

# Statewide ITS Architecture Assessment and Support

# Statewide and Regional ITS Architecture Compliance and Use



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### Statewide ITS Architecture Assessment and Support



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APPENDIX A – RITSA Use and Maintenance Survey



### 1. Introduction

### **1.1 Project Overview**

The *Statewide ITS Architecture Assessment and Support* project provided technical assistance to Caltrans in assessing compliance of the Statewide and Regional Intelligent Transportation Systems (ITS) Architectures with federal requirements and the current state of the practice. Secondly, it assessed how the architectures are used in support of transportation planning activities and project development. For both of the above, the Project Team identified those areas where the architectures are in compliance and are being used as intended, as well as those areas where architectures are non-compliant, are not being maintained, or are not being used for integrated planning and project development. The primary outcome of this effort is updated guidance on the use of ITS architectures as part of transportation planning and project development activities.

### 1.2 Purpose of this Document

The purpose of this document is to assess and report on the state of California's current SWITSA and RITSAs (hereafter referred to collectively as RITSAs). The assessment was performed during the summer and fall of 2016 through a review of the most recent RITSAs, and a survey of their owners. The assessment identifies the current RITSAs, compliance with Federal requirements, their use and the RITSA owner's perception of the value and usability of the architectures as perceived by their owners.

### 2. Summary and Status of California SWITSA and RITSAs

**Table 1** provides a high level summary of the most current California RITSAs that were identified for this project. The list was compiled through a review of federal RITSA documentation, discussion with California's Metropolitan Planning Organizations (MPOs) and a review of the available documentation from various sources. This list represents the RITSAs that were used to develop the architecture assessment in this document. The summary in the table provides:

- Architecture name
- Geographic coverage
- Architecture owner
- Year of most recent update or development

While Table 1 provides a comprehensive list of California regional architectures, not all RITSAs have been reviewed as part of this project. Some architectures were not reviewed because they were not accessible electronically or through contact with agency staff. Some architectures were not available on the owners' web sites. Some predate current owning agency staff, and the current staff were not aware of the architecture or how it was, or should be, used.



Also note that only five of the 20 RITSAs surveyed had been updated since 2010. Thirteen of the architectures were ten or more years old. The age of the architectures means that many have been developed based on versions of the National ITS Architecture and related development tools that had been superseded several times over the years. As a result, it is possible that the owning agencies have gone through major transportation planning exercises without integrating or updating their ITS architectures. **Figure 1** shows the ages of the RITSAs.

It is noted that one update (Bay Area) was underway during the period of the assessment, and a new "Upstate California" ITS architecture and strategic plan is being developed for the 16 northernmost counties in the State (covering all or parts of three Caltrans Districts), and which encompass five regional architectures shown on the list, all which were developed prior to 2006 except for Caltrans District 2 (in 2008). Updates for the San Diego and Sacramento regions are upcoming.

Also note that the Los Angeles Region has a Regional ITS Architecture and an Arterial ITS Architecture, both developed in 2004. The Arterial Architecture is a subset of the Regional ITS Architecture, and the Regional is assessed here. Since developing its ITS Architecture in 2003, the San Diego Region developed an ITS Strategic Plan in 2011. While the Plan identified ITS strategies and projects, it does not include an architecture. Therefore, the 2003 San Diego Regional ITS Architecture is assessed in this report.

| Architecture Name  | Geographic Coverage   |                      | Architecture Owner  | Year                   |
|--|---|----------------------|---|------------------------|
|  | Counties  | Caltrans<br>District |   | Developed /<br>Updated |
| Bay Area ITS Architecture  | Alameda, Contra Costa,<br>Marin, Napa, San<br>Francisco, San Mateo,<br>Santa Clara, Solano,<br>Sonoma Counties    | 4                    | Metropolitan<br>Transportation<br>Commission (MTC)            | 2016                   |
| Caltrans District 2<br>Architecture*                             | Caltrans 2, comprised of<br>Lassen, Modoc, Plumas,<br>Shasta, Sierra, Siskiyou,<br>Tehama, Trinity                | 2                    | Caltrans  | 2008                   |
| Central Coast ITS<br>Architecture                                | Monterey, San Benito,<br>San Luis Obispo, Santa<br>Barbara, Santa Cruz  | 5                    | Association of<br>Monterey Bay Area<br>Governments<br>(AMBAG) | 2010                   |
| California Oregon Advanced<br>Transportation Systems<br>(COATS)* | Colusa, Del Norte,<br>Glenn, Humboldt, Lake,<br>Lassen, Mendocino,<br>Modoc, Plumas, Shasta,<br>Siskiyou, Trinity | 1, 2                 | COATS Consortium  | 2000                   |

#### Table 1: Summary of Current California ITS Architectures (Completed Fall 2016)



| Architecture Name  | Geographic Coverage  |                      | Architecture Owner  | Year                   |
|--|--|----------------------|---|------------------------|
|  | Counties   | Caltrans<br>District |   | Developed /<br>Updated |
| Fresno County Regional ITS<br>Architecture                                   | Fresno   | 6                    | Fresno Council of<br>Governments (Fresno<br>COG)                          | 2015                   |
| Imperial Valley Subregional<br>ITS Architecture                              | Imperial   | 11                   | Southern California<br>Association of<br>Governments                      | 2005                   |
| Inland Empire Subregional<br>ITS Architecture                                | Riverside, San<br>Bernardino   | 8                    | San Bernardino<br>Association of<br>Governments                           | 2005                   |
| Los Angeles County Regional<br>ITS Inventory and<br>Architecture             | Los Angeles  | 7                    | Los Angeles County<br>Metropolitan<br>Transportation<br>Authority (Metro) | 2004                   |
| Modoc County Regional ITS<br>Architecture*                                   | Modoc  | 2                    | Modoc County<br>Transportation<br>Commission                              | 2006                   |
| North Valley Regional ITS<br>Architecture*                                   | Butte, Colusa, Glenn   | 3                    | Butte County<br>Association of<br>Governments                             | 2005                   |
| Orange County ITS Strategic<br>Deployment Plan                               | Orange   | 12                   | Orange County<br>Transportation<br>Authority (OCTA)                       | 2013                   |
| Sacramento Regional ITS<br>Architecture                                      | El Dorado, Sacramento,<br>Sutter, Placer, Yolo,<br>Yuba                    | 3                    | Sacramento Area<br>Council of<br>Governments<br>(SACOG)                   | 2005                   |
| San Diego Regional ITS<br>Architecture                                       | San Diego  | 11                   | San Diego Association<br>of Governments<br>(SANDAG)                       | 2003                   |
| San Joaquin Valley ITS<br>Strategic Deployment Plan                          | Fresno, Kern, Kings,<br>Madera, San Joaquin,<br>Stanislaus, Tulare         | 6, 9, 10             | Fresno COG  | 2001                   |
| Southern California<br>Association of Governments                            | Imperial, Los Angeles,<br>Orange, Riverside,<br>Ventura                    | 7, 8, 11, 12         | Southern California<br>Association of<br>Governments                      | 2011                   |
| Shasta County Regional ITS<br>Architecture and Strategic<br>Deployment Plan* | Shasta   | 2                    | Shasta Regional<br>Transportation<br>Authority                            | 2006                   |
| Sierra Nevada ITS Strategic<br>Deployment Plan                               | Alpine, Amador,<br>Calaveras, Inyo,<br>Mariposa, Merced,<br>Mono, Tuolumne | 9, 10                | Not determined  | 2002                   |
| Statewide ITS Architecture   | I All  | All                  | Caltrans  | 2010                   |



| Architecture Name                  | Geographic Coverage                  |                            | Architecture Owner   | Year      |  |
|------------------------------------|--------------------------------------|----------------------------|--|-----------|--|
|                                    | Counties                             | Counties Caltrans District |  | Updated / |  |
| Tahoe Gateway ITS<br>Architecture  | El Dorado, Nevada,<br>Placer, Sierra | 3                          | Placer County<br>Transportation<br>Planning Authority<br>(PCTPA) | 2002      |  |
| Ventura County ITS<br>Architecture | Ventura                              | 7                          | Ventura County   | 2004      |  |

\*-Denotes regional architectures that may be superseded by the Upstate California Regional ITS Master Plan





Figure 1: Age of ITS Architectures in California

### 3. SWITSA and RITSA Federal Compliance

#### 3.1 Federal Requirements

The development, use and maintenance of California's RITSAs are required to meet federal requirements defined by the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA).

Congress enacted the **Transportation Equity Act for the 21st Century (TEA-21)** on June 9, 1998. Section 5206(e) of TEA-21 required Intelligent Transportation System (ITS) projects funded through the highway trust fund to conform to the National ITS Architecture and applicable standards. One of the findings of Congress in section 5202 of the TEA-21 was that continued investment in systems integration was needed to accelerate the rate at which ITS is incorporated into the national surface transportation network. Two of the purposes of the ITS program, noted in section 5203(b) of the TEA-21, are to expedite the deployment and integration of ITS, and to improve regional cooperation and operations planning for effective ITS deployment.

In January 2001, to address the need to begin to work toward regionally integrated transportation systems, USDOT published **Federal Highway Administration (FHWA) 23 CFR Parts 655 and 940 Intelligent Transportation System Architecture and Standards, Final Rule** and **Federal Transit Administration (FTA) National ITS Architecture Policy on Transit Projects; Notice** to implement section 5206(e) of TEA-21. Conformance with the National ITS Architecture is defined in the final Rule/Policy as using the National ITS Architecture to develop a regional ITS architecture that would be tailored to address the local situation and ITS investment needs, and the subsequent adherence of ITS projects to the regional ITS architecture. Rule 23 CFR 940.5 requires that regional ITS architectures be "consistent with the (statewide and metropolitan) transportation planning process", although



parallel planning rules requiring an "ITS integration strategy" for a metropolitan area were not implemented.

Rule 23 CFR 940.9 described the requirement for regions to deploy RITSAs that allow for integration of information and services from different transportation entities and modes, for management and operations of regional transportation facilities. Given that 23 CFR 940 in general does not require or reference an integration strategy, the FHWA felt a need to provide more specific guidance on the definition of a region.

As such, the definition of a region was revised to indicate that a Metropolitan Planning Area (MPA) should be the minimum area considered when establishing the boundaries of a region for purposes of developing a RITSA within a metropolitan area. This should not be interpreted to mean that a region must be an MPA and no less, but the MPA and all the agencies and jurisdictions within the MPA should be at least considered for inclusion in the process of developing a regional ITS architecture within a metropolitan area. The FHWA also acknowledged it is possible that overlapping regions could be defined and overlapping regional ITS architectures could be developed to meet the needs of the regions.

For example, the Los Angeles-Ventura-Orange County-Riverside County area includes a regional architecture encompassing the entire Southern California Association of Governments (SCAG) region, and there are also more detailed, county-specific architectures (corresponding to metropolitan transportation organizations) that should be in effect subsets of the SCAG architecture. In one case, the Inland Empire Subregional ITS Architecture overlaps both the SCAG area (specifically Riverside County) and the San Bernardino Association of Governments (SANBAG) area.

While Federal policy requires development of regional ITS architectures as the basis for Federal funding of regional ITS projects, it does not mandate a statewide ITS architecture (SWITSA) unless the architecture is required to incorporate key operational roles, responsibilities and functions that may occur at the regional level. However, a SWITSA may have particular statewide roles and responsibilities that require interface and coordination with regional architecture elements, including interoperability, data and video sharing, and statewide or multi-regional functions such as performance management systems, traveler information, or statewide emergency management. As such, a SWITSA needs to be compliant with the National ITS Architecture in the same way as do regional ITS architectures.

Rule 23 CFR 940.11 required that a systems engineering analysis be utilized for projects (regardless of size or budget) to be Federally-funded, including the project ITS architecture being a part or subset of the RITSA. The specific rule, as illustrated in Figure 2, describes the steps required in defining and developing specific ITS projects. While the steps are a subset of the larger systems engineering analysis process, following the SE process assures that the Rule is being followed.



|    | FHWA Rule/FTA Policy         |
|----|------------------------------|
| 1. | Portion of Regional ITS      |
|    | Architecture                 |
| 2. | Participating agencies roles |
|    | and responsibilities         |
| 3. | Requirements definitions     |
| 4. | Alternatives analysis        |
| 5. | Procurement options          |
| 6. | ITS standards and testing    |
|    | procedures                   |
| 7. | Operations and management    |
|    | procedures and resources     |

Figure 2: Summary of 23 CFR 940.11 (FHWA Rule / FTA Policy)

California was one of the first states to establish a process to carry out the requirements of 23 CFR 940.11. Several states have since patterned their own process to reflect the California guidance. Caltrans and FHWA developed a *Systems Engineering Guidebook for ITS* that assists the State and local agencies in applying Systems Engineering in a standardized process and recommends guidance through best practices and lessons learned. A Systems Engineering Review form (SERF) must be completed by the project sponsor at project initiation. This form, referenced in the *Caltrans/FHWA Stewardship and Oversight Agreement* and included in the *Caltrans Local Assistance Procedures Manual (LAPM)*, includes one question for each of the seven systems engineering requirements in 23 CFR 940.11.

### 3.2 California SWITSA and RITSA Compliance Assessment

The Project Team reviewed RITSAs in California with available documentation to determine their compliance with all aspects of the Federal requirements including the architecture content, use and maintenance and coordination with regional transportation planning. In addition, assessments reviewed stakeholder access to the RITSAs. Accessibility significantly impacts RITSA usability and stakeholders ability to review and provide updates. **Table 2** provides a summary of the compliance of the assessed RITSAs.

### 3.2.1 Development and Compliance

The assessment found that California's RITSAs have largely been developed in compliance with the FHWA rule and FTA policy. The RITSAs have been developed to include the key components of an architecture as identified in 23 CFR 940.9, including:

- Geographic and service coverage description.
- Stakeholder identification.
- Definition of an operational concept.



- Existing and needed agreements among stakeholders.
- ITS elements.
- ITS user services.
- ITS functional requirements.
- Interconnect and information flow descriptions among ITS elements.
- Identification of applicable ITS standards.
- ITS project sequencing.

#### 3.2.2 Planning Compliance

Federal policy requires that RITSAs be consistent with the associated region's transportation planning process. In this area, many of the RITSAs lack clear documentation, such as mapping of projects and ITS services to regional needs, or goals and objectives. The lack of documentation does not necessarily mean there was no coordination between planning efforts and the RITSAs. At the time of their development, the RITSAs may have been aligned with regional transportation plans. However, for the older architectures (i.e., pre-2010) it is likely that transportation plans have been updated while the RITSA has not. If the RITSA was not updated at the same time, it may no longer be consistent with, or referenced to, the region's current transportation plans.

Another potential reason that some RITSAs do not demonstrate a link to the region's transportation plans may be a result of the tools used to develop the RITSA, which are discussed in more detail in Section 3.3. Turbo Architecture is a software tool provided by the Federal government to develop and maintain ITS architectures. It has been used to some extent for virtually all RITSAs in California. The current version of the tool provides the ability to map ITS components such as Service Packages (formerly known as Market Packages) to regional transportation plans, including specific needs, goals and objectives. However, earlier versions of Turbo Architecture (pre-2010) did not include planning tools. Therefore, RITSAs older than six or seven years may have linked ITS to regional planning, but used tools other than Turbo, with documentation of this mapping or of the tools used not be readily available.

#### 3.2.3 RITSA Use and Maintenance

Most of California's RITSAs include plans for their ongoing use and maintenance as required by Federal rules and policy. However, in several cases there is little evidence that those plans have been followed. A review of California's RITSAs and the responses of RITSA owners in our Team's survey (see Section 4) indicate that few have been updated since their development to reflect regional changes. Or, if they have been updated, the changes have not been made with stakeholder participation.

One key reason for the lack of RITSA maintenance activity appears to be a lack of resources to perform the maintenance. As the survey discussed in Section 4 shows, many of the RITSA owners stated they lacked the staff resources or technical skills to maintain the RITSA.



Similarly, the use of many RITSAs is unclear. As Table 2 shows, some RITSAs are unavailable or not easily accessible to stakeholders for referencing in ITS project planning, design and development. In other cases, the RITSA is available, at least in part, but does not provide current contact information for a stakeholder to request support.

It is possible that stakeholders with limited ITS architecture knowledge may be intimidated or unaware of what a RITSA provides and how it can provide benefit to their ITS projects. Conversely, a stakeholder interested in deploying an ITS project today may determine that the latest RITSA may be out-of-date or irrelevant to their current needs, and may thus develop the project without reference to the most recent ITS architecture. It is noted that the mandated deadline for RITSAs being in place was April 8, 2005, or within 4 years of the first ITS project in a region advancing to final design.

#### 3.2.4 RITSA Accessibility

In general, the most recent of California's RITSAs are more accessible. In fact, all of the RITSAs developed over the last five years are available on the Internet, some as fully interactive and searchable sites, while some older RITSAs do not have a physical presence and can only be found on the Internet as references in other regional planning documents. The actual architectures may not be available, nor is there contact information. Several reasons are possible for limited accessibility of certain RITSAs. Those reasons include:

- The tools to publish RITSAs to the Internet have continually improved over the last sixteen years, including the ability to generate interactive web pages directly from the Turbo Architecture software. More recent RITSAs may have interactive sites while older ones (that have not been updated) may not.
- Many RITSA owners have updated and rebuilt their agency web sites since they last updated their architectures, and the data wasn't incorporated into the new sites.
- The staff responsible for the development and / or maintenance of the RITSA may have left the owning agency or may have other responsibilities, with no other staff assigned to provide access or information.
- Because of their age, lack of use and data retention schedules, RITSAs may have been deleted by agencies, even if they are the most current architectures for the region.

#### 3.2.5 Summary of RITSA Compliance

Table 2 summarizes the California RITSAs' compliance with federal maintenance and use guidelines. This is based on the RITSAs that the Project Team was able to access and assess as part of this task. Since not all RITSAs were accessible in their entirety, some assessments are not complete. Each available RITSA was reviewed for the following:

• **Development Compliance** – The assessment reviewed the RITSAs for completeness and overall quality of its products in terms of the architecture components required by the FTA and FHWA. The assessment indicates whether the RITSAs are:



- Complete or mostly complete
- Partially complete
- Incomplete.
- <u>Use and Maintenance Compliance</u> The assessment reviewed the RITSAs to determine whether they had use and maintenance and use plans that were used during the life of the plan. The assessment indicates whether the RITSAs:
  - Developed maintenance and use plans that were demonstrably used
  - Developed maintenance and use plans that were not demonstrably used
  - Did not develop maintenance or use plans.

Note that demonstrable use and maintenance was assessed based on the availability of updated information after the RITSA was first developed.

- <u>Planning</u> The assessment reviewed the RITSAs to determine if the documentation included mapping or reference to other regional plans, including identifying how a region's ITS addressed regional transportation needs or helped to achieve regional goals and objectives. The assessment indicated whether the RITSAs:
  - Document regional needs, goals and objectives and demonstrate how ITS projects are related to them
  - Recognize the linkage to other transportation plans but does not show specifically how ITS projects are related to them
  - Do not reference other regional transportation planning.
- Accessibility The assessment reviewed the availability of the RITSA to stakeholders either via online or through a designated contact at the agency that owns the RITSA. The assessment also considered the availability of technical support to stakeholders in the form of an identified contact and instructions on how to request support. The assessment indicates whether the RITSAs are:
  - Accessible in their entirety online, with clear ownership and contact information
  - Partially accessible by being online in some form, with or without ownership and contact information
  - Unavailable online and no current contact information provided.



|  | Compliance   |   |  |  |
|--|--|---|--|--|
| RITSA Name   | Development  | Use and<br>Maintenance  | Planning   | Accessibility  |
| Bay Area ITS<br>Architecture (2011)                | Complete or<br>mostly complete                                 | Developed plans<br>that were<br>demonstrably used                 | Regional goals<br>and objectives<br>are not<br>identified.   | Accessible online<br>with current contact<br>information.                    |
| Central Coast ITS<br>Architecture                  | Santa Barbara<br>portion only<br>uploaded to<br>System Builder | Architecture has<br>not been<br>maintained.                       | There is no<br>mapping of<br>architecture<br>elements to<br>planning<br>processes<br>accessible.                 | Accessible via System<br>Builder but contact<br>information not<br>provided. |
| COATS  | Complete or<br>mostly complete                                 | There is a<br>maintenance plan<br>but it has not been<br>updated. | There is no<br>mapping to goals<br>and objectives.   | Accessible online but<br>contact information<br>is not current.              |
| Fresno County Regional<br>ITS Architecture         | Complete or<br>mostly complete                                 | Developed plans<br>that were<br>demonstrably used.                | The Strategic<br>Deployment<br>maps ITS<br>projects and<br>strategies to<br>needs and<br>existing<br>conditions. | Accessible online<br>with current contact<br>information.                    |
| Imperial Valley<br>Subregional ITS<br>Architecture | Complete or<br>mostly complete                                 | Architecture has<br>not been<br>maintained.                       | There is no<br>mapping of<br>architecture<br>elements to<br>planning<br>processes<br>accessible.                 | Accessible online but<br>contact information<br>is not available.            |
| Inland Empire<br>Subregional ITS<br>Architecture   | Complete or<br>mostly complete                                 | Architecture has<br>not been<br>maintained.                       | There is no<br>mapping of<br>architecture<br>elements to<br>planning<br>processes<br>accessible.                 | Accessible online but<br>contact information<br>is not available.            |

| Table 2: California | RITSA Compliance | and Accessibility |
|---------------------|------------------|-------------------|
|                     |                  |                   |



|   | Compliance                                     |  |  |   |  |
|---|--|--|--|---|--|
| RITSA Name  | Development                                    | Use and<br>Maintenance   | Planning   | Accessibility   |  |
| Los Angeles County<br>Regional ITS<br>Architecture          | Complete or<br>mostly complete                 | There is a plan and<br>stakeholders meet,<br>but the physical<br>architecture has not<br>been updated. | There is no<br>mapping of<br>architecture<br>elements to<br>planning<br>processes<br>accessible.                 | Accessible online but<br>contact information<br>is not available.                     |  |
| Modoc County Regional<br>ITS Architecture                   | Complete or<br>mostly complete                 | Architecture has<br>not been<br>maintained.  | There is no<br>mapping of<br>architecture<br>elements to<br>planning<br>processes<br>accessible.                 | Accessible via System<br>Builder but contact<br>information is not<br>available.      |  |
| North Valley Regional ITS<br>Architecture (Butte<br>County) | Architecture was not available for assessment. |  |  |   |  |
| Orange County<br>Subregional ITS<br>Architecture            | Complete or<br>mostly complete                 | Architecture has<br>been maintained<br>and was updated in<br>2013.                                     | The Strategic<br>Deployment<br>maps ITS<br>projects and<br>strategies to<br>needs and<br>existing<br>conditions. | Accessible online but<br>no contact<br>information is<br>available.                   |  |
| Sacramento Region ITS<br>Strategic Deployment<br>Plan       | Complete or<br>mostly complete                 | Developed plans<br>that were<br>demonstrably used  | There is no<br>mapping of<br>architecture<br>elements to<br>planning<br>processes<br>accessible.                 | Accessible online<br>with current contact<br>information                              |  |
| San Diego Region ITS<br>Architecture                        | Complete or<br>mostly complete                 | There is a plan, but<br>the physical<br>architecture does<br>not appear to be<br>regularly updated.    | There is no<br>mapping of<br>architecture<br>elements to<br>planning<br>processes<br>accessible.                 | Contact information<br>available but the<br>architecture is not<br>accessible online. |  |



| RITSA Name   | Development                                    | Use and<br>Maintenance   | Planning   | Accessibility   |  |
|--|--|--|--|---|--|
| San Joaquin Valley ITS<br>Strategic Deployment<br>Plan                         | Complete or<br>mostly complete                 | There is a plan, but<br>the physical<br>architecture does<br>not appear to be<br>regularly updated.  | There is no<br>mapping of<br>architecture<br>elements to<br>planning<br>processes<br>accessible. | Accessible online<br>with current contact<br>information  |  |
| Shasta County Regional<br>ITS Architecture and<br>Strategic Deployment<br>Plan | Architecture was not available for assessment. |  |  |   |  |
| Sierra Nevada ITS<br>Strategic Deployment<br>Plan                              | Architecture was not available for assessment. |  |  |   |  |
| Caltrans Statewide ITS<br>Architecture   | Complete or<br>mostly complete                 | There is a plan,<br>however, the<br>architecture is<br>made up of many<br>district<br>architectures, many<br>of which have not<br>been maintained. | There is no<br>mapping of<br>architecture<br>elements to<br>planning<br>processes<br>accessible. | Accessible online<br>with current contact<br>information. |  |
| Ventura County ITS<br>Architecture   | Complete or<br>mostly complete                 | There is a plan, but<br>the physical<br>architecture does<br>not appear to be<br>regularly updated.  | There is no<br>mapping of<br>architecture<br>elements to<br>planning<br>processes<br>accessible. | Accessible online but contact information is not current. |  |

### 3.3 Tools Used in RITSA Development

Accessibility and accuracy of a RITSA improves when its data is managed using a single tool. A single tool makes the architecture data easier to manage in a consistent manner through a single interface, and allows the output to be provided from a single tool to stakeholders in a cohesive and consistent manner.

An agency that develops and maintains an architecture entirely using Turbo Architecture will only need to access that one program to perform maintenance and updates. In addition, Turbo links the



components of a RITSA such that an update to an ITS element or ITS stakeholder in one place is propagated throughout the entire architecture.

An agency that uses several tools, resources and databases to develop and maintain an architecture typically has to utilize all of those tools to make an update. If the tools are not dynamically linked in some fashion (say, to a relational database), updates may essentially have to be done "manually", requiring concurrent updates to diagrams, databases, data flows, and word-processed documentation that may not be centrally managed from a single tool. Significant effort may be required to ensure consistency of architecture information as a result. For example, if the responsibility to maintain a Traffic Management Center transitions from one stakeholder to another, the agency that owns the architecture will have to update information stored in the various tools to ensure that change is properly reflected in, at least, the stakeholder definition, ITS elements, information flows, operational concept, ITS agreements. Then, the agency will have to ensure that all of the updated documentation is made accessible to stakeholders.

The tools described in Table 3 have been used to develop and document the components of California's RITSAs. The range of tools results in varying output formats, such as some data being stored in a database, while other data may be stored in word processing formats or in spreadsheets. Additionally, the tools do not ensure consistency in the manner or detail that define the RITSAs. Outputs in multiple formats make it more difficult for users to be able to identify and understand architecture information that may be relevant to their activities, and even more difficult to revise or update these architectures.

Most of the current architectures (i.e., those produced since the advent of 23 CFR 940) utilize Turbo Architecture as the basis for their documentation, although older versions of Turbo that were used are likely obsolete today (version 7.1, has been in use since 2015). The more current versions provide capabilities such as mapping architecture service packages to planning needs, goals and objectives.



| Tool Name             | Description   | Output  | Strengths / Weaknesses   |
|-----------------------|---|---|--|
| Turbo<br>Architecture | Turbo Architecture is a software<br>application that supports<br>development of regional and<br>project ITS architectures. Turbo<br>uses the National ITS<br>Architecture as its basis to help<br>ensure consistency and<br>compliance with it. Turbo has an<br>interface that directs the user to<br>select national ITS architecture<br>elements to define regional ITS.<br>It also allows for all architecture<br>data to be stored in a single<br>database and can output that<br>information as text, web pages<br>and graphic images. | <ul> <li>Physical<br/>architecture</li> <li>All architecture<br/>components</li> <li>Web pages</li> <li>Architecture<br/>diagrams</li> <li>Reports</li> </ul>             | <ul> <li>Strengths:</li> <li>Structured<br/>development<br/>processes support<br/>consistent,<br/>architecture-compliant<br/>development.</li> <li>Changes made through<br/>the Turbo interface are<br/>reflected in all output<br/>across all formats.</li> <li>Weaknesses:</li> <li>Built-in tools have<br/>limited flexibility in the<br/>appearance of the<br/>output.</li> <li>Requires staff to<br/>receive specific<br/>training</li> </ul> |
| Word<br>Processor     | Many RITSA owners have<br>developed architecture<br>documentation in word<br>processors. This tool is typically<br>used to complement Turbo<br>output, or to modify Turbo's<br>output format. The tool allows<br>for flexibility in the narrative<br>format and incorporation of<br>images. The output is text<br>documents and has been used<br>for project descriptions,<br>mapping needs to ITS services<br>and describing existing and<br>needed agreements.  | <ul> <li>Strategic Plans</li> <li>Project descriptions</li> <li>Some Architecture<br/>components</li> <li>Planning<br/>information</li> <li>Project agreements</li> </ul> | <ul> <li>Strengths:</li> <li>Flexibility of the output to include narrative, tables and images.</li> <li>Requires no special training.</li> <li>Weaknesses:</li> <li>Not automatically updated when Turbo data is updated, resulting in potential discrepancies in a region's documentation.</li> <li>Does not ensure compliance with ITS architecture requirements.</li> </ul>  |

#### Table 3: Architecture Development Tools



| Tool Name                          | Description  | Output  | Strengths / Weaknesses  |
|------------------------------------|--|---|---|
| Spreadsheet                        | Some RITSA owners have<br>developed high-level project<br>descriptions in spreadsheets<br>such as Excel. The descriptions<br>can be extended to include<br>project details outside the scope<br>of an architecture, such as<br>budgets, quantities and<br>locational details. The<br>spreadsheets can also be<br>developed to be consistent in<br>format and detail with other<br>regional planning documents,<br>such as Transportation<br>Improvement Plans.   | • Project definitions   | <ul> <li>Strengths:</li> <li>Flexibility of the output<br/>to include narrative,<br/>tables and images.</li> <li>Potential coordination<br/>with other regional<br/>planning project<br/>definitions.</li> <li>Requires no special<br/>training.</li> <li>Weaknesses:</li> <li>Not automatically<br/>updated when Turbo<br/>data is updated,<br/>resulting in potential<br/>discrepancies in a<br/>region's<br/>documentation.</li> <li>Does not ensure<br/>compliance with ITS<br/>architecture<br/>requirements.</li> </ul> |
| Proprietary<br>Consultant<br>Tools | A few of California's RITSAs have<br>used proprietary tools<br>developed by the consultants<br>who supported the RITSA<br>developments. The tools<br>typically are used to address the<br>noted inflexibility in Turbo<br>Architecture's output.<br>The proprietary tools interface<br>with the Turbo Architecture<br>database and are used to<br>customize the output. They<br>allow for tailored formatting of<br>reports, web pages and graphic<br>images that are more consistent<br>with the owning agencies' other<br>materials. | <ul> <li>Web pages</li> <li>Architecture diagrams</li> <li>Reports</li> </ul> | <ul> <li>Strengths:</li> <li>Flexibility of the output to include improved formatting and consistency with other agency materials.</li> <li>Support consistent, architecture-compliant development.</li> <li>Weaknesses:</li> <li>Require consultant support and can result in not being updated once consultant is no longer under contract.</li> <li>Require special training and access to tools.</li> </ul>   |



### 4. Use and Maintenance Survey Process

In order to understand the relationship between the regions and their RITSAs, a survey was developed and provided to RITSA owners, as well as Caltrans. The survey provided information about how they currently use, interact with and maintain their architectures. In addition, the survey was intended to collect candid opinions of the ITS architecture process, and identify issues that limit the region's ability to use and maintain them.

### 4.1 Target Audience

The target audience for the Use and Maintenance Survey consisted of SWITSA and RITSA owners who are in the process of developing, have developed or are responsible for current regional architectures. The audience was asked to candidly reply to the questions in order for the Project Team to gather an accurate understanding of:

- Whether and how the SWITSA and RITSAs are used in compliance with CFR 940.
- Whether and how the SWITSA and RITSAs are adequately maintained.
- Whether the SWITSA and RITSA owners have the appropriate resources and training.

#### 4.2 Survey Process

The Project Team identified ownership of California's most recent SWITSA and RITSAs. The contacts for each owning agency were invited to respond to an ITS Architecture Assessment Survey online. A copy of the survey is attached as **Appendix A**. Architecture owners were encouraged to have more than one staff member respond where appropriate, such as in the case that different staff is responsible for use and maintenance.

### 4.3 Survey Response

Of the twenty architecture owners invited, eight responded to the survey. The following subsections summarize the responses in the five categories of:

- 1. Architecture Basics
- 2. Architecture Ownership
- 3. Architecture Maintenance
- 4. Architecture Use
- 5. Architecture Compliance

#### 4.3.1 Architecture Basics

Responding RITSA owners represented architectures that ranged from the oldest "active" RITSA (COATS) to the most recently completed (Fresno County) and one currently in development. The



group also reflected owners who are not planning to update their RITSAs, those currently in the process of updating, and those who plan to update in the near future.

#### Table 5: Architecture Basics

| Names | Names of Regional Architecture                      |             |  |  |  |
|-------|---|-------------|--|--|--|
| 1.    | Bay Area ITS Architecture                           | 2011 / 2016 |  |  |  |
| 2.    | California Statewide ITS Architecture               | 2010        |  |  |  |
| 3.    | Caltrans District 2                                 | 2008        |  |  |  |
| 4.    | COATS   | 2000        |  |  |  |
| 5.    | Fresno County Regional ITS Architecture             | 2015        |  |  |  |
| 6.    | Los Angeles Arterial ITS Inventory and Architecture | 2004        |  |  |  |
| 7.    | Orange County ITS Architecture                      | 2013        |  |  |  |
| 8.    | Ventura County ITS Architecture                     | 2004        |  |  |  |

#### 4.3.2 Architecture Ownership

The survey asked respondents about the ownership of the RITSAs and the skills within—or contracted by—the owners to develop, maintain and provide support for the RITSA. Five of the responding agencies indicated they have dedicated staff, while three did not. A similar ratio was provided by respondents regarding the training of the staff.

Note that the responses likely suggest a greater percentage of RITSAs being maintained than actually are; it is assumed that many of the RITSA owners who did not respond to the survey specifically because they do not have staff responsible for the RITSA use and maintenance.



















#### 4.3.3 Architecture Maintenance

Consistent with the findings of the assessment conducted during this effort, the survey respondents stated that a majority of RITSAs received inconsistent or no maintenance. Also consistent with the assessment findings, the survey responses indicated newer RITSAs tend to be more actively maintained than older RITSAs.

Overall, survey responses indicate a lack of sufficient staff resources and training to maintain the RITSAs to the level required by FHWA rule and FTA policy. The lack of resources and training may indicate that RITSA owners either did not anticipate the level of effort required, or perceive maintenance to not be an important part of RITSA ownership.



Table 7: Architecture Maintenance









#### 4.3.4 Architecture Use

In general, survey responses mirrored the results of the assessment of California's RITSAs. The majority of the RITSAs are either not used or used in a very limited capacity. In addition, there is little support provided in many regions. This leaves stakeholders, who often have little ITS architecture training, to try and understand how to plan, develop and deploy their projects in a manner consistent with the regional vision.



#### Table 8: Architecture Use











#### 4.3.5 Architecture Compliance

The survey responses largely indicated that the RITSAs owners struggle with maintenance and a very small minority are actually maintained as required. The respondents indicated that there are many reasons for the region's poor RITSA maintenance record that include limited staff resources, and architecture knowledge, as well as a belief among some respondents that RITSAs have limited value to them.



Table 9: Architecture Compliance













### 5. Next Steps

The findings of the RITSA assessment, combined with the survey findings, has highlighted strengths and weaknesses in the use and maintenance of the RITSAs. Key findings include:

- California has RITSAs that cover every county in the State.
- Recent RITSA development has focused on improved accessibility and usability to enhance compliance with federal requirements.
- The majority of California's RITSAs are over ten years old and not maintained.
- Many agencies do not feel they have the training or resources to use and maintain their RITSAs, nor does it appear there is much incentive to do so.
- Some agencies question the value of RITSAs in planning.
- Most agencies do not consider SWITSA/RITSA to be a "highly useful" tool at this time.

These findings, and all others, will be used to guide the discussion and recommendations of this project to improve the development, use and maintenance of ITS Architectures. Future efforts will involve workshops and discussions with the RITSA owners with the purpose of expanding on their survey responses to identify the specific issues that limit the effectiveness of ITS architectures in the transportation planning process. Strategies will be developed to directly address the weaknesses identified through this assessment.



### **APPENDIX A**

# Regional ITS Architecture Use and Maintenance Survey

### Ownership:

The following questions should be answered by the agency responsible for the Architecture.

| Architecture Ownership   |   |
|--|---|
| <ol> <li>What agency has ownership of the<br/>architecture?</li> </ol>   |   |
| <ol><li>Was the architecture developed by the<br/>owning agency, a consultant or other?</li></ol>  |   |
| <ol> <li>Has the owning agency assigned<br/>specific staff members to supporting<br/>the use and maintenance of the<br/>architecture?</li> </ol> |   |
| <ul> <li>a. If yes to 3, was that staff<br/>involved in the architecture<br/>development process?</li> </ul>                                     |   |
| b. If yes to 3, what architecture<br>training has that staff had?  | Regional ITS Architecture<br>Turbo<br>Architecture Maintenance<br>Architecture Use<br>Systems Engineering<br>Other                                |
| 4. Is there a plan to update the architecture? If yes, what year?  |   |
| a. If yes to 4, in what year is the update planned?  |   |
| b. If yes to 4, will the architecture<br>update be done in-house, by a<br>consultant or other?   |   |
| <ol><li>Is the most recent version of the architecture available to the public?</li></ol>  | <ul> <li>via an interactive public website</li> <li>via documents available online</li> <li>via request for information</li> <li>other</li> </ul> |



### Maintenance:

The following questions should be answered by the agency responsible for the Architecture.

| Architecture Maintenance                   |                           |  |
|--|---------------------------|--|
| 1. Is there a Maintenance Plan?            |                           |  |
| a. If yes to 1, is the plan followed?      |                           |  |
| b. If yes to 1, is the staff identified    |                           |  |
| in the Maintenance Plan the                |                           |  |
| same staff that perform                    |                           |  |
| maintenance?                               |                           |  |
| 2. How often is maintenance performed      |                           |  |
| on the Architecture?                       |                           |  |
| 3. When was the last time the people       |                           |  |
| responsible for maintenance reviewed       |                           |  |
| the Architecture?                          |                           |  |
|  |                           |  |
| 4. How often do stakeholders suggest       | weekly                    |  |
| changes to the Architecture?               | monthly                   |  |
|  | a few times a year        |  |
|  | once a year or less often |  |
| 5. How do stakeholders identify and        |                           |  |
| request changes to the maintenance?        |                           |  |
| 6. Has the staff responsible for           |                           |  |
| maintenance participate in architecture    |                           |  |
| skills training since the Architecture was |                           |  |
| developed?                                 |                           |  |



### Use

The following questions should be answered by the agency responsible for the Architecture.

| Architecture Use   |  |  |
|--|--|--|
| <ol> <li>How often does your agency reference<br/>the architecture in reviewing the<br/>region's projects?</li> </ol>  |  |  |
| 2. When referencing, do you view the Turbo?  |  |  |
| 3. When referencing, do you review the written documentation (e.g. Strategic Plan, Architecture Report)?   |  |  |
| <ol> <li>Does your agency provide support to<br/>stakeholders when they request help<br/>understanding the architecture? If yes,<br/>please explain.</li> </ol>  |  |  |
| 5. Does your agency have a process in<br>place to verify that the region's ITS<br>projects are properly represented in the<br>Architecture?  |  |  |
| 6. How do stakeholders access the architecture?  | Online<br>Contacting the agency<br>Other |  |
| 7. Is there a process in place for<br>stakeholders to contact the<br>architecture owner with questions<br>about technical Architecture support?  |  |  |
| 8. Is the architecture referenced by stakeholders or regional planners in the transportation planning process?   |  |  |
| 9. Is compliance with the architecture required in order to receive funding?   |  |  |
| a. If yes to 9, please describe the process to verify project compliance?  |  |  |
| <ul> <li>b. If yes to 9, does the architecture<br/>owner provide support to<br/>stakeholders in verifying? If yes,<br/>please describe.</li> <li>10. Does the architecture owner coordinate</li> </ul> |  |  |
| communication between stakeholders<br>on planned ITS projects  |  |  |