Southern California Regional Intelligent Transportation Systems (ITS) Architecture Update

FINAL

Architecture Update

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LIST OF ACRONYMS

Acronyms	Description
ACTA	Alameda Corridor Transportation Authority
ARC-IT	Architecture Reference for Cooperative and Intelligent Transportation
BNSF	Burlington Northern Santa Fe
Caltrans	California Department of Transportation
CAHSR	California High Speed Rail
CAHSRA	California High Speed Rail Authority
CMS	Changeable Message Signs
CCTV	Closed-Circuit Television Cameras
C/AV	Connected /Autonomous Vehicle
CVRIA	Connected Vehicle Reference Implementation Architecture
DSRC	Dedicated Short Range Communications
ESS	Environmental Sensor Stations
FHWA	Federal Highway Administration
FRATIS	Freight Advanced Traveler Information System
FTA	Federal Transit Administration
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
HSR	High Speed Rail
IEOC	Inland Empire/Orange County
ITS	Intelligent Transportation Systems
ICTF	Intermodal Container Transfer Facility
LRT	Light Rail Transit
LB	Long Beach
LA	Los Angeles
LAX	Los Angeles International Airport
LA SAFE	Los Angeles Service Authority for Freeway Emergency
LATC	Los Angeles Transportation Center
MPO	Metropolitan Planning Organization
MVDS	Microwave Vehicle Detection Station
OCTA	Orange County Transportation Authority
PTC	Positive Train Control
RAD-IT	Regional Architecture Development for Intelligent Transportation
RIITS	Regional Integration of Intelligent Transportation Systems
RTP	Regional Transportation Plan
RCTC	Riverside County Transportation Commission
RSE	Roadside Equipment
SCAG	Southern California Associate of Governments

Acronyms	Description
SCRRA	Southern California Regional Rail Authority
TEA-21	Transportation Equity Act for the 21st Century
TMC	Transportation Management Center
UP	Union Pacific
US DOT	United Stated Department of Transportation
U.S.	United States
UZA	Urbanized Area

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1. INTRODUCTION

1.1. BACKGROUND

The Southern California Regional Intelligent Transportation Systems (ITS) Architecture is a planning framework for ensuring that ITS and technologies for managing transportation systems are deployed in a coordinated fashion. As the federally designated Metropolitan Planning Organization (MPO), the Southern California Association of Governments (SCAG) has developed the Regional ITS Architecture to address ITS projects and deployments that require connectivity and information exchange across the six-county SCAG region. The ITS architecture promotes coordination and cooperation among stakeholders and is also a resource for ITS project development, procurement, and delivery.

The Regional ITS Architecture was developed by SCAG in 2005 and has been updated twice. The 2008 update incorporated security elements and the 2011 update addressed topics such as express lanes, positive train control (PTC), non-motorized transportation technologies, and new cross-county services. Since 2011, there have been many ITS project deployments and technology testbeds, which have created the impetus to convene regional stakeholders to update the ITS architecture for Southern California:

- The **National ITS Architecture** is currently version 8.1; the 2011 update is based on version 6.1. The National ITS Architecture and the Connected Vehicle Reference Implementation Architecture (CVRIA) are now an integrated framework called the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT).
- **High Occupancy Toll (HOT)/Express Lanes** were addressed in the 2011 update to reflect the implementation of the I-110 and I-10 Express Lanes projects. Today, there are several express lanes projects underway across Southern California that will eventually form a Regional Express Lane Network.
- **Connected /Autonomous Vehicle (C/AV)** research and development is advancing rapidly. County and local agencies in the region are starting to deploy CV technologies featuring Digital Short-Range Communications (DSRC) for transit priority and arterial traffic management. The Regional ITS Architecture reflects CV applications based on ARC-IT.
- **Goods Movement** was addressed in the 2011 update that identified a number of ITS technologies related to port scheduling, vehicle credentialing, and traveler information services. Since then, efforts to coordinate and optimize terminal, freight rail, and commercial vehicle operations are underway with the development of the Freight Advanced Traveler Information System (FRATIS).
- **Non-Motorized Transportation** was addressed in the 2011 update, which resulted in custom service packages that depicted information flows between standard arterial control systems and roadside equipment (RSE) for bicycle and pedestrian detection. Those technologies are now implemented in pilot projects in the region via CV safety applications using Dedicated Short Range Communications (DSRC) to detect and provide priority to pedestrians on a mobile device.
- **Regional Traveler Information** is undergoing upgrades with the development of the NextGen 511 system. NextGen 511 features new web and mobile technologies to disseminate multi-modal traveler information to the public through a variety of platforms and services that extend to the smartphone user. Crowdsourced data and mobile apps were not yet relevant in 2011 but are included in this update.
- **Big Data** was a concept that was touched upon in the 2011 update that focused on data exchange and data archiving services in the region. The modernization of the Regional Integration of Intelligent Transportation Systems (RIITS) Network, which will feature new interfaces with agency and crowdsourced data providers, as well as, a platform to conduct data analytics for regional

performance reporting and corridor management applications, is revised in this updated architecture.

The purpose of the Regional ITS Architecture (RITSA) Update is to address these developments and provide opportunities for stakeholders to update their ITS inventories and learn about how to use the ITS architecture as a planning and project development tool.

1.2. PROJECT OVERVIEW

The SCAG RITSA Update began with extensive stakeholder outreach, informing the many agencies throughout the SCAG region of the architecture update and collecting each agencies' input on the projects, goals, and objectives to be included in the RITSA. A core Advisory Committee consisting of Metro, Imperial County Transportation Commission (ICTC), Riverside County Transportation Commission (RCTC), Ventura County Transportation Commission (VCTC), Orange County Transportation Authority (OCTA), San Bernardino County Transportation Authority (SBCTA), Caltrans, Los Angeles County Department of Public Works, Federal Highway Administration (FHWA)/Federal Transit Administration (FTA), representatives from local agencies, the Ports, and SCAG was convened to lead the update effort.

The scope of the RITSA Update includes revisions to stakeholders, operational concepts, ITS elements, ITS services, ITS projects, and institutional agreements for cross county systems. These revisions were informed by reviewing the regulatory framework of regional ITS architectures, existing ITS architectures in the region, existing agreements between stakeholders, and an inventory of existing ITS elements. Then, the project team worked with the Advisory Committee to develop a description of the region's transportation system and define the roles and responsibilities of the stakeholders. The Advisory Committee also helped refine the ITS needs and goals of the region, which led to the identification of missing programs, services, requirements, stakeholders, or standards needed to create a complete regional ITS program. The horizon year for this update spans 10 years, as consistent with the 2017, 2019, and 2021 Federal Transportation Improvement Program (FTIP) timelines.

Following the development and acceptance of the SCAG RITSA update, the regional stakeholders will follow the Intercounty RITSA Maintenance Plan developed as a part of this project. The project team has developed an architecture maintenance guide that helps stakeholders continually use the architecture content and keep it up-to-date. The project team has developed key performance indicators (KPIs) to monitor the use and performance of the RITSA. These metrics will provide SCAG with information on the use and effectiveness of the architecture in the region, and help SCAG determine value of the architecture to the agencies in the region.

1.3. PURPOSE OF THE ARCHITECTURE DOCUMENT

The Architecture Document presents a comprehensive plan for planning and deploying technology for managing and operating the transportation system in the SCAG region. This document will provide guidance to stakeholders on the planning and development of cross-county ITS projects in the region for the next 10 years.

This document explains how ITS activities in the SCAG region are organized, coordinated, and integrated. The document covers the following aspects of the architecture:

- Institutional – The document describes who the stakeholders are, their roles and responsibilities, and operational concepts and ITS services that the technology enables.

- Technological – Using the architecture database tool, the document describes the ITS elements and how they operate, the communication connections between the systems, the interfaces between each element, ITS standards, and the data flows between systems.
- Policy – The document supports regional initiatives and plans such as the long-range transportation plan (LRTP) and the regional transportation plan (RTP).

This document provides guidance to project sponsors throughout the ITS project lifecycle, including systems engineering, design, and implementation. As stakeholders use and maintain the architecture, the architecture helps them anticipate future projects, services, and technologies. The architecture also assists in leveraging the region for competitive project funding opportunities, as it provides documentation that the region's stakeholders have the institutional and technological infrastructure ready to design and implement the funded project. This architecture update brings the region into compliance with FHWA Final Rule 23 CFR § 940 that requires projects to conform to the current National ITS Architecture and applicable standards through a regional ITS architecture.

1.4. Report Overview

The Report consists of the following sections:

- Section 1 – Introduction;
- Section 2 – Regional Description;
- Section 3 – Regional Needs;
- Section 4 – Operational Concepts;
- Section 5 – Operational Agreements;
- Section 6 – Functional Requirements;
- Section 7 – Standards;
- Section 8 – Integration of ITS into Transportation Planning Process;
- Section 9 – Architecture Maintenance and Training

2. SCAG REGION

The SCAG Region encompasses six counties: Los Angeles (LA), Orange, Ventura, Imperial, Riverside, and San Bernardino (**Figure 1**) and 191 cities within those counties. SCAG, as the region's MPO, produces plans and programs for the SCAG Region. It is the largest MPO in the United States (U.S.).

In addition to the MPO roles and responsibilities, SCAG is responsible for transportation priorities for the southern California region through the development of Regional Transportation Plan (RTP). RTPs integrate information captured through the regional ITS architecture process to maximize transportation systems in the region.

The SCAG Region is 38,000 square miles; bordering two states (Nevada and Arizona), one country (Mexico), and an ocean (Pacific). It is one of the top 20 largest economies in the world. The region also has extensive transportation infrastructure that includes miles of freeways, seaports, air, rail, and other supporting transportation systems.

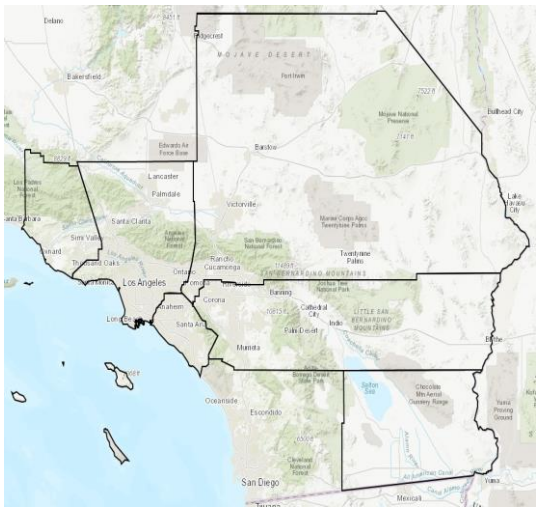

Figure 1 - SCAG County Boundaries

(http://maps.scag.ca.gov/offices/index.html)

2.1. TRANSPORTATION NETWORK

2.1.1. FREEWAYS

The SCAG Region includes freeway, non-carpool lanes, express lanes, high occupancy vehicle (HOV) lanes, and high occupancy toll (HOT) lanes, as well as arterial lane miles. The infrastructure deployed along the freeway, in general, includes:

- Microwave vehicle detection stations (MVDS);
- Closed-circuit television (CCTV) cameras;
- Changeable message signs (CMS);
- Ramp meters; and
- Environmental sensor stations (ESS).

The field infrastructure is connected and links back to the transportation management center (TMC) specific for each of the California Department of Transportation (Caltrans) districts 7, 8, 11, and 12.

The SCAG Region also has several HOT or express lanes that are priced to reflect demand. The existing express lanes network includes the SR-91 Express Lanes in Orange County that are operated by Orange County Transportation Authority (OCTA) and Riverside County Transportation Commission (RCTC) and the I-10 Express Lanes and I-110 Express Lanes in LA County that are operated by LA County Metropolitan Transportation Authority (Metro). Additional express lanes are planned for construction and deployment on freeways throughout the region. SCAG's 2016 Regional Transportation Plan/Sustainable Communities

Strategy (2016 RTP/SCS) includes the proposed Regional Express Lanes Network, which connects express lanes facilities into a regional system.

2.1.2. PUBLIC TRANSIT

The public transit system within the SCAG Region includes fixed route local buses, community circulators, express buses, bus rapid transit (BRT), demand response, heavy rail, and urban light rail transit (LRT). With 68 fixed route transit operators and over 100 providers of specialized transit services such as dial-a-rides, ferries, community circulators, and paratransit, the SCAG Region's combined transit network provides the second largest number of service hours in the country, after that of the New York City metropolitan area.

Within each county, several large transit operators provide the majority of transit services for the region, supplemented by smaller specialized and local operators. In Imperial County, Imperial Valley Transit, a service brand of the Imperial County Transportation Commission (ICTC), operates the majority of fixed route bus service. In LA County, Metro operates heavy rail, LRT, BRT, and fixed route services and provides the bulk of transit trips in the SCAG Region. In addition, municipal operators in LA County provide short-distance fixed route services within smaller areas than Metro. Some municipal operators like Foothill Transit, which serves the San Gabriel Valley, cover larger areas and some operators like Beach Cities or Culver City Transit cover small service areas. In Orange County, OCTA operates fixed route bus transit and paratransit. In Riverside County, Riverside Transit Agency (RTA) and SunLine Transit operate fixed route bus service. In San Bernardino County, Omnitrans and the Victor Valley Transit Authority provide fixed route bus service. In Ventura County, Gold Coast Transit operates the largest fixed route bus service.

In addition, several transit agencies provide interregional services crossing the boundaries of the SCAG Region. These agencies include: VISTA, The Eastern Sierra Transit Authority, RTA, Metrolink, Yuma County Intergovernmental Public Transportation Authority, Chemehuevi Indian Tribe, North County Transit District, Kern Transit, and Santa Barbara's Metropolitan Transit District.

2.1.3. INTERCITY BUS

According to FTA section 5311(f), Intercity bus service is defined as regularly scheduled bus service for the general public which operates with limited stops over fixed routes connecting two or more urban areas not in close proximity, has the capacity to carry passenger baggage, and makes meaningful connections with scheduled intercity bus service to points outside the service area.

Intercity bus service providers in the SCAG Region area include Amtrak, Megabus, Bolt Bus, Greyhound, Intercalifornias, Tres Estrellas de Oro, and Flixbus.

2.1.4. PASSENGER RAIL

Intercounty passenger rail in the SCAG Region consists of intercity rail, commuter rail, and the future California High Speed Rail.

Intercity rail in the U.S. involves Amtrak services that operate passenger trips that are longer than traditional commuter rail. The trips are interregional and interstate in nature. Amtrak operates six lines in the region, Pacific Surfliner, Coast Starlight, San Joaquin, Southwest Chief, Sunset Limited, and Texas Eagle passenger rail lines.

Commuter rail in the region is operated by Southern California Regional Rail Authority (SCRRA), which transports passengers within urbanized areas (UZAs) or between UZAs and outlying areas. Metrolink is the brand name of SCRRA. There are seven Metrolink lines, including:

- Antelope Valley Line – Los Angeles to Palmdale and Lancaster in Antelope Valley
- Inland Empire/Orange County Line (IEOC) – San Bernardino and Riverside to Oceanside
- Riverside Line – Los Angeles to Riverside
- San Bernardino Line – Los Angeles to San Bernardino
- Ventura County Line – Los Angeles and East Ventura
- 91 Line – Los Angeles to South Perris via downtown Riverside and Fullerton along the SR-91 corridor

The Orange County Line connects to the COASTER commuter rail service in San Diego and the SPRINTER rail service to Escondido at its last stop in Oceanside in San Diego County.

The California High Speed Rail is a voter-approved high-speed rail service connecting the State's major metropolitan areas. When completed, the sections that will serve the SCAG Region are Bakersfield to Palmdale, Palmdale to Burbank, Burbank to Los Angeles, Los Angeles to Anaheim, and Los Angeles to San Diego.

2.1.5. FREIGHT RAIL

Freight rail is an integral component of the Southern California region's goods movement system. In 2015, California accounted for $400 billion of U.S. imports, about eighteen percent (18%) of the national total.[1] International trade in the U.S. depends heavily on the transportation network in the SCAG Region; the region is the largest international trade gateway in the U.S., supporting imports and exports through the Ports of LA and Long Beach (LB), border crossings with Mexico, and several airports. The Ports of LA and LB are where 50% of the nation's containerized cargo enter, but 77% of that cargo is distributed outside of Southern California, requiring extensive freight infrastructure.

Class I freight rail in Southern California is operated by Burlington Northern Santa Fe (BNSF) railways and Union Pacific (UP) railways. Class III railroads include the Pacific Harbor Line, Inc., Ventura County Railway, and the Los Angeles Junction Railway. BNSF and UP both operate on the Alameda Corridor that connects the lines to the Ports of LA and LB. UP and BNSF both operate intermodal terminals for containers and trailers, with BNSF operating the Hobart Yard and UP operating the East Los Angeles Yard, Los Angeles Transportation Center (LATC), City of Industry, and Intermodal Container Transfer Facility (ICTF).

[1] http://www.dot.ca.gov/californiarail/docs/Rail_CAEconomy_Book_Report_V28_LowResPages.pdf

2.1.6. AIR

The region is home to six major commercial airports, including Los Angeles International Airport (LAX), John Wayne Airport, Ontario International Airport, Long Beach Airport, Hollywood Burbank Airport, and Palm Springs International Airport. There also are various smaller commercial airports throughout the region, including the Imperial County Airport.

LAX is by far the busiest passenger airport located in the SCAG Region, handling nearly three quarters of all commercial passenger traffic in the SCAG Region in 2012. LAX also handles the majority of the region's air cargo traffic. Together with Ontario International Airport, LAX handles more than 99 percent of the SCAG Region's air cargo.[2]

2.1.7. PORTS

Seaports

Seaports are vital to the economics of Southern California, as these are intertwined with the movement of goods via trucks or rail. The region includes three seaport facilities: Los Angeles, Long Beach, and Hueneme. The Ports of LA and LB, together called the San Pedro Bay Ports, handled 32.5 percent of all containers in the U.S. in 2014.[3]

The seaports are investing in port area rail capacity improvements to accommodate increased shipping activity. In 2014, approximately 36.6 percent of the San Pedro Bay Ports' containers were shipped by rail "intact," meaning the cargo was moved by rail in marine containers without being transloaded or deconsolidated first. Containers may also be transloaded into 53-foot domestic containers, which are then trucked to off-dock rail yards at intermodal facilities for loading onto trains onto freight rail and transported out of the region. Major projects supporting on-dock and near-dock rail capacity include the Pier B Street On-Dock Rail Support Facility, which expands the existing Pier B Rail Yard, and the Port Area Rail Infrastructure Improvements, which are projects at the Ports of LA and LB that support increased on-dock rail service, reduce railroad delay, and reduce conflicts with highway traffic.

The region had also invested in technology that improves seaport operations, such as the Advanced Transportation Management Information System, monitoring truck traffic within the San Pedro Bay Ports using vehicle detection devices and CCTV cameras. The ports also jointly operate a TMC that provides traveler information in the area. Additionally, the Freight Advanced Traveler Information System (FRATIS) project is testing an advanced intermodal logistics information technology system designed to improve drayage and container handling at the Port of Los Angeles.

International Ports of Entry

Southern California's Imperial County borders Mexico and has three Ports of Entry (POE) for transportation to and from the borders, Calexico West – Mexicali I, Calexico East – Mexicali II, and Andrade

[2] Goods Movement, SCAG 2016-2040 Regional Transportation Plan/Sustainable Communities Strategy Plan
[3] American Association of Port Authorities (AAPA)

– Los Algodones. These three POEs accounted for over $14 billion in international trade in 2014.[4] Most of the goods move across the border by truck, but the border areas are also serviced by the UP and Carrizo Gorge Railway, which is located at the Calexico East border crossing.

2.2. EXISTING REGULATORY FRAMEWORK

2.2.1. FHWA FINAL RULE

Congress passed the surface transportation authorization bill, Transportation Equity Act for the 21st Century (TEA-21), in 1997 that contained Section 5206(e) that requires ITS projects funded by the Highway Trust Fund and the Mass Transit Account to conform with the National ITS Architecture and Standards. To implement Section 5206(e), FHWA published Rule 940 (23 CFR Part 940), or Final Rule, on January 8, 2001 that requires regions implementing ITS projects funded by the Highway Trust Fund to develop a regional ITS architecture that is consistent with the National ITS Architecture. FTA published the companion policy that applied the same requirements to ITS projects using funding from the Mass Transit Account.

The Final Rule/Final Policy is comprised of the following sections:

- 940.1: Purpose
- 940.3: Definitions
- 940.5: Policy
- 940.7: Applicability
- 940.9: Regional ITS Architecture
- 940.11 Project Implementation
- 940.13 Project Administration

The complete text for the Final Rule is provided on the FHWA website:

https://ops.fhwa.dot.gov/its_arch_imp/policy_1.htm

Regional Architecture Requirements (Sec. 940.9)

The Final Rule requires that regional ITS architectures are to be produced for metropolitan regions in accordance with Section 940.9 (a). Development of a regional ITS architecture must be based on the National ITS Architecture and consistent with local goals and strategies developed in the regional transportation planning process. The Southern California Regional ITS Architecture was developed in 2005

[4] Goods Movement, SCAG 2016-2040 Regional Transportation Plan/Sustainable Communities Strategy Plan

based on version 5.0 of the National ITS Architecture. The 2005 architecture documentation includes the following sections that are required by Section 940.9 (d):

- Regional description;
- Identification of participating agencies and other stakeholders;
- An operational concept that identifies the agency roles and responsibilities involved in the operation and implementation of systems in the regional ITS architecture;
- Stakeholder agreements required for operations including agreements that apply to the project integration, interoperability of different technologies and the utilization of ITS related standards;
- System functional requirements;
- Interface requirements and information exchanges with planned and existing systems and subsystems;
- ITS standards for supporting regional and national inoperability; and
- Sequencing of projects required for the implementation of the regional ITS architecture.

Additionally, Section 940.9 (d) requires the development and implementation of policies and procedures to maintain the regional ITS architecture. Maintenance is needed to update the architecture to reflect the evolving transportation needs and policies of the region, typically in conjunction with the regional transportation planning process.

Project Implementation (Sec. 940.11)

Section 940.11(a) in the Final Rule requires ITS projects funded by the Highway Trust Fund to follow a systems engineering process. Systems engineering refers to a process for managing the project lifecycle in the design and implementation of complex systems. Systems engineering is a recommended best practice for ITS projects that is described in the *Systems Engineering Guidebook for ITS,* co-authored by FHWA and Caltrans:

https://www.fhwa.dot.gov/cadiv/segb/index.cfm.

The systems engineering process is required to reference and include certain parts of the regional ITS architecture during project development to ensure the interoperability of ITS deployments with other systems and technologies. While project sponsors have the latitude to apply a systems engineering process that is commensurate to the complexity of the project, an analysis of the following is required according to Section 940.11(c) that references the regional ITS architecture:

- Identification of portions of the regional ITS architecture being implemented;
- Identification of participating agencies roles and responsibilities;
- Requirements definitions; and
- Procedures and resources necessary for operations and management of the system

Major ITS projects are also required to support interface requirements and standards for data exchange as described in the regional ITS architecture. The Systems Engineering "V" diagram shown in **Figure 2** was developed by the FHWA and provides a visual guide for following the systems engineering process. As shown in the diagram, before the Systems Engineering process can begin, the regional architecture must be established to inform project planning activities.

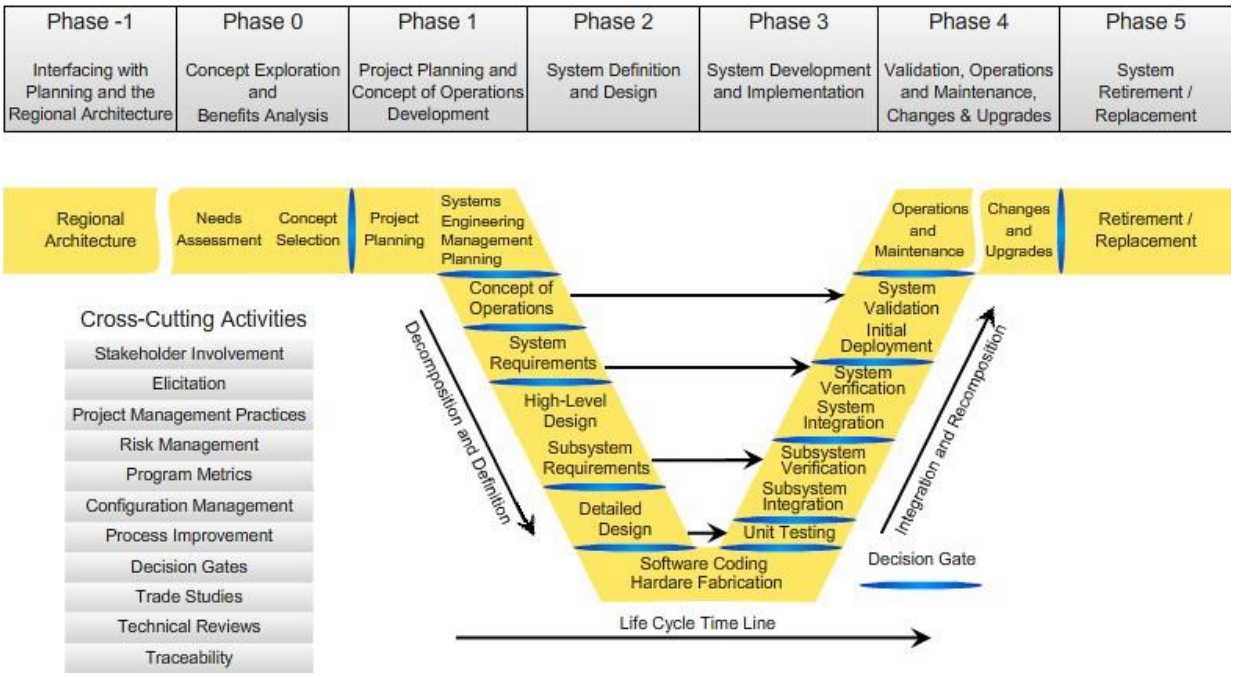

Figure 2. Systems Engineering "V" Diagram

2.2.2. CALTRANS LOCAL ASSISTANCE PROGRAM GUIDELINES

The requirements of the Final Rule extend to the planning and implementation of ITS projects at the statewide level. The Caltrans Local Assistance Program Guidelines (LAPG) incorporates the requirements of 23 CFR Part 940.11 in Chapter 13 addressing the development of federally funded ITS projects in California. Chapter 13 of the LAPG is located on the Caltrans Division of Local Assistance web page: http://dot.ca.gov/hq/LocalPrograms/ITS/ITS.htm

Consistent with the Final Rule, project sponsors must perform a systems engineering analysis to determine the level of risk (Exempt, Low-Risk and High-Risk). The determination is made by the project sponsor by completing a Systems Engineering Review Form (SERF). The SERF is submitted to the Caltrans District Local Assistance Engineer (DLAE) as part of the E-76 Package for authorization of federal funds.

While SCAG does not oversee the project development process in the LAPG, the development of the Regional ITS Architecture is critical for completing the SERF. The 2011 update of the Regional ITS Architecture included online resources for project sponsors on navigating the project planning process. The resources are located on the ITS page of the SCAG web site:

http://www.scag.ca.gov/programs/Pages/RegionalProjectPlanning.aspx

2.3. STAKEHOLDERS

Stakeholders consist of agencies that are actively planning and implementing ITS projects in the SCAG region. It is important to include non-traditional stakeholders in the architecture as they are important to defining the interfaces and needs of the Region. **Table 1** summarizes stakeholders that represent the SCAG Regional ITS Architecture. The table includes the stakeholders name, description, and whether they have a supporting role (planning) versus a more direct operational role (operations) within the SCAG Region.

Table 1. SCAG Stakeholders

Stakeholder Name	Stakeholder Description	Planning	Operations
Broadcast and Print Media	Represents media outlets in the region who are a consumer of ITS information.	●	
California DMV	Department of Motor Vehicles	●	
California Highway Patrol (CHP)	California Highway Patrol		●
Caltrans	This stakeholder group is the local Caltrans districts, 7, 8, 11, and 12. These four districts cover six of the Southern California counties (Los Angeles, Orange, Ventura, San Bernardino, Riverside, and Imperial).	●	●
Commercial Vehicle Operations Services Providers	These represent private companies that provide services to the goods movement community. These services could include logistics services such as container scheduling and tracking, or CVO related traveler information.		●
Commercial Vehicle Operators	The generic stakeholder that represents all freight carrier companies that operate in the Southern California Region.		●
Financial Institutions	Financial and banking institutions that play a role in the transfer of funds for fare collection as well as for other fee based transportation services.	●	
Federal Motor Carrier Safety Administration	Federal Motor Carrier Safety Administration (FMCSA)	●	●
IFTA, Inc.	The corporation that administers the IFTA Clearinghouse.		X
Inland Empire	This stakeholder represents the Inland Empire 511 system, jointly operated by the Riverside County Transportation Commission (RCTC) and the San Bernardino Associated Governments (SANBAG).		●
IRP, Inc.	The corporation that administers the IRP Clearinghouse for netting of registration funds.		X

Stakeholder Name	Stakeholder Description	Planning	Operations
Information Service Providers (ISPs)	All the Transportation Information Providers in the region including public and private	●	●
LA SAFE	Los Angeles County Service Authority for Freeway Emergencies (LA SAFE)	●	●
Local Emergency/ Health Agencies	Stakeholder category that represents local level of Emergency Management Agencies including law enforcement, fire departments and public health departments. This stakeholder also includes: California Office of Emergency Services and the regional Offices of Emergency Services (i.e. Los Angeles, Riverside, Orange, San Bernardino, Ventura, and Imperial County and City of Los Angeles	●	
Local Jurisdictions	Counties or local cities that are within or adjacent to the SCAG counties.	●	●
Los Angeles County Metropolitan Transportation Authority	Los Angeles County Metropolitan Transportation Authority (METRO) serves as the transportation planner and coordinator, designer, builder and operator for LA County. Metro operates over 2,000 peak-hour buses on an average weekday. It also designed, built and operates 98 miles of Metro Rail. In addition, Metro funds 16 municipal bus operators and funds a wide array of transportation projects.	●	●
National Railroad Providers	Stakeholder category that represents national passenger railroad providers such as Amtrak and commercial freight railroads such as Union Pacific (UP) and Burlington North Santa Fe (BNSF)	●	●
Ports	Stakeholder category representing the operations (load/offload) at ports in the region. These include SCAG Region 3 deep water seaports (Hueneme, Long Beach, and Los Angeles)	●	●
Private Application and Service Providers	Private entities that provide transportation related applications and services.		●
Regional Airports	Stakeholder category represents the seven (7) commercial airports In SCAG as well as commuter and general aviation airports.	●	●
Regional Express Lane and Toll Road Agencies	This stakeholder category represents the private or public agencies that operate express lanes and toll roads.	●	●
Regional Transit Agencies	This stakeholder category represents the many transit agencies that operate in the SCAG region.	●	●
RIITS Agencies	This stakeholder category represents the agencies responsible for operation and maintenance of the Regional Integration of Intelligent Transportation Systems (RIITS).	●	
Southern California Association of Governments (SCAG)	The Southern California Association of Governments (SCAG) is the federally designated Metropolitan Planning Organization for the Southern California region encompassing Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura counties	●	

Stakeholder Name	Stakeholder Description	Planning	Operations
Southern California Regional Rail Authority (SCRRA)	The purpose of Southern California Regional Rail Authority (SCRRA) was to plan, design, construct and administer the operation of regional passenger rail lines serving the counties of Los Angeles, Orange, Riverside, San Bernardino and Ventura. SCRRA is comprised of MTA, VCTC, OCTA, SANBAG, and RCTC. The regional commuter rail system "Metrolink." has 2 Centers: Operations Center in Pomona and Maintenance Facility in Glendale.	●	●
State Office of Emergency Services	California State Office of Emergency Services operates the State Emergency Operations Center.		●
Traveling Public	The traveling public accesses various modes of transportation, including surface street, air, rail/transit, and non-motorized transport like walking and biking.	●	
U.S. Customs and Border Protection	US agency that performs border inspections.		●

2.4. SYSTEM INVENTORY

Based on a combination of stakeholder feedback, previous SCAG Regional ITS Architectures, and knowledge of the area, a list of the assets within the region are included within **Table 2**. Each inventory element includes:

- Stakeholder
- Element Name
- Element Description
- Status of the Element
- County the ITS inventory resides in
- Associated Service Package Area – as defined below in ARC-IT
    - **Commercial Vehicle Operations** – The development of systems to facilitate the management of commercial vehicles (e.g., electronic clearance).
    - **Data Management** – The development of systems to collect transportation data for use in both non-operational purposes (e.g., planning and research) as well as operational purposes (i.e. real-time signal timing changes).
    - **Maintenance and Construction** – The development of systems to manage the maintenance of roadways in the Region, including winter snow and ice clearance. Includes the managing of construction operations and infrastructure monitoring.
    - **Parking Management** – The development of smart parking management within one parking lot, curbside parking, or within the region, including electronic parking payment.
    - **Public Safety** – The development of systems to provide rapid and effective response to incidents. Includes systems to detect and verify incidents, along with coordinated agency response to the incidents.
    - **Public Transportation** – The development of systems to efficiently manage fleets of transit vehicles or transit rail. Includes systems to provide transit traveler information both pre-trip and during the trip.
    - **Support** – The development of backend support systems for managing connected vehicles, including distribution of data, privacy protection, and maintenance of equipment and vehicles.
    - **Sustainable Travel** – The development of sustainable transportation systems, including monitoring and reduction of emissions through various strategies like HOV/HOT Lane Management.
    - **Traffic Management** – The development of signal systems that react to changing traffic conditions and provide coordinated intersection timing over a corridor, an area, or multiple jurisdictions. The development of systems to monitor freeway (or tollway) traffic flow and roadway conditions and provide strategies such as ramp metering or lane access control to improve the flow of traffic on the freeway.
    - **Traveler Information** – The development of systems to provide static and real-time transportation information to travelers.
    - **Vehicle Safety** – The development of systems to support private sector vehicle safety initiatives (e.g., intersection collision avoidance.)
    - **Weather** – The development of systems to collect, analyze, and disseminate weather data for use in operational purposes (i.e. maintenance decisions support systems).

Table 2. Current SCAG Inventory

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
Broadcast and Print Media	Broadcast and Print Media	This element represents the TV, Radio, Internet, and Print Media that are users of ITS information.	Existing	X	X	X	X	X	X	Traveler Information
California DMV	CA DMV Enforcement Vehicles	Represents DMV's enforcement vehicles.	Existing	X	X	X	X	X		Public Safety
California Highway Patrol	ASPEN	A laptop based system to conduct roadside safety inspections.	Existing	X	X	X	X	X	X	Public Safety
California Highway Patrol	CA CVIEW	Commercial Vehicle Information Exchange Window. Collects snapshots for interstate and intrastate carriers, vehicles, and drivers. Interfaces with SAFER for interstate snapshot exchange. Also, distributed snapshots to other states.	Existing	X	X	X	X	X	X	Commercial Vehicle Operations
California Highway Patrol	California Commercial Vehicle Inspection System (CCVIS)	This system allows electronic collection of inspection data while an inspection is being performed. Information is electronically forwarded to a CHP headquarters database and then to SAFETYNET, a federal commercial vehicle information system database. The CHP currently conducts 70 percent of its inspections using CCVIS. The system has improved accuracy, timeliness of reporting, and has significantly reduced data entry time. Future expansions or improvements may include modifications for mobile road enforcement officer use.	Existing	X	X	X	X	X	X	Commercial Vehicle Operations
California Highway Patrol	CHP Commercial Vehicle Section	Section of CHP responsible for commercial vehicle inspection and enforcement.	Existing	X	X	X	X	X		Commercial Vehicle Operations

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
California Highway Patrol	CHP Dispatch	This element represents CHP dispatch centers in the region.	Existing	X	X	X	X	X	X	Public Safety
California Highway Patrol	CHP Enforcement	Officers providing safety and enforcement of traffic laws on California highways.	Existing	X	X	X	X	X	X	Public Safety
California Highway Patrol	CHP Weigh-In-Motion/ Inspection stations	Weigh-in-Motion stations that are a part of inspection stations. The WIM Bypass System is a high-speed weigh in motion technology used in the PrePass operation, which enables registered heavy vehicles to legally bypass open weigh stations after electronic verification of their size, weight, registration, safety inspection and other credentials. These stations reduce delay in the weight enforcement process and increase ability to provide highway truck statistics data. Law enforcement reports the following issues with previous installations: Rough road conditions are reported to affect the accuracy of weights detected by the WIM equipment; the system cannot reliably distinguish between transponder equipped and non-equipped trucks.	Existing	X	X	X	X	X	X	Commercial Vehicle Operations
California Highway Patrol	CVO Automatic Safety Inspection Devices	Rapid inspection via handheld units to download information directly from the vehicle. Technology type unspecified, may include handheld computers, information exchange software, CVISN database, and automated analysis tools.	Planned	X	X	X	X	X	X	Commercial Vehicle Operations
California Highway Patrol	CVO PrePass Sites	PrePass is a nationwide AVI system that allows participating transponder equipped CVO to bypass designated weigh stations and port-of entry facilities. California has 35	Existing		X	X	X	X	X	Commercial Vehicle Operations

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
		sites in northern, central, and southern parts of the state. Sites are at Antelope (northeast of Sacramento, CA)- I-80, Blythe (near CA/ AZ border)I-10, Cache Creek (east of Bakersfield, CA) CA-58, Cajon (north of San Bernardino, CA) I-15, Carson (north of Long Beach, CA) I-405, Castaic (north of Santa Clarita, CA) I-5, Chowchilla River (south of Modesto, CA) CA-99, Conejo (west of Thousand Oaks, CA) US101, Cordelia (north of Oakland, CA)I-80, Cottonwood (south of Redding, CA) I-5, Desert Hills (west of Palm Springs, CA) I-10, Dunsmuir Grade (north of Redding, CA) I-5, Gilroy (south of San Jose, CA)I-101, Grapevine (south of Bakersfield, CA)I-5, Livermore (east of Oakland, Ca)I-580, Mission Grade (northeast of Oakland, CA) I-680, Nimitz (east of Oakland, Ca) I-880, Otay Mesa (near US/Mexico border) S-905, Peralta Hwy (east of Anaheim, CA) I-91, Rainbow (south of Temecula, CA) I-15, San Onofre (north of Oceanside, CA) I-5, Santa Nella (east of San Jose, CA) I-5, and Truckee (near CA/NV border) I-80.								
California Highway Patrol	Freeway Service Patrol Vehicles	Freeway Service Patrol vehicles dispatched on freeways in the region.	Existing	X	X	X	X	X	X	Public Safety
California Highway Patrol	Statewide Integrated Reporting System (SWITRS)	The Statewide Integrated Reporting System (SWITRS) consists of two components working in conjunction to record and manage accident/crash reporting data. The server component resides on a central database server, which hosts numerous	Existing	X	X	X	X	X	X	Data Management

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
		other applications/databases. CHP's Support Services Section (SSS) gathers and processes the data, produces statistical reports, and provides custom statistical reports to public and private sector clients. The client component (data collection) is central to entering and maintaining the accident/crash data. Data collection tools and methods are developed within the framework of the California Vehicle Code (CVC) and the Traffic Collision Report (CHP 555) is the standard reporting tool. In the future, the client component may be a web client that interconnects to the server component via XML and other Internet related protocols and standards. Pertinent data will be exported or queried by other systems such as xCVIEW.								
Caltrans	Caltrans Connected Vehicle RSE	This element represents the connected vehicle Roadside Equipment (RSE) owned and operated by Caltrans to support connected vehicle applications	Planned							Traffic Management, Vehicle Safety
Caltrans	Caltrans Lane Closure System	This element provides a view, both to the public and to other systems of planned and current lane closures on the highway system.	Existing							Traffic Management
Caltrans	Caltrans QuickMap	Quickmap provides a traveler focused interface for traffic information provided by Caltrans.	Existing							Traveler Information
Caltrans	Caltrans Regional TMCs	This element represents the Caltrans TMCs for the regions within SCAG. Caltrans District 7 TMC manages Los Angeles and Ventura Counties, District 8 TMC manages	Existing	X	X	X	X	X	X	Traffic Management

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
		Riverside and San Bernardino Counties, District 12 TMC manages Orange County, and District 11 TMC manages San Diego and Imperial Counties.								
Caltrans	Caltrans Regional TMCs- Other Regions	This element represents other Caltrans TMCs that interface with the Caltrans Regional TMC element.	Existing	X	X	X	X	X	X	Traffic Management
Caltrans	Caltrans TMC Roadside Equipment	Field equipment owned and operated by Caltrans.	Existing	X	X	X	X	X	X	Traffic Management
Caltrans	Excise Summary Terminal Activity Reporting System (ExSTARS)	A fuel tracking system developed with the cooperation of the IRS, DOT, States and Motor Fuel Industry which details the movement of any liquid product into or out of an IRS approved terminal.	Existing	X	X	X	X	X	X	Data Management
Caltrans	PeMS	The Freeway Performance Measurement System (PeMS) is a consolidated database of information collected via Caltrans loop detectors from traffic management centers (TMCs) throughout the state.	Existing	X	X	X	X	X	X	Data Management
Caltrans	Roadway/Railroad Inspection Facilities	Commercial vehicle inspection facilities along roadways.	Existing	X	X	X	X	X	X	Commercial Vehicle Operations
Caltrans	Video Surveillance Clearing House	Element that provides secure storage and distribution of video surveillance footage.	Existing	X	X	X	X	X	X	Traffic Management
Commercial Vehicle Operations Services Providers	Automatic Vehicle Locator System	Gathers anonymous truck data using technologies such as commercial GPS/AVL systems or RFID tags.	Existing	X	X	X	X	X	X	Vehicle Safety

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
Commercial Vehicle Operations Services Providers	Commercial Credentialing System	Represents information systems providing commercial vehicle registration and safety inspection data collected by regulatory and enforcement agencies.	Planned	X	X	X	X	X	X	Commercial Vehicle Operations
Commercial Vehicle Operations Services Providers	Container Scheduling Systems	Provides trucking companies with scheduling services to make appointments for container pick up.	Existing	X	X	X	X	X	X	Commercial Vehicle Operations
Commercial Vehicle Operations Services Providers	Container Tracking System	This element represents systems that provide container tracking services. An example of this type of system in the region is Voyager Track.	Existing	X	X	X	X	X	X	Commercial Vehicle Operations
Commercial Vehicle Operations Services Providers	CVO Traveler Information System	This system would collect traveler information relevant to commercial vehicles and disseminate the information.	Planned	X	X	X	X	X	X	Commercial Vehicle Operations
Commercial Vehicle Owners	Commercial Fleet Operations	This element represents commercial vehicle fleet operations, which can communicate with their commercial vehicles to obtain vehicle location and other information. The fleet operations also communicate with other commercial vehicle services and public agencies that perform permitting and inspection.	Existing	X	X	X	X	X	X	Commercial Vehicle Operations
Commercial Vehicle Owners	Commercial Vehicle Operation Centers	Dispatch and operations of commercial vehicle fleets.	Existing	X	X	X	X	X	X	Commercial Vehicle Operations
Commercial Vehicle Owners	Commercial Vehicles	Vehicles used for commercial purposes including trucks.	Existing	X	X	X	X	X	X	Commercial Vehicle Operations
Financial Institutions	Financial Institutions	Financial and banking systems that play a role in the transfer of funds for fare	Existing	X	X	X	X	X	X	Support

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
		collection as well as for other fee-based transportation services.								
FMCSA	Commercial Driver's License Information System (CDLIS)	The nationwide driver's license system that the Federal Highway Administration (FHWA) has developed and issued standards for testing and licensing CMV drivers.	Existing	X	X	X	X	X	X	Support
FMCSA	Safety and Fitness Electronic Report (SAFER)	SAFER provides carrier, vehicle, and driver safety and credential information to fixed and mobile roadside inspection stations. This information will allow the roadside inspector to select vehicles and/or drivers for inspection based on the number of prior carrier inspections, as well as carrier, vehicle, and driver safety and credential historical information.	Existing	X	X	X	X	X	X	Public Safety
IFTA, Inc.	IFTA Clearinghouse	This element represents the clearinghouse of IFTA information used to support commercial vehicle credentialing.	Existing							Commercial Vehicle Operations
Inland Empire	Inland Empire 511 System	This element represents the 511-system operating in Riverside and San Bernardino Counties.	Existing			X		X		Traveler Information
IRP, Inc	IRP Clearinghouse	This is a registration reciprocity agreement among jurisdictions in the United States and Canada which provides for payment of license fees on the basis of fleet miles operated in various jurisdictions	Existing							Commercial Vehicle Operations
National Railroad Providers	Freight Rail Operations	Rail operations for BNSF and Union Pacific (UP). Class I railroads operating in the SCAG region.	Existing	X	X	X	X	X	X	Traffic Management
National Railroad Providers	Rail Data Archive	Data archive - currently in the process of being upgraded. Information is manually extracted and made available to local	Existing	X	X	X	X	X	X	Data Management

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
		government agencies, as well as federal agencies.								
Local Emergency/ Health Agencies	Regional EOCs	Represents emergency operations centers operating in the region.	Existing	X	X	X	X	X	X	Public Safety
Local Jurisdictions	Arterial Roadside Equipment	Arterial Roadside ITS Equipment such as traffic signal controllers.	Existing	X	X	X	X	X	X	Traffic Management
Local Jurisdictions	Arterial Traffic Control Systems	Traffic signal systems operated by cities and counties in the region.	Existing	X	X	X	X	X	X	Traffic Management
Local Jurisdictions	IEN (Information Exchange Network) Corridor Server	Facilitates the exchange of real-time arterial traffic information between within a corridor, and limited signal control between participating Agencies. Also facilitates exchange of traffic information with Agencies not part of any TF (e.g., Caltrans, etc.).	Existing	X	X	X	X	X	X	Traffic Management
Local Jurisdictions	Other Arterial Traffic Control Systems	This element represents local jurisdiction traffic Control Systems and is used to indicate interfaces between two arterial systems.	Existing							Traffic Management
Local Jurisdictions	Railroad Crossing Monitoring System	Collects video images and detection data from at-grade railroad crossings to provide information on delays from queuing.	Planned	X	X	X	X	X	X	Traffic Management
Los Angeles County Metropolitan Transportation Authority	Metro ADMS	The LA Metro Archived Data Management System (ADMS) is a data library to store historical data and provide analytical tools for transportation planning, operation evaluation, and management analysis. The ADMS will use the RIITS real-time data coming from multiple agencies in the region.	Existing		X					Data Management

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
Los Angeles County Metropolitan Transportation Authority	Metro Management System	Metro Management System that manages the transportation network in the LA County area and also dispatches and organizes the fixed route, demand responsive, and dial-a-ride transit services within LA County.	Existing		X					Transit Management
Los Angeles County Metropolitan Transportation Authority	Metro Parking Management System	Metro planned parking management infrastructure including detection for monitoring ingress/egress as well as real-time parking dynamic message signs that will link with high-speed rail in the future.	Existing		X					Parking Management
Los Angeles County Metropolitan Transportation Authority	Metro Transit Vehicles	Metro Operations includes fixed-route, demand response, and a Bus Rapid Transit (BRT) system and this element represents the Metro buses that are equipped with AVL and participate in the transit priority system. Transit vehicles have on-board equipment for facilitating data exchange.	Existing		X					Transit Management
Los Angeles County Metropolitan Transportation Authority	Metro Traveler Information Displays	" Metro Transit Center providing traveler information in the form of displays in-vehicle, at transit stop, in transit center, or other physical displays.	METRO Traveler Information Displays							Transit Management
Los Angeles County Metropolitan Transportation Authority	Metro Traveler Information Services	Metro Transit Center provides traveler information to the public in the form of social media systems, website information posting, media press releases, or email/text notifications to distribution groups. Metro.net website and other methods provide trip planning information to the traveling public.	Existing							Traveler Information

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
National Railroad Providers	Railroad Roadside Equipment	Railroad roadside equipment that supports infrastructure security and rail grade crossing services.	Existing	X	X	X	X	X	X	Traffic Management
National Railroad Providers	Operation Center	Local operation center operated by national railroad providers, such as Amtrak.	Existing	X	X	X	X	X	X	Traffic Management
NCTD	NCTD Train Operations	NTCD train operations center providing dispatch and communications with NTCD trains.	Existing							Traffic Management
Ports	Automatic Vehicle Identification System	This vehicle identification system recognizes commercial vehicles to allow entry and exit from the port. An example of the back-end aspect of this would be PrePass.	Existing		X					Vehicle Safety
Ports	Port ATMIS	Advanced Transportation Management Information System (ATMIS) is a Traffic Management Center operated by the Ports of Los Angeles and Long Beach that collects and disseminates real time traffic data and video images from detection devices in the Port vicinity	Existing		X					Traffic Management
Ports	Port DMS	Dynamic Message Signs operated by the Ports.	Existing		X					Traffic Management
Ports	Port Operation Centers	Traffic and operations center at a port.	Existing	X	X					Traffic Management
Ports	Port Roadside Equipment	Truck traffic monitoring and traffic operations control equipment.	Existing	X	X					Traffic Management
Ports	Port Terminal Operations	This element represents the port terminal operations including such functions as container pickup and delivery.	Existing		X					Traffic Management
Regional Airports	Airport Security Center	Airport Security Centers for Regional Airports.	Existing	X	X	X	X	X		Public Safety

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
Regional Airports	Airport Security Monitoring Field Equipment	Security monitoring field equipment includes sensors and surveillance devices that monitor transportation infrastructure and public areas.	Existing	X	X	X	X	X		Traffic Management
Regional Express Lane and Toll Road Agencies	Consolidated Express Lane Back Office	This element represents a consolidated express lane back office which can support toll reconciliation between regional express systems.	Planned							Traffic Management
Regional Express Lane and Toll Road Agencies	Electronic Toll Administration Centers	Represents the back-office operations or administrative systems of the regional Express Lane operating agencies	Existing		X		X	X		Traffic Management
Regional Express Lane and Toll Road Agencies	Express Lane Field Equipment	Represents the roadway equipment (e.g. tag readers and DMS signs)	Existing		X		X	X		Traffic Management
Regional Express Lane and Toll Road Agencies	Express Lane Transportation Management Centers	Represents the traffic operations centers of the regional Express Lane operating agencies.	Existing		X		X	X		Traffic Management
Regional Express Lane and Toll Road Agencies	Express Lane Traveler Information Systems	Provides various traveler information outlets with Express Lane related travel information such as travel time and real time toll rates.	Existing		X		X	X		Traffic Management
Regional Express Lane and Toll Road Agencies	Other express Lane Toll Administration Centers	This element is used to represent interface from one Regional Tolling Center to another.	Existing		X		X	X		Traffic Management
Regional Express Lane and Toll Road Agencies	Regional Toll Reconciliation Network	Administration function that performs payment reconciliation between toll systems in the region.	Existing		X		X	X		Traffic Management

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
Regional Transit Agencies	Fare System Regional Reconciliation Network	This element represents the fare reconciliation function needed to put a universal fare card into operation.	Existing	X	X	X	X	X		Public Transportation
Regional Transit Agencies	Transit Access Pass	The Transit Access Pass (TAP) is a multiagency fare card accepted by many transit providers in Los Angeles County.	Existing		X					Public Transportation
Regional Transit Agencies	Transit Field Security Equipment	This element represents field security equipment such as surveillance cameras deployed at transit stations and stops.	Existing	X	X	X	X	X		Public Transportation
Regional Transit Agencies	Transit Operation Centers	This element represents the operations centers of regional transit agencies.	Existing	X	X	X	X	X		Public Transportation
Regional Transit Agencies	Transit Station Equipment	This element represents station equipment used for electronic fare payment.	Existing	X	X	X	X	X	X	Public Transportation
Regional Transit Agencies	Transit Vehicles	This element represents transit vehicles with ITS equipment installed.	Existing	X	X	X	X	X	X	Public Transportation
RIITS Agencies	RIITS	Regional Integration of Intelligent Transportation Systems (RIITS) provides regional data sharing and exchange, including coordination across all modes of transportation, and is a source of real-time traffic congestion data in the region.	Existing		X					Data Management
SCAG	Data Archive	Various transportation and transit data is collected and archived by SCAG to satisfy various federal and state performance monitoring and data reporting requirements for the Region	Existing	X	X	X	X	X	X	Data Management
SCAG	Regional Centralized Information Clearinghouse	This element represents a web-based to provide relevant data, links, and contact information to enhance awareness and use of existing ITS related data including traffic	Planned	X	X	X	X	X	X	Data Management

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
		information, emergency preparedness and response, and evacuation plans.								
SCAG	Regional Centralized Information Clearinghouse	This element represents a planned clearinghouse of regional threat information.	Planned							Data Management
SCAG	SCAG GIS Data System	This element represents a regional repository of GIS data for use by local agencies.	Planned							Data Management
Southern California Regional Rail Authority (SCRRA)	Rail Management Improvement System	Including Upgraded Fare Management, Maintenance Enhancement, Rolling Stock Enhancement, Station Security Surveillance Enhancement, Parking Information, Communication Improvement, Grade Crossing Analyzer	Existing	X	X	X	X	X		Data Management
Southern California Regional Rail Authority (SCRRA)	SCRRA Back Office System	The back-office system stores track geometry, speed restrictions and signaling configurations in a database. The back office communicates movement authorities and track restrictions to all trains in its operating territory. The back-office system serves as the communications interface with other back office systems operated in other railroad territories.	Planned	X	X	X	X	X		Data Management
Southern California Regional Rail Authority (SCRRA)	SCRRA Infrastructure Monitoring Equipment	Equipment used to monitor tracks, yards, and other rail infrastructure.	Existing	X	X	X	X	X		Public Transportation
Southern California Regional Rail Authority (SCRRA)	SCRRA On-board Passenger Information Signs	Signage on board the trains.	Existing	X	X	X	X	X		Traveler Information

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
Southern California Regional Rail Authority (SCRRA)	SCRRA On-board PTC Component	The on-board equipment package includes a display unit, computer processor, GPS receivers and radios to interface with other PTC components. The computer will determine movement authorities and speed and track restrictions based on information obtained from the back office and the wayside signal system.	Existing	X	X	X	X	X		Public Transportation
Southern California Regional Rail Authority (SCRRA)	SCRRA Passenger Information Signs	Train arrival signs at stations.	Existing	X	X	X	X	X		Traveler Information
Southern California Regional Rail Authority (SCRRA)	SCRRA Rail Information System	Rail Traveler Information System to provide information on trains, at train stations, and via personal devices.	Planned	X	X	X	X	X		Traveler Information
Southern California Regional Rail Authority (SCRRA)	SCRRA Train Control and Operations Center	Houses the back-office systems. Staffed to provide computer aided dispatching (CAD) functions. Coordinate response activities and communication exchanges with other train operations centers.	Planned	X	X	X	X	X		Public Transportation
Southern California Regional Rail Authority (SCRRA)	SCRRA Wayside Signal System	PTC system overlay will use the existing wayside signal system to obtain data on the status of signals, switches, locking and track occupancy. Wayside devices will communicate with the back office and locomotives over a wireless communications network operating at the 220 MHz spectrum.	Existing	X	X	X	X	X		Public Transportation
Southern California Regional Rail Authority (SCRRA)	Work Zone Safety Management System	Communications from the field to the back office seeking work authority using remote access. Work zone enforcement limits are communicated from the back office to the locomotives to prevent trains from	Planned	X	X	X	X	X		Maintenance & Construction

Stakeholder	Element Name	Element Description	Element Status	County						Service Package Area
				V	LA	SB	O	R	I	
		entering or exceeding speed limits in restricted areas.								
State Office of Emergency Services	California Statewide EOC	The California Statewide EOC coordinates disaster response and evacuations at the state level.	Existing							Public Safety
Traveling Public	Personal Vehicles with Toll Tags	Personal use vehicles that are outfitted with toll tags, which allow them to take toll roads and express lanes.	Existing	X	X	X	X	X	X	Traffic Management
Traveling Public	Traveler Card	Traveler Cards enable the actual transfer of electronic information from the user of a service (I.e. a traveler) to the provider of the service.	Existing	X	X	X	X	X	X	Traffic Management
Traveling Public	User Personal Computing Devices	User Personal Computing Devices refers to equipment an individual owns and can personalize with their choices for information about transportation networks, such as mobile phones connected to the internet.	Existing	X	X	X	X	X	X	Traveler Information
Traveling Public	Vehicles	Personal use vehicles.	Existing	X	X	X	X	X	X	Traffic Management
U.S. Customs and Border Protection	Border Inspection Station Systems	This element represents the ITS aspects of border clearance systems.	Existing							Commercial Vehicle Management

3. REGIONAL NEEDS

The regional needs and goals were developed with direct input by the stakeholders to provide guidance for determining which service packages should be included in the SCAG Regional ITS Architecture and to direct future transportation technology planning.

3.1. ITS NEEDS AND GOALS

The foundation for the regional ITS architecture, like many other regional planning documents, are the needs and goals. Needs are more "external." They serve as the foundation for the effort needed to reach a goal. Fulfilling needs can illustrate the desire stakeholders have for achieving a goal. Goals are what is desired to be achieved. They typically have steps identified to achieve the goals. Goals are considered "internal" to the stakeholders; things they want and can control.

Needs and goals also are the starting point for identifying gaps in service areas that should be included within the architecture.

3.1.1. IDENTIFYING NEEDS

Direct feedback from the stakeholders is one method for identifying needs. Architecture updates typically include stakeholder meetings, held individually or in a group setting. Often the stakeholders identify needs by explaining their "every day job" responsibilities. The needs may be teased out from issues the stakeholders are experiencing and solutions they offer. For example, at the September Steering Committee meeting, stakeholders mentioned their desire to leverage connected vehicle applications during integrated corridor management projects for future use. This would be a need that can be implemented to achieve an established goal (i.e. *Preserve and ensure a sustainable regional transportation system,* **Table 4**).

County-level ITS architectures also can be used to identify needs of the region. Federally funded ITS projects are required to be compliant with their regional ITS architectures. As such, it is recommended for regional ITS architectures to be updated routinely. During these updates, the region and/or county needs are captured within the architecture documentation. The needs can be compared from previous versions to denote how the region's growth is affected by the changes in the industry.

The needs in **Table 4** were gathered by pulling pre-identified needs from each of the county-level ITS architectures. In addition, through the project's Steering Committee meetings, each agency provided feedback on its current needs. The table shows the developed needs and the yellow dots denote where each need was named.

3.1.2. IDENTIFYING GOALS

SCAG is responsible for identifying transportation priorities for the Southern California region through the development of Regional Transportation Plans (RTP). RTPs can incorporate information captured through the regional ITS architecture process including integration opportunities, operational needs, and strategies to maximize transportation systems in the region. Likewise, the architecture can incorporate goals and the guiding policies already identified through the RTP process.

Goals also can be identified through additional planning documentation, including the Long-Range Transportation Plan (LRTP), which are developed by county transportation commissions, such as Metro

and OCTA. As regular updates occur, any changes in the counties' visions or potential projects are documented in those plans and can help steer the goals.

Also, as bills or acts are signed into law, they themselves establish programs and expectations for programs. These expectations can steer a region to focus on one goal more than another, as they guide funding for certain types of projects. One thing to consider though, is that the bills or acts may not explicitly state a goal. For example, the *Moving Ahead for Progress in the 21st Century* (MAP-21) Act passed in 2012. One key component of the MAP-21 Act for MPOs includes performance based planning. This is not a goal, but rather a focus for the MPOs as they establish their goals.

3.1.3. REGIONAL ITS NEEDS AND GOALS

Each of the goals and needs identified via various methods are highlighted within **Table 3** and **Table 4** (respectively). They also include an identification number and is linked to a corresponding service package area. Also, both tables designate their source(s).

Table 3. SCAG ITS Goals

G#	Goal	Service Package Area	SCAG RTP 2008	2012-2035 RTP/ SCS	2016-2040 RTP/ SCS
G1	Ensure travel safety and reliability for all people and goods in the region.	Public Safety	●	●	●
G2	Encourage land use and growth patterns that facilitate transit and non-motorized transportation.	Public Transportation		●	●
G3	Maximize the security of our transportation system through improved system monitoring, rapid recovery planning, and coordination with other security agencies.	Support	●		●
G4	Preserve and ensure a sustainable regional transportation system.	Sustainable Travel	●	●	●
G5	Protect the environment, improve air quality and promote energy efficiency.	Sustainable Travel	●		
G6	Encourage land use and growth patterns that complement our transportation investments and improve the cost-effectiveness of expenditures.	Sustainable Travel	●		
G7	Protect the environment and health of our residents by improving air quality and encouraging active transportation.	Sustainable Travel		●	●
G8	Actively encourage and create incentives for energy efficiency, where possible.	Sustainable Travel		●	
G9	Maximize mobility and accessibility for all people and goods in the region.	Traveler Information	●	●	●
G10	Maximize the productivity of our transportation system.	Traffic Management	●	●	●

Table 4. SCAG ITS Needs

N#	Need	Service Package Area	Steering Committee	Imperial County	Inland Empire	LA County	Orange County	Ventura County
N1	HAZMAT management	Commercial Vehicle Operations		●			●	
N2	Border interfaces	Commercial Vehicle Operations			●			
N3	Data storage, exchange, and sharing	Data management	●		●		●	●
N4	Integration of 3rd party information	Data management	●		●	●		●
N5	Performance monitoring system	Data management	●				●	
N6	Maintenance and construction coordination	Maintenance and Construction				●		
N7	Work zone monitoring	Maintenance and Construction					●	
N8	Parking management	Parking Management		●			●	
N9	Emergency system coordination	Public Safety					●	
N10	Multi-modal coordination	Public Transportation					●	●
N11	Transit coordination	Public Transportation					●	●
N12	Standards development	Support	●			●		●
N13	Emissions monitoring	Sustainable Travel				●		
N14	Surveillance along arterials and freeways	Traffic Management	●	●				
N15	Incident management	Traffic Management	●	●				
N16	Operations and maintenance	Traffic Management	●			●	●	●
N17	Cross jurisdictional signal timing	Traffic Management					●	●
N18	Railroad coordination	Traffic Management		●			●	
N19	Dynamic lane management	Traffic Management	●				●	
N20	Dissemination of traveler information in real-time	Traveler Information	●	●	●	●	●	●
N21	Connected vehicle (CV) technology	Vehicle Safety	●					
N22	Weather data collection, processing, and dissemination	Weather					●	

3.2. GAPS IN THE ARCHITECTURE

The needs and goals serve as the foundation for building the region's architecture. ITS solutions describe what ITS accomplishes from the user's perspective and are used to define a project solution that addresses a transportation need. ITS solutions can be mapped to service packages or service package areas.

After selecting service packages based on ITS solutions, whether existing or planned, they should align to already identified needs and goals. As a result, any need or goal not associated with a service package or service package area would indicate a gap. Identified gaps inform the determination of additional service packages or service package areas that should designated in the architecture to ensure all needs and goals are met.

Based on the identified ITS goals and needs in **Table 3** and **Table 4**, and a comparison of the previous architecture's existing elements, **Table 5** shows an assessment of the service package areas that are considered gaps. These service package areas are included in this update to address these user needs.

Table 5. Assessment of ITS Service Package Gaps

Included in Existing Architecture	ARC-IT Service Package Areas
●	Commercial Vehicle Operations
●	Data Management
●	Maintenance & Construction
●	Public Safety
●	Public Transportation
Gap	Support
Gap	Sustainable Travel
●	Traffic Management
●	Traveler Information
Gap	Vehicle Safety
●	Weather

4. OPERATIONAL CONCEPT

The National ITS Architectures currently has 12 service areas. An operational concept documents each stakeholder's current and future roles and responsibilities as they relate to those service areas. It spans across a range of transportation services, as grouped in the *Roles and Responsibilities* section of RAD-IT. Existing and planned systems were identified in the following services:

- Commercial Vehicle Operations
- Data Management
- Maintenance and Construction
- Parking Management
- Public Safety
- Public Transportation
- Support
- Sustainable Travel
- Traffic Management
- Traveler Information
- Vehicle Safety
- Weather

4.1. STAKEHOLDERS ROLES AND RESPONSIBILITIES

The roles and responsibilities of each stakeholder emphasizes strategic relationships as well as the key functions they perform.

The purpose of defining the roles and responsibilities is to:

- Avoid duplicative and/or conflicting efforts by various stakeholders;
- Clarify expectations and intent so that all stakeholders are aware of the consequences of their actions on other stakeholders;
- Clarify roles and responsibilities of all stakeholders so activities do not "fall through the cracks;"
- Share data and information across agency and jurisdictional boundaries to allow for seamless operations;
- Provide faster, more coordinated responses to incidents, emergencies, and natural disasters by defining roles before incidents take place.

The detailed roles and responsibilities are listed in **Table 6.** Each organization's roles and responsibilities are listed as they relate to providing services within the ITS Service Package Areas.

Table 6. Stakeholders' Roles and Responsibilities Relating to Service Package Areas

RR Area Name	Stakeholder	RR Description	RR Status
Commercial Vehicle Operations for SCAG Region	California DMV	Review and adopt federal regulations pertaining to registration, permits and licenses.	Existing
	California Highway Patrol	Enforce regulations adopted at the state level pertaining to loading, load securement and size.	Existing
		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.	Existing
	Caltrans	Establish statewide design standards for weigh stations, inspection stations, and borders.	Existing
		Maintain and disseminate data regarding the state highway network and vehicle restrictions on various highways.	Existing
		Operate WIM stations; operate PrePass, California's automated pre-clearance system.	Existing
		Promote inter-agency communications for Commercial Vehicle automated roadside safety inspection on a local level.	Existing
		Promote the ability to use a standard transponder technology for any activity that uses Automatic Vehicle Identification.	Existing
		Work cooperatively with trucking companies and information service providers on developing technology and data sharing agreements.	Existing
	Commercial Vehicle Owners	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 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.	Planned
	Local Jurisdictions	Work cooperatively with trucking companies and information service providers on developing technology and data sharing agreements	Planned
	Ports	Work cooperatively with trucking companies and information service providers on developing technology and data sharing agreements	Existing
Data Management for SCAG Region	Caltrans	Operate and maintain a transportation system performance monitoring system for the state.	Planned
		Input performance monitoring data to the statewide system	Planned
	LA Metro	Provide transit data to regional data warehouses	Planned

RR Area Name	Stakeholder	RR Description	RR Status
	Regional Express Lane and Toll Road Agencies	Provide Express Lane data to regional data warehouses	Planned
	SCAG	Collect and archive transportation data for the SCAG region.	Planned
		Operate and maintain a data warehouse for transportation data in the SCAG region.	Planned
	SCRRA	Provide rail operations data to regional data warehouses.	Planned
Emergency Management for SCAG Region	Caltrans	Monitor transportation infrastructure for potential threats using sensors and surveillance equipment	Existing
		Provide evacuation and transportation status information to the public through transportation information systems.	Existing
	Local Emergency/ Health Agencies	Provide wide area alerts to other centers in the region, including those that can alert the public to emergency situations such as child abductions, severe weather events, civil emergencies, and other situations that pose a threat to life and property	Existing
		Manage disaster response and recovery operations in region.	Existing
		Monitor evacuation activities in the region.	Existing
		Provide evacuation and transportation system status information to transportation information systems that can inform the public.	Existing
		Provide evacuation and transportation status information to the public through transportation information systems.	Planned
	SCAG	Provide a security threat and guidance clearinghouse to which regional centers can access for early warning of natural or man-made disasters.	Planned
	SCRRA	Monitor rail infrastructure for potential threats using sensors and surveillance equipment	Planned
Express Lane Operations for SCAG Region	California Highway Patrol	Enforce HOV and express lane occupancy requirements	Existing
	Caltrans	Implement and operate HOV lanes on freeways, in partnership with regional agencies.	Existing
		Monitor and control freeway sensors and video surveillance on express lanes in the region.	Existing
	Regional Express Lane and Toll Road Agencies	Utilize traffic sensors and data shared by partner agencies to monitor express lane usage.	Existing

RR Area Name	Stakeholder	RR Description	RR Status
		Make adjustments to Express Lane tolling rates to maintain free flow operations.	Existing
		Support trip planning by disseminating dynamic pricing and occupancy information to the public using the various traveler information outlets.	Existing
		Operate and maintain local toll collection on respective agency-owned facility/facilities.	Existing
		Identify and process toll violations.	Existing
		Provide anonymous toll usage data to support other agency planning or operations (i.e., travel times)	Existing
		Administer and manage back office functions to process payments, service accounts, and transmit violation notifications to enforcement agencies.	Existing
		Develop integrated electronic payment services that allow a single user account to pay for tolls, parking and transit.	Existing
Traffic Management for SCAG Region	Caltrans	Operate lane control devices on regional highways.	Existing
		Operate traffic information devices on regional highways.	Existing
		Monitor surveillance and traffic detection devices on regional highways.	Existing
		Implement connected vehicle applications on regional highways.	Planned
		Monitor travel times on regional highways.	Existing
		Share traffic and incident information with other agencies including other Caltrans regions.	Existing
		Share field device control with other agencies (including both local jurisdictions and other Caltrans regions.	Existing
		Coordinate the operation of ramp meters and freeway connector signals.	Existing
		Collect road weather information with agency field equipment and distribute it to regional traffic, maintenance and transit agencies as well as the media.	Existing
	Local Jurisdictions	Interconnect with signal systems operated by neighboring jurisdictions.	Existing
		Operate municipal traffic signal systems.	Existing
		Coordinate with regional transit services to provide transit signal priority for fixed route buses.	Existing
		Implement connected vehicle applications on regional arterials.	Planned

RR Area Name	Stakeholder	RR Description	RR Status
		Share field device control with other agencies (including both local jurisdictions and other Caltrans regions.	Existing
		Coordinate with SCRRA on operations of rail grade crossings.	Existing
		Collect road weather information with agency field equipment and distribute it to regional traffic, maintenance and transit agencies as well as the media.	Planned
	SCRRA	Operate advanced railroad grade crossing safety enhancement systems	Existing
		Coordinate with local jurisdictions regarding railroad operations.	Planned
Transit Services for SCAG Region	Local Jurisdictions	Provide traffic signal priority for fixed route transit vehicles from the local agencies through the arterial field equipment.	Existing
	Los Angeles County Metropolitan Transportation Authority	Obtain traffic signal priority for fixed route transit vehicles from the local jurisdictions within the agency's service area through the arterial field equipment.	Existing
		Provide transit traveler information to regional information providers.	Existing
		Provide transit traveler information travelers on board transit vehicles and at transit stop or transfer points.	Existing
	Regional Transit Agencies	Track vehicle location and evaluate schedule performance on agency fixed route transit vehicles, and paratransit vehicles.	Existing
		Provide transit passenger electronic fare payment on all agency fixed route and paratransit vehicles.	Existing
		Support interoperability with regional electronic fare systems.	Existing
		Provide security on agency transit vehicles and at transit transfer and stop locations through silent alarms, sensors, and monitoring systems.	Existing
		Provide automated vehicle maintenance scheduling through automated vehicle condition reports on agency vehicles.	Planned
		Provide transit traveler information to regional information providers.	Existing
		Obtain traffic signal priority for fixed route transit vehicles from the local jurisdictions within the agency's service area through the arterial field equipment.	Existing
	SCRRA	Provide security on all agency rail vehicles and at rail stations through silent alarms, sensors, and monitoring systems.	Existing
		Provide positive train control of regional trains, including tracking of train location and speed.	Planned

RR Area Name	Stakeholder	RR Description	RR Status
		Provide automated vehicle maintenance scheduling through automated vehicle condition reports on agency trains.	Planned
		Provide passenger information on board trains and at stations.	Existing
Traveler Information for SCAG Region	Caltrans	Provide roadway/transit/ traffic and incident information to travelers.	Existing
		Share traffic information with other traffic and emergency agencies (including sharing among Caltrans regions).	Existing
		Share control of field equipment with other transportation and emergency agencies	Existing
		Update information to other traveler information outlets and Media Outlets (Websites, TV, etc.) and send alerts to DMS equipment	Existing
		Provide interactive traveler information for travelers in the region	Existing
	Commercial Vehicle Operations Services Providers	Operate commercial vehicle-oriented traveler information system.	Planned
	Inland Empire	Operate inland Empire 511 system for traveler information	Existing
		Provide traveler alerts to regional travelers.	Existing
	LA SAFE	Operate SoCal511 system for traveler information.	Existing
		Provide traveler alerts to regional travelers.	Existing
	Local Jurisdictions	Share traffic information with other traffic and emergency agencies.	Planned
Vehicle Safety for SCAG Region	Caltrans	Implement connected vehicle applications to provide alerts or warnings to vehicles on the highway relating to queues, road weather, or lane closures.	Planned
	Local Jurisdictions	Implement connected vehicle safety applications to improve safety for pedestrians and cyclists.	Planned
		Implement connected vehicle safety applications to improve intersection safety.	Planned

4.2. CONSISTENCY WITH EXISTING REGIONAL ITS ARCHITECTURES

When multiple architectures are updated simultaneously, coordination between the updates is a large factor in ensuring consistency between all architectures. Coordinating between those ITS architecture updates helps to alleviate multiple meetings or stakeholder engagement as well as duplicating effort. Also, coordinating between the updates can identify which service packages and service package areas are most appropriate for which ITS architectures; eliminating duplication which in turn eliminates multiple areas to update for architecture maintenance. Coordination will occur with other on-going architecture update efforts in order to:

- Ensure consistency between the different architectures and
- Identify the appropriate set of ITS Services to include in the SCAG update.

4.2.1. CONSISTENCY BETWEEN ARCHITECTURES

The update to the SCAG architecture includes changes to the following components of the regional ITS architecture:

- Stakeholders
- Stakeholder Roles and Responsibilities
- Inventory
- ITS Services
- ITS Projects
- Functional Requirements
- Standards
- Agreements

Of the components noted above, stakeholder, elements and ITS projects are the three areas where coordination between the other architectures for consistency is most important.

For stakeholders and elements, consistency is key. Multiple regional ITS architectures exist within the SCAG Region, each completed at different times. A stakeholder name and definition in one architecture may not be labeled the same in another. In addition, through the years, stakeholder names and/or their definitions change. The same is true with elements. In doing this update the team found that several stakeholder and element names had changed. Care has been taken to coordinate names with the LA architecture which is currently under update. The rest of the architectures are at least a few years old, so coordination with them is less useful.

ITS projects were compared among the multiple regional ITS architectures. However, the comparison only applies to the LA ITS Architecture because it is currently being updated. Other architectures have outdated inventory that is not useful for a baseline at this time. Some projects will appear in both architectures. In that case, they will be presented in the same way in both architectures.

The remaining components of the architecture (*e.g. functional requirements*) are detailed outputs largely determined by the services and projects chosen, thus not subject to detailed comparison between architectures.

4.2.2. ITS SERVICES CONSIDERED

One of the key outputs of the SCAG regional ITS architecture update is a set of customized service package diagrams that define the ITS services. These services include all the existing cross county services, such as those provided by 511 and commercial vehicle operations, as well as any new services provided by projects defined within the update (e.g. connected vehicle services).

The regional ITS architecture identified additional ITS services that have been included in the update. These additional services include the following:

1. Cross county initiatives that don't have defined projects yet but are likely to in the not too distant future.
2. Advanced technology services (*e.g. connected vehicle applications*) that the region will implement locally but might want to define globally.
3. Services that may be implemented at the county level but are not included in the existing county architecture. If the county architecture will not be updated in the timeframe needed to support federal requirements, there may be a need to include them in the regional ITS architecture.

The service packages represent the portions of the architecture that are deployed in the region to provide specific ITS Services that address the transportation needs of the region

Table 7 provides a summary of the service packages included in the SCAG ITS Architecture. The table is organized around the service package areas of ARC-IT and provides a comparison of these current areas in ARC-IT with Version 7.1 and identifies the service packages included in the original Multi-County Architecture and updates in 2008 and 2011. Updates from the previous architecture are denoted in bold.

4.3. PHYSICAL OBJECTS COMPARISON

The final area of detailed comparison is at the element level, which will look at how these elements map to Physical Objects from ARC-IT.

Table 8 compares the physical objects in ARC-IT with the entities in Version 7.1 and then identifies the inventory elements in the Multi-County Architecture and the 2008 and 2011 architecture updates that are mapped to the Physical Object. Inventory elements added or updated in conjunction with the service packages introduced in the 2008 and 2011 updates are denoted in bold. ARC-IT includes Physical Objects that are new to the National ITS Architecture such as the Connected Vehicle RSE from the CVRIA. Mapping the new Physical Objects to elements in the existing architectures will be considered as part of the Regional ITS Architecture update.

Table 7. Service Package Comparison (Regional ITS Architecture)

ARC-IT Service Area	National ITS Architecture Version 7.1 Service Area	2005 Multi-County Architecture Service Packages	2008 Security Supplemental Service Packages	2011 Cross-County ITS Services Service Packages	2018 SCAG ITS Architecture
Commercial Vehicle Operations (CVO)	Commercial Vehicle Operations (CVO)	CVO01: Fleet Administration	CVO01: Fleet Administration **CVO02: Freight Administration** **CVO03: Electronic Clearance** **CVO04: CV Administrative Process** **CVO07: Roadside CVO Safety** **CVO08: On-board CVO and Freight Safety and Security** **CVO10: HAZMAT Management** **CVO11: Roadside HAZMAT Security Detection and Mitigation** **CVO12: CV Driver Security Authentication** **CVO13: Freight Assignment Tracking**	CVO01: Fleet Administration CVO02: Freight Administration CVO03: Electronic Clearance CVO04: CV Administrative Process **CVO06: Weigh-in-Motion** CVO07: Roadside CVO Safety CVO08: On-board CVO and Freight Safety and Security **CVO09: CVO Fleet Maintenance** CVO10: HAZMAT Management CVO11: Roadside HAZMAT Security Detection and Mitigation CVO12: CV Driver Security Authentication CVO13: Freight Assignment Tracking	CVO01: Carrier Operations and Fleet Management CVO03: Electronic Clearance CVO04: CV Administrative Processes CVO07: Roadside CVO Safety CVO08: Smart Roadside and Virtual WIM CVO09: Freight-Specific Dynamic Travel Planning CVO11: Freight Drayage Optimization CVO12: HAZMAT Management CVO15: Fleet and Freight Security
Data Management (DM)	Archived Data (AD)	AD3: ITS Virtual Data Warehouse	**AD2: ITS Data Warehouse** AD3: ITS Virtual Data Warehouse	AD2: ITS Data Warehouse AD3: ITS Virtual Data Warehouse	DM01: ITS Data Warehouse
Maintenance and Construction (MC)	Maintenance and Construction Management (MC)	MC07: Roadwork Maintenance and Construction MC10: Maintenance and Construction and Activity Coordination	**MC03: Road Weather Data Collection** MC07: Roadwork Maintenance and Construction MC10: Maintenance and Construction and Activity Coordination	MC03: Road Weather Data Collection MC07: Roadwork Maintenance and Construction **MC09: Work Zone Safety Monitoring**	MC06: Work Zone Management MC07: Work Zone Safety Monitoring MC08: Maintenance and Construction Activity Coordination

ARC-IT Service Area	National ITS Architecture Version 7.1 Service Area	2005 Multi-County Architecture Service Packages	2008 Security Supplemental Service Packages	2011 Cross-County ITS Services Service Packages	2018 SCAG ITS Architecture
				MC10: Maintenance and Construction and Activity Coordination	
Parking Management (PM)	Included in ATMS				PM01: Parking Space Management
Public Safety (PS)	Emergency Management (EM)		**EM01: Emergency Call Taking and Dispatch** **EM05: Transportation Infrastructure Protection** **EM07: Early Warning System** **EM08: Disaster Response and Recovery** **EM09: Evacuation and Reentry Management** **EM10: Disaster Traveler Information**	EM01: Emergency Call Taking and Dispatch EM05: Transportation Infrastructure Protection EM07: Early Warning System EM08: Disaster Response and Recovery EM09: Evacuation and Reentry Management EM10: Disaster Traveler Information	PS08: Roadway Service Patrols PS09: Transportation Infrastructure Protection PS10: Wide-Area Alert PS11: Early Warning System PS12: Disaster Response and Recovery PS13: Evacuation and Reentry Management PS14: Disaster Traveler Information
Public Transportation (PT)	Advanced Public Transportation Systems (APTS)	APTS04: Transit Passenger and Fare Management APTS06: Transit Maintenance	**APTS01: Transit Vehicle Tracking** APTS04: Transit Fare Collection Management **APTS05: Transit Security** APTS06: Transit Fleet Management **APTS07: Multi-modal Coordination** **APTS08: Transit Traveler Information**	APTS01: Transit Vehicle Tracking APTS04: Transit Fare Collection Management APTS05: Transit Security APTS06: Transit Fleet Management APTS07: Multi-modal Coordination APTS08: Transit Traveler Information	PT01: Transit Vehicle Tracking PT04: Transit Fare Collection Management PT05: Transit Security PT06: Transit Fleet Management PT08: Transit Traveler Information PT09: Transit Signal Priority PT14: Multi-modal Coordination
Support (SU)	N/A				SU03: Data Distribution SU04: Map Management
Sustainable Travel (ST)	N/A				ST04: Roadside Lighting

ARC-IT Service Area	National ITS Architecture Version 7.1 Service Area	2005 Multi-County Architecture Service Packages	2008 Security Supplemental Service Packages	2011 Cross-County ITS Services Service Packages	2018 SCAG ITS Architecture
					ST06: HOV/HOT Lane Management
Traffic Management (TM)	Advanced Traffic Management Systems (ATMS)	ATMS01: Network Surveillance ATMS07: Regional Traffic Control ATMS13: Standard Railroad Grade Crossing	ATMS01: Network Surveillance **ATMS03: Surface Street Control** **ATMS06: Traffic Information Dissemination** ATMS07: Regional Traffic Management **ATMS08: Traffic Incident Management System** ATMS13: Standard Railroad Grade Crossing **ATMS14: Advanced Railroad Grade Crossing** **ATMS15: Railroad Operations Coordination**	ATMS01: Network Surveillance ATMS03: Surface Street Control **ATMS05: HOV Lane Management** ATMS06: Traffic Information Dissemination ATMS07: Regional Traffic Management ATMS08: Traffic Incident Management System **ATMS10: Electronic Toll Collection** ATMS13: Standard Railroad Grade Crossing ATMS14: Advanced Railroad Grade Crossing ATMS15: Railroad Operations Coordination	TM01: Infrastructure-Based Traffic Surveillance TM02: Vehicle-Based Traffic Surveillance TM03: Traffic Signal Control TM04: Connected Vehicle Traffic Signal System TM05: Traffic Metering TM06: Traffic Information Dissemination TM07: Regional Traffic Management TM08: Traffic Incident Management System TM09: Integrated Decision Support and Demand Management TM10: Electronic Toll Collection TM13: Standard Railroad Grade Crossing TM14: Advanced Railroad Grade Crossing TM15: Railroad Operations Coordination TM16: Reversible Lane Management TM21: Speed Harmonization

ARC-IT Service Area	National ITS Architecture Version 7.1 Service Area	2005 Multi-County Architecture Service Packages	2008 Security Supplemental Service Packages	2011 Cross-County ITS Services Service Packages	2018 SCAG ITS Architecture
					TM23: Border Management Systems
Traveler Information (TI)	Advanced Traveler Information Systems (ATIS)		ATIS01: Broadcast Traveler Information ATIS06: Transportation Operations Data Sharing	ATIS01: Broadcast Traveler Information **ATIS02: Interactive Traveler Information** ATIS06: Transportation Operations Data Sharing	TI01: Broadcast Traveler Information TI02: Personalized Traveler Information TI07: In-Vehicle Signage
Vehicle Safety (VS)	Advanced Vehicle Safety Systems (AVSS)				VS05: Curve Speed Warning VS07: Road Weather Motorist Alert and Warning VS08: Queue Warning VS09: Reduced Speed Zone Warning / Lane Closure VS10: Restricted Lane Warnings VS12: Pedestrian and Cyclist Safety VS13: Intersection Safety Warning and Collision Avoidance
Weather (WX)	Included in MC				WX01: Weather Data Collection

Table 8. Subsystem Comparison

Class	ARC-IT Physical Object	National ITS Architecture Version 7.1 Subsystems	2005 Multi-County Architecture Inventory Elements	2008 Security Supplemental Inventory Elements	2011 Cross-County ITS Services Service Packages	2018 SCAG Regional ITS Architecture
Center	Center	N/A	N/A	N/A	N/A	Arterial Traffic Control Systems Caltrans Regional TMCs CHP Dispatch METRO Management System Rail Management Improvement System RIITS SCRRA Train Control and Operations Center Transit Operation Centers
Center	Commercial Vehicle Administration Center	Commercial Vehicle Administration	N/A	**Arterial Traffic Data Exchange** **Caltrans TMC Interfaces** **Port Operation Centers**	**CA VIEW** **Commercial Credentialing System** **Commercial Drivers License Information System (CDLIS)** **Excise Summary Terminal Activity Reporting System (ExSTARS)** **IFTA Clearinghouse** **IRP Clearinghouse** Port Operations Centers	**CA VIEW** **Commercial Credentialing System** **Commercial Drivers License Information System (CDLIS)** **Excise Summary Terminal Activity Reporting System (ExSTARS)** **IFTA Clearinghouse** **IRP Clearinghouse** **Port Operations Centers**

Class	ARC-IT Physical Object	National ITS Architecture Version 7.1 Subsystems	2005 Multi-County Architecture Inventory Elements	2008 Security Supplemental Inventory Elements	2011 Cross-County ITS Services Service Packages	2018 SCAG Regional ITS Architecture
					Safety and Fitness Electronic Report (SAFER) **Statewide Integrated Reporting System (SWITRS)**	**Safety and Fitness Electronic Report (SAFER)** **Statewide Integrated Reporting System (SWITRS)**
Center	Emergency Management Center	Emergency Management	N/A	**Airport Security Center** **Amtrak Operation Center** **Arterial Traffic Data Exchange** **Caltrans TMC Interfaces** **Commercial Vehicle Operations Centers** **Data Archive** **Port Operations Centers** **Rail Management Improvement System** **Transit Operations Centers**	Airport Security Center Amtrak Operation Center **Arterial Traffic Control Systems** **Caltrans Regional TMCs** **CHP Dispatch** Commercial Vehicle Operation Centers Data Archive Port Operation Centers Rail Management Improvement System Transit Operations Centers	Airport Security Center Arterial Traffic Control Systems California Statewide EOC Caltrans Regional TMCs CHP Dispatch Commercial Vehicle Operation Centers Data Archive Local Emergency Dispatch Port Operation Centers Rail Management Improvement System Railroad Operation Center Regional EOCs Regional Security Threat Database RIITS

Class	ARC-IT Physical Object	National ITS Architecture Version 7.1 Subsystems	2005 Multi-County Architecture Inventory Elements	2008 Security Supplemental Inventory Elements	2011 Cross-County ITS Services Service Packages	2018 SCAG Regional ITS Architecture
						SCRRA Train Control and Operations Center Transit Operations Centers
Center	Financial Center	Financial Institution	N/A	N/A	N/A	Financial Institutions
Center	Fleet and Freight Management Center	Fleet and Freight Management	Wayside Hotbox	**Commercial Vehicle Operation Centers**	**Commercial Fleet Operations** Commercial Vehicle Operation Centers	Commercial Fleet Operations Commercial Vehicle Operation Centers
Center	Freight Distribution and Logistics Center	N/A	N/A	N/A	N/A	Container Scheduling Systems Container Tracking System
Center	Maintenance and Construction Management Center	Maintenance and Construction Management	Caltrans TMC Interfaces	**Arterial Traffic Data Exchange** Caltrans TMC Interfaces	**Arterial Traffic Control Systems** **Caltrans Regional TMCs**	Arterial Traffic Control Systems Caltrans Lane Closure System Caltrans Regional TMCs
Center	Media	Media	N/A	N/A	N/A	Broadcast and Print Media
Center	Payment Administration Center	Payment Administration	N/A	N/A	**Electronic Toll Administration Centers** **HOT Lane Toll Operations** **Other Southern California Toll Administrators**	Consolidated Express Lane Back Office Electronic Toll Administration Centers
Center	Rail Operations Center	Rail Operations	N/A	N/A	N/A	Freight Rail Operations NCTD Train Operations Rail Management Improvement System Railroad Operation Center

Class	ARC-IT Physical Object	National ITS Architecture Version 7.1 Subsystems	2005 Multi-County Architecture Inventory Elements	2008 Security Supplemental Inventory Elements	2011 Cross-County ITS Services Service Packages	2018 SCAG Regional ITS Architecture
						SCRRA Train Control and Operations Center
Center	Traffic Management Center	Traffic Management	Arterial Traffic Data Exchange Caltrans MTC Interfaces	Arterial Traffic Data Exchange Caltrans TMC Interfaces **Port Operation Centers**	**Arterial Traffic Control Systems** **Caltrans D-7 Transportation Management Center** **Caltrans Regional TMCs** **Express Lane Transportation Management Centers** **IEN Corridor Server** **IEN Regional Server** **IEN Workstation** **Port ATMIS** Port Operation Centers **RIITS**	Arterial Traffic Control Systems Caltrans Regional TMCs Caltrans Regional TMCs- Other Regions CHP Dispatch Express Lane Transportation Management Centers IEN Corridor Server IEN Regional Server IEN Workstation Other Arterial Traffic Control Systems Port ATMIS Port Operation Centers RIITS
Center	Transit Management Center	Transit Management	Rail Management Improvement System	**Amtrak Operation Center** Rail Management Improvement System **Transit Operation Centers**	Amtrak Operation Center **Fare System Regional Reconciliation Network** Rail Management Improvement System **RIITS**	Fare System Regional Reconciliation Network METRO Management System METRO Traveler Information Services Rail Management Improvement System

Class	ARC-IT Physical Object	National ITS Architecture Version 7.1 Subsystems	2005 Multi-County Architecture Inventory Elements	2008 Security Supplemental Inventory Elements	2011 Cross-County ITS Services Service Packages	2018 SCAG Regional ITS Architecture
					SCRRA Back Office System **SCRRA Rail Information System** **SCRRA Train Control and Operations Center** Transit Operation Centers	Railroad Operation Center RIITS SCRRA Back Office System SCRRA Rail Information System SCRRA Train Control and Operations Center Transit Operation Centers
Center	Transportation Information Center	Information Service Provider	Regional Traveler Information Systems and Networks	Regional Traveler Information Systems and Networks **Video Surveillance Clearinghouse**	**511 MATIS/Go511** **Automatic Vehicle Locator System** **CVO Traveler Information System** **Express Lane Traveler Information Systems** **Inland Empire 511** **Private Information Service Provider Systems** Regional Traveler Information Systems and Networks **RIITS** Video Surveillance Clearinghouse	Automatic Vehicle Locator System Caltrans Lane Closure System Caltrans QuickMap CVO Traveler Information System Express Lane Traveler Information Systems Inland Empire 511 METRO Traveler Information Services Private Information Service Provider Systems Regional Traveler Information Systems and Networks RIITS

Class	ARC-IT Physical Object	National ITS Architecture Version 7.1 Subsystems	2005 Multi-County Architecture Inventory Elements	2008 Security Supplemental Inventory Elements	2011 Cross-County ITS Services Service Packages	2018 SCAG Regional ITS Architecture
						SoCal511 Video Surveillance Clearing House
Field	Border Inspection System	N/A	N/A	N/A	N/A	Border Inspection Station Systems
Field	Commercial Vehicle Check Equipment	Commercial Vehicle Check		**Port Roadside Equipment** **Roadway/Railroad Inspection Facilities**	**ASPEN** **California Commercial Vehicle Inspection System (CCVIS)** **CHP Weigh-In-Motion/ Inspection stations** **CVO Automatic Safety Inspection Devices** **CVO Pre-Pass Sites** Port Roadside Equipment Roadway/Railroad Inspection Facilities	ASPEN California Commercial Vehicle Inspection System (CCVIS) CHP Weigh-In-Motion/ Inspection stations CVO Automatic Safety Inspection Devices CVO Pre-Pass Sites Port Roadside Equipment
Field	Connected Vehicle Roadside Equipment	N/A	N/A	N/A	N/A	Arterial Connected Vehicle RSE Caltrans Connected Vehicle RSE
Field	Intermodal Terminal	N/A	N/A	N/A	**Automatic Vehicle Identification System** **Container Scheduling Systems** **Container Tracking System** **Port Terminal Operations**	Automatic Vehicle Identification System Port Terminal Operations

Class	ARC-IT Physical Object	National ITS Architecture Version 7.1 Subsystems	2005 Multi-County Architecture Inventory Elements	2008 Security Supplemental Inventory Elements	2011 Cross-County ITS Services Service Packages	2018 SCAG Regional ITS Architecture
Field	ITS Roadway Equipment	Roadway	Arterial Traffic Data Exchange Caltrans MTC Interfaces Wayside Hotbox	Arterial Traffic Data Exchange Roadside Equipment Caltrans TMC Interfaces Roadside Equipment **Port Roadside Equipment** Wayside Hotbox	**Arterial Roadside Equipment** **Caltrans TMC Roadside Equipment** **Express Lane Field Equipment** **I-10 HOT Lane Roadside Equipment** **Port DMS** Port Roadside Equipment **Railroad Crossing Monitoring System** **SCRRA Wayside Signal System** Wayside Hotbox **Work Zone Safety Management System**	**Arterial Roadside Equipment** **Caltrans TMC Roadside Equipment** **Express Lane Field Equipment** **Port DMS** **Port Roadside Equipment** **Railroad Crossing Monitoring System** **SCRRA Wayside Signal System** **Work Zone Safety Management System**
Field	ITS Roadway Payment Equipment	Roadway Payment	N/A	N/A	**Express Lane Field Equipment** **I-10 HOT Lane Roadside Equipment**	**Express Lane Field Equipment**
Field	Parking Management System	Parking Management	N/A	N/A	N/A	METRO Parking Management System Parking Systems
Field	Security Monitoring Equipment	Security Monitoring	N/A	**Airport Security Monitoring Field Equipment**	Airport Security Monitoring Field Equipment	Airport Security Monitoring Field Equipment

Class	ARC-IT Physical Object	National ITS Architecture Version 7.1 Subsystems	2005 Multi-County Architecture Inventory Elements	2008 Security Supplemental Inventory Elements	2011 Cross-County ITS Services Service Packages	2018 SCAG Regional ITS Architecture
				Arterial Traffic Data Exchange Roadside Equipment **Caltrans TMC Interfaces Roadside Equipment** **Port Roadside Equipment** **Railroad Roadside Equipment** **Transit Field Security Equipment**	**Arterial Roadside Equipment** **Caltrans TMC Roadside Equipment** Port Roadside Equipment Railroad Roadside Equipment **SCRRA Infrastructure Monitoring Equipment** Transit Field Security Equipment	Arterial Roadside Equipment Caltrans TMC Roadside Equipment Port Roadside Equipment Railroad Roadside Equipment SCRRA Infrastructure Monitoring Equipment Transit Field Security Equipment
Support	Archived Data System	Archive Data Management	Data Archive PeMS Rail Data Archive	Data Archive PeMS Rail Data Archive **Regional Centralized Information Clearinghouse**	Data Archive **LA Metro ADMS** PeMS Rail Data Archive Regional Centralized Information Clearinghouse **SCAG ERTMIS**	Data Archive LA METRO ADMS PeMS Rail Data Archive Regional Centralized Information Clearinghouse
Support	Data Distribution System	N/A	N/A	N/A	**RIITS** **Video Surveillance Clearing House**	**RIITS** **Video Surveillance Clearing House**
Support	Map Update System	N/A	N/A	N/A	N/A	SCAG GIS Data System
Traveler	Personal Information Device	Personal Information Access	N/A	**User Personal Computing Devices**	User Personal Computing Devices	User Personal Computing Devices

Class	ARC-IT Physical Object	National ITS Architecture Version 7.1 Subsystems	2005 Multi-County Architecture Inventory Elements	2008 Security Supplemental Inventory Elements	2011 Cross-County ITS Services Service Packages	2018 SCAG Regional ITS Architecture
Traveler	Traveler Support Equipment	Remote Traveler Support	N/A	**Airport Security Monitoring Field Equipment** **Railroad Roadside Equipment** **Transit Field Security Equipment**	Airport Security Monitoring Field Equipment Railroad Roadside Equipment **SCRRA Passenger Information Signs** Transit Field Security Equipment **Transit Station Equipment**	Airport Security Monitoring Field Equipment Arterial Roadside Equipment Caltrans TMC Roadside Equipment Port Roadside Equipment Railroad Roadside Equipment SCRRA Infrastructure Monitoring Equipment Transit Field Security Equipment
Vehicle	Commercial Vehicle OBE	Commercial Vehicle	N/A	**Commercial Vehicles**	Commercial Vehicles	Commercial Vehicles
Vehicle	Emergency Vehicle OBE	Emergency Vehicle	N/A	**Emergency Vehicles**	**CA DMV Enforcement Vehicles** Emergency Vehicles	**CA DMV Enforcement Vehicles** **Freeway Service Patrol Vehicles**
Vehicle	Freight Equipment	N/A	N/A	N/A	**Commercial Vehicles**	N/A
Vehicle	Transit Vehicle OBE	Transit Vehicle	N/A	**Transit Vehicles**	**SCRRA On-board Passenger Information Signs** **SCRRA On-board PTC Component** Transit Vehicles	**METRO Transit Vehicles** **SCRRA On-board Passenger Information Signs** **SCRRA On-board PTC Component** **Transit Vehicles**
Vehicle	Vehicle OBE	Vehicle	N/A	**Commercial Vehicles** **Emergency Vehicles**	Commercial Vehicles Emergency Vehicles	Commercial Vehicles Personal Vehicles with Toll Tags

Class	ARC-IT Physical Object	National ITS Architecture Version 7.1 Subsystems	2005 Multi-County Architecture Inventory Elements	2008 Security Supplemental Inventory Elements	2011 Cross-County ITS Services Service Packages	2018 SCAG Regional ITS Architecture
				Transit Vehicles	**Personal Vehicles with Toll Tags** Transit Vehicles Vehicles	Transit Vehicles Vehicles

5. OPERATIONAL AGREEMENTS

The stakeholders of the Southern California Regional ITS Architecture comprise numerous agencies across the transportation spectrum. This section describes key topics concerning the types of agreements between of the Southern California Regional ITS Architecture stakeholders.

Agreements among the different stakeholder agencies and organizations in Southern California region may be required to realize the integration proposed in the Architecture. Each connection between (and some connections within) projects in the Architecture represents the need for cooperation between stakeholders, which may require an agreement.

Agreement Focus

The focus of agreements is usually on the scope-of-service and specific agency responsibilities for various components of the service, rather than on particular technologies. For example, agreements should describe the information that each agency needs to exchange in order to meet the goals and expectations rather than defining how the delivery of that information will occur.

List of Agreements

Table 9 summarizes common types of agreements. This is based on the Regional ITS Architecture Guidance.

Table 9. Common Types of Agreement

Type of Agreement	Description
Handshake Agreement	✓ Early agreement between one or more partners ✓ Not recommended for long-term operations.
Memorandum of Understanding (MOU)	✓ Initial agreement used to provide minimal detail and usually demonstrating a general consensus. ✓ Used to expand a more detailed agreement like an Interagency Agreement that may be broad in scope but contains all of the standard contract clauses required by a specific agency. ✓ May serve as a means to modify a much broader Master Funding Agreement, allowing the master agreement to cover various ITS projects throughout the region and the MOUs to specify the scope and differences between the projects.
Interagency Agreement	✓ Between public agencies (e.g., transit authorities, cities, counties, etc.) for operations, services or funding. ✓ Documents responsibility, functions and liability at a minimum.
Intergovernmental Agreement	✓ Between governmental agencies (e.g., Agreements between universities and State DOT, MPOs, etc.).
Operational Agreement	✓ Between any agency involved in funding, operating, maintaining or using the right-of-way of another public or private agency. ✓ Identifies respective responsibilities for all activities associated with shared systems being operated and/or maintained.
Funding Agreement	✓ Documents the funding arrangements for ITS projects (and other projects).

Type of Agreement	Description
	✓ Includes at a minimum standard funding clause, detailed scope, services to be performed, detailed project budgets, etc.
Master Agreements	✓ Standard contract and/or legal verbiage for a specific agency and serving as a master agreement by which all business is done. These agreements can be found in the legal department of many public agencies. ✓ Allows states, cities, transit agencies, and other public agencies that do business with the same agencies on a regular basis (e.g., cities and counties) to have one Master Agreement that uses smaller agreements (e.g., MOUs, Scope-of-Work and Budget Modifications, Funding Agreements, Project Agreements, etc.) to modify or expand the boundaries of the larger agreement to include more specific language.

Table 10 summarizes list of agreements for Southern California regional ITS development. This table is organized by the ITS service addressed by the agreement, the stakeholders involved, the type of agreement anticipated, high-level status (near-term or long-term), and a concise description of the purpose of the agreement.

Table 10. Regional List of Agreements

ITS Service	Involved Stakeholder	Type of Agreement	Date of Execution/ Status	Agreement Description/ Roles and Responsibilities
Arterial Traffic Control Interfaces	Local Jurisdictions	Interagency Agreement	Ongoing	Specifies interface requirement, responsibilities, and functions for all participating and neighboring cities
Data Archive System	Caltrans and Local Jurisdictions	Interagency Agreement		Specifies data source, access control, and configuration requirement
Emergency Management / Security Region Wide Integration	Caltrans, Local Jurisdictions, California Highway Patrol (CHP), and Local Emergency Agencies	Interagency Agreement/or MOU		Provides the guidelines of the integration of emergency management system, including the roles and responsibilities of each agency as well as the functions required for each of their systems
Interjurisdictional Traffic Management	Caltrans, Local Jurisdictions, and California Highway Patrol (CHP)	Interagency Agreement and/or MOU	Current	Provides for data exchange and device control and details jurisdiction-to-jurisdiction operations and

ITS Service	Involved Stakeholder	Type of Agreement	Date of Execution/ Status	Agreement Description/ Roles and Responsibilities
				regional incident management.
Regional Traffic Management and Emergency Services	Caltrans, Local Jurisdictions and Local Emergency Agencies	Interagency Agreement and/or MOU	Current	Provides for signal operations and coordination and local incident management.
Emergency Vehicle Signal Pre-emption	Local Jurisdictions and Local Emergency Agencies	Interagency Agreement and/or MOU	Current	Documents details on roles, responsibilities, and functions for emergency vehicle pre-emption at signalized intersections within a city for police, fire, ambulance, or another agency.
Transit Signal Priority	Metro and/or Local Jurisdictions and Regional Transit Agencies	Interagency Agreement and/or MOU	Current	Documents details on roles, responsibilities, and functions for transit vehicle priority at signalized intersection within a city for a transit agency.
Freeway Service Patrol	Caltrans and California Highway Patrol (CHP)	Interagency Agreement and/or MOU	Current	Documents details on roles, responsibilities, and functions for providing freeway service patrol activities.
Transit Fare Management	Metro and Regional Transit Agencies	Interagency Agreement and/or MOU	Current	Provides details on the usage of a common regional fare card and the cost allocation formulas.

ITS Service	Involved Stakeholder	Type of Agreement	Date of Execution/ Status	Agreement Description/ Roles and Responsibilities
Corridor Agreements	Caltrans and/or Local Jurisdictions and Regional Transit Agencies	Interagency Agreement and/or MOU	Current	Documents details on roles, responsibilities, and functions for operation, maintenance, data-sharing, and funding of corridors and other corridor projects
Traveler Information	Caltrans, Local Jurisdictions, and Information Service Providers (media)	Interagency Agreement and/or MOU	Current	Documents expectations, roles, and responsibilities for the provision of transportation-related data and information to the traveling public. Also, documents the policy or disclaimer for release of traveler information.
Archived Data Management	Caltrans (PeMS) and Local Jurisdictions	Interagency Agreement and/or MOU	Current	Documents expectations, roles, and responsibilities for the dissemination of transportation-related data and information for archive purposes.
Regional Parking Payment	Metro, Local Jurisdictions, and Private/ public agencies	Interagency Agreement and/or MOU	Current	Documents provisions for design, development, maintenance, enforcement, price setting, and revenue sharing
Real Time Transit Information	Metro and Regional Transit agencies	Interagency Agreement and/or MOU	Current	Documents provisions for funding with stipulations for data sharing and maintenance
Regional, Sub-regional, and local Traffic Management	Caltrans, Local Jurisdictions, and Regional	Partnering Agreement	In-progress	CVAG Regional Signal Interconnect Project and Synchronization Program. Specifies the lead agency role, participating agency

ITS Service	Involved Stakeholder	Type of Agreement	Date of Execution/ Status	Agreement Description/ Roles and Responsibilities
and Signal Synchronization	Transportation Agencies			role, center-to-center communications, sharing data and video, and coordination and collaboration protocols. Includes funding, design, implementation, and maintenance of system. Readiness for: ICM, Smart Cities technologies, and CV/AV technologies. Creation of a TSMO Sub-committee to oversee and manage the entire Program.
Integrated Corridor Management	SCAG, Metro, Caltrans, Local Jurisdictions, National Railroad Providers, private/ public agencies	Project Charter, MOU	Current	I-210 Connected Corridors. Specifies participation, timely review documents and deliverables, proactive coordination and collaboration & operations, letters of support for funding, seek local funding, participate in MOU development, active input with stakeholders.
Congestion Pricing/ Express Lanes/ HOV/HOT Lane Management	Caltrans, Local Jurisdictions, and Regional Express Lane Operators	Interagency Agreement and/or MOU	Current	SR-91 Express Lanes. Documents provisions for design, development, maintenance, enforcement, price setting, and revenue sharing.
Congestion Pricing/ Express Lanes /	Caltrans, Local Jurisdictions, and Regional	Interagency Agreement and/or MOU	Current	I-15 Express Lanes. Documents provisions for design, development, maintenance, enforcement,

ITS Service	Involved Stakeholder	Type of Agreement	Date of Execution/ Status	Agreement Description/ Roles and Responsibilities
HOV/HOT Lane Management	Express Lane Operators			price setting, and revenue sharing.
Congestion Pricing/ Express Lanes / HOV/HOT Lane Management	Caltrans, Local Jurisdictions, and Regional Express Lane Operators	Interagency Agreement and/or MOU	Current	I-10 Express Lanes. Documents should include provisions for design, development, maintenance, enforcement, price setting, and revenue sharing.
Congestion Pricing/ Express Lanes / HOV/HOT Lane Management	Caltrans, Local Jurisdictions, and Regional Express Lane Operators	Interagency Agreement and/or MOU	Near-term (Future)	SR-241 Toll Road to the SR-91 Managed Lanes. Documents should include provisions for design, development, maintenance, enforcement, price setting, and revenue sharing.
Congestion Pricing/ Express Lanes / HOV/HOT Lane Management	Caltrans, Local Jurisdictions, and Regional Express Lane Operators	Interagency Agreement and/or MOU	Near-term (Future)	I-405 Managed Lanes. Documents should include provisions for design, development, maintenance, enforcement, price setting, and revenue sharing.

6. FUNCTIONAL REQUIREMENTS (RAD-IT)

Functions are a description of what the system must do. In the National ITS Architecture V8, functions are defined as the functional objects within a service package. Functional objects operate as a group with similar processes based on the physical objects or stakeholder inventory.

Functional requirements have been identified at two levels. The service packages, describing the services that ITS need to provide in the Region and the informational flows between the elements. These service packages and informational flows describe what systems in the SCAG Region have to do and the data that needs to be shared among elements.

At a more detailed level, functional requirements are described in terms of functions that each element in the architecture performs or will perform in the future. **Appendix B** contains a table that summarizes the functions by element. It is recommended that the development of detailed functional requirements such as the “shall” statements included in process specifications for a system be developed at the project level. These detailed “shall” statements identify all functions that a project or system needs to perform.

7. STANDARDS (RAD-IT)

Standards are an important tool that will allow efficient implementation of the elements in the SCAG Regional ITS Architecture over time. Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances, vendors change, and as new approaches evolve. The USDOT's ITS Joint Program Office is supporting Standards Development Organizations (SDOs) with an extensive, multi-year program of accelerated, consensus-based standards development to facilitate successful ITS deployment in the United States. **Table 11** identifies each of the ITS standards that could apply to the SCAG Regional ITS Architecture. These standards are based on the services and functions of the region.

Table 11. ITS Standards

Group	SDO	Document ID	Standard Title	Standard Type
No	American National Standards Institute	ANSI TS813	Electronic Filing of Tax Return Data	Message/Data
No	American Public Transportation Association	APTA TCIP-S-001 3.0.4	Standard for Transit Communications Interface Profiles	Message/Data
No	American Society for Testing and Materials	ASTM E2468-05	Standard Practice for Metadata to Support Archived Data Management Systems	Message/Data
No	American Society for Testing and Materials	ASTM E2665-08	Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data	Message/Data
No	Consortium of AASHTO, ITE, and NEMA	NTCIP 1201	Global Object Definitions	Message/Data
No	Consortium of AASHTO, ITE, and NEMA	NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller (ASC) Units	Message/Data
No	Consortium of AASHTO, ITE, and NEMA	NTCIP 1203	Object Definitions for Dynamic Message Signs (DMS)	Message/Data
No	Consortium of AASHTO, ITE, and NEMA	NTCIP 1204	Object Definitions for Environmental Sensor Stations (ESS)	Message/Data
No	Consortium of AASHTO, ITE, and NEMA	NTCIP 1205	Object Definitions for Closed Circuit Television (CCTV) Camera Control	Message/Data

Group	SDO	Document ID	Standard Title	Standard Type
No	Consortium of AASHTO, ITE, and NEMA	NTCIP 1207	Object Definitions for Ramp Meter Control (RMC) Units	Message/Data
No	Consortium of AASHTO, ITE, and NEMA	NTCIP 1208	Object Definitions for Closed Circuit Television (CCTV) Switching	Message/Data
No	Consortium of AASHTO, ITE, and NEMA	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems (TSS)	Message/Data
No	Consortium of AASHTO, ITE, and NEMA	NTCIP 1210	Field Management Stations (FMS) - Part 1: Object Definitions for Signal System Masters	Message/Data
No	Consortium of AASHTO, ITE, and NEMA	NTCIP 1211	Object Definitions for Signal Control and Prioritization (SCP)	Message/Data
No	Consortium of AASHTO, ITE, and NEMA	NTCIP 1213	Object Definitions for Electrical and Lighting Management Systems (ELMS)	Message/Data
No	European Committee for Standardization	TS 15531	Service Interface for Real-Time Information (SIRI)	Message/Data
No	General Transit Feed Specification Discussion Group	GTFS	General Transit Feed Specification (GTFS) Static	Message/Data
No	General Transit Feed Specification Discussion Group	GTSF-Realtime	General Transit Feed Specification (GTFS) Realtime	Message/Data
No	Institute of Electrical and Electronic Engineers	IEEE 1512 -2006	Standard for Common Incident Management Message Sets for use by Emergency Management Centers	Message/Data
No	Institute of Electrical and Electronic Engineers	IEEE 1512.3-2006	Standard for Hazardous Material Incident Management Message Sets for Use by Emergency Management Centers	Message/Data

Group	SDO	Document ID	Standard Title	Standard Type
No	Institute of Electrical and Electronic Engineers	IEEE 1570-2002	Standard for the Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection	Message/Data
No	Institute of Electrical and Electronic Engineers	IEEE 1609.11	Standard for Wireless Access in Vehicular Environments (WAVE) - Over- the-Air Data Exchange Protocol for Intelligent Transportation Systems (ITS)	Message/Data
No	Institute of Transportation Engineers	ITE TMDD	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC)	Message/Data
No	Society of Automotive Engineers	J2945/1	On-Board System Requirements for V2V Safety Communications	Communication s Protocol
No	Society of Automotive Engineers	SAE J2354	Message Set for Advanced Traveler Information System (ATIS)	Message/Data
No	Society of Automotive Engineers	SAE J2735	Dedicated Short Range Communications (DSRC) Message Set Dictionary	Message/Data
No	Society of Automotive Engineers	SAE J3067	Candidate Improvements to Dedicated Short Range Communications (DSRC) Message Set Dictionary [SAE J2735] Using Systems Engineering Methods	Message/Data
Yes	Profile	Contact-Proximity-Interface	Proximity Communication Interface	Standard Profile
Yes	Profile	DSRC-UDP	Vehicle-to-Vehicle/Infrastructure using UDP	Standard Profile
Yes	Profile	DSRC-WSMP	Vehicle-to-Vehicle/Infrastructure using WSMP	Standard Profile

Group	SDO	Document ID	Standard Title	Standard Type
Yes	Profile	NTCIP-DATEX	NTCIP using DATEX	Standard Profile
Yes	Profile	NTCIP-SMTP	NTCIP using SMTP	Standard Profile
Yes	Profile	NTCIP-SNMP	NTCIP using SNMP	Standard Profile
Yes	Profile	RSE-C2F	RSE - Center to Field Communications	Standard Profile
Yes	Profile	RSE-C2F-SNMP	RSE - Center to Field Communications - SNMP	Standard Profile
Yes	Profile	RSE-F2F	Roadside Equipment to ITS Roadway Equipment	Standard Profile
Yes	Profile	RSEGateway-VehicleDestination	Vehicle Communications via RSEs, Vehicle Destination	Standard Profile
Yes	Profile	RSEGateway-VehicleSource	Vehicle Communications via RSEs, Vehicle Source	Standard Profile
Yes	Profile	SRC-Legacy	Legacy Short Range Comm Using IEEE 1455	Standard Profile
Yes	Profile	VehicleGateway-CenterSource	Vehicle Cluster from Center	Standard Profile
Yes	Profile	WAB-Via-WAID	Wide-Area-Broadcast-Via-WAID	Standard Profile
Yes	Profile	WAW-ASN1	Wide Area Wireless using ASN.1 as encoding method	Standard Profile
Yes	Profile	WAW-WWWBrowser-JSON	Wide Area Wireless using JSON as encoding method	Standard Profile
Yes	Profile	WAW-XML	Wide Area Wireless using XML as encoding method	Standard Profile
Yes	Profile	XML	eXtensible Markup Language	Standard Profile

8. PLANNED ITS PROJECTS

The regional ITS architecture defines a number of planned elements, interfaces, and information flows. As regional plans are developed these parts of the regional ITS architecture will be implemented by a series of projects. **Table 12** provides a summary of regional projects that have been identified. The Timeframe column represents the following information about when the project is planned for implementation:

- Short Term: 1-6 years
- Long Term: over 6 years

The projects listed will be implemented by key interfaces in the architecture as defined by the service packages identified with these projects. The full architecture contains many additional planned interfaces that represent possible interfaces for the future that have not yet been defined in projects. Over time additional projects will be developed to address further aspects of the architecture.

Table 12. Planned ITS Projects

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
Border Crossing Upgrades	ICTC/Caltrans - border crossings	U.S. Customs and Border Protection, Caltrans	TM23-01	Short
Critical Transportation Infrastructure Surveillance and Information Dissemination	Implement traffic management systems and field elements on corridors with security concern or significances and or identified critical transportation infrastructure that are monitored and controlled by local agencies including CCTV, HAR, RWIS, and DMS.	Caltrans, Local Jurisdictions	TM01-01, TM01-02, TM06-01, TM06-02, Wx01-01, Wx01-02	Short
Express lane Back Office Reconciliation	Express lanes for Southern California - back office reconciliation for common transponder through accounts with different agencies (OCTA, Metro, TCA, RCTC, SBCTA)	Regional Express Lane and Toll Road Agencies	TM10-02	Short
Express Lane Development	This project represents the development of new express lane projects in the region.	Regional Express Lane and Toll Road Agencies	TM01-06, TM10-01	Short
Express Lane Integration with PEMS	PeMS collects and reports performance data for Bay Area HOT facilities. This project will report performance data for	Regional Express Lane and Toll Road Agencies, Caltrans	DM01-04	Short

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
	Southern California Express Lane and toll road facilities.			
Express Lanes-Archived Congestion Pricing Performance Data	This project will archive sources of dynamic pricing data - parking and express lanes to support regional congestion pricing and planning	Regional Express Lane and Toll Road Agencies, SCAG	DM01-02	Short
Express Lanes-Integrated Account Services	This project allows express lane users to manage accounts for different operating agencies under a single point of access by phone or online.	Regional Express Lane and Toll Road Agencies	TM10-01	Short
FRATIS Expansion	Expansion of existing capabilities Including both traveler information and drayage optimization	Ports, Commercial Vehicle Owners, Commercial Vehicle Operations Services Providers	CVO09-01, CVO11-01	Short
Goods Movement-Disseminate Real Time CVO Information	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.	Commercial Vehicle Owners, Commercial Vehicle Operations Services Providers, Caltrans, Local Jurisdictions	CVO01-01, TI01-03, TI02-02	Short
Goods Movement-Truck Fleet Communications Program	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.	Commercial Vehicle Owners, Commercial Vehicle Operations Services Providers, SCAG	CVO01-01	Short

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
Goods Movement-Truck Fleet Data Integration	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.	Commercial Vehicle Owners	CVO01-01	Short
IE511 Upgrades	Expansion of Inland Empire 511 capabilities.	Inland Empire	TI01-02	Short
Integrated Corridor Management (ICM)	Integrated multimodal transportation management and traveler information.	Caltrans, Local Jurisdictions, METRO, RIITS Agencies	PM01-01, PT08-02, TI01-01, TM06-02, TM07-01, TM09-01, TM09-02	Short
ITS Data Repository	Develop and implement a web-based regional education tool for transit agencies, transportation agencies, law enforcement, and emergency responders to provide relevant data, links, and contact information to enhance awareness and use of existing ITS related data including traffic information, emergency preparedness and response, and evacuation plans.	SCAG, Caltrans, Local Jurisdictions	DM01-06, DM01-07	Short
Local Transit System TSP	Expansion of TSP for local transit systems	Regional Transit Agencies	PT09-01	Short
Metro BRT	Expansion of BRT with TSP	METRO	PT08-03, PT09-2	Short
Port Security	Enhance existing Port security systems through sensor and surveillance equipment to monitor all entrance points, critical infrastructure, perimeter security, and to track commercial vehicles/freight equipment, monitoring identities, monitoring freight equipment, and monitor commercial vehicles.	Ports, Commercial Vehicle Owners	CVO08-2, PS09-05	Short

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
Rail GPS Train Location System	Project is underway and will be on-going for some time. The completion of the fiber communication is of importance. Human interpretation of information remains necessary to understand train delays before posting of information. There is no fully automated on-time performance system. This project would be supported by the deployment of onboard PTC equipment.	SCRRA	PT01-01	Short
Rail Infrastructure Security	Install ITS devices including communication backbone to monitor and secure trains, rail cars, fixed assets (tracks, wayside equipment), highway-rail intersections and personnel with interfaces to traffic and emergency management centers. This project would access data collected from various onboard and wayside PTC devices. Data shared using communication interfaces between the railroad operations centers and regional TMCs.	SCRRA	PS09-01	Short
Rail Location and Notification	Provide the ability for rail operators (UP, BNSF) to notify public agencies in SCAG region of manifest data within 24hrs of receiving the data to allow first responders to properly respond in an emergency event. Implement necessary ITS elements to share train location and ID data with public agencies.	SCRRA	TM15-01	Short

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
Rail Quad Gate Synchronization	Investigate alternate means of clearing the crossing by detecting vehicles that are still in the crossing as the first barrier is lowered and synchronize actions with traffic signal systems in the vicinity. This project would be supported by PTC devices that monitor at-grade crossing safety. Events could trigger alerts that are communicated to the train operator by the computer aided dispatch (CAD) system or wayside signaling system. Onboard computers on the locomotives could apply brakes automatically if alerts or warnings are not acted on.	SCRRA	TM14-01	Short
Regional Traveler Information	A general project category that covers potential multi-agency initiatives to increase integrated dissemination of traveler information as widely as possible throughout the Southern California Region. This project would integrate real-time train location and predictive train arrival data obtained from PTC components.	Caltrans, Local Jurisdictions, LA SAFE, METRO, RIITS Agencies	TI01-01, TI01-02	Short
Regional Traveler Information for Evacuation Routing and Emergency Diversion	This project should provide the ability to implement a multi-jurisdictional Advanced Traveler Information System (ATIS) to collect, process, validate, and disseminate both pre-trip and en route real-time information to public agencies, private stakeholder, and the public including: ▪ Emergency and evacuation information regionally to inform travelers of an emergency event, affected areas, and evacuation instructions	Local Emergency/ Health Agencies, California Highway Patrol, Caltrans, SCRRA	PS13-1, PS14-1	Short

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
	▪ Freeway/arterial congestion, video images, and links to alternative transportation services via web page(s) ▪ Interstate/inter-region traveler information covering a wide area (targeted to CVO) This effort should support the MATIS system.			
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 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	RIITS Agencies	DM01-01, MC06-1, MC08-1, PT08-02, PT08-03, SU03-1, TM06-01, TM06-03	Short

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
	applications. The ADMS is expected to support the MATIS program and support performance evaluation for future Express Lane operations.			
Smart Parking	Technology initiatives to improve on street and garage parking	Local Jurisdictions	PM01-01	Short
SoCal511 Upgrades	Expansion of 511 capabilities	LA SAFE	TI01-02, TM02-1	Short
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	Local Jurisdictions	PT04-01	Short
Arterial Interfaces	Develop special event management systems to coordinate seasonal traffic, emergency management, disaster operations, and wide area evacuation by sharing of real-time traffic conditions across county boundaries by local agencies.	Local Jurisdictions, Caltrans	TM07-01, TM07-03	Long
Connected Vehicle Arterial Applications	Possible arterial connected vehicle V2I applications include Signal Phase and Timing (SPAT), Restricted Lane Warnings, Pedestrian Safety, Intersection Safety Warning and Collision Avoidance	Local Jurisdictions	TM04-01, VS10-1, VS12-1, VS13-1	Long
Connected Vehicle Highway Applications	Possible highway connected vehicle V2I applications include Queue Warning, Curve Speed Warning, Road Weather Motorist Alert and Warning, Speed Harmonization, and In-Vehicle Signing.	Caltrans	TI07-1, TM02-1, TM21-1, VS05-1, VS07-1, VS08-1, VS09-1	Long

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
Emergency Response Communication Infrastructure	Improve information sharing and communication between transit operators, law enforcement, transportation agencies, and emergency personnel during significant events or natural disasters. Provide the ability for local agencies to share data collected from local traffic management systems with other agencies, transit operators, emergency services, and law enforcement.	Caltrans, Local Jurisdictions, Local Emergency/ Health Agencies, Transit Agencies	TM08-03	Long
Evacuation and Emergency Response Resource Management	Utilized ITS to facilitate enhanced regional evacuation and emergency response by: Developing sub-regional focal points to refer all citizens during emergency events Providing the ability for Caltrans, EMC, and TMC's to track all response resources including vehicles and all assets that are necessary during an emergency event such as food, water, medical supplies, temporary shelters, etc.	Local Emergency/ Health Agencies, Caltrans, California Highway Patrol	PS12-1, PS13-1	Long
Express Lane Integration with Regional Trip Planners	This project will allow travelers to plan cross county trips that use Express Lane facilities. The user can access trip cost based on the tolling schedules for the Express Lane operators involved.	Regional Express Lane and Toll Road Agencies, LA SAFE	TM10-01	Long
Express Lanes-Automated Enforcement Technologies	This project will implement technologies to automatically detect the occupancy of vehicles in a reliable manner.	Regional Express Lane and Toll Road Agencies, California Highway Patrol	ST06-01	Long
Goods Movement-Container Tracking System	This project establishes a centralized and standardized system for scheduling the pickup and delivery of containers.	Ports, Commercial Vehicle Owners, Commercial Vehicle Operations	CVO11-01, CVO11-02	Long

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
		Services Providers		
Goods Movement-Commercial Vehicle Clearance System	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	California Highway Patrol, Commercial Vehicle Owners, Commercial Vehicle Operations Services Providers	CVO03-01, CVO04-01	Long
Goods Movement-Truck Inspection Stations (Physical and Virtual)	Deployment of truck inspection stations in the SCAG region. These may include physical and/or virtual stations, over time.	California Highway Patrol, Commercial Vehicle Owners	CVO03-01, CVO07-01, CVO08-01	Long
Multi Transportation Agency Regional Interfaces	Develop special event management systems to coordinate seasonal traffic, emergency management, disaster operations, and wide area evacuation by sharing traffic information among the Southern California Caltrans districts and transportation agencies to support a regional control strategy. Provide the ability to relinquish control of local agency signals to regional TMC during significant events or natural disasters to maintain regional traffic flows.	Caltrans, Local Jurisdictions	TM07-01, TM07-03	Long
Multi-agency Video Sharing and Distribution	Establish a common web enabled and secure clearing house for transportation video surveillance for use by multiple transportation and security agencies for security and event preparation, response, and evacuation. Provide the ability for images to be converted to a common selected and web capable format and then distributed through secure	Caltrans, Local Jurisdictions, RIITS Agencies	TM07-01, TM07-03, TM07-04	Long

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
	Internet and commercial wireless channels.			
Non- Motorized Vehicles	This project covers traffic management related efforts to provide support for non-motorized vehicles such as bicycles.	Local Jurisdictions	VS12-1	Long
Ports Traffic Information	Enhance existing Port traffic information dissemination through Closed Circuit Television (CCTV) cameras, Changeable Message Signs (CMS), and gate queue detectors. Enable the ports to receive real-time traffic conditions from local agencies and dissemination through Closed Circuit Television (CCTV) cameras, Changeable Message Signs (CMS), and gate queue detectors. Enable the ports to receive real-time traffic conditions from local agencies and disseminating real-time port information and traffic conditions to local agencies and to Commercial Vehicle Operators.	Ports	TM01-05, TM06-04	Long
Rail Automated Maintenance Support	Long-term goal as funding becomes available. This project would be supported by the restriction of train movements in work zone areas.	SCRRA	PT06-01	Long
Rail Information Dissemination	Future real-time information projects including dissemination to websites, smartphone applications, and displays in trains. The current website has only static displays. This project could be supported by data collected on real-time train movements.	SCRRA	PT08-01	Long

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
Regional Integrated GIS Database	SCAG shall offer a regional repository of GIS data for use by local agencies in emergency planning, and response, in a standardized format. This project would include track geometries, location of wayside elements and other spatial data maintained by the PTC back office systems.	SCAG	SU04-01	Long
Regional Rail Grade Crossing Security	Improve rail grade crossing security and response to emergency events by: ▪ Using sensors and surveillance to monitor at-grade rail crossings ▪ Improving highway-railroad intersections with train detectors, advance warning systems and link train detectors to traffic signal system and EMS dispatch ▪ Utilizing ITS elements to direct vehicles to alternate routes at and in advance of blocked at-grade rail crossings on major arterials during train events (HAZMAT, derailment, train-vehicle collision) ▪ Providing the ability to view and control CCTV through a Windows based system that is compatible with Intelligent Roadway/Rail Interface System (IR/RIS) program and sub-regional ATMS and ATIS. This project would be supported by PTC monitoring of at-grade crossing safety. Regional emergency response could be coordinated by exchanging data between the rail operations centers and regional TMCs.	Local Jurisdictions	TM01-04, TM14-01	Long

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
Security Threat and Guidance Clearinghouse	Develop a SCAG database and GIS resources with a security threat and response guidance expert system and information process. Allow for the receipt of generalized threat information from federal, state, and regional law enforcement and security agencies	SCAG	PS11-1	Long
Traffic Control and Management Systems	Implement traffic control and management systems to enhance emergency response and evacuation including: ▪ Providing centralized traffic control systems (TCS) to cities for signal monitoring and control, incident management, event management, transit coordination, ITS element control and provide connection to sub-regional TMC and adjacent cities. ▪ Implement an Advanced Traffic Management System (ATMS) to detect and monitor signal status, identify traffic congestion and incidents, and display information through a fully integrated mapping function. ▪ Provide ATMS data sharing capability to coordinate operations with Caltrans and adjacent cities and provide arterial information to a traveler information system covering a larger area and multiple modes.	Local Jurisdictions, Caltrans	TM03-01, TM03-02, TM07-01, TM07-03	Long

Project Name	Project Description	Key Stakeholders	Service Packages	Project Timeframe
Upgraded Rail Passenger Information Signs	Includes future capital projects entailing the electronic passenger information system. This project would use real-time train location data to provide predictive train arrival information. The information could be distributed to the public through regional traveler information services such as SoCal511 and Inland Empire 511.	SCRRA	PT08-01	Long

9. USING THE ARCHITECTURE

The regional ITS architecture developed for the SCAG Region addresses the Region's vision for ITS implementation at the time the architecture was revised. As the Region grows, needs will change, and, as technology progresses, new ITS opportunities will arise. Shifts in the Region needs and focus as well as changes in the National ITS Architecture will necessitate that the SCAG Regional ITS Architecture be updated to remain a useful resource for the Region.

Once a regional ITS architecture has been created, it's important that it be used as a key reference in the transportation planning process. This will ensure all proposed ITS projects are consistent with the regional ITS architecture and additional integration opportunities are considered, leading to more efficient implementations. An ITS Architecture provides guidance for planning ITS projects within a region. It also provides information that can be used in the initial stages of project definition and development. This section presents the approach for integrating the SCAG Regional ITS Architecture in SCAG's transportation planning/programming process and leveraging the ITS Architecture for project definition. The approach facilitates and provides a mechanism for the projects identified in this document or in the MTP and TIP to be planned and deployed in an orderly and integrated fashion.

The primary objective of the ITS Architecture is integration. The integration of transportation systems to share information and coordinate activities provides significant benefits over the operation of systems in a stove-piped fashion. The SCAG Regional ITS Architecture identifies the information to be exchanged between transportation systems to meet the transportation needs of the stakeholders in the region.

The ITS Architecture addresses these needs through ITS Services which are mapped to the ITS projects that address them. The ITS Architecture was developed with these objectives in mind through the definition of ITS Services or Service Packages. By defining the ITS Architecture with services that address the needs, projects can be defined through the planning process using the architecture that addresses these needs through deployment.

9.1. USING THE SCAG REGIONAL ITS ARCHITECTURE IN THE PLANNING PROCESS

One of the most important outcomes of the SCAG Regional ITS Architecture is that it will be used to plan and deploy ITS across the region. To do this, the ITS Architecture must be integrated into the regional planning process. As a result of integrating the ITS Architecture into the planning process, the architecture will link the needs of the region with the ITS deployments in the field.

SCAG is the designated MPO in the region and is responsible for facilitating the prioritization and programming for all projects in the region through the development of the long-range RTP/SCS and its near-term FTIP, the latter being compatible with the Statewide Transportation Improvement Programs (STIPs) developed by Caltrans.

Since the formation of MPOs out of the Federal Aid Highway Act of 1962, the '*continuous, comprehensive, cooperative*' (3-C) planning process has been the basis for long-range, multi-modal planning. FHWA states that "*[t]ransportation planning processes are required to be organized and directed…*" This proposed ITS integration process seeks to establish an *organized and directed* process that is *continuous, comprehensive*, and *cooperative* in nature.

During the initial development phases of the RTP/SCS, the most critical aspect of the ITS integration process from an MPO perspective is the coordination and collaboration with local partners/stakeholders. Consistent communication should occur during all key elements of the planning process. Through the

planning process, the MPO should assess those ITS projects currently listed and any new ITS projects that have been developed. To truly integrate ITS planning, it is important that the MPO evaluate the proposed ITS projects alongside other Regional projects. The regional ITS architecture can support this assessment by providing a full set of ITS projects in the region.

The integration process should consider several other planning documents that include ITS solutions. These documents may include the Congestion Management Process (CMP), Travel Demand Management (TDM), transit plans, and special studies. It is anticipated any of these documents could inform the RTP as necessary. **Table 13** lists several planning practices and the anticipated ITS related event and expected output that potentially could be required.

Table 13. Planning Practices and ITS Related Events

Planning Element	Potential ITS Events	Desired Outputs
STIP	Prepare a statewide project list based on the ranking methodology which may be informed by ITS Deployment Analysis System (IDAS) evaluation measures	Adopted STIP that includes appropriate ITS projects
California Transportation Plan (CTP)	Establishes vision, goals, and objectives that will guide long-range transportation decisions and investments. It is broken into several modal plans and programs. It should consider ITS solutions as part of statewide project initiative and is informed by all local, regional, and statewide planning practices.	Statewide Plan that includes planned ITS solutions
FTIP	Develop a comprehensive listing of transportation projects proposed over a six-year period, which includes ITS projects across the modal areas.	Adopted FTIP that includes ITS projects
RTP/SCS	Long-range visioning plan for the SCAG region that includes a wide range of transportation projects, with many having ITS elements.	Adopted RTP/SCS that includes planned ITS projects that could be federally funded
CMP/TDM	CMP and TDM plans are conducted at the county-level and uses historical congestion data in the region to determine policies and projects to implement that manages the transportation impacts of urban growth. It considers current regional model and IDAS results and the success of previously recommended mitigation strategies which may include ITS solutions.	Adopted CMP/TDM that includes ITS projects
Transit Urban Application/ Technology Plan	Projects must be included in the Regional ITS Architecture; project meets the FTA's Triennial Review checklist	Completed Application with ITS solutions identified

In order to facilitate the connection between the Regional ITS Architecture and the local transportation program (RTP and FTIP) it is recommended that SCAG adopt the SCAG Regional ITS Architecture as part of the official set of planning documents for the region.

The goal of the planning process is to make quality, informed decisions pertaining to the investment of public funds for regional transportation systems and services. Using the regional ITS architecture to support these planning activities is an important step in the mainstreaming of ITS into the traditional decision-making of planners and other transportation professionals. Once an architecture is complete, it can feed detailed ITS-specific information back into the planning process.

Figure 3 below shows some of the key steps in the general transportation planning process and the ITS Architecture interrelation to the steps in the process. These steps will be elaborated on in following sections. The process is driven by a regional vision and set of goals. These drive transportation improvement strategies that are a mix of capital improvements and operational improvements. The planning organizations evaluate and prioritize the various strategies, and the resulting output is the Metropolitan Transportation Plan (MTP). This plan is the key output of long range planning.

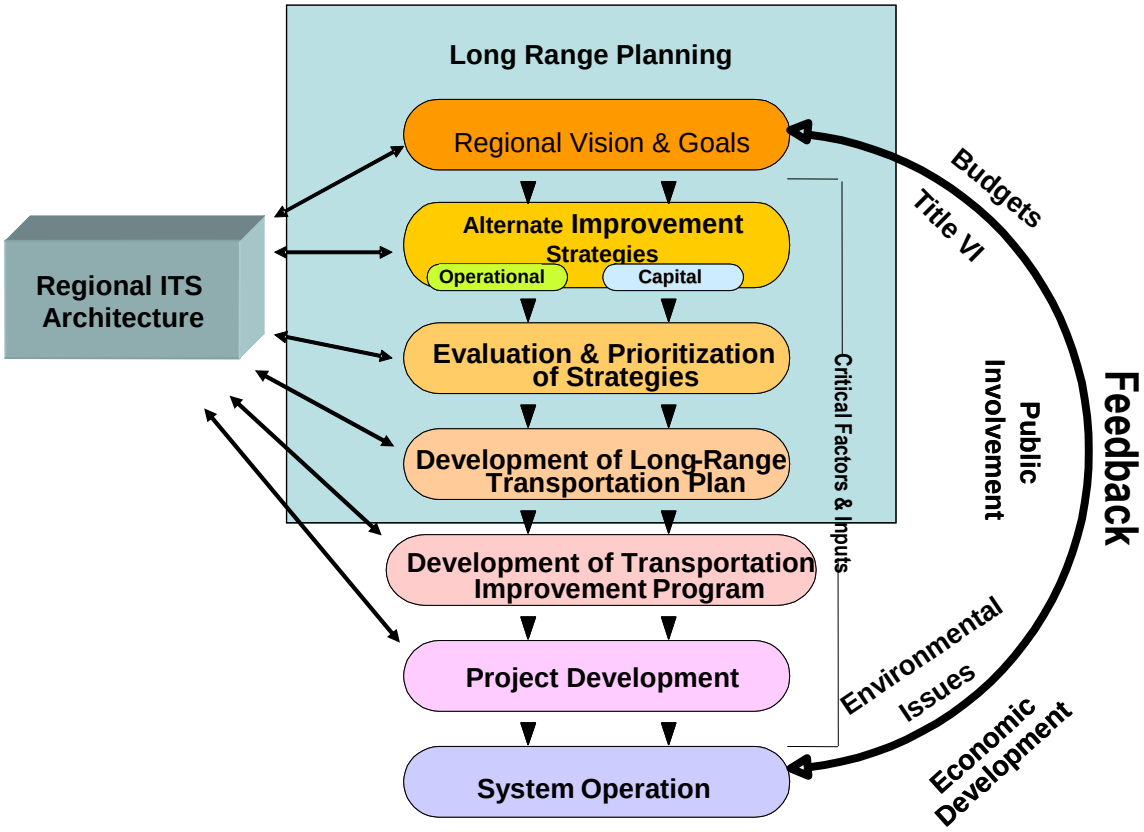

Figure 3: ITS Architecture and the Transportation Planning Process

For the SCAG region the primary planning document is the 2016 RTP/SCS. It is the long-range guide for major investments in the region's multimodal surface transportation system. The RTP recommends major projects, systems, policies and strategies designed to maintain the existing transportation system and serve the region's future travel needs. With the update of the SCAG Regional ITS Architecture, it is recommended that the RTP be reviewed and updated as necessary to incorporate any new aspects of transportation connectivity defined in the architecture.

The 2016 RTP/SCS goals are as follows:

- Align the plan investments and policies with improving regional economic development and competitiveness.
- Maximize mobility and accessibility for all people and goods in the region.
- Ensure travel safety and reliability for all people and goods in the region.

- Preserve and ensure a sustainable regional transportation system.
- Maximize the productivity of our transportation system.
- Protect the environment and health of our residents by improving air quality and encouraging active transportation (non-motorized transportation, such as bicycling and walking).
- Actively encourage and create incentives for energy efficiency, where possible.
- Encourage land use and growth patterns that facilitate transit and non-motorized transportation.
- Maximize the security of the regional transportation system through improved system monitoring, rapid recovery planning, and coordination with other security agencies.
- A list of projects, programs, and strategies meant to address the regional priorities.

The RTP/SCS is the expression of SCAG's long-range approach to planning and implementing the multimodal transportation system. It is the policy forum for balancing transportation investments among modes, geographic areas, and institutions.

The Regional ITS Architecture supports the transportation process through the following ways:

- The services described in the regional ITS Architecture can provide the basis for operational strategies that can be used to improve the transportation system to meet the region's vision and goals.
- The definition of an integrated transportation system described by the regional ITS architecture can support the ITS elements of the RTP.
- The process of developing and maintaining a regional ITS architecture can help to enhance the linkage between operations and planning through closer involvement of a wider array of stakeholders from both of these areas of transportation.

The discussion above focuses on supporting the MPO transportation planning process, but the architecture can also be used to support the other planning processes used by agencies in the region (e.g. public safety agencies). As shown in **Figure 4**, agencies that do not use federal transportation funds (or operate through the MPO planning process) will still have some form of long range plan and capital plan whose development can be supported by the regional ITS architecture.

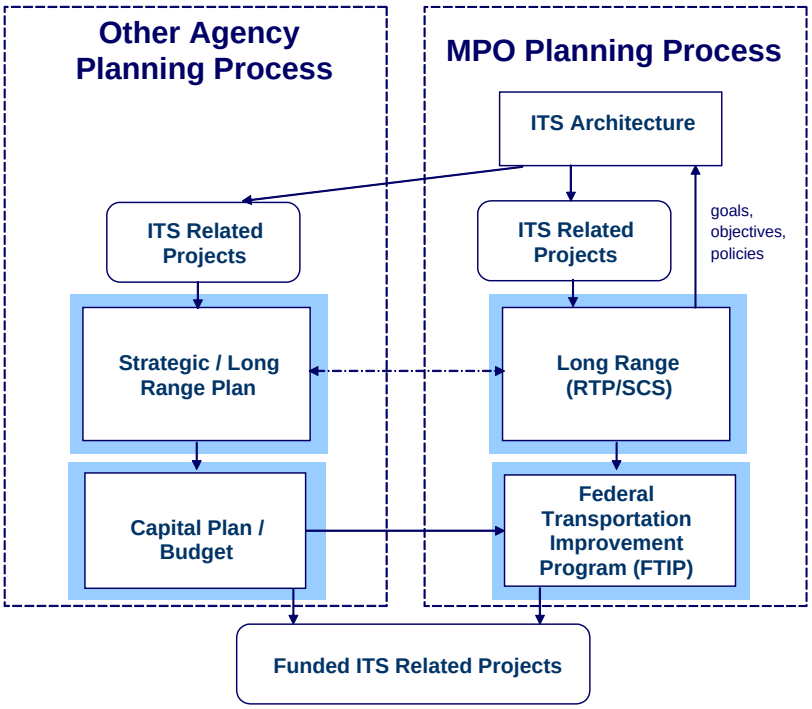

Figure 4: Supporting the Transportation Planning Processes

The challenge for achieving integration across planned ITS projects in the region is to know how they fit together and interact or depend on each other. The regional ITS architecture can be leveraged to bridge the MPO processes to other agencies planning processes that do not use federal transportation funding. If all the processes are using the same reference point, the regional ITS architecture, then project integration can start in the planning phase

In addition to the discussion above, the following publications are a sample of the assistance offered at a national level to help guide the integration of planning and operations and many of these documents include additional input on how a regional ITS architecture can support this linkage:

- Applying Analysis Tools in Planning for Operations (FHWA),
- Statewide Opportunities for Linking Planning and Operations A Primer, Getting More by Working Together (FHWA)
- Opportunities for Linking Planning and Operations (FHWA,)
- Incorporating ITS into the Transportation Planning Process: An Integrated Planning Framework (ITS, M&O, Infrastructure) Executive Guidebook Transportation Research Board, National Cooperative Highway Research Board.

9.2. ARCHITECTURE USE IN PROJECT PROGRAMMING

All agencies including SCAG, Caltrans, Metro, local municipalities, etc. use a budgeting process to allocate funds to projects. The primary programming document for the region is the FTIP. The current version of the FTIP is the FY2019 version which, along with amendments, defines the regional transportation projects that have funds programmed for development. While most of the projects are Capital Improvement Projects (CIP), the FTIP does include some ITS projects. Many ITS improvements are implemented as part of larger capital improvement projects. As traditional capital projects are defined and programmed, it is important to identify the associated opportunities for efficient ITS implementation.

The SCAG Regional ITS Architecture is a record of the ITS implementation planned by each agency that can be used to identify these opportunities. Most agencies in the region have developed policies to review each capital project to determine if ITS measures should be included before the project moves forward. One important consideration with these "locally-funded" ITS projects is the consideration of the Systems Engineering Process (discussed in the next section) that is necessary in order to integrate with the larger federally-funded ITS system. Without System Engineering, the project's ability to integrate with other deployments may be at risk.

9.3. Architecture Use in Project Definition and Development

Projects that emerge from the planning process can benefit from the use of the SCAG Regional ITS Architecture in their definition and development. ITS project implementation should follow a systems engineering process. The ITS Architecture is most effective in the early phases of systems engineering processes. Figure 5 shows a typical project implementation process for deploying ITS projects.

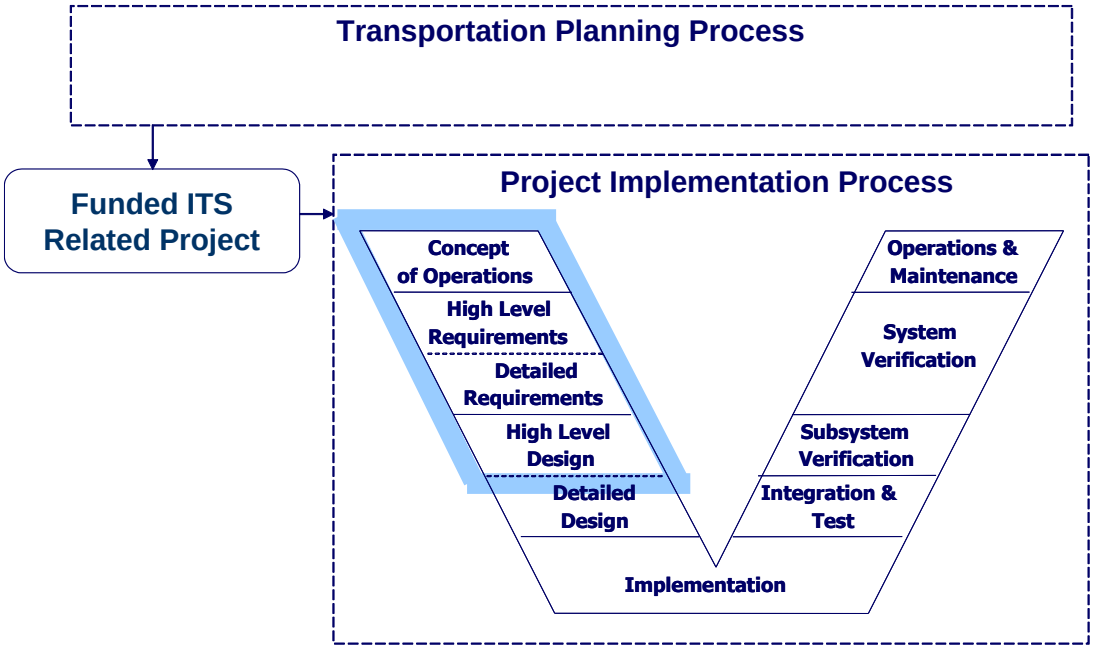

Figure 5: Project Implementation Process

The project implementation process shown in Figure 5 is a Systems Engineering process. It is a process that can be used to systematically deploy ITS while reducing the risks associated with deployments. The Systems Engineering process is more than just steps in systems design and implementation; it is a life-cycle process. The process recognizes that many projects are deployed incrementally and expand over time. US DOT Rule 940 requires that the systems engineering process be used for ITS projects that are funded with federal funds.

Applying the System Engineering process to ITS project development is a key requirement that must be addressed by stakeholders using federal funds.

FHWA Rule 940/FTA Policy contains a set of requirements that apply to ITS projects. The Rule indicates that a Project Systems Engineering Analysis (PSEA) be created. The requirements for the PSEA, summarized below, state:

a) All ITS projects funded with highway trust funds shall be based on a systems engineering analysis.
b) The analysis should be on a scale commensurate with the project scope.
c) The systems engineering analysis shall include, at a minimum:
    1. Portions of the Regional ITS Architecture Being Implemented
    2. Participating Agencies Roles and Responsibilities
    3. Requirements Definitions
    4. Analysis of Alternative System Configuration and Technology Options
    5. Procurement Options
    6. Applicable ITS Standards and Testing Procedures
    7. Procedures and Resources Necessary for Operations and Management of the System.

To support development of the PSEA Caltrans has created the ITS Program Guidelines in the Local Assistance Program Guide - http://dot.ca.gov/hq/LocalPrograms/ITS/ITS.htm

The Systems Engineering Review Form helps establish consistency with the Regional ITS Architecture. The form is found in the Local Assistance Program Guidelines from the above link.

The checklist provides for project name, description, and contact information, and leads the respondent through a series of specific project related questions where detailed project information, procurement methods, and phasing is identified. Other queries associate the project to the regional Architecture, as well as the stages included in the Systems Engineering "V Diagram". The form allows for the attachment of all applicable service packages diagrams which can be obtained directly from the architecture website or other architecture documentation.

The following are some key references that stakeholders can access to assist in using this process:

General Resources

- FHWA Systems Engineering Website (ops.fhwa.dot.gov/int_its_deployment/sys_eng.htm)
- International Council on Systems Engineering (www.incose.org)

Training

- The National ITS Architecture team provides Systems Engineering training, with information at the following link: https://local.iteris.com/arc-it/html/resources/training.html
- Advanced Systems Engineering for Advanced Transportation Projects (CITE - www.citeconsortium.org/courses/syseng.html)

Publications

- Building Quality Intelligent Transportation Systems through Systems Engineering (FHWA-OP-02-046): www.itsdocs.fhwa.dot.gov/jpodocs/repts_te/13620.html
- Systems Engineering Guidebook for ITS (FHWA California Division/Caltrans): www.dot.ca.gov/research/se_guidebook_ver1-12_14_05.pdf
- Systems Engineering for Intelligent Transportation Systems, An Introduction for Transportation Professionals: http://ops.fhwa.dot.gov/publications/seitsguide/seguide.pdf

There are similarities between the systems engineering process and the project development process followed by agencies in the region. A typical agency project development process for a federally funded or regionally significant transportation project is as follows:

- Project Planning

- Development of individual county TIP
- Evaluation of alignment with RTP/SCS
- Inclusion into FTIP

- Project Selection
- Authorization to Proceed
- Project Definition
  - Purpose and Need
  - Project Scoping
  - Conceptual Design
- Project Design
  - Preliminary Plan Development
  - Semi-Final Plan Development
  - Final Plan Development
- Construction
  - Testing
- Operation and Maintenance

Table **14** shows the relationship a typical transportation project development process has to the FHWA systems engineering process.

Table 14: Regional Project Development Process Relation to FHWA System Engineering Process

Traditional Project Development Process	Relation	Systems Engineering Process
Project Definition Purpose and Need Project Scoping Conceptual Design	=>	Concept of Operations High Level Requirements Detailed Requirements
Project Design Preliminary Plan Development Semi-Final Plan Development Final Plan Development	=> =>	High Level Design Detailed Design
Construction Testing	=>	Implementation Integration & Test Subsystem Verification System Verification
Operation and Maintenance	=>	Operations & Maintenance

As shown by the highlights in **Figure 5** and in **Table 14**, the SCAG Regional ITS Architecture can be used to support development of the concept of operations, requirements and high level design in the systems engineering process.

In deployment of an ITS related project, the ITS Architecture should be used as the starting point for developing a project **concept of operations** (not to be confused with an Architecture's Operational Concepts that define the roles and responsibilities of the Architecture's stakeholders). The concept of operations shows at a high level how the systems involved in a project operate in conjunction with the other systems of the region. According to the NHI course "Introduction to Systems Engineering for Advanced Transportation", a Concept of Operations includes the following information:

- Identification of stakeholders,
- Development of a vision for the project,
- Description of where the system(s) will be used,
- Description of organizational procedures or practices appropriate to the system(s), definition of critical performance parameters associated with the systems(s),
- Description of the utilization environment (conditions under which various parts of the system(s) will be used),
- Definition of performance measures used to evaluate the effectiveness of the system(s),
- Considerations of life cycle expectations, and
- Conditions under which the system(s) must operate (e.g. environmental conditions).

The customized service package diagrams tailored by the regional stakeholders can also assist in definition of requirements for ITS systems involved in a specific project. The ITS Architecture contains high level functional requirements for all ITS elements in the region. These high-level requirements can be the starting point for developing more detailed requirements.

The ITS Architecture can support high level system design. The ITS architecture can be used by system designers to identify the ITS standards that are applicable for the interfaces included in the architecture.

While the above discussion relates the architecture to the general system engineering process, Rule 940 does have a specific set of system engineering analysis requirements (listed above) that apply to all ITS projects that use funds from the Highway Trust Fund. The required system engineering analysis steps are:

The SCAG Regional ITS Architecture provides inputs to a number of these steps as shown in **Table 15**.

Table 15: Systems Engineering Requirements supported by SCAG Regional ITS Architecture

Systems Engineering Requirements	SCAG Regional ITS Architecture Output
Identification of portions of the regional ITS architecture being implemented	Mapping project to the elements and interfaces of the regional ITS architecture
Identification of participating agencies' roles and responsibilities (this relates to the Concept of Operations described earlier.)	Use Operational Concept as a starting point
Requirements definitions	Use Functional Requirements as a starting point.
Identification of applicable ITS standards and testing procedures	Use regional architecture standards outputs as a starting point for the standards definition.

In summary, the regional ITS architecture represents a detailed plan for the evolution of the ITS systems in the region and can be used to support regional transportation planning efforts and project development efforts.

10. ARCHITECTURE MAINTENANCE PLAN

The SCAG Regional ITS architecture is not a static set of outputs. It must change as plans change, ITS projects are implemented, and the ITS needs and services evolve in the region. This section describes a plan for the maintenance of the architecture. The plan covers the following four key areas:

- Who will be involved in the maintenance of the architecture?
- When will the architecture be updated?
- What will be maintained?
- How it will be maintained (i.e. what configuration control process will be used)?

The regional ITS architecture is created as a consensus view of what ITS systems the stakeholders in the region have currently implemented and what systems they plan to implement in the future. The regional ITS architecture will need to be updated to reflect changes resulting from project implementation or resulting from the planning process itself.

- Changes for Project Definition. When actually defined, a project may add, subtract or modify elements, interfaces, or information flows from the regional ITS architecture. Because the regional ITS architecture is meant to describe the current (as well as future) regional implementation of ITS, it must be updated to correctly reflect how the developed projects integrate into the region.
- Changes for Project Addition/Deletion. Occasionally a project will be added or deleted through the planning process and some aspects of the regional ITS architecture that are associated with the project may be expanded, changed or removed.
- Changes in Project Priority. Due to funding constraints, or other considerations, the planned project sequencing may change. Delaying a project may have a ripple effect on other projects that depend on it. Raising the priority for a project's implementation may impact the priority of other projects that are dependent upon it.
- Changes in Regional Needs. Transportation planning is done to address regional needs. Over time these needs can change and the corresponding aspects of the regional ITS architecture that addresses these needs may need to be updated.

In addition, new stakeholders may come to the table and the regional ITS architecture should be updated to reflect their place in the regional view of ITS elements, interfaces, and information flows.

Finally, the National ITS Architecture may be expanded and updated from time to time to include new user services or better define how existing elements satisfy the user services. The National ITS Architecture may have expanded to include a user service that has been discussed in a region, but not been included in the regional ITS architecture, or been included in only a very cursory manner.

10.1. ROLES AND RESPONSIBILITIES FOR MAINTENANCE

Responsibility for maintenance of the SCAG Regional ITS Architecture will lie with SCAG, since they are the primary planning organization for the region and will be one of the primary users of the architecture. While they assume responsibility for maintenance, the region will also need a group of core stakeholders to act as an "institutional framework" to review proposed changes to the architecture. The regional ITS architecture is a consensus framework for integrating ITS systems in the region. As it was a consensus driven product in its initial creation, so it should remain a consensus driven product as it is maintained. An institutional framework is needed for maintaining the products. This might be an advisory committee

or some similar group, convened by SCAG and having representatives from key stakeholder agencies in the region. This section defines the stakeholder groups and their roles and responsibilities for the maintenance of the SCAG Regional ITS Architecture.

Definitions

The following stakeholder groups will have a role in the maintenance of the architecture:

- Stakeholders – Any government agency or private organization that has a role in providing transportation services in the region.
- Responsible Agency – The stakeholder agency with primary responsibility for maintenance of the architecture.
- Lead Staff for Maintenance – A person (or group) responsible for overseeing and guiding the maintenance efforts.

Stakeholders

Stakeholders are any government agency or private organization that is involved with or has an interest in providing transportation services in the state. Each stakeholder owns, operates, and/or maintains one or more ITS elements in the architecture.

The success of the change management process outlined in this Maintenance Plan is highly dependent on the participation of the stakeholders identified in the architecture. Without stakeholder's participation in tracking the development of their ITS systems, and properly updating the architecture, the change management process will not succeed, and the usefulness of the architecture will diminish over time.

The primary responsibilities of the stakeholder agencies are submitting the changes in plans or projects to the Responsible Agency.

Responsible Agency

The Responsible Agency is the government agency that will formally maintain the architecture. The Responsible Agency will assign resources for making the physical changes to the architecture baseline, and for coordinating the maintenance of the architecture. For the maintenance of the SCAG Regional ITS Architecture, the Responsible Agency is SCAG, since they are the primary planning organization for the region, and will be primary users of the architecture.

SCAG's role may include the following responsibilities:

- Collecting and compiling proposed changes and updates to the architecture from stakeholder agencies.
- Evaluating each proposed change from a technical standpoint, and reaching a consensus on the proposed change.
- Approving changes to the architecture.
- Making any institutional or policy related decisions that arise in the maintenance of the architecture.

Lead Staff for Maintenance

The Responsible Agency should appoint a person to the role of Lead Staff for Maintenance to coordinate the maintenance activities of the SCAG Regional ITS Architecture. The Lead Staff for Maintenance will be

the coordinator and main point of contact for all maintenance activities, including receiving Change Requests forms, tracking Change Requests, and distributing documentation. The Lead Staff for Maintenance is ideally an employee of the Responsible Agency who is formally tasked with the described efforts, but it is not a requirement

The Lead Staff for Maintenance has the following responsibilities:

- Coordinate the activities of updating the architecture
- Receive Change Request forms and requests for documentation from Stakeholders
- Distribute the baseline documents and outputs of the architectures to stakeholders.
- Maintain the "official" records of the SCAG Regional ITS Architecture, including the baseline documents, meeting minutes, the Change Request Database, and the list of Points of Contacts for the Stakeholder
- Ensures the status of each Change Request are properly updated in the Change Request Database

Some of these responsibilities will likely be delegated to staff or consultants.

10.2. TIMETABLE FOR MAINTENANCE

The timetable will depend on the basic approach chosen for maintaining the architecture. There are several options that could be considered:

- **Periodic Maintenance.** This approach ties the maintenance of the architecture to one of the recurring activities of the transportation planning process. For example, it's natural that the ITS architecture would be updated at the same frequency as the RTP is updated (every four years, since this is a non-attainment area) or the Transportation Improvement Program is updated (at least every two years). The update of the architecture could occur several months prior to the transportation planning document update, so that the revised architecture could serve as an input to the planning update. Publication and versioning costs are minimized for the periodic maintenance approach since there is a new version only once in the maintenance cycle.
- **Exception Maintenance**. This approach considers and makes changes to the regional ITS architecture in a process that is initiated as needed. Publication and versioning costs are dependent on the frequency of changes made to the regional ITS architecture.

Timetable Approach

A comprehensive architecture update should occur every four years, concurrent with the formal update of the TIP. This is a natural result of the SCAG Regional ITS Architecture being a component of the regional transportation planning process. The update is necessary to ensure that the architecture continues to accurately represent the regional view of ITS Systems. The comprehensive update may include adding new stakeholders, reviewing transportation needs and services for the region, updating the status of projects, and reflecting new goals and strategies, as appropriate. Operational concepts, system functional requirements, project sequencing, ITS standards, and list of agency agreements may also be updated at this time.

Between major updates of the architecture, the following interim update actions will be performed:

- Accept comments as they come in and make ***minor updates every year if needed***. Defer any major changes to the comprehensive update.

- ***Actively solicit changes on an annual basis*** from each key stakeholder a set of needed updates.
- ***Perform minor or major updates as needed*** based upon the inputs and any other change requests received.

The Maintenance Plan should also be reviewed at the previously discussed times for required changes. Use of the Regional ITS Architecture and modifications to it may differ from what was anticipated during the initial development of the Maintenance Plan. Revising the Maintenance Plan may ensure that the change management process defined is effective.

10.3. Architecture Baseline

Establishing an architecture baseline requires clear identification of the architecture products that will be maintained, including specific format and version information. For the SCAG Regional ITS Architecture the following outputs represent the architecture baseline:

- Architecture Document (this document)
- Turbo Architecture Database
- Visio file of Customized Service Package diagrams
- Regional ITS Architecture Web pages
- Change Request Database

Regarding the Architecture document, the source document, in Microsoft Word format, will be held by SCAG, while a PDF version of the document can be created for general distribution. In addition, a version number and date should be included inside the cover page.

Regarding the Turbo Architecture Database, SCAG will maintain a zipped version of the final delivered SCAG Regional ITS Architecture database. The name, date, and size of the database file inside the zipped file should be entered into an architecture log as version 4.0 of the architecture.

10.4. Change Management Process

Once the baseline is defined, the process for making changes to this baseline must be established. The change management process specifies how changes are identified, how often they will be made, and how the changes will be reviewed, implemented, and released. The basic process for change management is shown in Figure 6.

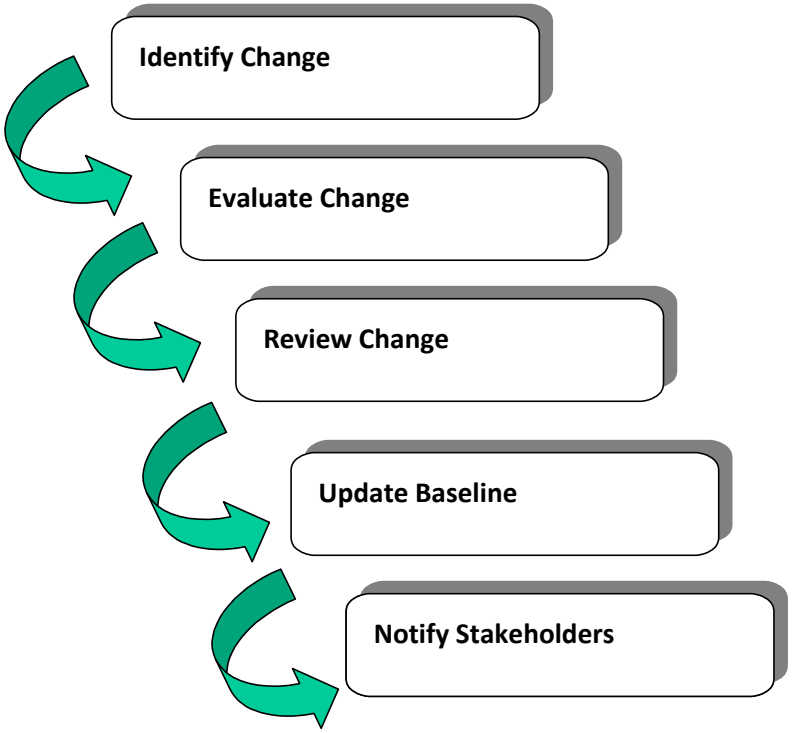

Figure 6: Change Management Process

Identify Change

This involves two issues-

- who can identify a change to the architecture? and
- how will the change request be documented?

The question of who can make change requests is an important one. If literally anyone can input requests the region runs the risk of being overrun by requests that will tax scarce resources to review and decide upon. On the other end of the spectrum, if too much formality or paperwork is added to the process then many valid or needed changes may go unexpressed. The plan is that all changes should come through a voting member of the Maintenance Working Group. This effectively means that any change suggested has the approval of a member of the working group. This has the added benefit of spreading the resources needed to generate or evaluate changes among the group.

As to how the change request should be documented—a simple change request form should be created that contains at least the following information

- Name of change
- Description of change
- Part of baseline affected (could be check boxes for document, database, web site, and not known)
- Rationale for change
- Originator name or agency
- Date of origination

This information will ultimately be added to a change database (recommended to be maintained by SCAG personnel) that will add the following additional fields of information

- Change number (some unique identifier)
- Change disposition (accepted, rejected, deferred)
- Change type (minor or significant)
- Disposition comment
- Disposition date

Evaluate Change

Upon receiving a Change Request by the Maintenance Manager, an initial evaluation of the Change Request is to be made for the impact to the overall architecture or the affected document. The purpose of the evaluation is two-fold:

- Verify that the Change Request form and supporting materials is complete and correct
- Compare with other Change Request forms and determine if there are any conflicts

If the proposal for architecture modification has an impact on other stakeholders, the evaluator(s) should contact the Stakeholders to confirm their agreement with the modification. All Stakeholders directly affected by the proposed change(s) must approve and sign-off the Change Request before the Maintenance Working Group considers the Change Request.

There are several options as to who performs the initial assessment, including:

- The Maintenance Manager
- Maintenance Working Group
- The person submitting the change
- A consultant, hired to support the maintenance activities of the architecture

Each of the above options has positive and negative implications, but the evaluator must have working knowledge of the architecture to evaluate the proposed changes.

Reviewing the Change Request

Upon completing the initial assessment, the Change Request form should be reviewed by the Maintenance Working Group (either at a Maintenance Working Group meeting or via some electronic means). Maintenance Working Group meetings are called by the Maintenance Manager (or their designated representative).

Maintenance Working Group meetings called by the Maintenance Manager will occur at least on an annual basis. On an annual basis, the Maintenance Manager will send a reminder to all Stakeholders to update their ITS Elements and Interfaces in the architecture, if necessary. If sufficient Change Request Forms are submitted, the Maintenance Manager may call a Maintenance Working Group meeting at more frequent intervals to review the Change Request forms. The Maintenance Manager will act as Chairperson for these meetings. The Maintenance Manager will distribute the Change Request forms and all supporting materials to all Stakeholders prior to the meeting for their review and assemble an agenda.

Maintenance Working Group meetings can also be requested by one of the stakeholders if there is an urgent need to update the architecture quickly.

The Maintenance Working Group should have sufficient time to review the Change Requests before the meeting. During the meeting, the Maintenance Working Group shall review the proposed changes and offer any comments.

After each Change Request is reviewed, if no further comments are offered by the Maintenance Working Group, the Change Request will be considered approved, and the Chairperson shall sign off on the Change Request.

If additional comments are made that require action, those comments should be noted on the Change Request form. Where comments (or changes required) are minor in nature they can be made by the submitter of the change Request form, or by resources designated by the Maintenance Manager and the change considered approved. In the case of major comments or changes to the Change Request, the approval of the change may be deferred until the next meeting of the Maintenance Working Group.

If a Change Request is to be withdrawn from consideration, the Chairperson or the Maintenance Manager must sign-off on the Change Request Form to close out the Change Request.

At the end of the meeting, the Maintenance Working Group shall agree if all the approved changes to the architecture necessitate a minor revision of the appropriate baseline documents or a major revision. The decision will be based on the number of Change Requests approved and the nature of the approved changes.

Minutes should be kept for all Maintenance Working Group meetings. Minutes should include, at a minimum, an attendance list, comments made on each Change Request, and the disposition of each Change Request Form (Approved/Withdrawn/Deferred/Request More Information). Minutes are to be distributed to all members of the Maintenance Working Group meeting no less than 5 working days after the meeting. Comments are due within 10 working days to the Maintenance Manager. Approved minutes shall be signed by the Chairperson and will be distributed to all Stakeholders and posted on the website. The minutes provide a recording process for the change management process and provides traceability.

One additional procedure the region may want to consider is to streamline the review and approval process for minor Change Requests, handling via email rather than through face to face meetings.

Update Baseline: The decision is implemented.

If the decision is to accept the change, then the appropriate portions of the architecture baseline are updated and an updated architecture baseline is defined. In addition to updating the baseline documents, databases, or other outputs, the configuration status should be updated. In the discipline of Configuration Management this is known as Configuration Status Accounting. This accounting is performed by having a document that defines the following information for each separate output of the architecture baseline:

- Output name;
- Output revision number;
- Date of latest revision;
- File Name; and
- Location/Point of Contact.

Periodically, the information in the various outputs of the architecture baseline should be audited to assure that the different representations of the architecture information (e.g. the database and document) are in sync. This configuration auditing should be performed by someone independent of the staff or resources used to actually enter the changes.

Notify Stakeholders: Point of Contacts for each stakeholder should be notified by e-mail from the Maintenance Manager when baseline documents have been updated. All baseline documents shall also be available to stakeholders from a website or other electronic location, such as an ftp site. It is the responsibility of the Maintenance Manager to ensure the most recent document is available from the website. The Configuration Status Document should be one of those outputs that is available.

Request for copies or access to the baseline documents should be made to the Maintenance Manager.

After major revisions to the architecture or the baseline documents, the Maintenance Working Group may elect to also provide all baseline documents to members on CD-ROMs.

The purpose of this section is to develop Key Performance Indicators (KPIs) that will be used to monitor the use and performance of the SCAG Regional ITS Architecture. As the lead MPO (SCAG) and to leverage the investments made for the Regional ITS Architecture update, it is important to promote and maintain stakeholder involvement and usage of the Architecture. In addition, as we embark into the connected world, the scope of ITS has expanded, and with that expansion there will be more stakeholder involvement, and new stakeholders. Through this evolution, SCAG has realized that the Architecture platform should be readily available, accessible, and geared towards being more user friendly to promote, capture, and maintain stakeholder involvement.

Under this update, strategies have been initiated to enhance stakeholder participation by using more planner friendly terms, easier to follow processes, and an interactive project website to navigate through the Regional ITS Architecture. The website will be the primary tool for stakeholders to view and use the Architecture.

Based on the implementation of these strategies and the interactive project website, SCAG would like to be able to measure the performance and use of SCAG Regional ITS Architecture to understand if these initiatives are working, and provide tools to enhance the user experience, interaction, and feedback. By using the established KPIs, it provides SCAG with the criteria on “how to” monitor the use and performance of the SCAG Regional ITS Architecture through a series of metrics.

10.5. Development of Key Performance Indicators (KPIs)

The following section describes the development of KPIs, which will be used to evaluate the activity and performance of the SCAG Regional ITS Architecture.

The process of developing the KPIs began with the identifying metrics that help answer the following questions:

- How often the architecture website is viewed or accessed?
- How many ITS projects utilize architecture information?
- How many architecture change requests are submitted indicating that ITS efforts in SCAG are considering the architecture and actively seeking to improve it?

The metrics are supported by data to assess the performance under each metric. In addition, website analytics will be used to monitor the frequency and use of the website and the various components of the website. Follow up surveys will also be conducted quarterly or biannually for qualitative feedback on usability and value of the Architecture.

Based on our process for developing KPIs, metrics have been identified in **Table 16**. Each metric is defined including the type of data needed to report the metric. Most metrics are easily obtained by using automatic website analytics tracking. Though all KPIs are useful measures of performance, priority KPIs that should be tracked and monitored regularly to maintain usefulness of the architecture are indicated in **bold**.

Table 16. Key Performance Indicators

Category	Metric	Definition	Data Needed for Reporting
Website	**Site Traffic (Frequency)**	• **The number of site visits**	**Obtain through website analytics.**
Website	Traffic Source Hits	• Link from website or webpage to access site	Obtain through website analytics.
Website	New and Returning Visitors	• The number of new and returning visitors	Obtain through website analytics.
Website	Page Views Per Visit	• The page and the number of views per page	Obtain through website analytics.
Website	Pages Visited Most	• The page and the number of views per page	Obtain through website analytics.
Website	Time on Site	• The amount of time tracked per user	Obtain through website analytics.
Website	Subscribers (if provided)	• Number of subscribers on site. This would require a long in with username and password.	Obtain through website analytics.
Website	Website Assistance Email Count	• The number of assistance requests through email	Obtain through website analytics. Provide a separate database to track the number of emails.
Website	Website Assistance Service Phone Call Count	• The number of assistance requests through phone calls	Obtain through call tracking database.
Website	Website Concern Classification	• The type and number of concerns in regard to the website	Obtain through website analytics. Provide a separate database to track the number of concerns.
Regional ITS Architecture	ITS Projects	• List of ITS projects that were identified through the Architecture update process.	Obtain through website analytics.

Category	Metric	Definition	Data Needed for Reporting
		• A running list of existing and planned ITS projects.	Obtain through project database.
Regional ITS Architecture	Stakeholders associated with ITS Projects	• A list of project stakeholders will be provided and projects associated with each stakeholder. • This list will be updated based on modified and/or new stakeholders and projects	Obtain through website analytics. Obtain through project database.
Regional ITS Architecture	**Change Requests**	• **Request support from the Architecture Team in completing a change request.**	**Obtain through website analytics.** **Obtain through project database.**
Regional ITS Architecture	Changes in Project	• When formally defined during procurement and deployment, a project may add, subtract or modify elements, interfaces, or information flows from what was envisioned in the architecture • Used for updating current, and planned projects	Obtain through website analytics. Obtain through project database.
Regional ITS Architecture	Changes Resulting from Project Addition/ Deletion	• Occasionally a project will be added or deleted during the planning process. When this occurs, the aspects of the Architecture associated with the project must correspond. Because the regional ITS architecture is technology neutral, the changes will refer to changes in data flows, functional systems and interoperability. Changes will not be required if the technology to achieve a given function changes because the architecture is technology neutral – if the function remains essentially the same.	Obtain through website analytics. Update through project database.
Regional ITS Architecture	**Changes in Project Status**	• **As projects are deployed, the status of the Architecture elements, services, requirements, roles and responsibilities, and information flows that are part of the project must be changed from 'planned' to 'existing'. Elements, services, and flows are considered to change to "existing" status when they are substantially complete in that they have been installed, tested and are being used.**	**Obtain through website analytics.** **Update through project database.**
Regional ITS Architecture	Changes in Project Sequencing	• Due to funding constraints, technological changes, and other considerations, a project planned in the Region may be delayed or accelerated. Such changes that impact the sequence of projects in the Region need to be reflected in the architecture.	Obtain through website analytics. Update through project database.
Regional ITS Architecture	Stakeholder Changes	• Stakeholder additions, deletions, and changes will need to be documented in the architecture, along with any ITS inventory associated with the changing Stakeholders. A change may be as minor as a Stakeholder changing its organization name.	Obtain through website analytics. Update through project database.
Regional ITS Architecture	**Changes in Regional Needs**	• **Over time, the needs in the Region can change and the corresponding aspects of the SCAG Regional ITS Architecture will have to be updated. While the architecture has been developed with input from many ITS Stakeholders in the Region, not all**	**Obtain through website analytics.** **Update through project database.**

Category	Metric	Definition	Data Needed for Reporting
		identified Stakeholders participated in its development. As ITS deployment increases and benefits of integration are realized, additional Stakeholders may become interested in ITS, and the architecture should be updated to reflect their place in the Regional view of ITS. To engage Stakeholders, the Maintenance Team will send out periodic notices via e-mail and at regional transportation meetings and workshops to encourage their review of the architecture and identification of potential updates and changes.	
Regional ITS Architecture	Contact Requests	• To request support from the Architecture Team in verifying that an ITS project is represented in the Architecture and compliant with the Architecture.	Obtain through website analytics. Obtain through project database.

Reporting of these KPI metrics shall be generated on quarterly basis. The results shall be evaluated by designated staff and improvements or changes shall be identified and conducted on an as-needed basis. The Regional ITS Architecture is dynamic and over time will be updated through new ITS deployments and changes from projects to project stakeholders. The use of KPIs is one of the strategies to maintain an up-to-date Architecture and enhance stakeholder involvement.

APPENDIX A – INFORMATION EXCHANGE AND INTERFACE REQUIREMENTS

Refer to SCAG ITS ARCHITECTURE WEBSITE

APPENDIX B – FUNCTIONAL REQUIREMENTS (RAD-IT)

Refer to SCAG ITS ARCHITECTURE WEBSITE