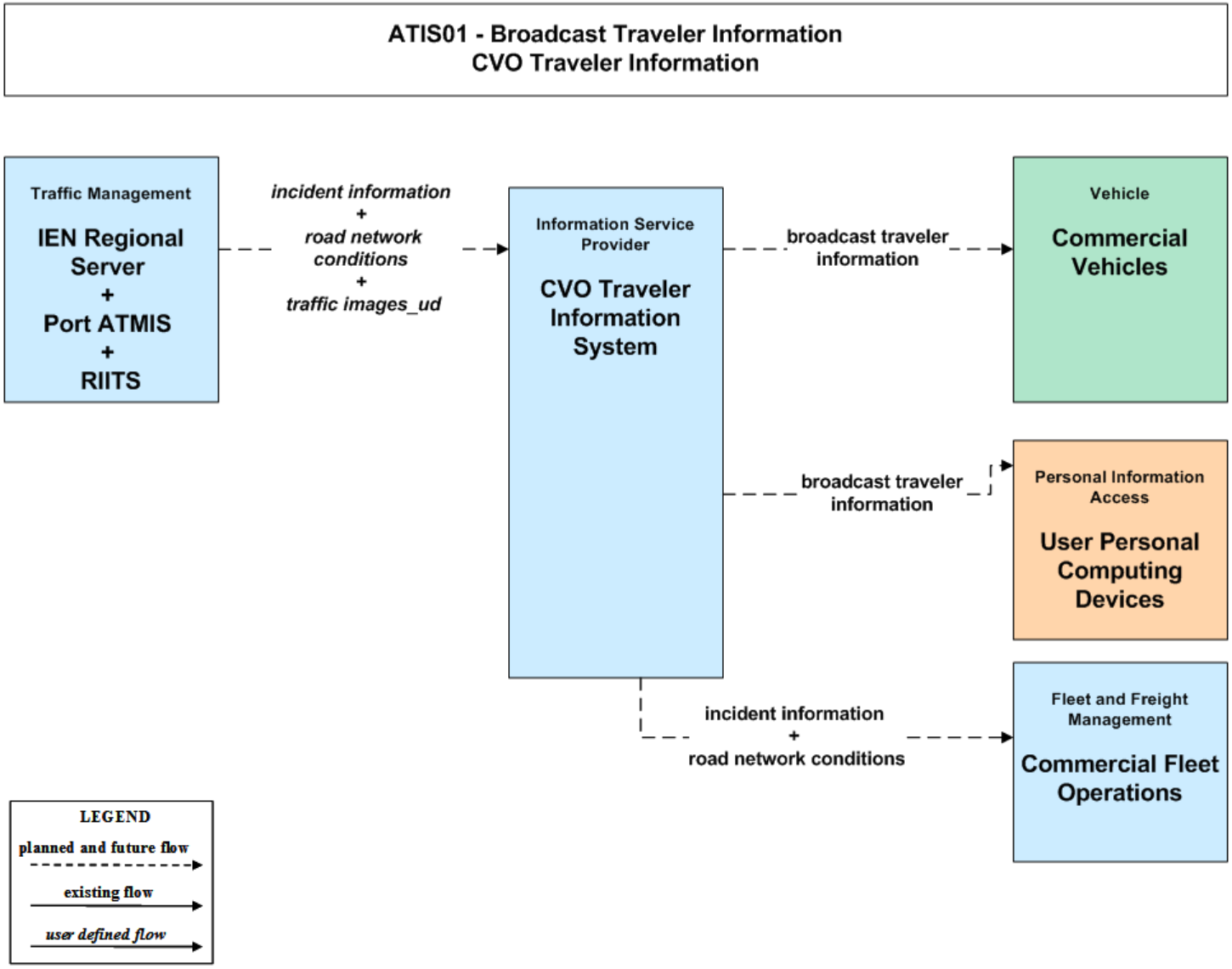

Figure 3 – CVO Traveler Information (Broadcast)

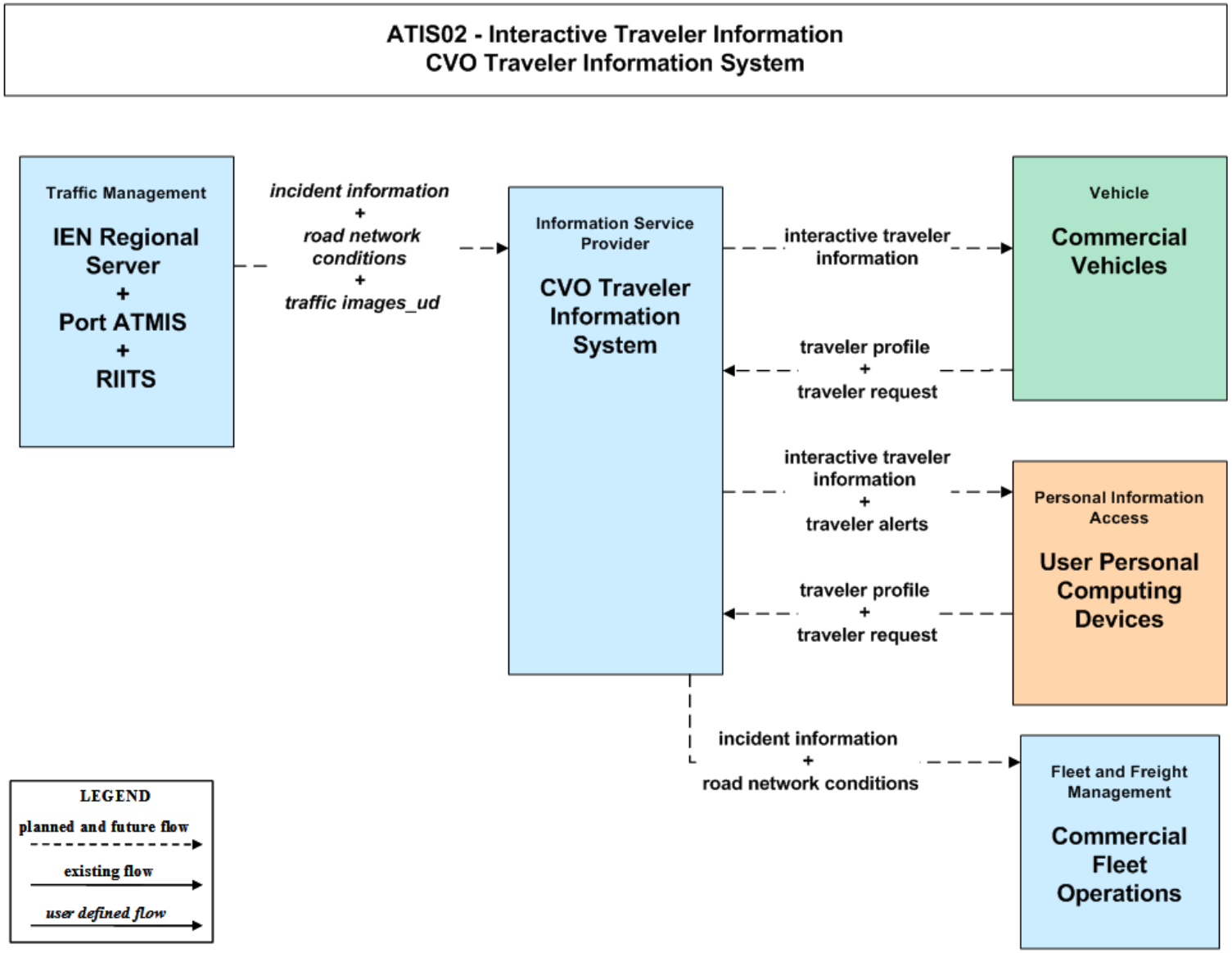

Figure 4 – CVO Traveler Information (Interactive)

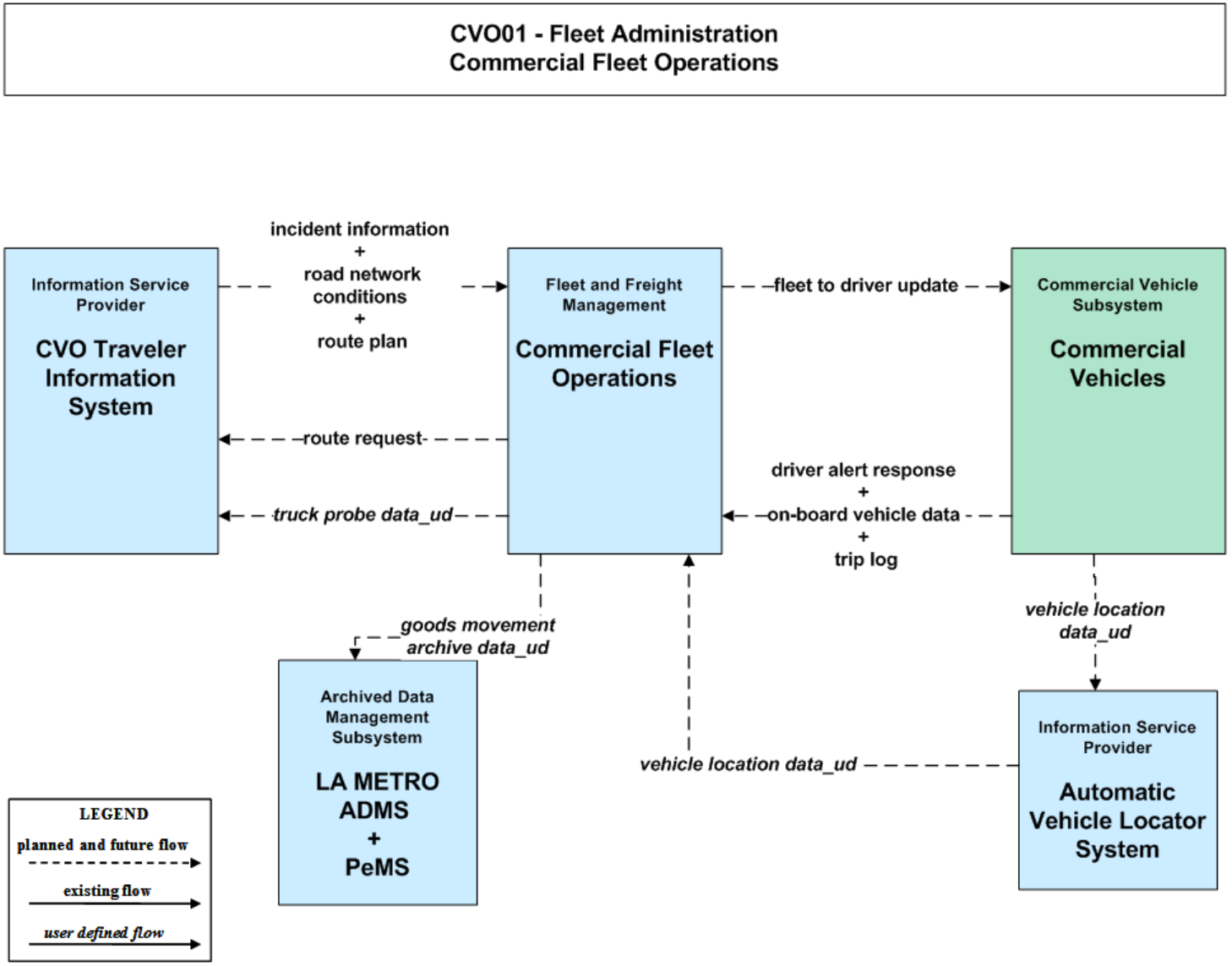

Figure 5 – Commercial Fleet Operations

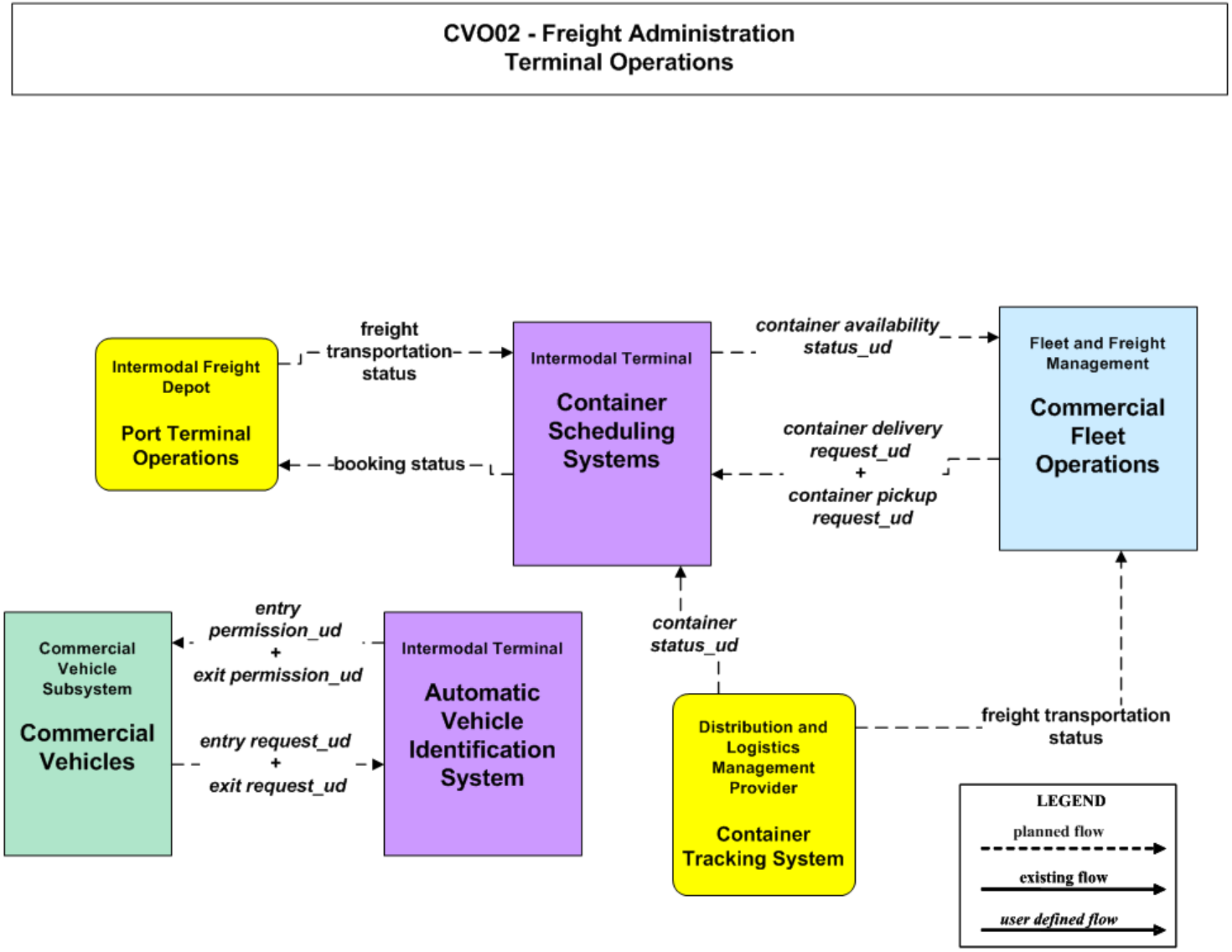

Figure 6 – Terminal Operations

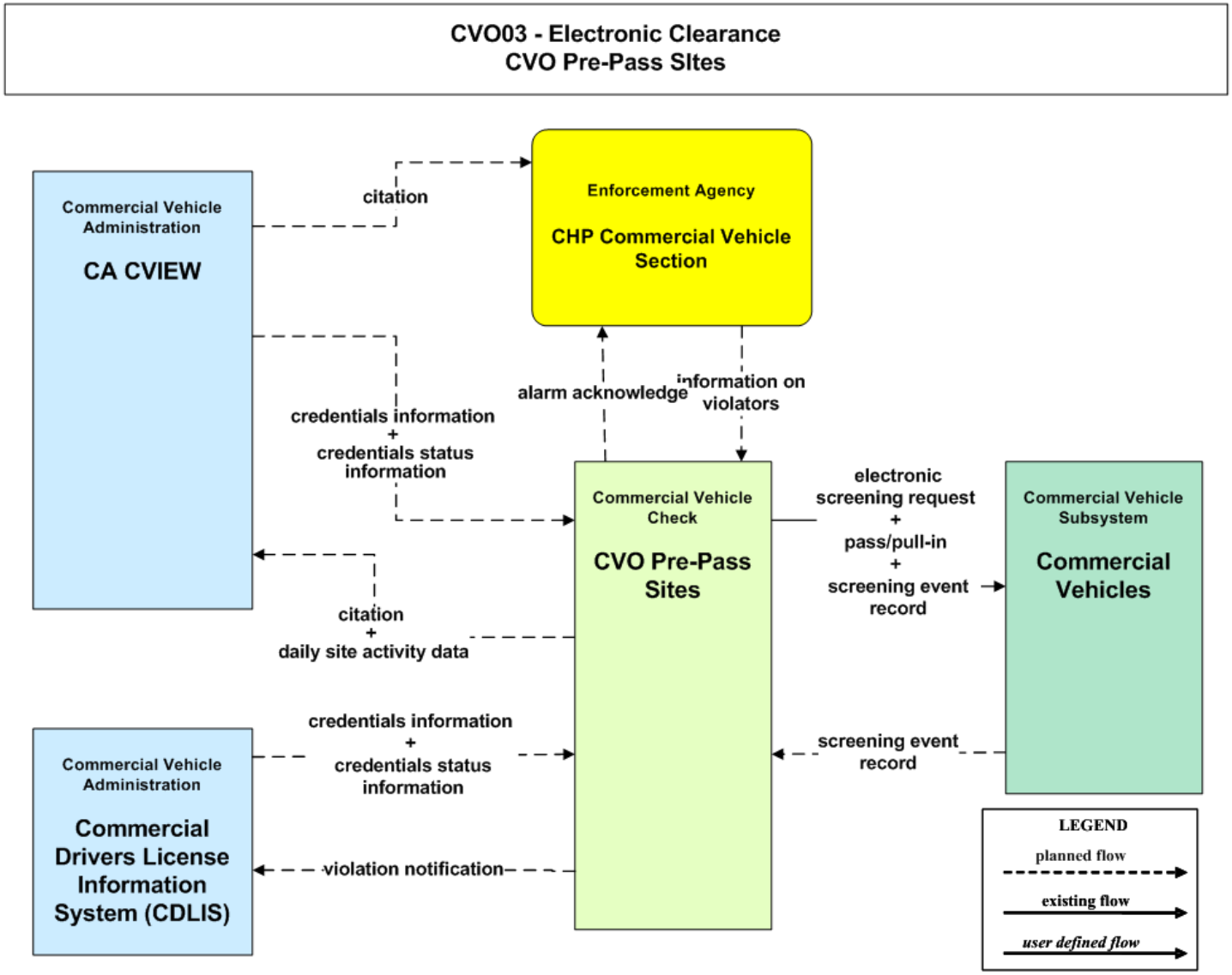

Figure 7 – PrePass Sites

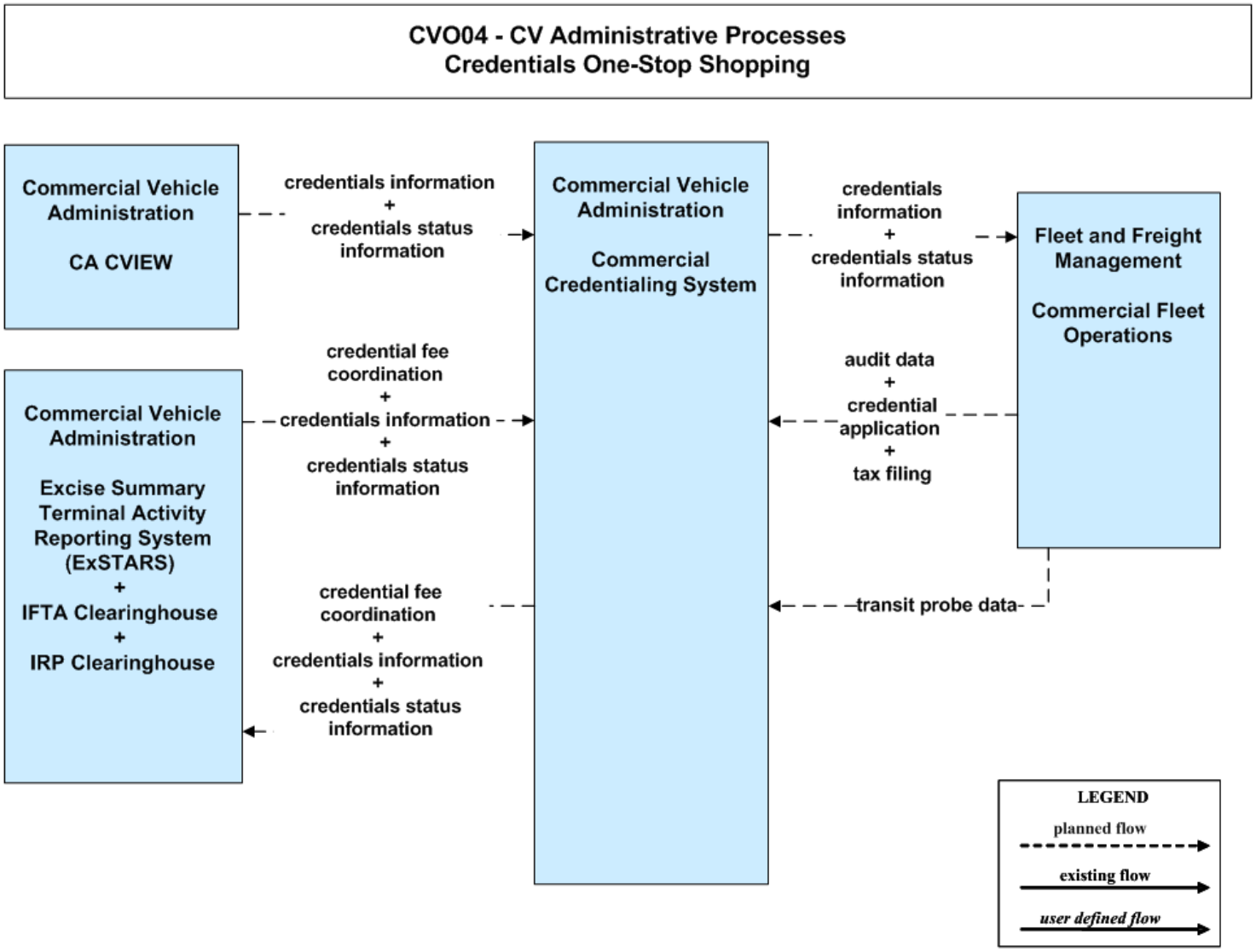

Figure 8 – Credentials One-Stop Shopping

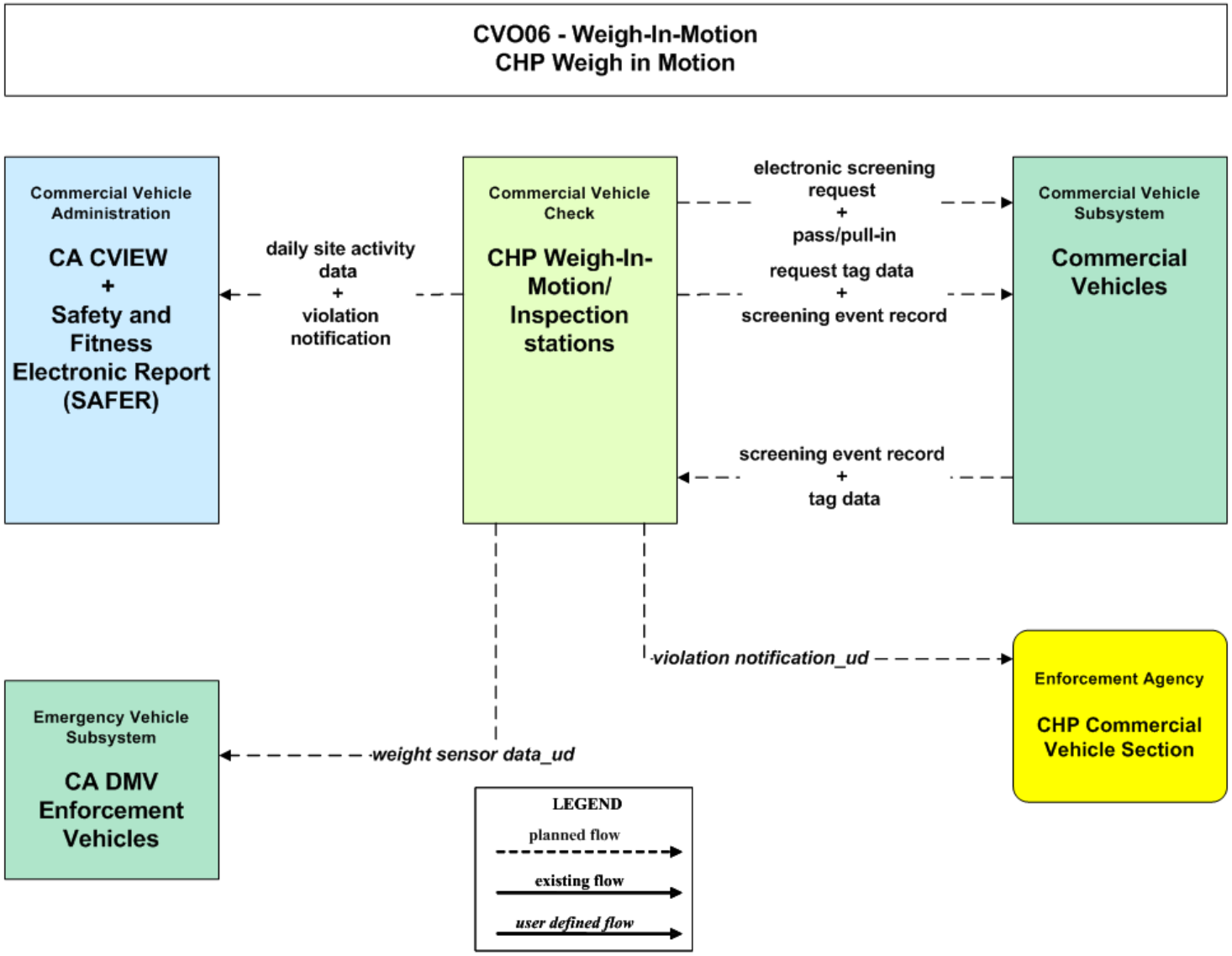

Figure 9 – CHP Weigh-in-Motion

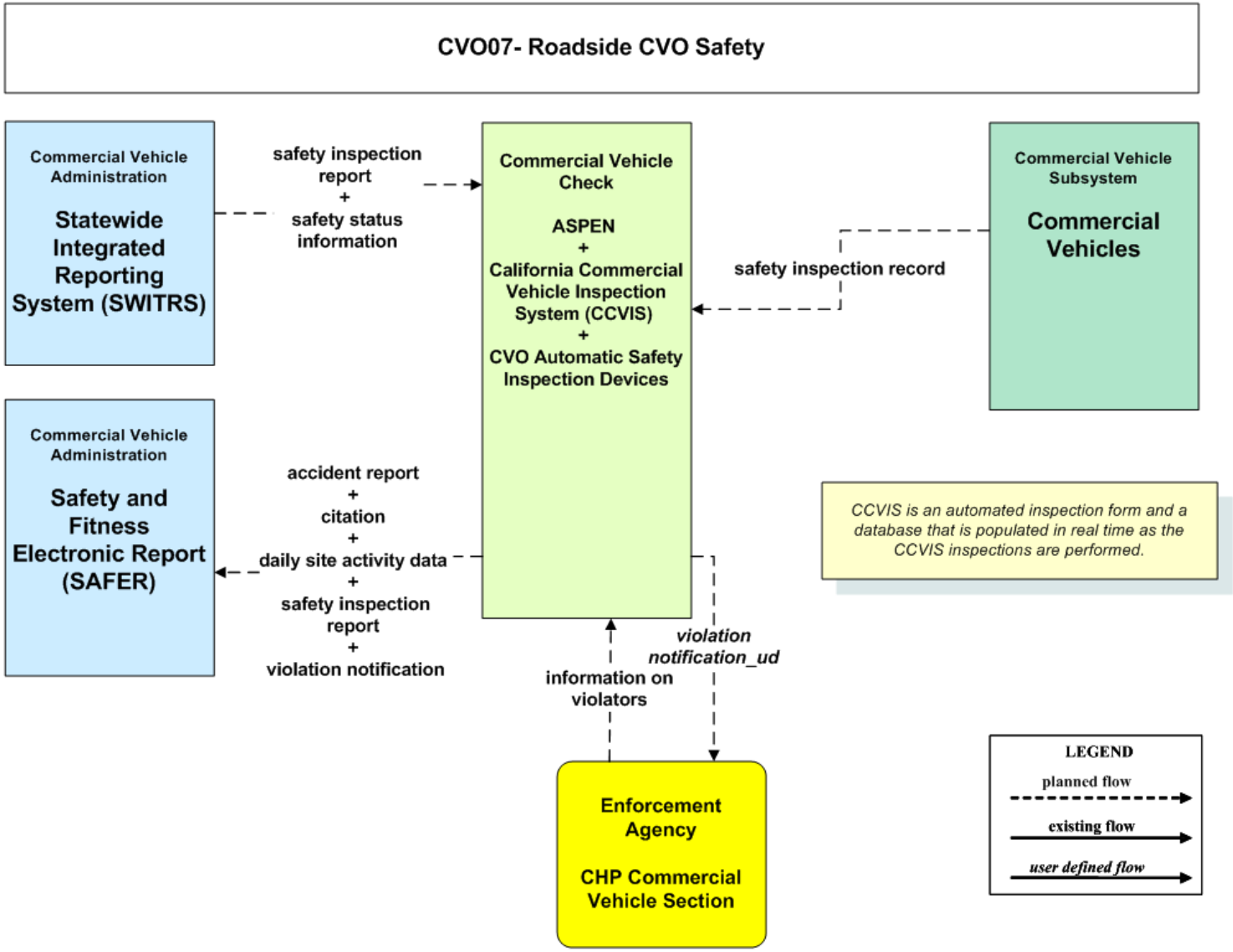

Figure 10 – Roadside CVO Safety

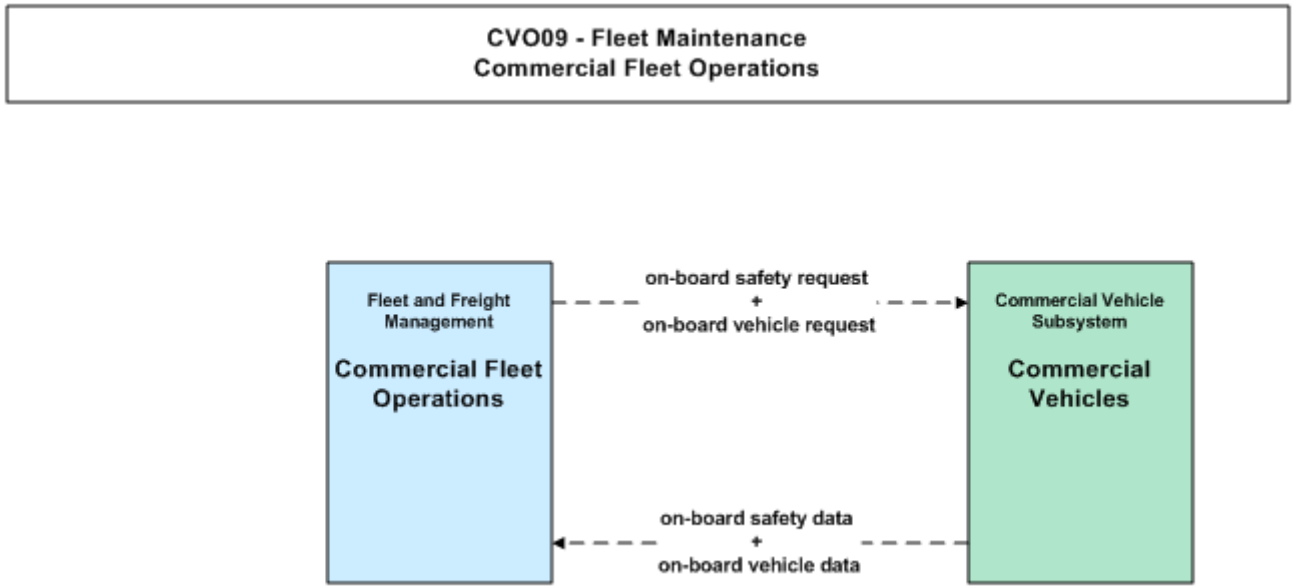

Figure 11 – Commercial Fleet Operations