



Executive Summary of the Bay Area ITS Architecture

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1.0 Introduction

The Bay Area Intelligent Transportation Systems (ITS) Architecture is the regional plan for the San Francisco Bay Area. The Architecture was prepared under the direction of the Metropolitan Transportation Commission (MTC) based on input from a broad range of stakeholders. Its purpose is to facilitate ITS planning and to aid in ITS project development and procurement. This document provides an overview of the San Francisco Bay Area's Regional ITS Architecture.

ITS refers to the use of communication technologies to improve transportation safety, operations, and efficiency. This definition encompasses a broad range of technologies and has created many opportunities for transportation professionals to respond proactively to increasing demand for effective transportation services. Many of these opportunities are predicated upon effective coordination between organizations, at both the institutional and technical level.

The Bay Area ITS Architecture, along with its technical framework, is one vehicle to facilitate coordination between organizations. The ITS Architecture represents a coordinated approach (over a ten-year horizon) to installing and operating technologies in the transportation system environment across jurisdictions in the Bay Area. It can be used to identify ITS deployment priorities, coordinate projects, and understand agency roles and responsibilities associated with ITS.

The last major revision of the Bay Area ITS Architecture was completed in 2019, which reflected the major update to the National ITS Architecture. In 2017, the National ITS Architecture was updated and renamed to the Architectural Reference for Cooperative and Intelligent Transportation (ARC-IT). ARC-IT merged the Connected Vehicle Reference ITS Architecture (CVRIA) Version 2.2 into the National ITS Architecture Version 7.1 and restructured the organization of the National ITS Architecture.

The 2019 update to the Bay Area ITS Architecture aligned with ARC-IT Version 8.2 and changes were made to the architecture based on stakeholder input, including projects, stakeholders, service packages, and other minor changes. Particularly, Express Lanes elements in the region were updated substantially in the 2019 update in accordance with new service packages in ARC-IT. The



process for updating the Architecture relied on stakeholder input to ensure the Architecture was truly regional and multi-jurisdictional. The stakeholders represent a cross-section of agencies, including the following:

- Counties
- Cities
- Emergency Responders
- Public Transportation Agencies
- Congestion Management Agencies
- Regional Transportation Agencies
- State Agencies
- Private Sector Transportation Service Providers
- Rail and Freight Services
- Commercial Vehicle Operators

Feedback was elicited in the form of individual and targeted group requests and from an online survey.

Agencies in the Bay Area that implement ITS projects using Federal transportation funds are required to be consistent with the Bay Area ITS Architecture (pursuant to 23 CFR 940.9 and 940.11). In addition, ITS projects must comply with system engineering requirements and applicable Federal standards. This Architecture provides all the components required by the FHWA Final Rule and FTA Policy for regional ITS architectures. The Architecture is designed for ease of use and understanding in support of project planning and development.

The Architecture is project-based, meaning that stakeholders can access, understand, and use the Architecture directly via project names and types. Most other Architectures from across the nation use a different organization of content based on predetermined types of systems. The Bay Area





Approach encourages use of this Architecture for actual project development and coordination, thereby promoting systems that connect and share and minimize duplicating investments.

The Architecture uses laymen’s terms. The National ITS Architecture provides not only a framework but a vocabulary that has historically been extended to be used in Regional Architectures and ITS Plans. The Bay Area has altered the approach to ensure that, while providing full compliance with federal rules and policies, the Architecture avoids jargon, making the document more accessible by a variety of project sponsor staff, regardless of technical background or tenure in ITS/technology-based projects.

The Architecture is web-based. It is not a paper report posted online, but a truly robust, organized and accessible web site that answers stakeholders’ requests in an easy-to-browse manner. The Architecture website is located at:

<http://itsbayarea.mtc.ca.gov/index.html>

The 2019 ITS Architecture can be used as a roadmap to integrated and complementary regional project investment in the Bay Area, continuing our tradition of performance-based, coordinated programs. By referring to this document during project development, project sponsors can determine with whom to coordinate projects, where regional projects may be able to provide solutions to local agencies (thereby reducing potential duplication of spending), and how to move toward further sharing of information (through the use of regional standards).

2.0 Background

ITS is a collection of communication and technology applications that are used to increase information to users of roadways and transit systems and make managing the assets and infrastructure more efficient and effective. Information technology can make transportation infrastructure more efficient at a fraction of the cost of infrastructure projects. The Bay Area ITS Plan covers the nine-county Bay Area and addresses the needs and interests of stakeholders large and small within the region.

The Bay Area ITS Architecture covers ITS in the following transportation service areas:

- Traffic Management



- Public Transportation Management
- Electronic Payment (Tolls and Fares)
- Commercial Vehicle Operations
- Emergency Management
- Advanced Vehicle Systems (e.g. Connected and Autonomous Vehicles)
- Information Management
- Maintenance and Construction Management

Over 100 project architectures are documented in the ITS Architecture, which provides project descriptions, project status, participating stakeholders, ITS services involved, and information flows. The project architectures have been consolidated from a larger list of projects, because when multiple projects are largely similar (from an ITS Architecture perspective), they are grouped into a single, “generic” project. They identify not only what is in place today, but also how to move toward the next generation of integration and effectiveness for the region. This means that we get more for less: more mobility, more air quality conformance, more efficient travel, at a lower, combined cost for our region.

In order to be eligible for federal funding (FHWA or FTA, any Highway Trust Funds), projects must be consistent with the regional ITS architecture. In order to accommodate this requirement and assist project sponsors in quickly and thoroughly understanding what that means to their projects, the Architecture has been developed to address project specifics in different ways. The Architecture is composed of projects, stakeholders, and elements and is navigable on the website through the following methods:

Find a Specific Project by Project Sponsor or Alphabetically

The first way is to look up your project by the name of the sponsoring public agency (such as BART, Caltrans, or the City of San Jose) or look through an alphabetical list of projects. From there, you can quickly jump to diagram(s) that represent that project in relation to other projects and agencies in the area. This provides the benefit of showing a project sponsor, at a glance, how their projects connect with others in the Bay Area now and how they can potentially connect in the future.

Find a Stakeholder or Stakeholder Group

The Stakeholders page provides a list of stakeholders from both public and private sectors and spans the organizations that manage, support, or are impacted by the surface transportation system, with particular focus on agencies



that operate transportation systems in the region. Some stakeholders are grouped to reduce the complexity of the architecture. Navigating to a specific Stakeholder or Stakeholder Group page provides more details about the stakeholders, including their roles and responsibilities, associated elements and projects, and description.

Find a Specific Element by Stakeholder or Alphabetically

An element is an ITS system or a piece of system that is considered the basic building blocks of ITS Architectures. Elements listed in the Bay Area ITS Architectures provide an inventory of existing and planned ITS systems in the region, as well as non-ITS systems like vehicles and people, that exchange information with the ITS systems. The elements are listed alphabetically or by stakeholders. Each element has detailed information within the website including its status (existing or planned), description, associated stakeholder(s), systems interconnected with the element, information flows, diagrams, and relevant functional requirements from the National ITS Architecture.

3.0 Stakeholder Roles and Responsibilities

Champions from cities, counties, law enforcement, MTC, Caltrans, transit agencies, CMA's, and special purpose agencies round out the list of stakeholders, large and small, who have had input to the development of the Architecture. The Architecture illuminates critical relationships among these agencies from an operational standpoint, with a special emphasis on the information and infrastructure that is produced and shared.

4.0 Technical Detail

The overall purpose of the Architecture is to establish how projects interact. The technical detail provides information such as which standards and interfaces can move the region toward greater integration, and depicts, for the benefit of project sponsors, which other projects and agencies might be connected in the future. Future integration emphasis for Bay Area agencies should promote connectivity to, and build-out of, large regional and sub-regional projects. These projects, such as the center-to-center project and the smart corridors, provide regional data sharing opportunities and help to realize the maximum potential of previous and ongoing investment. This technical detail is helpful to project sponsors in that it identifies with which potential partners or agencies to coordinate and provides details supporting connections and standards.



Additionally, the Architecture includes ITS Service Packages that are fulfilled or are planned to be fulfilled by ITS Projects. Service Packages are a “bundle” of multiple ITS Elements that address specific transportation management services, such as surface street control or traveler information. An ITS Project may include multiple Service Packages that provide multiple interrelated functions. For example, a transit ITS project designed to improve service efficiency may include Service Packages for vehicle tracking, fixed-route schedule management, and automated passenger counting. The full list of ITS Services is provided under ITS Architecture Details on the website, and each service package is linked to elements and/or projects. Each service also is provided with a graphic, which illustrates the intersystem connections (existing and proposed) of each service package.

Other Architecture details not previously discussed in this document include the list of Agreements, which is a list of potential interagency agreements and memorandums of understanding that can help agencies identify other agencies with whom to form a formal partnership. These agreements are categorized by ITS service area, and were developed based on regional roles and responsibilities of the stakeholders, knowledge of the types of existing or planned ITS projects for implementation by the region, and the information that will be exchanged in order to operate those systems.

Lastly, ITS Standards applicable to ITS activities in the region are listed in the Standards page. Standards are important components of the information flows in the Bay Area Regional ITS Architecture. They facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances and new approaches evolve. Standards encourage interoperability between systems, allowing different agencies to connect to one other, and stakeholders are strongly encouraged to use the applicable standards when feasible.

5.0 Maintenance of the ITS Architecture

Maintenance of the ITS Architecture may be periodically necessary to comply with federal regulations and facilitate coordination and integration of ITS projects. To this end, MTC will continue to serve as the lead agency responsible for coordinating Architecture maintenance efforts and project sponsors will continue to be responsible for providing new and updated project information. Between MTC-initiated update efforts, MTC will maintain a list of project updates and additions submitted by project sponsors. If necessary, MTC may convene a



Maintenance Committee of representative stakeholders to advise MTC on maintenance activities and other ITS policy and planning issues.

MTC may also need to respond to questions from project sponsors about compliance with federal Architecture and systems engineering requirements.