

Technical Memorandum

SOUTHERN CALIFORNIA REGIONAL ITS ARCHITECTURE
2011 UPDATE

**Existing and Planned Cross-County Services and Interfaces
Recommended Subregional ITS Architecture Elements**

Prepared for:



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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 Southern California or regional level architecture, completed in 2005, was built on the foundation of five subregional or county-level ITS architectures, and focused on regional level and inter-county ITS issues. The subregional or county-level ITS architectures, champion agencies, and the year they were developed and last updated are:

- Ventura County Regional ITS Architecture, championed by Ventura County Transportation Commission (VCTC), (2005)
- Orange County Regional ITS Architecture, championed by Orange County Transportation Authority (OCTA), (2005)
- Imperial County Regional ITS Architecture, championed by Imperial Valley Transit, (IVT), (2005)
- Los Angeles County Regional ITS Architecture (2004) & Los Angeles County Arterial ITS Inventory and Architecture (2004), championed by Los Angeles County Metropolitan Transportation Authority (Metro)
- Inland Empire Regional ITS Architecture, championed by Riverside County Transportation Commission (RCTC) and San Bernardino Associated Governments (SANBAG) 2003, last updated in 2005

The update to the Southern California Regional ITS Architecture is focused on the following areas: Cross-county services, goods movement, express lanes, non-motorized technologies, and positive train control.

The purpose of this document is to provide guidance to the subregional ITS architecture owners on updating the subregional or county-level architectures to reflect existing and planned cross-county services since 2005 if desired. Cross-county services describe activities and system interactions that are inter-regional or take place across county boundaries. Goods movement, express lanes, non-motorized technologies, and positive train control are addressed in separate documents and will be included as market packages developed for the Southern California Regional ITS Architecture.

1.2 Cross-County Projects

Several of the cross-county projects identified in the 2005 Architecture have been implemented. The specific projects include:

LA County IEN: The Los Angeles County Information Exchange Network (IEN) is a system developed by the Los Angeles County Department of Public Works (DPW) that shares information and control of municipal traffic control systems (TCS) throughout the county and is offered to agencies outside of LA County if a connection is desired. The system is interoperable with different TCS packages by using open architecture components such as a standard software interface to connect the TCS to the IEN. Agencies participating in the IEN can share and access real-time intersection data to support enhanced arterial traffic management, improve traffic operations along multi-jurisdictional corridors and coordinate emergency response. Through 2009, the TCS of eight cities are connected to the IEN backbone, with the IEN and the City of Los Angeles (LADOT) TCS exchanging data through a separate interface. An interface between the IEN and signals in the LA County DPW network is currently being planned.

RIITS: The Regional Integration of Intelligent Transportation System (RIITS) network is the core project within the LA County Regional ITS Architecture that integrates different sources of transportation data from multiple agencies. The RIITS network features interfaces with MTA Bus, MTA Rail and Long Beach Transit for real-time transit arrival times and static schedules. The interface with Caltrans District 7 provides freeway and incident data. The RIITS network distributes the data to users through a XML data feed. The RIITS network currently supplies data to the MATIS traveler information service, local agencies, and information services providers who distribute the data to the public through a variety of applications. Future plans include data interfaces with Caltrans District 8 and 12 in neighboring counties, the Los Angeles County IEN, CHP, Foothill Transit and an archived data management system.

LA Metro is currently developing an Archived Data Management Service (ADMS) that that will capture real-time data transmitted through the RIITS network. The ADMS will store three years of historical data for all modes of transportation from the various participating agencies. The ADMS database could be used to monitor system performance, support regional and corridor-level planning efforts and provide input for project funding applications. The ADMS is expected to support the MATIS program and support performance evaluation for future Express Lane operations.

511 Traveler Information: Two traveler information programs provide the public with traveler information services in the SCAG region. The Motorist Aid and Traveler Information System (MATIS) program in Los Angeles County is overseen by LA SAFE and provides traveler information services via phone and web for Orange, Los Angeles, and Ventura counties primarily

and a the Inland Empire 511 provides traveler information services via web and phone interfaces to the Riverside and San Bernardino areas .

The LA SAFE MATIS program delivers multi-modal traveler information to the public in Southern California through a 511 interactive voice response (IVR) telephone services and 511 website (go511.com). The system was designed to be the real-time and static data collection, analysis, and dissemination tool to provide relevant traveler information to the public as well as monitor and manage service on the freeways in Los Angeles, Orange, and Ventura primarily, with data also provided for Riverside and San Bernardino counties. The system provides information about traffic drive times and freeway speeds, road construction, incidents, buses and trains, carpool/vanpool, bicycle information, and weather. Sources for real-time data include RIITS (District 7), Caltrans Traffic Management Center (District 8 and District 12), Caltrans Lane Closure System portal, California Highway Patrol CAD and Nextrip (transit vehicle status). Callers to the 511 phone system can request roadside assistance from Freeway Service Patrol (FSP) tow trucks.

After working cooperatively on the LA SAFE MATIS program, the Riverside County Transportation Commission (RCTC) and the San Bernardino Association of Governments (SANBAG) formed a separate partnership to develop a 511 system for the Inland Empire. The system provides a similar traveler information service with an interactive voice response (IVR) telephone component and a 511 website (IE511.org). Traffic coverage is primarily focused on Riverside and San Bernardino counties, with data also provided for Orange, Los Angeles, Ventura, and San Diego counties. Callers do not have to distinguish between Inland Empire or the LA SAFE MATIS service; callers dial the same 511 number and are handed off to either system depending on the originating area code for landline users or the location of the receiving cell phone tower for mobile users.

Universal Fare System (UFS): The UFS will consolidate fare and revenue collection for Metro bus, Metro rail and municipal transit operators throughout Los Angeles County. The Transit Access Pass (TAP) will serve as the regional smartcard that transit users could use to pay for fares on services operated by agencies participating in the UFS. The UFS deployment includes TAP readers on buses, barrier gates / TAP readers at Metro Rail stations and a clearinghouse service center to process fare transactions. Though the TAP program serves transit users in Los Angeles County, there is potential for future interactions with Metrolink or transit providers in neighboring counties.

PeMS: The Freeway Performance Measurement System (PeMS) is a program that was developed jointly by the University of California at Berkeley and the California Department of Transportation to collect historical and real-time freeway data from the various freeway management systems in the state for performance measurement calculations. The detector data is transmitted from Caltrans district traffic management centers over the Caltrans WAN to the PeMS host server which aggregates the data and provides performance measurement tools to review the data on its website. Planned enhancements for PeMS include Arterial PeMS (A-PeMS) that seeks to collect, analyze and display arterial data and Transit PeMS that seeks to collect, analyze and display transit operations data.

2. STAKEHOLDERS

2.1 Subregional Stakeholders

To accommodate data exchanges between the ITS elements for cross-county services in the Southern California Regional ITS Architecture stakeholders are identified at the state, regional, and local levels. **Table 1** maps the stakeholders in the subregional architectures to the topics being updated at the regional ITS Architecture level.

Table 1 – Subregional ITS Stakeholders

Stakeholder	Existing and Planned Cross-County Services	Goods Movement	Express Lanes	Non-Motorized Transportation	Positive Train Control
SCAG	X	X	X	X	X
LA Metro	X	X	X	X	X
SANBAG	X	X	X	X	X
RCTC	X	X	X	X	X
OCTA	X	X	X	X	X
VCTC	X	X		X	X
Los Angeles County	X			X	
Ventura County	X			X	
Orange County	X			X	
Imperial County				X	
San Bernardino County	X			X	
Riverside County	X			X	
Caltrans District 7	X	X		X	
Caltrans District 8	X	X		X	
Caltrans District 12	X	X		X	
Local Municipalities	X			X	
Ports of LA/LB		X			
SCRRRA	X				X
UP/BNSF		X			X
Amtrak		X			X

2.2 Agreements

To support the data interconnections described in the Southern California Regional ITS Architecture for cross-county services, cooperative agreements are needed in some cases to define the roles and responsibilities of the participating agencies. The following are key considerations that would shape the data sharing agreements for information generated and shared for cross-county services:

- Maintenance and operations;

- Business rules and processes for reciprocating the exchange of data;
- Data accuracy and reliability;
- Data security;
- Performance monitoring;
- 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 describes the ITS projects for cross-county services and their associated market packages, as defined by the National ITS Architecture.

3.1 ITS Elements

If the county architecture owners choose to add ITS elements related to cross-county services, the elements summarized in **Table 2** should be included in the update to the subregional architectures to support information flows and data exchanges:

Table 2 – ITS Elements Related to Cross-County Services

Cross-County Services	Elements	Associated Stakeholders	Mapped to
PeMS Enhancements	Data Archive	County Cities Transit providers CHP Caltrans District 7, 8, 12	Traffic Management Transit Management
511 Traveler Information	Regional Traveler Information Systems	LA SAFE (Go511) RCTC SANBAG	Information Service Provider
Universal Fare System	Regional Fare Card System	Transit Providers	Traveler Card Transit Management
RIITS	Traffic and Transit Data Exchange	Metro Bus Metro Rail Foothill Transit Long Beach Transit LADOT County of Los Angeles DPW CHP Caltrans District 7, 8,12	Traffic Management Transit Management Information Service Provider
ADMS	Data Archive	RIITS stakeholders	Archived Data Management Subsystem
Los Angeles County IEN	Arterial Traffic Data Exchange	County Cities	Traffic Management Traffic Operations Personnel Roadway Subsystem

3.2 Market Packages

User services and market packages, standard terms defined in 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 market packages related to cross-county services and the status for each in the subregional ITS architectures (whether each is shown as existing, planned or is not currently included).

Table 3 – Market Packages Related to Cross-County Services

Market Package		Cross-County Services	LA	Orange	Inland Empire	Ventura	Imperial
AD2	ITS Data Warehouse	RIITS ADMS	N/A	N/A	N/A	N/A	N/A
AD3	ITS Virtual Data Warehouse	PeMS enhancements	N/A	N/A	N/A	N/A	N/A
APTS04	Transit Fare Collection Management	Universal Fare System	N/A	N/A	N/A	Existing	Existing
APTS07	Multi-Modal Coordination	Universal Fare System	Existing	Planned	N/A	Existing	N/A
ATIS01	Broadcast Traveler Information	511 Traveler Information	Existing	Planned	Existing	Existing	N/A
ATIS02	Interactive Traveler Information	511 Traveler Information	N/A	Planned	Existing	Existing	N/A
ATIS06	Transportation Operations Data Sharing	RIITS	N/A	N/A	N/A	N/A	N/A
ATMS06	Traffic Information Dissemination	LA County IEN	Existing	Existing	Existing	Existing	N/A
ATMS07	Regional Traffic Management	LA County IEN	Existing	Existing	N/A	Existing	N/A
ATMS08	Traffic Incident Management System	RIITS	Existing	Planned	N/A	Existing	N/A

*Not Applicable (N/A) – market package is not covered in the current architecture

If the county ITS architecture owners choose to add ITS elements for cross-county services, the following market packages should be considered:

AD2 – ITS Data Warehouse: This market package includes all the data collection and management capabilities provided by the ITS Data Mart, and adds the functionality and interface definitions that allow collection of data from multiple agencies and data sources spanning across modal and jurisdictional boundaries. It performs the additional transformations and provides the additional meta data management features that are necessary so that all this data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests additional on-line analysis and data mining features that are also included in this market package in addition to the basic query and reporting user access features offered by the ITS Data Mart.

AD3 – ITS Virtual Data Warehouse: This market package provides the same broad access to multimodal, multidimensional data from varied data sources as in the ITS Data Warehouse Market Package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse Market Package are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the

request. (CVO08) market package, utilize additional on-board vehicle safety monitoring and reporting capabilities in the commercial vehicle to augment the roadside safety check.

APTS04 – Transit Fare Collection Management: This market 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. Readers located either in the infrastructure or on-board the transit vehicle allows electronic fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed to the Transit Management Subsystem. Two other market packages, ATMS10: Electronic Toll Collection and ATMS16: Parking Facility Management also provides electronic payment services. These three market packages in combination provide an integrated electronic payment system for transportation services.

APTS07 – Multi-Modal Coordination: This market 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. Transit transfer information is shared between Multimodal Transportation Service Providers and Transit Agencies.

ATIS01 – Broadcast Traveler Information: This market package 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 web casts. The information may be provided directly to travelers or provided to merchants and other traveler service providers so that they can better inform their customers of travel conditions. Different from the market package ATMS6 - Traffic Information Dissemination, which provides localized HAR and DMS information capabilities, ATIS1 provides a wide area digital broadcast service. Successful deployment of this market package relies on availability of real-time traveler information from roadway instrumentation, probe vehicles or other sources.

ATIS02 – Interactive Traveler Information: This market 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 between the traveler and Information Service Provider. 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 kiosk, personal digital assistant, personal computer, and a variety of in-vehicle devices. This market package also allows value-added resellers to collect transportation information that can be aggregated and be available to their personal devices or remote traveler systems to better inform their customers of transportation conditions. Successful deployment of this market package relies on availability of real-time transportation data from roadway instrumentation, transit, probe vehicles or other means. A traveler may also input personal preferences and identification information via a "traveler card" that can convey information to the system about the traveler as well as receive updates from the system so the card can be updated over time.

ATIS06 – Transportation Operations Data Sharing: This market package makes real-time transportation operations data available to transportation system operators. The Information Service Provider collects, processes, and stores current information on traffic and travel conditions and other information about the current state of the transportation network and makes this information available to transportation system operators, facilitating the exchange of qualified, real-time information between agencies. Using the provided information, transportation system operators can manage their individual systems based on an overall view of the regional transportation system. The regional transportation operations data resource represented by the Information Service Provider may be implemented as a web application that provides a web-based access to system operators, an enterprise database that provides a network interface to remote center applications, or any implementation that supports regional sharing of real-time transportation operations data.

ATMS06 – Traffic Information Dissemination: This market 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, 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 Information Service Providers. A link to the Maintenance and Construction Management subsystem allows real time information on road/bridge closures due to maintenance and construction activities to be disseminated.

ATMS07 – Regional Traffic Management: This market package provides for the sharing of traffic information and control among traffic management centers to support regional traffic management strategies. Regional traffic management strategies that are supported include coordinated signal control in a metropolitan area and coordination between freeway operations and arterial signal control within a corridor. This market package advances the Surface Street Control and Freeway Control Market 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 Surface Street Control and Freeway Control Market Packages and adds hardware, software, and fixed-point to 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 control between traffic management centers.

ATMS08 – Traffic Incident Management System: This market package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The market 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 market package to detect and verify incidents and implement an appropriate response. This market 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 center subsystems. Incident response also includes presentation of information to affected travelers using the Traffic Information Dissemination market package and dissemination of incident information to travelers through the Broadcast Traveler Information or Interactive Traveler Information market 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 field personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel.

4. OPERATIONAL CONCEPTS

The operational concepts outline the roles and responsibilities of participating stakeholders that are currently or will be involved with in the provision of interregional services related to the existing and planned cross-county services as described earlier in this report.

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 cross-county services, operational concepts for the recommended market packages should be included in the subregional architecture update(s). Operational concepts for the recommended market packages are provided in **Table 5**.

Table 4 – Operational Concepts

Market Package(s)	Description
AD2 – ITS Data Warehouse AD3 – ITS Virtual Data Warehouse	<u>LA Metro:</u> <ul style="list-style-type: none"> ▪ Maintain RIITS ADMS ▪ Collect and disseminate archived data with other agencies <u>County cities:</u> <ul style="list-style-type: none"> ▪ Share arterial traffic information with other agencies through A-PeMS (future) and the LA County IEN <u>Transit providers:</u> <ul style="list-style-type: none"> ▪ Share real-time transit arrival information with RIITS and Transit PeMS (future) ▪ Share static transit schedule and spatial data with RIITS and Transit PeMS (future)
APTS04 – Transit Fare Collection Management APTS07 – Multi-modal Coordination	<u>Transit providers:</u> <ul style="list-style-type: none"> ▪ Establish a regional clearinghouse to manage electronic payments ▪ Share data collected through smart cards systems ▪ Exchange customer lists and smart card IDs ▪ Exchange information on fare structures
ATS01 – Broadcast Traveler Information	<u>County Transportation Commissions:</u> <ul style="list-style-type: none"> ▪ Collect and disseminate traveler information to GO511 and Inland Empire 511 users ▪ Maintain and operate web site and 511 phone information outlets ▪ Maintain data interfaces with data providers <u>Caltrans District 7, 8 and 12:</u> <ul style="list-style-type: none"> ▪ Provide information on freeway traffic conditions and road closure data <u>CHP:</u> <ul style="list-style-type: none"> ▪ Provide incident information

Market Package(s)	Description
ATS02 – Interactive Traveler Information	<u>County Transportation Commissions:</u> <ul style="list-style-type: none"> ▪ Provide traffic and transit feeds to 3rd party application developers ▪ Provide trip planning services through the 511 web site and phone systems ▪ Provide customized transit arrival information
ATMS06 – Traffic Information Dissemination ATIS06 – Transportation Operations Data Sharing ATMS08 – Traffic Incident Management System	<u>County cities:</u> <ul style="list-style-type: none"> ▪ Provide arterial traffic and incident data to RIITS (via LA County IEN), traveler information services and A-PeMS (future)
ATMS07 – Regional Traffic Management	<u>LA County DPW:</u> <ul style="list-style-type: none"> ▪ Oversee IEN integration efforts ▪ Develop policies and agreements for connecting agencies and sharing control of traffic devices <u>County cities:</u> <ul style="list-style-type: none"> ▪ Participate in IEN integration efforts ▪ Share arterial data from local traffic management systems

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 5 identifies the ITS standards that are possible for cross-county services based upon the identified interfaces and information flows.

Table 5 – Applicable ITS Standards for Cross-County Services

SDO	Document ID	Standard Title	Standard Type
AASHTO/ITE	ITE TMDD	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)	Message/ Data
AASHTO/ITE/ NEMA	NTCIP 1201	Global Object Definitions	Message/ Data
AASHTO/ITE/ NEMA	NTCIP 1211	Object Definitions for Signal Control and Prioritization (SCP)	Message/ Data
AASHTO/ITE/ NEMA	NTCIP C2C	NTCIP Center-to-Center Standards Group	Group
APTA	APTA TCIP-S-001 3.0.3	Standard for Transit Communications Interface Profiles	Message/ Data
ASTM	ASTM E2468-05	Standard Practice for Metadata to Support Archived Data Management Systems	Other
ASTM	ASTM E2665-08	Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data	Message/ Data
IEEE	IEEE IM	Incident Management Standards Group	Group
SAE	ATIS General Use	Advanced Traveler Information Systems (ATIS) General Use Standards Group	Group
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 elements related to cross-county services. 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 Southern California 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 cross-county services is provided in **Table 6** for consideration in updating county-level architectures.

Table 6 – Functional Requirements

Functional Areas	Function (Equipment Package)	Requirements
Archived Data Management Subsystem	ITS Data Repository	<p>The center shall collect data to be archived from one or more data sources.</p> <p>The center shall collect data catalogs from one or more data sources. A catalog describes the data contained in the collection of archived data and may include descriptions of the schema or structure of the data, a description of the contents of the data; e.g., time range of entries, number of entries; or a sample of the data (e. g. a thumbnail).</p> <p>The center shall store the archived data in a focused repository that is suited to a particular set of ITS data users.</p> <p>The center shall include capabilities for performing quality checks on the incoming archived data.</p>

Functional Areas	Function (Equipment Package)	Requirements
		<p>The center shall include capabilities for error notification on the incoming archived data.</p> <p>The center shall include capabilities for archive to archive coordination.</p> <p>The center shall support a broad range of archived data management implementations, ranging from simple data marts that collect a focused set of data and serve a particular user community to large-scale data warehouses that collect, integrate, and summarize transportation data from multiple sources and serve a broad array of users within a region.</p> <p>The center shall perform quality checks on received data.</p> <p>The center shall provide the capability to execute methods on the incoming data such as cleansing, summarizations, aggregations, or transformations applied to the data before it is stored in the archive.</p> <p>The center shall respond to requests from the administrator interface function to maintain the archive data.</p> <p>When data or a catalog of data is received from the archive, the center shall generate the requested data product for the users systems.</p> <p>For archive data requiring financial payment, the center shall process the financial requests and manage an interface to a Financial Institution.</p>
Archived Data Warehouse Services	Virtual Data Warehouse Services	<p>The center shall provide capabilities to access "in-place" data from geographically dispersed archives. These capabilities may include analysis, data fusion, or data mining.</p> <p>The center shall coordinate information exchange with a local data warehouse.</p> <p>The center shall provide the specialized publishing, directory services, and transaction management functions associated with coordinating remote archives.</p> <p>The center shall support the collection of archived data from other archives on an as-needed basis. (This minimizes the need to duplicate the comprehensive set of data from the remote archives in the local data warehouse.)</p> <p>The center shall use data collected from different archives to build a set of global schema including the data archive definitions for the local archive plus any archives known to the local archive.</p> <p>The center shall provide the local archived data schema to other archive systems.</p>
Information Service	Basic Information	The center shall disseminate traffic and highway condition

Functional Areas	Function (Equipment Package)	Requirements
Provider	Broadcast	<p>information to travelers, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes.</p> <p>The center shall disseminate maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities.</p> <p>The center shall disseminate transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers.</p> <p>The center shall disseminate parking information to travelers, including location, availability, and fees.</p> <p>The center shall disseminate toll fee information to travelers.</p> <p>The center shall disseminate weather information to travelers.</p> <p>The center shall disseminate event information to travelers.</p> <p>The center shall disseminate air quality information to travelers.</p> <p>The center shall provide the capability to support requests from the media for traffic and incident data.</p> <p>The center shall provide the capability for a system operator to control the type and update frequency of broadcast traveler information.</p>
Information Service Provider	Interactive Infrastructure Information	<p>The center shall disseminate customized traffic and highway condition information to travelers, including incident information, detours and road closures, recommended routes, and current speeds on specific routes upon request.</p> <p>The center shall disseminate customized maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities upon request.</p> <p>The center shall disseminate customized transit routes and schedules, transit transfer options, transit fares, and real-time schedule adherence information to travelers upon request.</p> <p>The center shall disseminate customized parking information to travelers, including location, availability, and fees upon request.</p> <p>The center shall disseminate customized toll fee information to travelers upon request.</p> <p>The center shall disseminate customized weather information to travelers upon request.</p> <p>The center shall disseminate customized multimodal transportation service information (for example, from ferry and</p>

Functional Areas	Function (Equipment Package)	Requirements
		<p>airline operators), including transfer points and other information, to travelers upon request.</p> <p>The center shall disseminate customized event information to travelers upon request.</p> <p>The center shall disseminate customized air quality information to travelers upon request.</p> <p>The center shall provide all traveler information based on the traveler's current location or a specific location identified by the traveler, and filter or customize the provided information accordingly.</p> <p>The center shall accept traveler profiles for determining the type of personalized data to send to the traveler.</p> <p>The center shall manage payment for services, such as tolls, transit fares, parking lot charges, map updates, and advanced payment for tolls, and provide transaction success or failure details.</p> <p>The center shall support requests for traveler information and advanced payment for traveler services from commercial fleet operators.</p> <p>The center shall provide the capability to exchange information with another traveler information service provider current or predicted data for road links that are outside the area served by the local supplier.</p> <p>The center shall manage updates of digitized map data and provide updates to traveler interface systems upon request.</p> <p>The center shall provide the capability to support requests from the media for traffic and incident data.</p> <p>The center shall provide the capability for a system operator to control the type and update frequency of traveler information.</p>
Transit Management	Transit Center Fare Management	<p>The center shall manage the actual value of transit fares for each segment of each regular transit route, including the transmission of the information to transit vehicles and transit stops or stations.</p> <p>The center shall provide the capability for a system operator to manage the transit fares and control the exchange of transit fare information.</p> <p>The center shall process the financial requests from the transit vehicles or roadside and manage an interface to a Financial Institution.</p> <p>The center shall support the payment of transit fare transactions using data provided by the traveler cards / payment instruments.</p>

Functional Areas	Function (Equipment Package)	Requirements
		<p>The center shall collect data on fare payment violations and send the data, including images of the violator, to the appropriate enforcement agency.</p> <p>The center shall process requests for transit fares to be paid in advance.</p> <p>The center shall process requests for the advanced payment of tolls and parking lot charges as well as other non-transportation services, e.g. yellow-pages services.</p> <p>The center shall be capable of establishing emergency fare structures to override all other fares during disasters, states of emergency, or evacuations.</p> <p>The center shall maintain a list of invalid traveler credit identities or bad tag lists that can be forwarded to transit vehicles and transit stops or stations.</p> <p>The center shall collect fare statistics data to implement variable and flexible fare structures.</p> <p>The center shall exchange fare and load information with other transit management centers, including potential Centralized Payments facilities.</p> <p>The center shall provide transit fare information to other centers, including traveler information providers upon request.</p>
Transit Management	Transit Center Information Services	<p>The center shall provide travelers using public transportation with traffic and advisory information upon request. Such information may include transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.</p> <p>The center shall provide transit information to the media including details of deviations from schedule of regular transit services.</p> <p>The center shall exchange transit schedules, real-time arrival information, fare schedules, and general transit service information with other transit organizations to support transit traveler information systems.</p> <p>The center shall provide transit service information to traveler information service providers including routes, schedules, schedule adherence, and fare information as well as transit service information during evacuation.</p> <p>The center shall enable yellow pages (including non-motorized transportation) information to be output to the traveler.</p> <p>The center shall broadcast transit advisory data, including alerts and advisories pertaining to major emergencies, or man made</p>

Functional Areas	Function (Equipment Package)	Requirements
		disasters.
Traffic Management	TMC Regional Traffic Management	<p>The center shall exchange traffic information with other traffic management centers including incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.</p> <p>The center shall exchange traffic control information with other traffic management centers to support remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).</p>
Traffic Management	Traffic Information Dissemination	<p>The center shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.</p> <p>The center shall remotely control driver information systems that communicate directly from a center to the vehicle radio (such as Highway Advisory Radios) for dissemination of traffic and other information to drivers.</p> <p>The center shall collect operational status for the driver information systems equipment (DMS, HAR, etc.).</p> <p>The center shall collect fault data for the driver information systems equipment (DMS, HAR, etc.) for repair.</p> <p>The center shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions (lane/shoulder use, weight restrictions, width restrictions, HOV requirements), and the definition of the road network itself.</p> <p>The center shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.</p> <p>The center shall distribute traffic data to the media; the capability to provide the information in both data stream and graphical display shall be supported.</p> <p>The center shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.</p>

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 cross-county services market packages are provided in **Figures 1** through **11**.

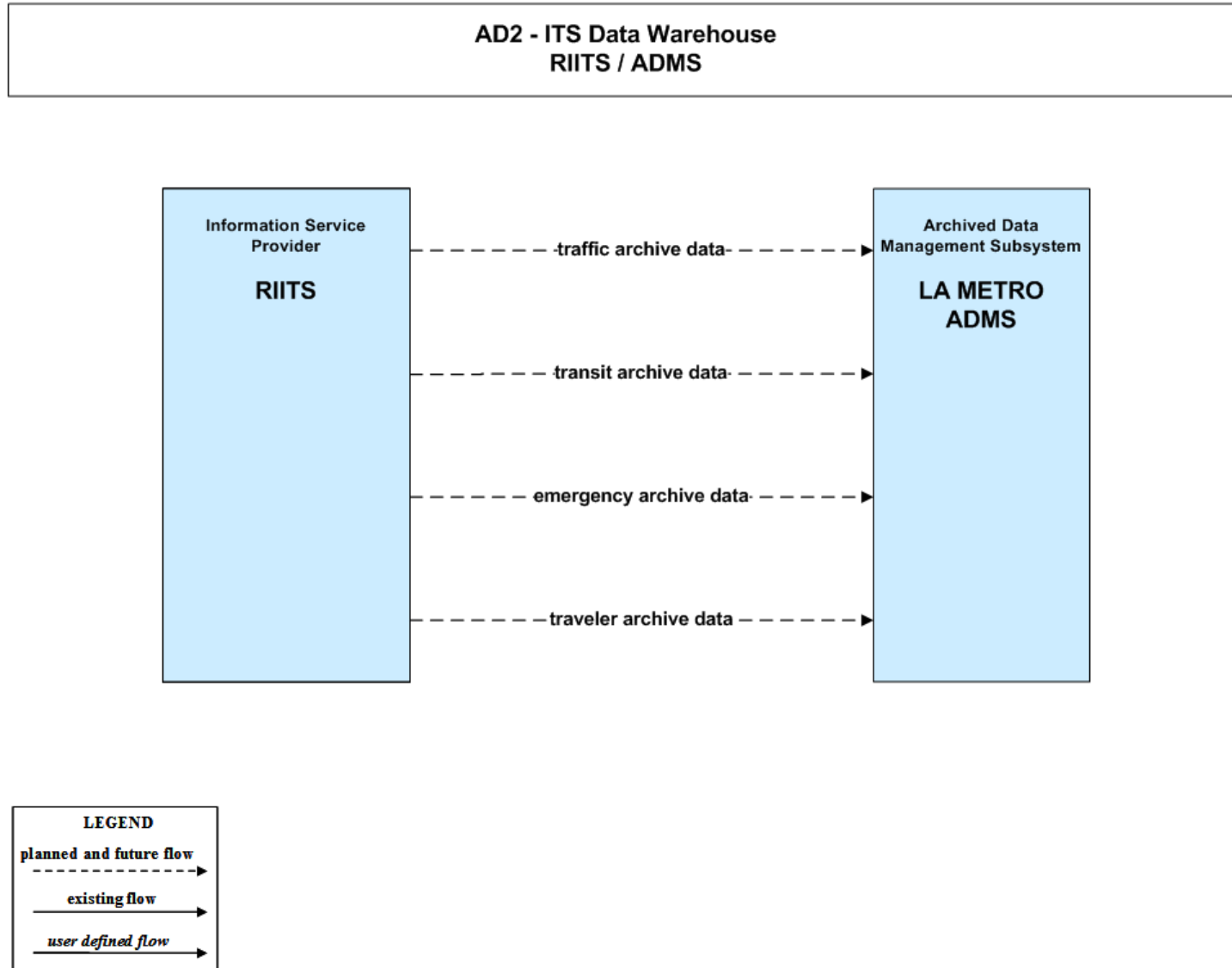


Figure 1 – RIITS/ADMS Data Warehouse

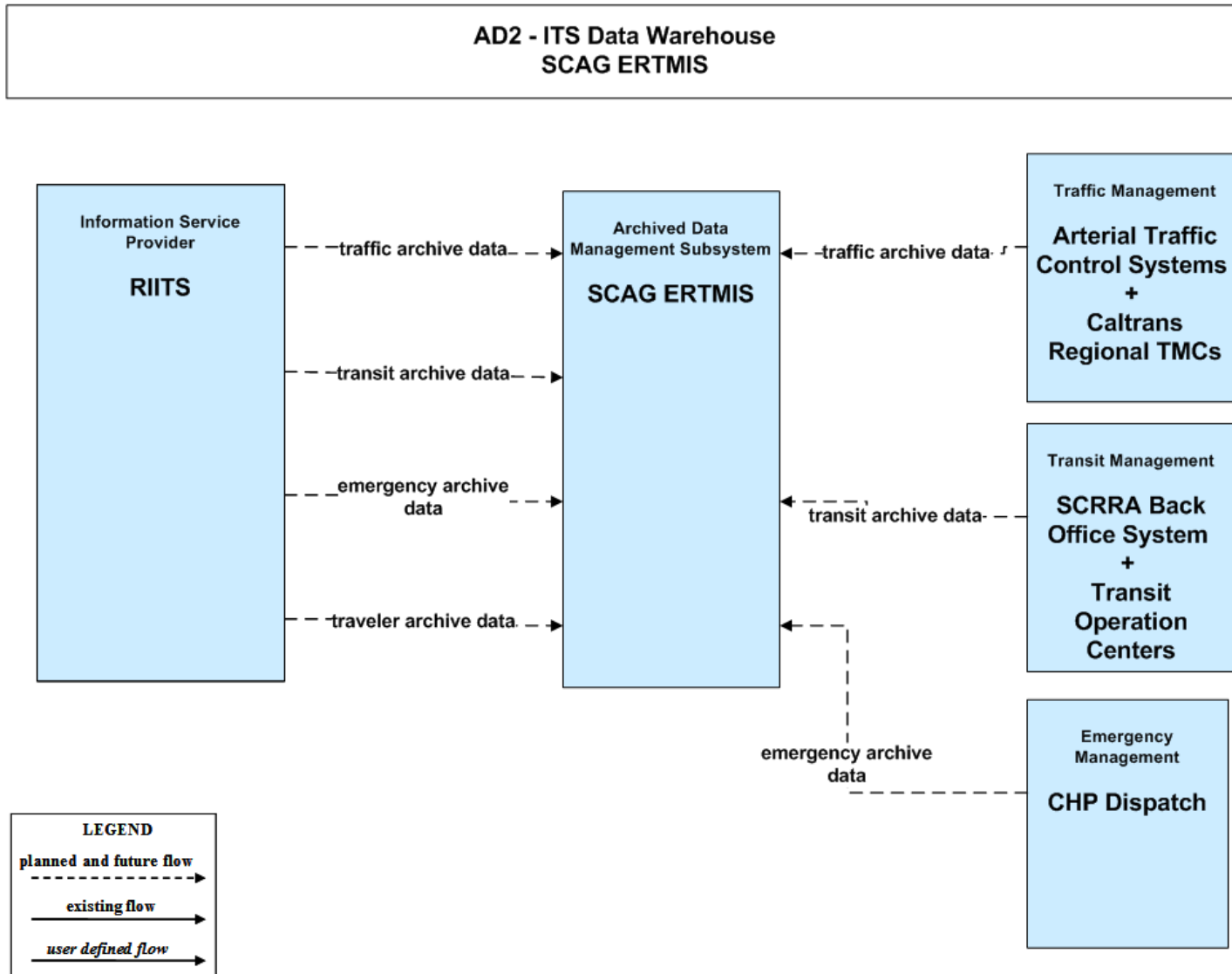


Figure 2 – SCAG ERTMIS Data Warehouse

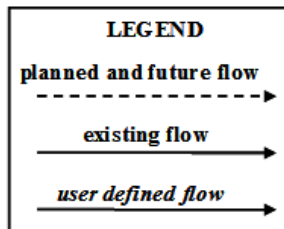
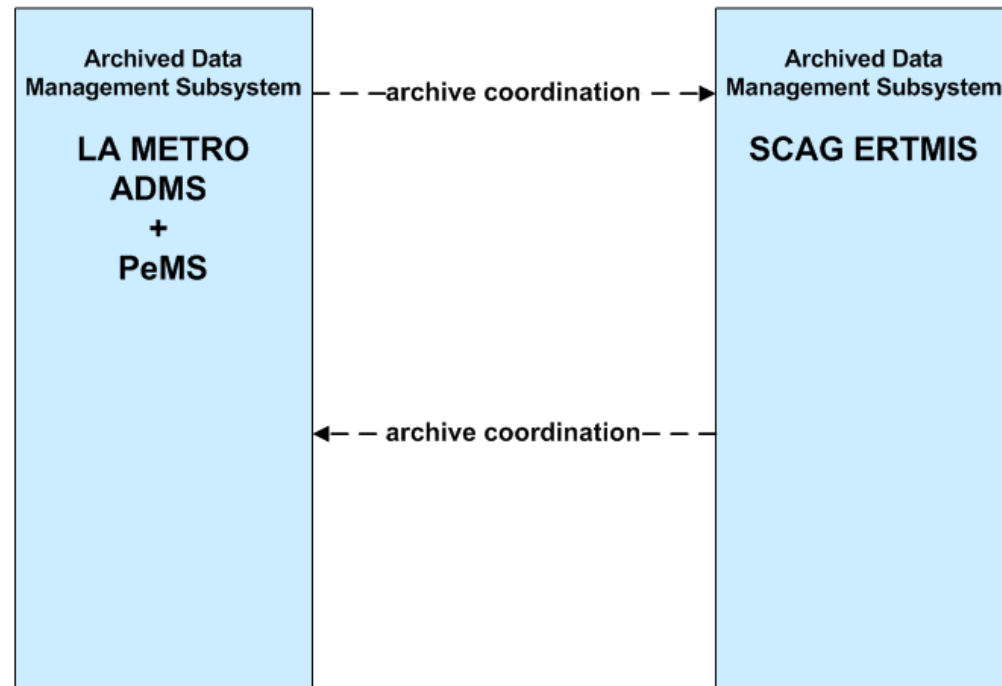


Figure 3 – Data Warehouse Coordination

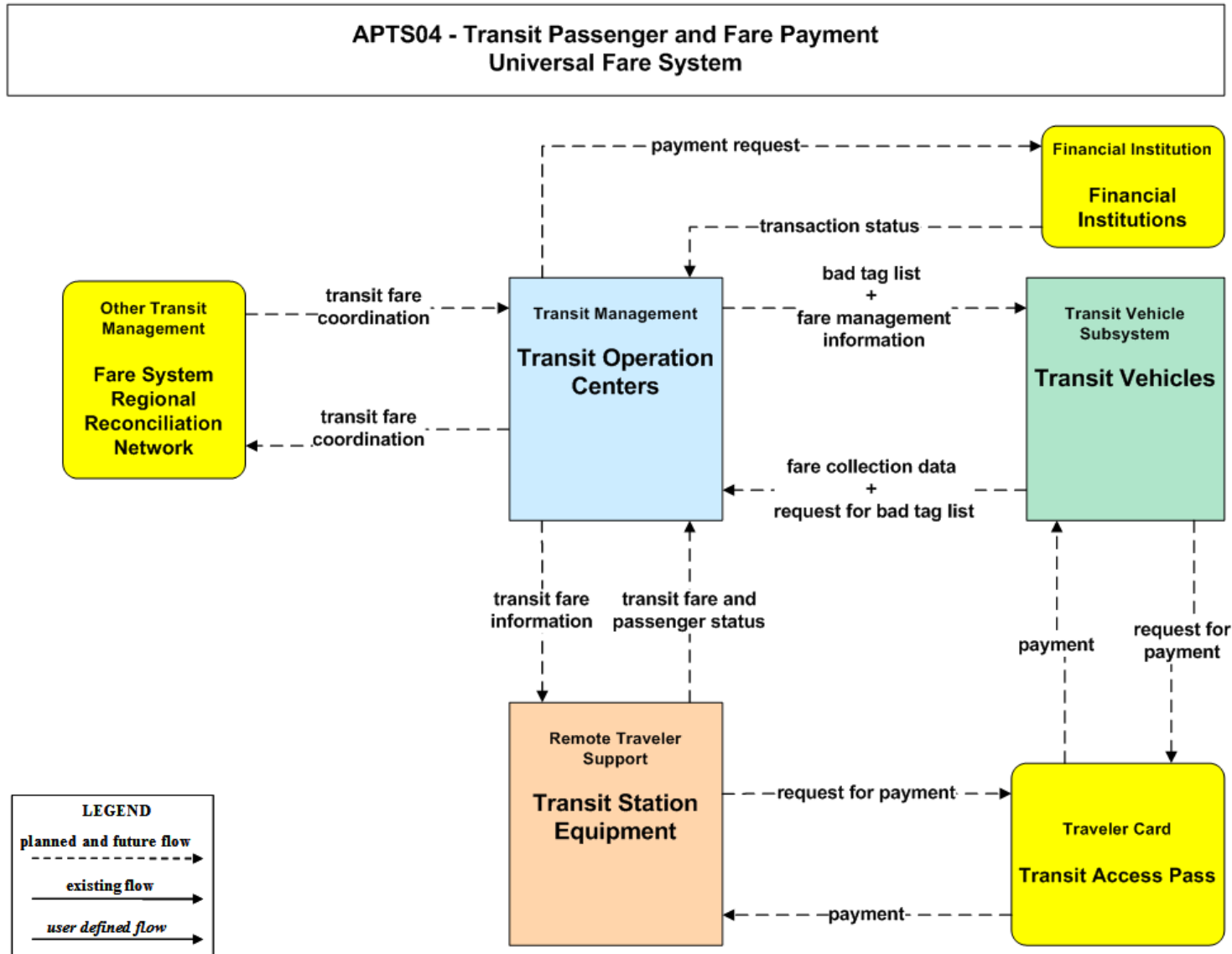


Figure 4 – Universal Fare System

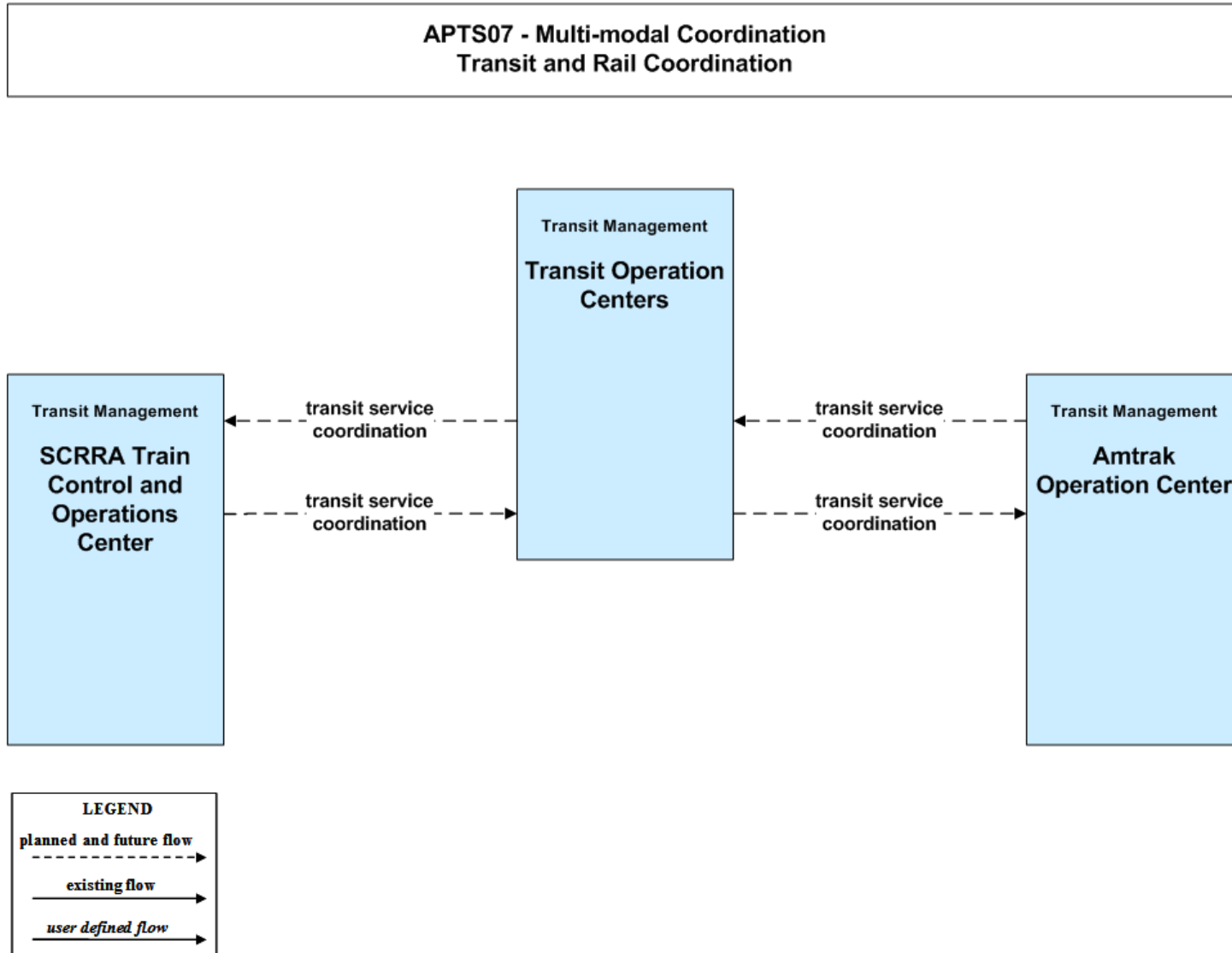


Figure 5 – Transit and Rail Coordination

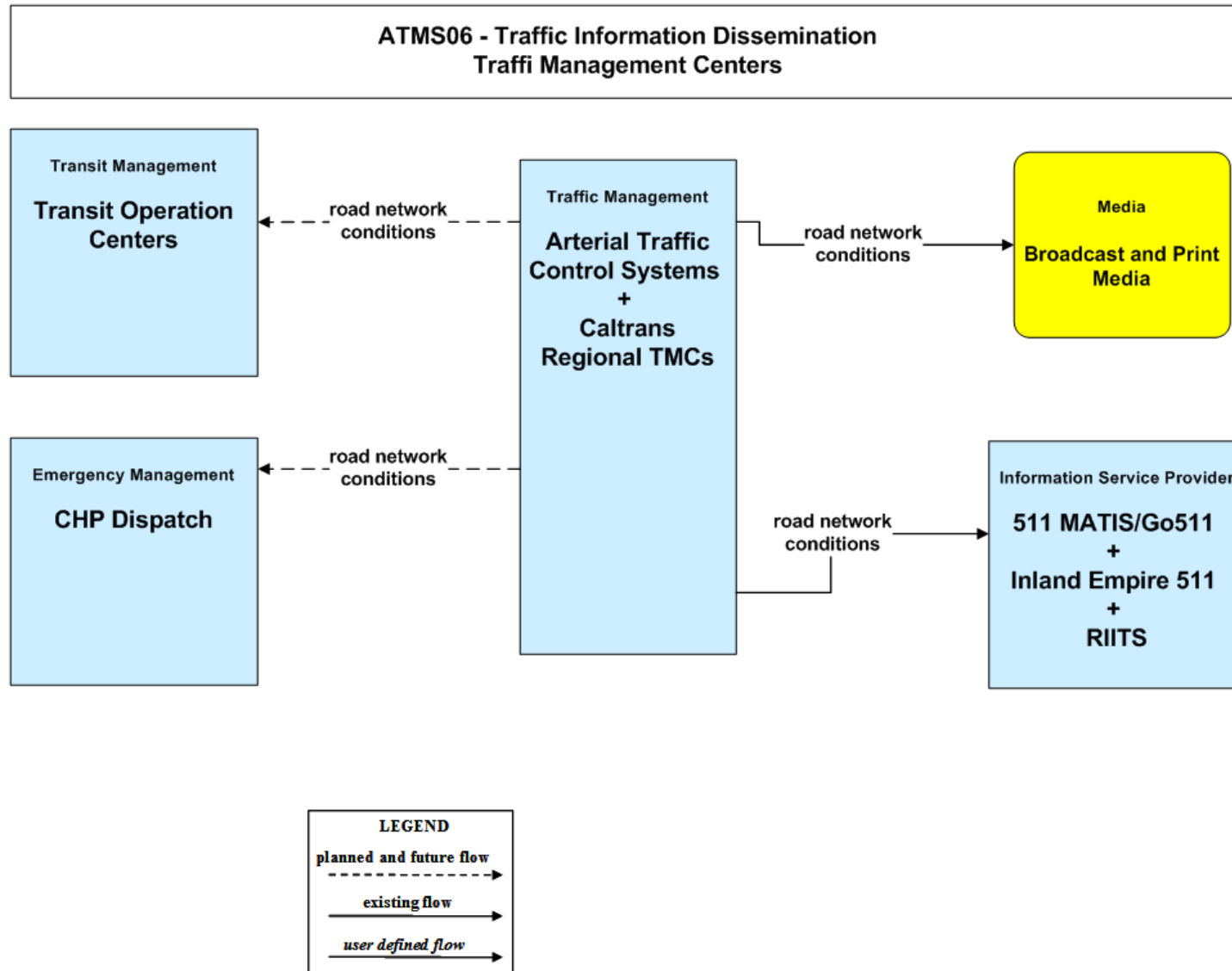


Figure 6 – Traffic Information Dissemination

**ATMS07 - Regional Traffic Management
Traffic Management Center and EMC Communications**

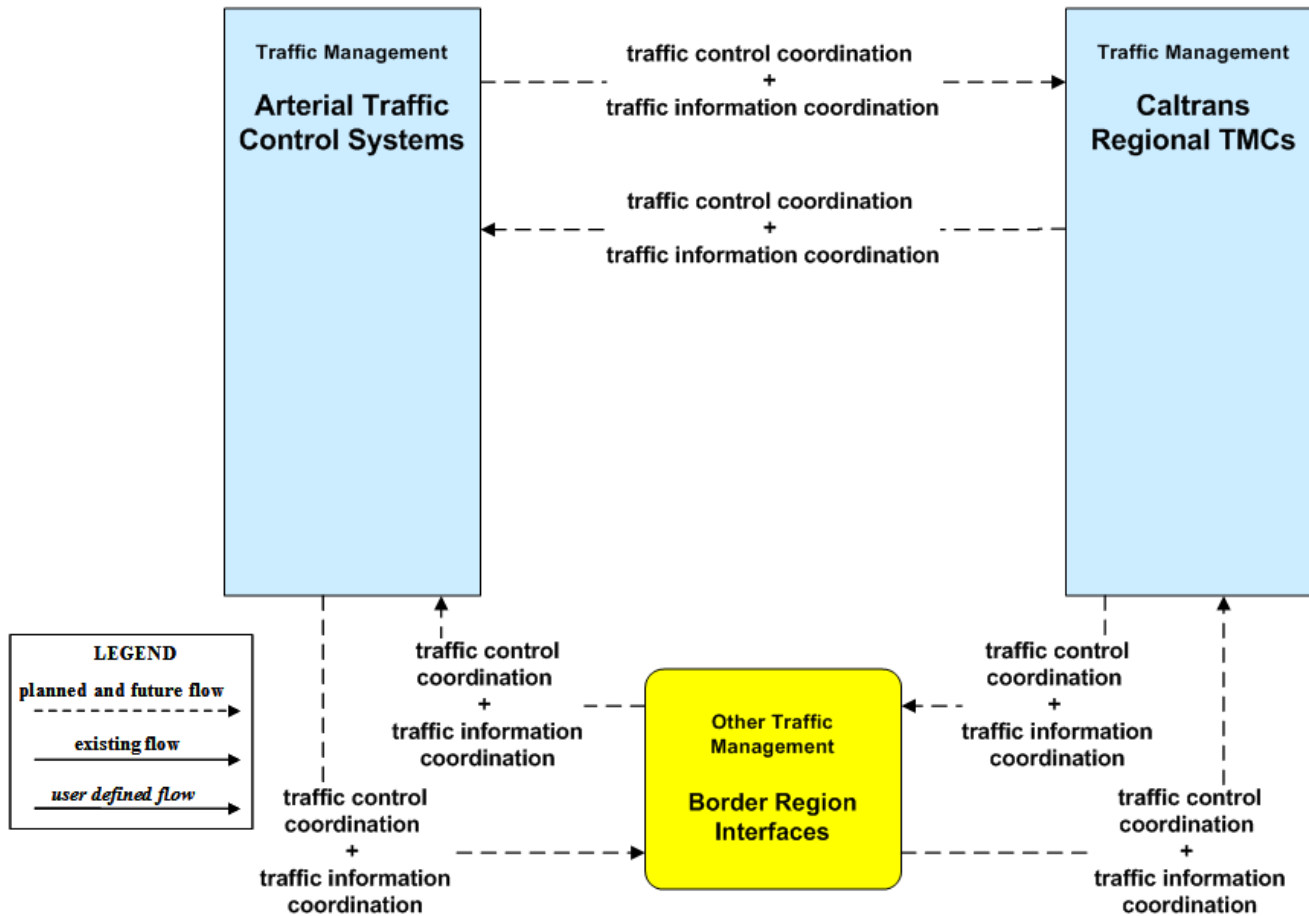


Figure 7 – TMC and EMC Communications

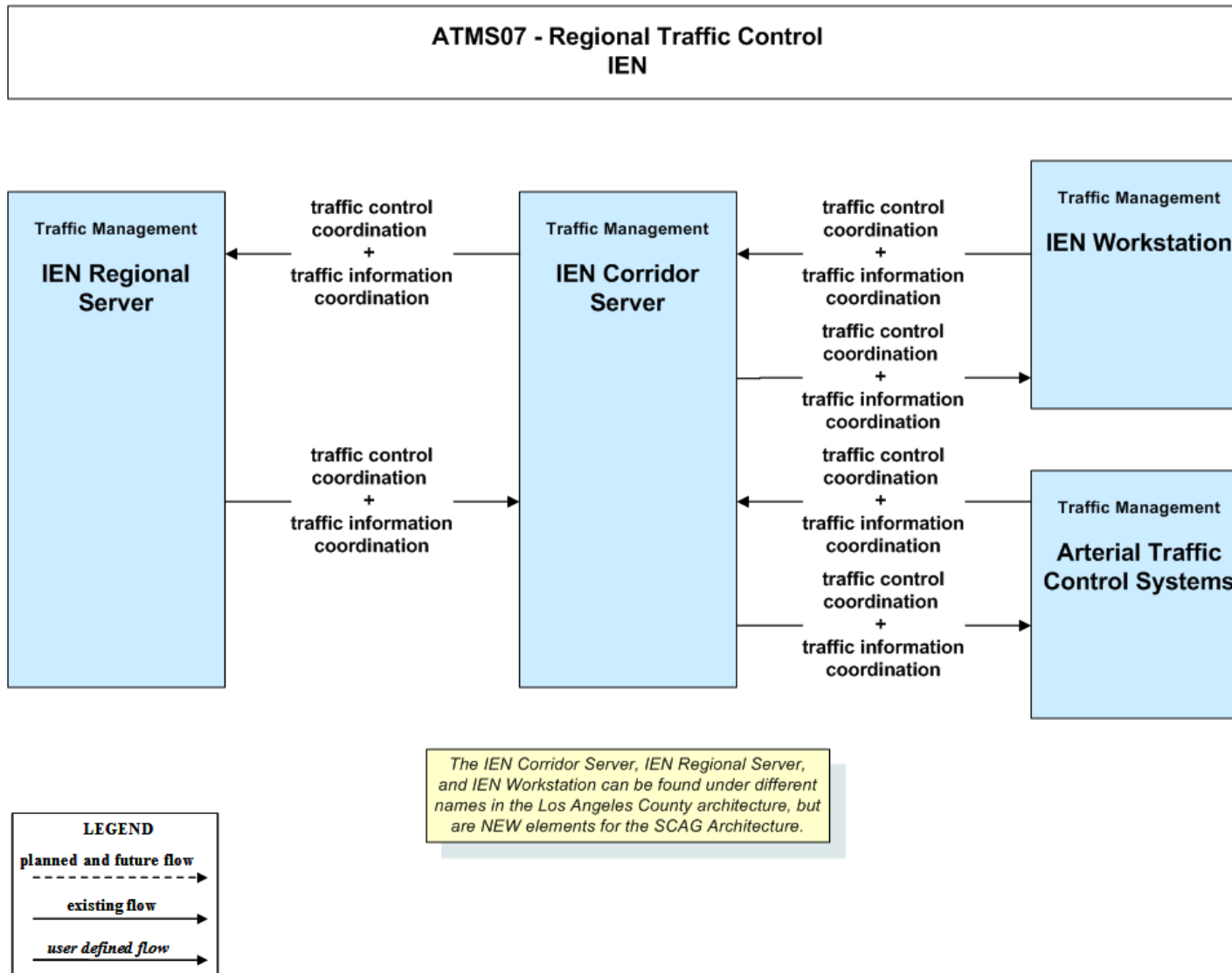


Figure 8 – Regional Traffic Control, IEN

**ATMS08 – Traffic Incident Management System
Arterial Traffic Control Systems**

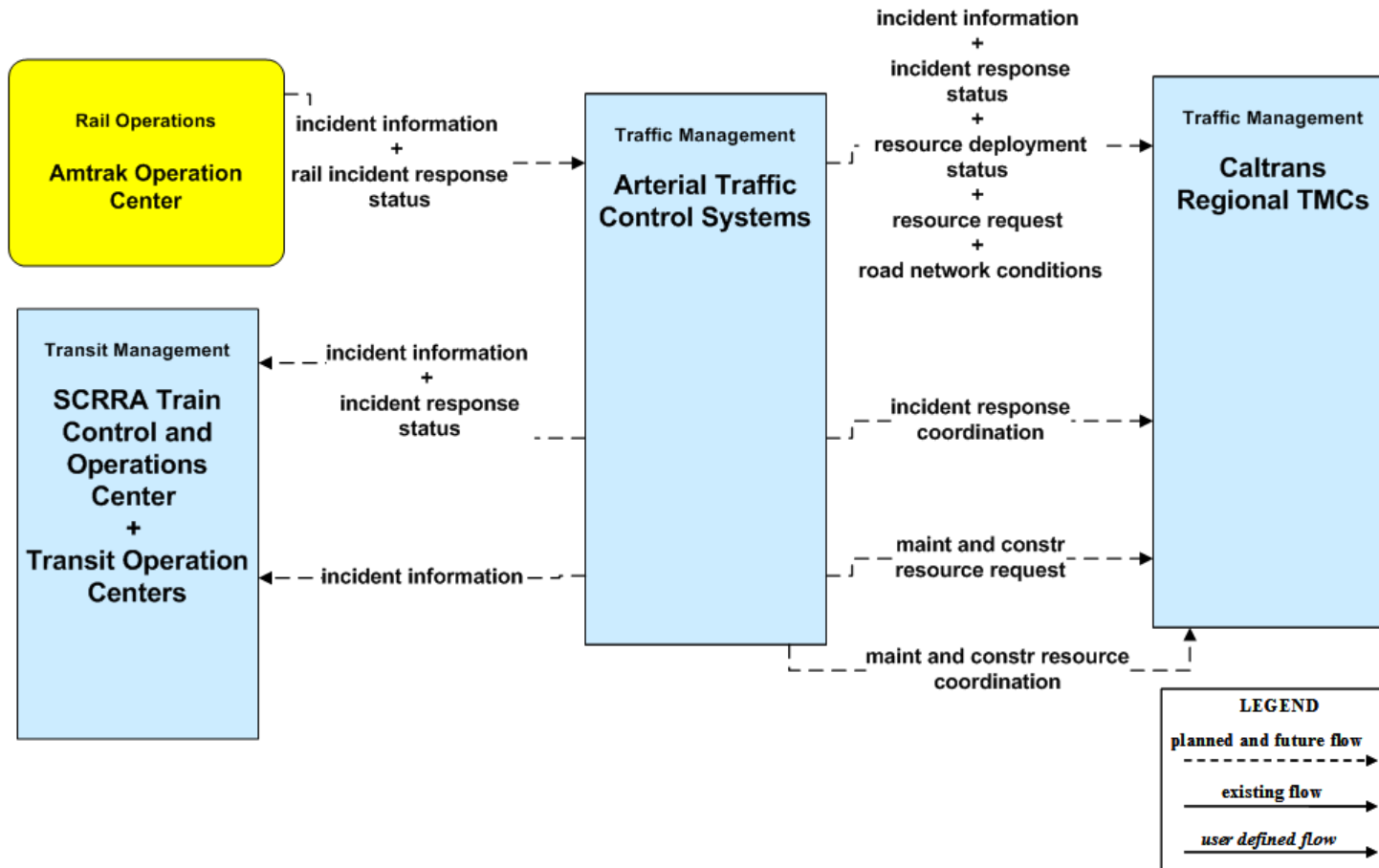


Figure 9 – Traffic Incident Management Systems, Arterial TMCs

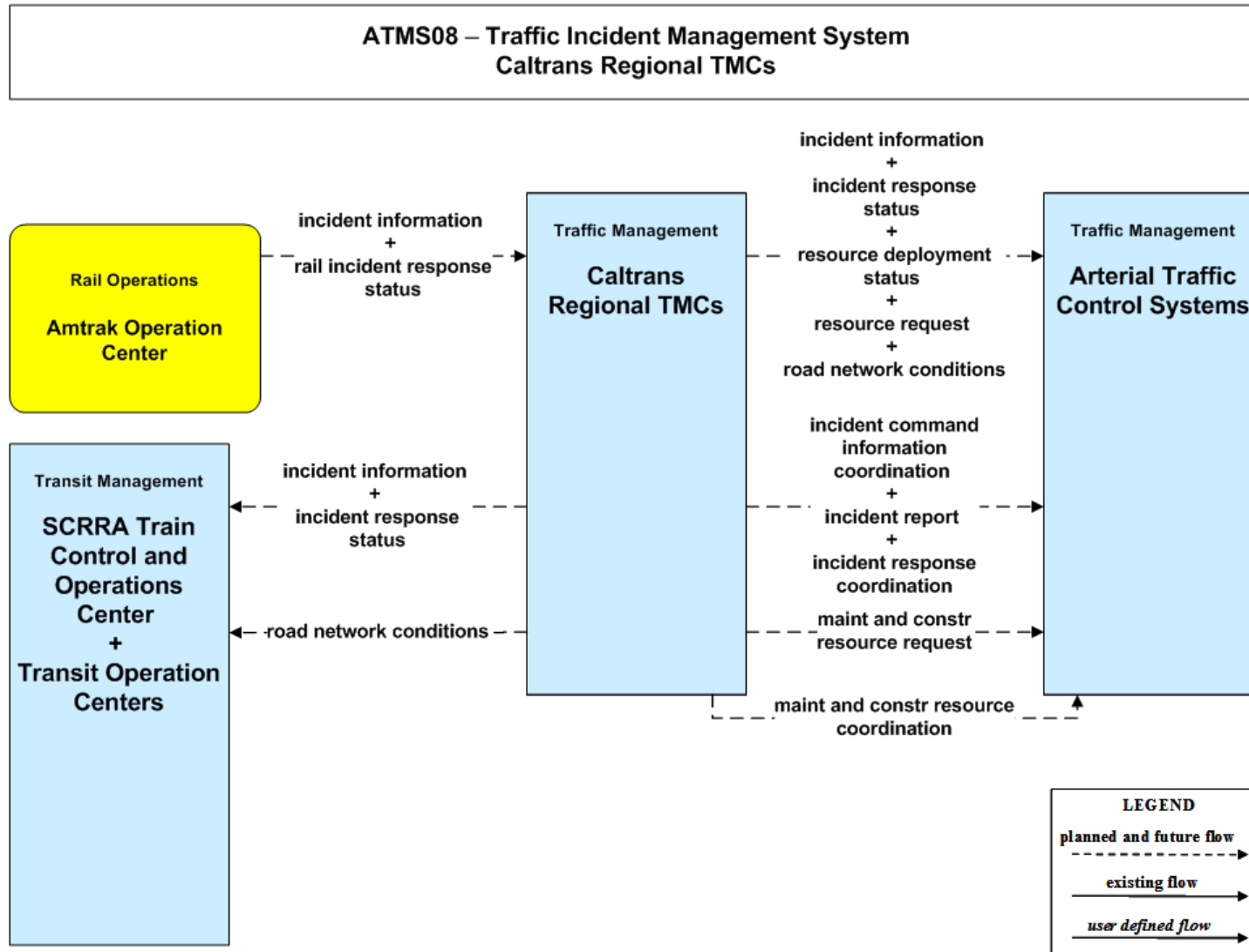


Figure 10 – Traffic Incident Management Systems, Caltrans TMCs

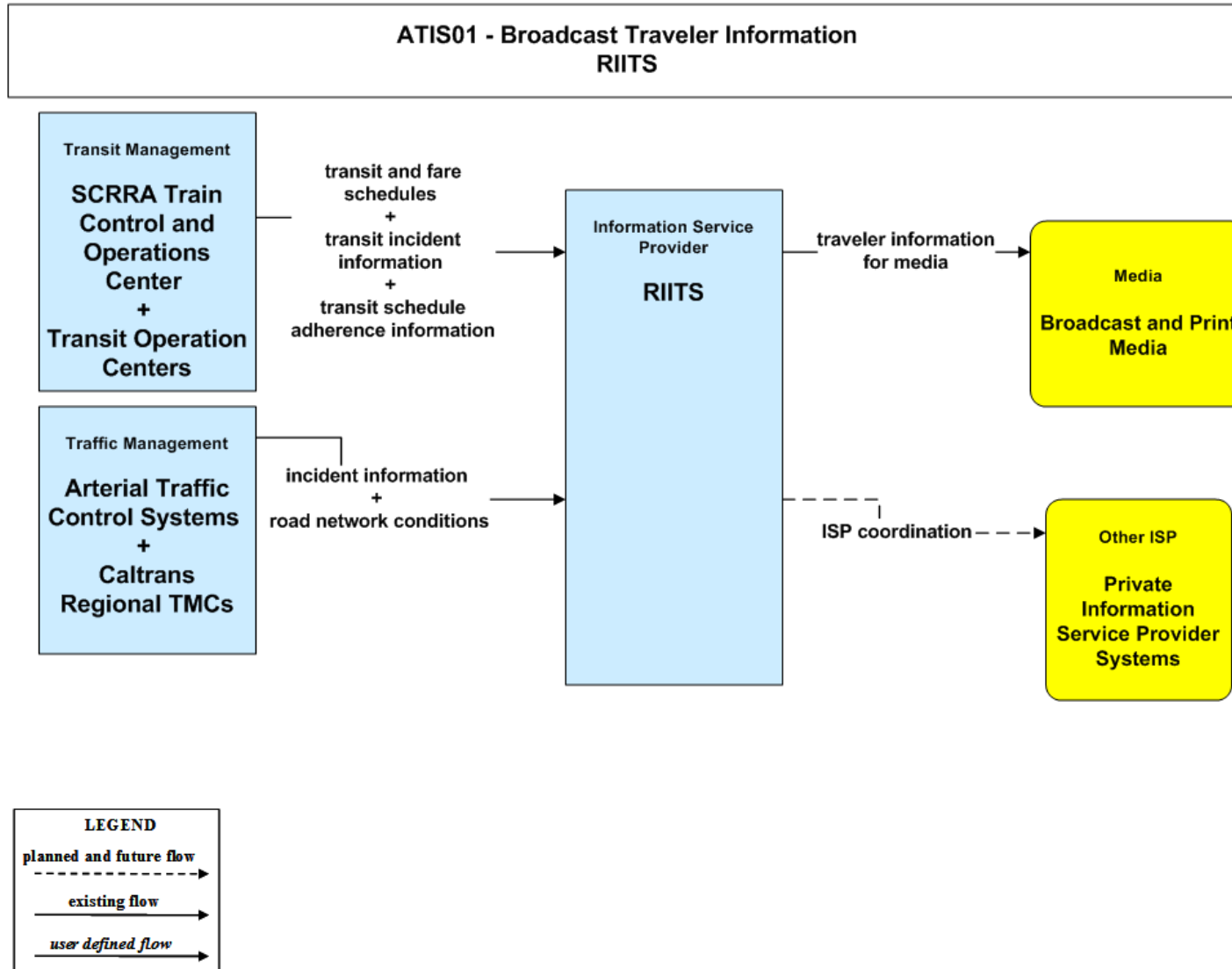


Figure 11 – Broadcast Traveler Information, RIITS

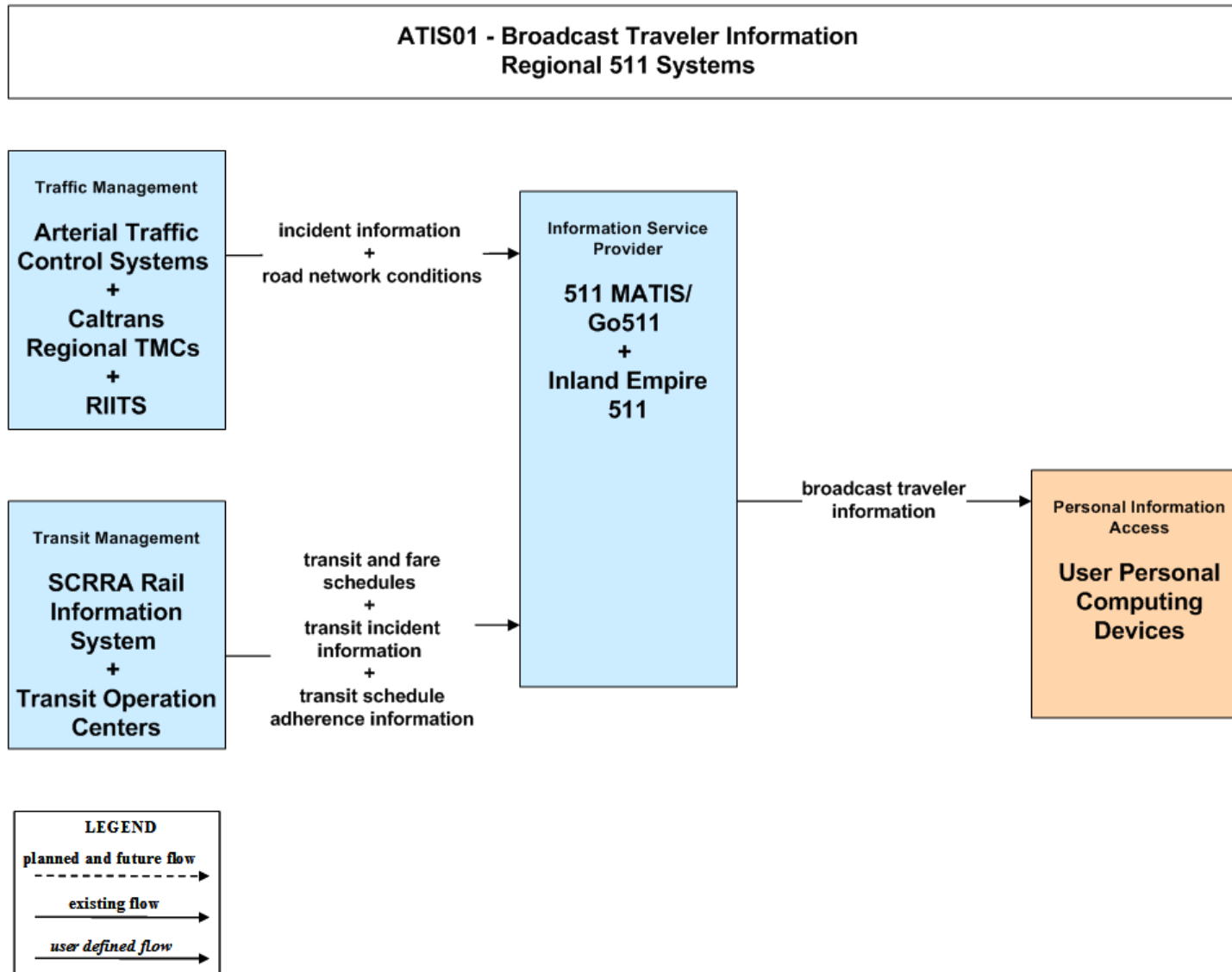


Figure 12 – Broadcast Traveler Information, 511 Systems

**ATIS02 - Interactive Traveler Information
Regional 511 Systems**

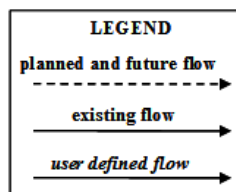
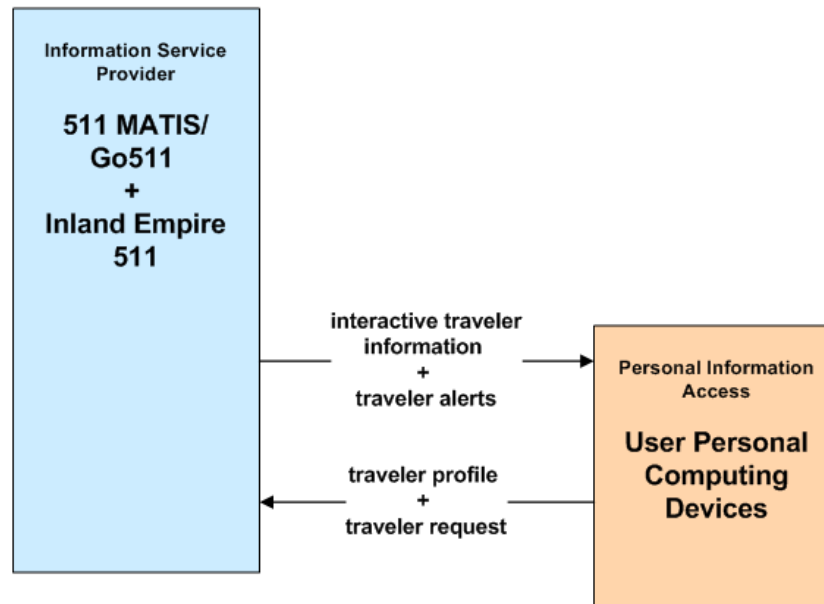


Figure 13 – Interactive Traveler Information, 511 Systems

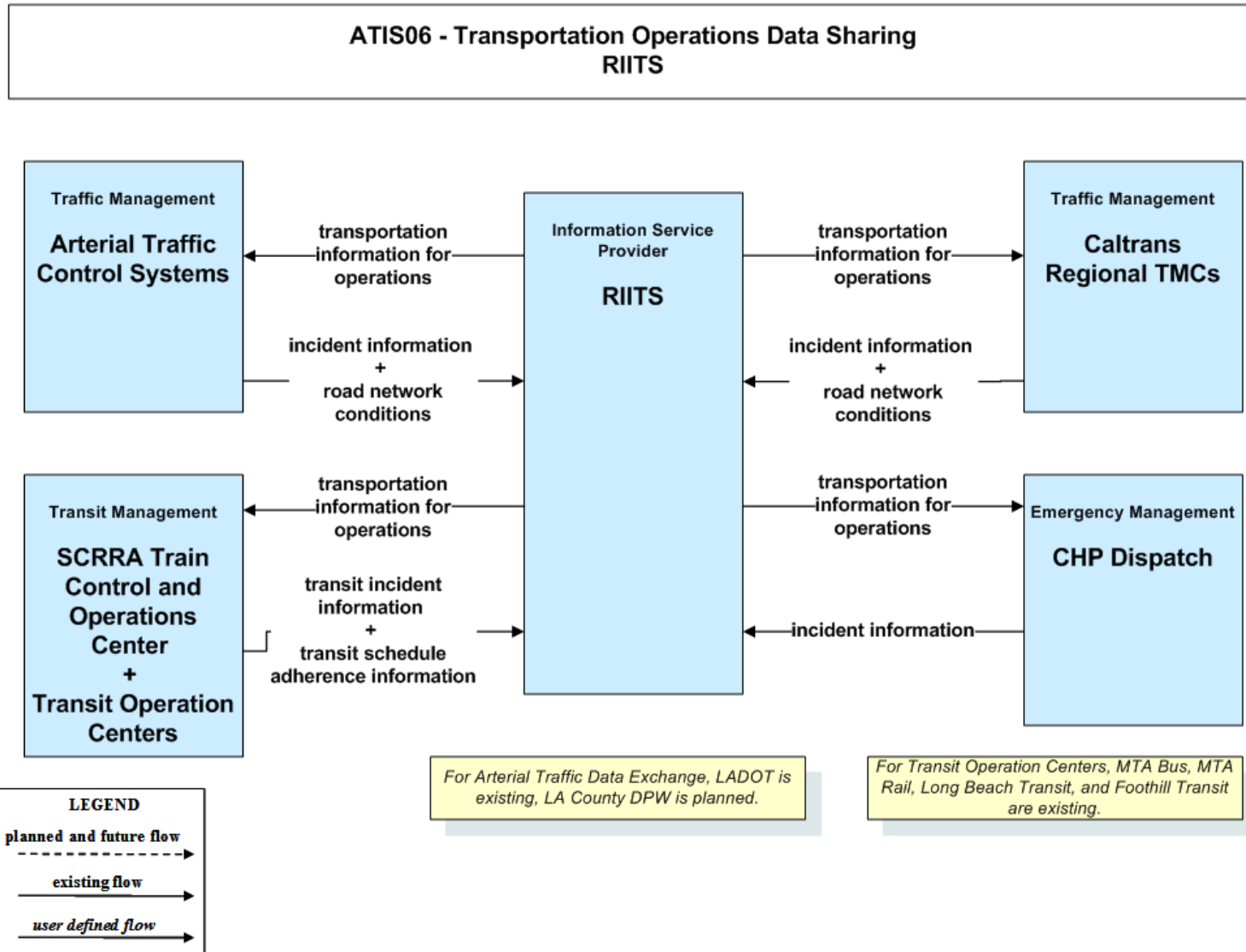


Figure 14 – Transportation Operations Data Sharing