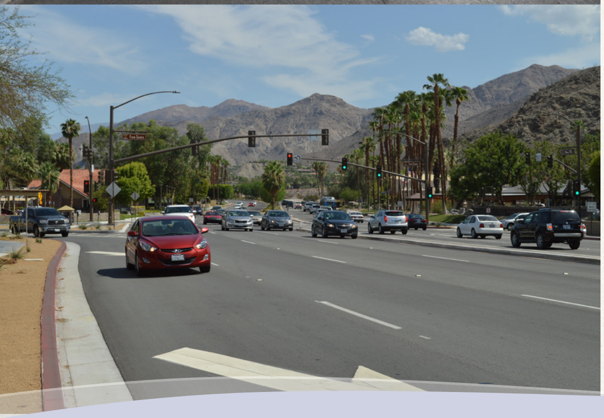
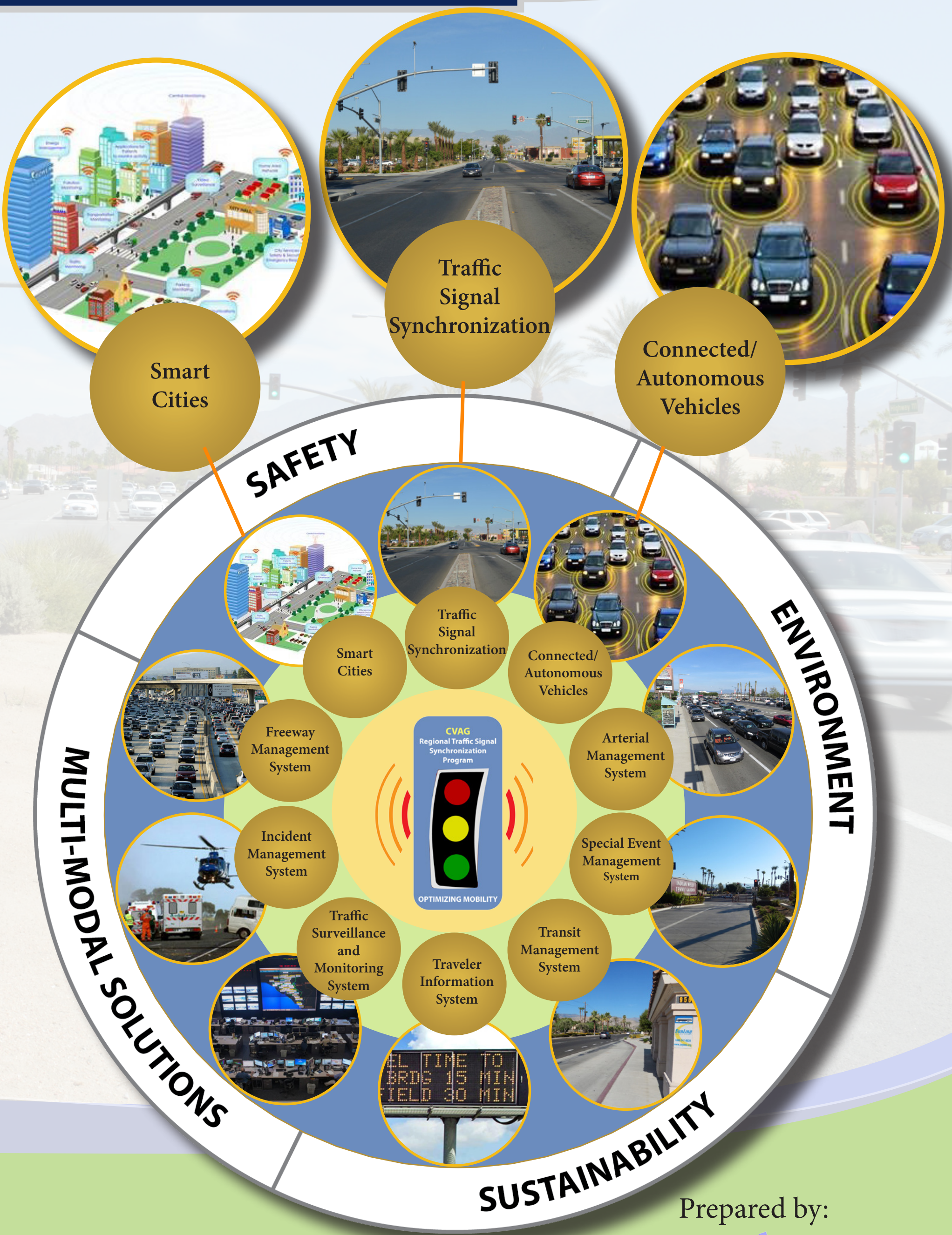
COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS (CVAG)
REGIONAL TRAFFIC SIGNAL SYNCHRONIZATION PROJECT

# TRAFFIC SIGNAL INTERCONNECT MASTER PLAN

## SYSTEMS REQUIREMENTS PLAN






Prepared for:

Coachella Valley Association of Governments

Prepared by:

ADVANTEC Consulting Engineers

**COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS (CVAG)**

**REGIONAL TRAFFIC SIGNAL SYNCHRONIZATION PROJECT**

# *TRAFFIC SIGNAL INTERCONNECT MASTER PLAN*

## Systems Requirements Plan

*Prepared for:*

**Coachella Valley Association of Governments (CVAG)**

Prepared by:

ADVANTEC
Consulting Engineers

1200 Roosevelt
Irvine, CA 92620

October 24, 2017

## COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS (CVAG)

## REGIONAL TRAFFIC SIGNAL SYNCHRONIZATION PROJECT

# *TRAFFIC SIGNAL INTERCONNECT MASTER PLAN*

## Systems Requirements Plan


Prepared By

ADVANTEC Consulting Engineers

Under the Supervision of:

________________________________Date: ________

Carlos A. Ortiz, P.E., T.E., P.T.O.E.


**October 24, 2017**

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| Version | Date | Author/ QA/QC | Comment |
|---|---|---|---|
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## Project Website

An electronic copy of this report can be found at: http://cvag-regionaltssp.com/

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## List of Acronyms

| | |
|---|---|
| AASHTO | American Association of State Highway and Transportation Officials |
| ATC | Advanced Transportation Controller |
| ATMS | Advanced Traffic Management System |
| C2C | Center-to-Center communications |
| C2F | Center-to-Field communications |
| CAD | Computer Aided Dispatch |
| Caltrans | California State Department of Transportation |
| CCTV | Closed-Circuit Television |
| CMS | Changeable Message Sign |
| DAC | Data Aggregation Center |
| DOT | Department of Transportation |
| DSRC | Dedicated Short Range Communication |
| EAS | Ethernet Access Switch |
| FHWA | Federal Highway Administration |
| GHG | Greenhouse Gas |
| ICM | Integrated Corridor Management |
| IP | Internet Protocol |
| IT | Information Technology |
| IoT | Internet of Things |
| ITE | Institute of Transportation Engineers |
| ITS | Intelligent Transportation Systems |
| MAP-21 | Moving Ahead for Progress in the 21$^{st}$ Century Act |
| MOU | Memorandum of Understanding |
| MPAH | Master Plan of Arterial Highways |
| NEMA | National Electrical Manufacturers Association |
| NTCIP | National Transportation Communications for ITS Protocol |
| SDP | Strategic Deployment Plan |
| SR | State Route |
| TMC | Traffic Management Center |
| TMS | Traffic Management System |
| TSS | Traffic Signal Synchronization |
| V2I | Connected Vehicle to Infrastructure |
| V2V | Connected Vehicle to Vehicle |
| V2X | Connected Vehicle to Everything |
| VMS | Video Management System |

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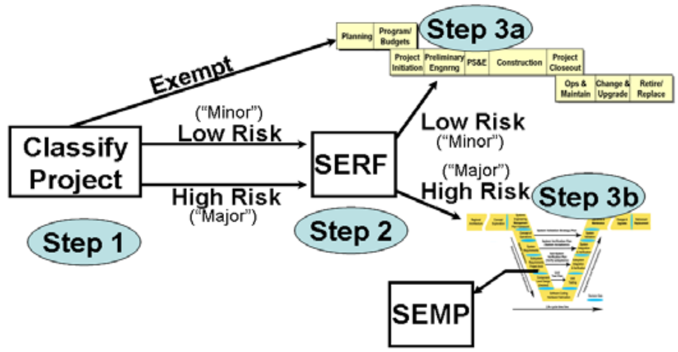
## 9-1. INTRODUCTION




The application and oversight process for Intelligent Transportation System (ITS) projects is very different from traditional roadway construction projects in many significant ways. Designing and developing ITS projects represent a paradigm shift in the engineering mindset, especially when compared to traditional highway projects. Some ITS projects may not include a construction phase with "ground breaking" improvements, and it may not be suitable to accept the "low-bid" from contractors because the ITS technology may serve a specific function that not all competitors can deliver and/or provide the required operations and maintenance services after the technology has been deployed. The nature of the engineering development for ITS projects also implies a greater risk and uncertainties to successful completion. This includes ITS projects that require new hardware and software development and for ITS projects that require commercial off-the-shelf (COTS) ITS technologies. New ITS developments typically serve as a higher risk, while the deployment of COTS ITS technologies are typically considered a lower risk solution. Regardless, the systems engineering process is required to help mitigate those risks and set the course for successful implementation, deployment and maintenance of these systems.

The purpose of this system requirements plan is to ensure the preliminary project planning and review process follows FHWA, ITS, and Caltrans guidelines, which is also tied to the funding sources for federally funded projects. By following these guidelines, we use a system engineering approach that allows us to thoroughly vet and understand the process of inception to implementation, deployment and maintenance of these ITS projects. One of these requirements include the preparation of Systems Engineering Review Form (SERF) that will be submitted to the Caltrans Department of Local Assistance (DLA). The SERF is normally submitted as part of the E-76 package when initial funding is requested. The SERF must be filled out for all ITS projects unless they are "Exempt."

The purpose of the SERF is to demonstrate that we are adhering to the FHWA/ITS and Caltrans guidelines and planning process, which includes providing the project contact, project summary, preliminary planning (e.g. investigation of options, associated internal or external systems examined, etc. – this is related to all chapters of the Regional Traffic Signal Interconnect Master Plan), risk assessment, and regulatory compliance information, such as:

1. Identification of portions of the Regional ITS Architecture (RA) being implemented
2. Identification of participating agencies roles and responsibilities
3. Procedures and resources necessary for operations and management of the system
4. Requirements definitions
5. Identification of applicable ITS standards and testing procedures
6. Analysis of alternative system configurations and technology options to meet requirements
7. Procurement options

The Systems Engineering Review Form (SERF) has been prepared as a part of this chapter and will be submitted to the Caltrans Department of Local Assistance (DLA) for their review and approval to release funding for the subsequent phases of this project. The following sections provide additional detail regarding the ITS Program Guidelines for ITS projects and requirements of the Systems Engineering Review Form (SERF).

## 9-2. ITS Program Guidelines

As the Systems Engineering Review Form (SERF) is defined, the ITS Program Guidelines describe best professional practices for planning and implementing ITS projects. They also establish the roles and responsibilities for all parties who are involved in the federal-aid ITS process, as well as define the process required for all ITS projects that will utilize federal funds. In general, all federal-aid funded projects require that the project:

- Consistent with the Regional ITS Architecture
- Uses applicable ITS Standards
- Perform a Systems Engineering Analysis that matches the scope of the project

### 9-2.1. ITS Projects

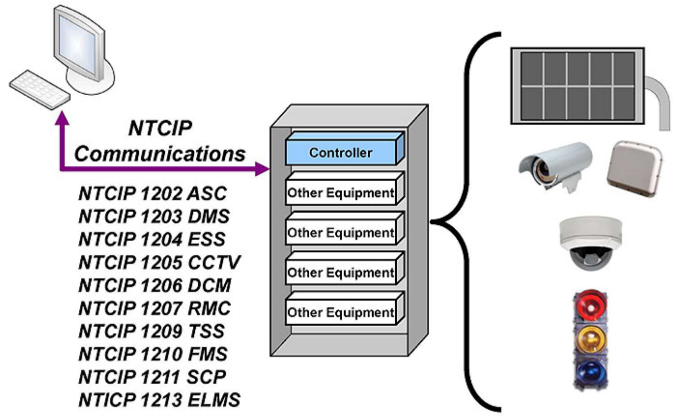
The definition of ITS has changed dramatically over the past decades, and it continues to evolve. Several decades ago, most people considered a computerized traffic signal to be “state-of-the-art” ITS. Today, every traffic signal is computerized and most people do not call them “ITS” – they are just “hardware” now. As state and local agencies have installed more and more electronic equipment over the past two decades, the emphasis of ITS has shifted from internal operational improvements to external coordination with other agencies, which enable each agency to achieve their mission more effectively. This inter-agency cooperation is a major objective of the Regional ITS Architecture (RA) and the Regional Traffic Signal Interconnect (TSI) Master Plan.

In 2001, ITS was defined as “…electronics, communications, or information technology, used singly or in combination, to improve the efficiency or safety of the surface transportation system.” This is a broad definition covering the range from small, simple devices up to large and complex systems. In addition to this legal definition, most people say that ITS must include comprehensive management strategies and apply technologies in an integrated manner. The purpose of ITS integration is to share information and reduce redundant spending between jurisdictions. ITS integration includes both technical and inter-agency aspects of system development.

The inter-agency challenge is to take advantage of the investment in infrastructure that has occurred over the years and use it to tackle regional mobility challenges. This means removing the institutional barriers that have existed in order to benefit the region as a whole.

These ITS Program Guidelines reflect the latest ITS concepts by emphasizing 'best professional practices' and requirements for ITS projects that are more complex and that include external cooperation. In contrast, procedural requirements for simple and low-risk projects have been simplified or eliminated.

### 9-2.2. Regional ITS Architecture




A regional Intelligent Transportation System (ITS) architecture is a structured view of the world of transportation technology and is intended to help optimize the benefit of individual investments. That is, it tries to capitalize on years of previous investment in transportation technology by identifying the interfaces and paths that will make it possible to integrate many systems in the future. Sharing information in this way multiplies the value of the original investment many times over while promoting the efficiency of regional transportation operations.

The Southern California Association of Governments (SCAG) provides a Regional ITS architecture for Southern California that includes the counties of Ventura, Los Angeles, Orange, Riverside, and San Bernardino. The ITS framework includes a vision for the future deployment of ITS applications throughout the region. The Regional ITS Architecture incorporates the existing and planned ITS projects, and it effectively provides a path to be followed as new projects are conceived, designed and deployed. As part of the Coachella Valley Regional TSI Master Plan, the following portions of the SCAG Regional ITS Architecture may be implemented:

- **ATIS 01** – Broadcast Traveler Information
- **ATIS 03** – Interactive Traveler Information
- **AD 02** – ITS Data Warehouse
- **AD 03** – ITS Virtual Data Warehouse
- **ATMS 01** – Network Surveillance
- **ATMS 03** – Surface Street Control
- **ATMS 06** – Highway Information (HAR)
- **ATMS 07** – Regional Traffic Control


### 9-2.3. ITS Standards

The current high-level system design was conceived and designed using applicable ITS standards widely used throughout the industry today. The transportation sector has a history of deploying systems with unique data definitions and proprietary communications protocols. Field devices and systems from one manufacturer or developer were not interoperable with other manufacturers or developers. As a result, expansion of a system after initial deployment can generally only be done using equipment of the same type and usually the same brand as in the initial deployment, unless there are investments in major systems integration efforts.

ITS standards, such as the National Transportation Communications for ITS Protocol (NTCIP) family of standards defines protocols and profiles that are open, consensus-based data communications standards. When used for remote control of roadside and other transportation management devices, NTCIP-based devices and software can help achieve interoperability and interchangeability. When used between other traffic, transit and emergency management centers, NTCIP standards facilitate agency coordination and information sharing.

The NTCIP standard and other ITS Standards i.e. IEEE, ITE, TMDD and ATC standards define common data definitions and open protocols. The proper use of open-standards in an ITS deployment allows future expansion of the system to benefit from true competitive bidding, as well as allowing other types of field devices to be added. Only equipment and interfaces that comply with the latest open architecture protocols will be used on this project.

### 9-2.4. Risk Management

As said above, the application and oversight process for ITS projects is different in some significant ways from the traditional roadway construction process. A successful ITS project is one which completes on schedule, within budget, and delivers all capabilities required. Studies of Information Technology (IT) application developments in the U.S. show 24% of projects are cancelled prior to completion. Further results indicate 44% were challenged (late, over budget, and/or with less than the required features and functions). This is especially true of ITS projects that involve something new, which the lead agency has not done before. This might include new technology or new software or new communications, or joint efforts with new partners. Because of the high risk of failure for certain ITS projects, special procedures are required to help mitigate those risks.

**Table 9.1** summarizes the risk factors associated with ITS projects.

**Table 9.1- Risk factors associated with ITS Projects**

| | Low-Risk Project Attributes | High-Risk Project Attributes | Risk Factors |
|---|---|---|---|
| **1** | Single jurisdiction and single transportation mode (highway, transit or rail) | Multi-Jurisdictional or Multi-modal | With multiple agencies, departments, and disciplines, disagreements can arise about roles, responsibilities, cost sharing, data sharing, schedules, changing priorities, etc. Detailed written agreements are crucial! |
| **2** | No software creation; uses commercial-off-the-shelf (COTS) or proven software | Custom software development is required | Custom software requires additional development, testing, training, documentation, maintenance, and product update procedures -- all unique to one installation. This is very expensive, so hidden short-cuts are often taken to keep costs low. Additionally, integration with existing software can be challenging, especially because documentation is often not complete and out-of-date. |
| **3** | Proven COTS hardware and communications technology | Hardware or communications technology are “cutting edge” or not in common use. | New technologies are not “proven” until they have been installed and operated in a substantial number of different environments. New environments often uncover unforeseen problems. New technologies or new businesses can sometimes fail completely. Multiple proven technologies combined in the same project would be high risk if there are new interfaces between them. |

| | Low-Risk Project Attributes | High-Risk Project Attributes | Risk Factors |
|---|---|---|---|
| **4** | No new interfaces | New interfaces to other systems are required. | New interfaces require that documentation for the "other" system be complete and up-to-date. If not (and often they are not), building a new interface can become difficult or impossible. Duplication of existing interfaces reduces the risk. "Open Standard" interfaces are usually well-documented and low risk. |
| **5** | System requirements fully-detailed in writing | System Requirements not detailed or not fully documented | System Requirements are critical for an RFP. They must describe in detail all the functions the system must perform, performance expected, plus the operating environment. Good requirements can be a dozen or more pages for a small system, and hundreds of pages for a large system. When existing systems are upgraded with new capabilities, requirements must be revised and rewritten. |
| **6** | Operating procedures fully-detailed in writing | Operating procedures not detailed or not fully documented | Standard Operating Procedures are required for training, operations, and maintenance. For existing systems, they are often out-of-date. |
| **7** | None of the technologies used are near end of service life | Some technologies included are near end of service life | Computer technology changes rapidly (e.g. PC's and cell phones become obsolete in 2-4 years). Local area networks using internet standards have had a long life, but in contrast some mobile phones that use proprietary communications became obsolete quickly. Similarly, the useful life of ITS technology (hardware, software, and communications) is short. Whether your project is a new system or expanding an existing one, look carefully at all the technology elements to assess remaining cost-effective service life. |

Project risk may be defined in terms of schedule, cost, quality, and requirements. These risks can increase or decrease significantly based on several identified factors associated with ITS projects. Typically, these factors include:

- Number of jurisdictions and modes
- Extent of software creation
- Extent of proven hardware and communications technology used
- Number and complexity of new interfaces to other systems
- Level of detail in requirements and documentation
- Level of detail in operating procedures and documentation
- Service life of technology applied to equipment and software

As part of the SERF, and initial risk assessment - these seven questions must be conducted to help understand the extent of risk involved in this project:

1. Will the project depend on ***only <u>your</u> agency*** to complete & operate?
    a. Each agency will be responsible for operating and maintaining their own traffic management systems and communications systems. The recommended upgrades are commercial off-the-shelf (COTS) products and will be upgrading/integrating with existing technologies.
2. Will the project use only software proven elsewhere, with ***<u>no</u>*** new software writing?
    a. Yes, recommended upgrades will use proven (COTS) products with no new software writing.
3. Will the project use only hardware and communications ***proven*** elsewhere?
    a. Yes, recommended upgrades will use proven (COTS) hardware and communications.
4. Will the project use only ***existing interfaces*** (no new interfaces to other systems)?
    a. The project will use existing and proven (COTS) interfaces, with **no** new interface, software, hardware or communications development. The project will also provide upgrades to the existing interfaces through the same manufacturer.
5. Will the project use only ***existing system interfaces*** that are defined in writing?
    a. Yes, the project will use existing and proven (COTS) interfaces, which are already defined in writing (e.g. specifications).
6. Will the project use only ***existing operating procedures*** that are defined writing?
    a. Yes, the project will use existing operating procedures from proven (COTS) technologies, which are already defined in writing (e.g. specifications).
7. Will the project use only technologies with service life ***longer*** than 2-4 years?
    a. Yes, the project will use technologies with service life longer than 2-4 years. It is anticipated that minimum service life will be 10 years.

As part of the Caltrans funding application package, a Systems Engineering Review Form (SERF) must be filled out, which consists of these seven (7) essential questions to further mitigate these risks. Based on the results, it is determined that this project is considered **Low-Risk** since each agency will operate and maintain their respective systems, and all new equipment and software will be commercial off-the-shelf (COTS) products and will be upgrading/integrating with existing technologies for the local agencies. The completed SERF form for the Regional TSI master plan can be found in **Appendix A**.

## 9-3. ITS Project Type Examples

### 9-3.1. Exempt Project

An example of an **Exempt** ITS project would be the installation of traffic signal hardware (traffic controller/software, cabinet, detectors, etc.) to control an isolated intersection in "City A". No software development is needed; merely adjusting programmable settings and parameters for control. Standard plans, specifications, identified special provisions have been well documented over the years for the design and construction of signal control field equipment. The traditional roadway project development process will be used. Typical of this kind of project is for plans, specifications, and estimate (PS&E) to be developed, and construction contracts handled through a low-bid selection.

### 9-3.2. Low-Risk Project

An example of a **Low-Risk** ITS project is the addition of 30 full matrix changeable message signs to an existing system that has five identical signs already deployed. No changes are needed to the existing central or field equipment. The system was initially designed to accommodate these additional signs so no additional software is needed. Assumptions are:

- The initial system has been completed and the system is working well
- The contractor will deploy the signs, poles and foundations, controllers, and wire the controllers into the signs
- The agency will add configuration information about the signs at the central computer. Updates to the existing plans have been reviewed to ensure that the original design and implementation is not adversely affected because of adding the elements

Additional examples of **Low-Risk** ITS projects include:

- Adding five identical CCTV cameras to the existing 20 – with no other changes to the system or how it's used
- Adding 50 identical new loops to the existing 200 – no other changes
- Installing an existing parking management system at 2 additional garages – with no changes
- Expanding the pre-existing system/network by adding several more units – with no changes
- Expanding existing communications systems – this consists of extending existing fiber-optic or wireless communications systems, using the same technology and specifications as the pre-existing system
- Leasing turnkey services only (e.g., website-based information service) – with no hardware or software purchases

Although, during the design process, it may be discovered that several changes to the existing system are needed in addition to adding the expansion elements. This may the result of new and better technologies (or the old hardware is no longer available or the old software is no longer supported), or because of the desire to improve or expand the functionality of the "previous" system, or because of the need to use the system in a different way (e.g. sharing control with another party). Any of these instances would elevate the project to a High-Risk implementation.

### 9-3.3. High-Risk Project

**High-Risk** ITS projects are often referred to as ITS System developments. For example, a High-Risk ITS project will result from adding the following new requirement to the previously described Low-Risk project: "The changeable message signs will have shared control with a partner Agency B." For this example, Agency B manages events at two activity centers. As part of the installation, Agency A will be installing six signs that would assist agency B for their event management. Agency B would use the CMS to divert traffic to get the attendees in and out of the event faster and more safely. To enable this shared control, new software may need to be developed and integrated into the existing system. With this requirement for new functionality (shared control), new risks and complexity are introduced.

Although the traditional roadway design/development and construction process is needed for the signs and controllers to be installed at each location, there will be a need for systems engineering to address the software development and integration efforts. In this example, revisions to the existing "concept of operations" and development of agreements for interagency coordination will be especially important to clarify expectations and avoid future disputes.

Additional examples of **High-Risk** ITS projects include:

- Multi-jurisdictional or multi-modal system implementation, for example:
  - A traveler information system that collects data from multiple agencies or modes
  - A Bus Traffic Signal Priority system between City Traffic and Regional Transit, or one that crosses multiple jurisdictions
- The first stage of an "umbrella" system implementation. During this first stage, the full system engineering process would be used to develop the overall system framework plus the first implementation of that framework, for example:
  - New Traffic Signal Coordination system design plus implementation at an initial number of signals, with more signals added in later project(s)
  - New Traffic Information System design plus the first implementation in Cities X and Y, with more cities added in later project(s)
  - New Electronic Fare-Payment System design and initial implementation on Metro buses, with other transit agencies added in later project(s). If subsequent stages replicate the initial implementation, they would not be high risk. Instead, they fit the definition of a low risk ITS project, expanding the existing system with no new capabilities, and no new interfaces

As mentioned previously, based on our risk assessment from the SERF in **Appendix A**, it is determined that this project is considered **Low-Risk** since all new equipment and software will be commercial off-the-shelf (COTS) products.

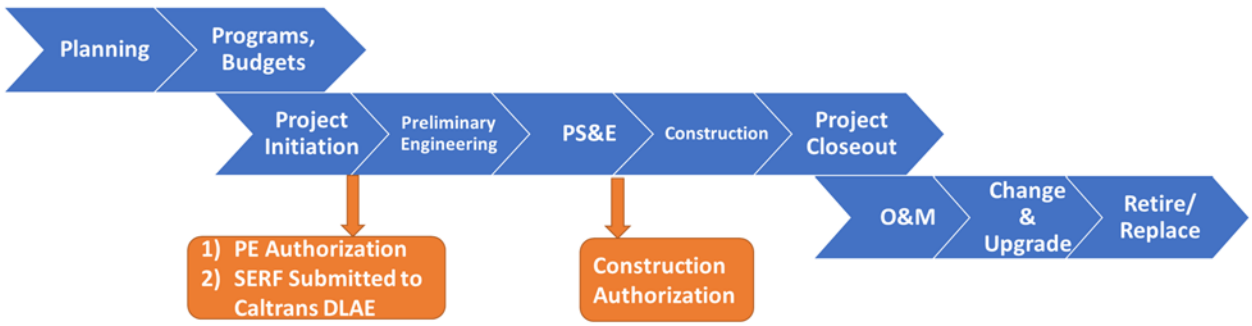
## 9-4. ITS Project Deployment and Funding Steps

The three types of ITS projects (**Exempt**, **Low-Risk**, and **High-Risk**) are linked to specific process by way of their risk characteristics. The traditional road building "process" has been used for many years. Design and installation is well documented. Over the years, requirements have become well defined, product performance is solid, and the technology is proven. As with roadway elements (pavement, drainage), ITS field elements (signals, CCTV, CMS) are designed and constructed with Standard Plans, Standard Specifications, and Standard Special Provisions that are well documented. Risk of failure is low for these ITS projects, except when changing to new technology. Commercial Off-the-Shelf (COTS) hardware and software are recommended for all local traffic signal locations, HUB locations and TMC central locations for the Coachella Valley.

### 9-4.1. Exempt and Low-Risk

For **Exempt** and **Low-Risk** (formerly "Minor") ITS projects, the traditional single-phase PE obligation and authorization process will be followed. Work will include all activities of the traditional roadway project development life-cycle process leading up to construction. Funding steps for Low-Risk ITS Projects can be seen in **Figure 9.1.**

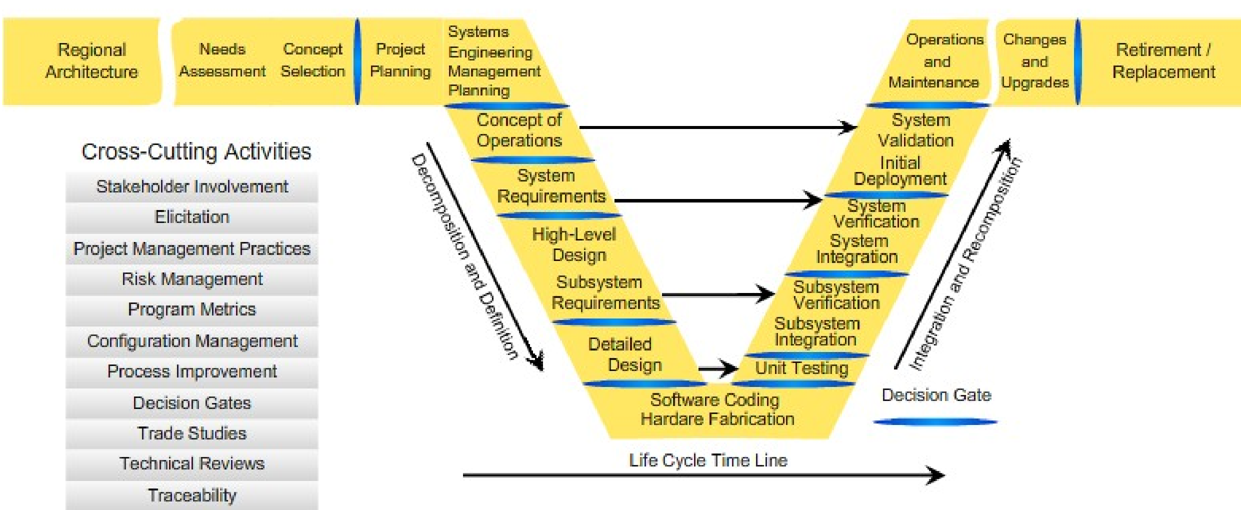
**Figure 9.1 Funding Steps for Low-Risk ITS Projects**




More complex ITS projects lead to higher risks, such as: termination, time delays or cost increases. Additional elements are needed in the process of development to mitigate the higher risks. These additional elements can be thought of as extensions to the traditional road building process. The systems engineering approach is graphically depicted in **Figure 9.2**.

**Figure 9.2 Systems Engineering Vee Process**

| Phase -1 | Phase 0 | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 |
|---|---|---|---|---|---|---|
| Interfacing with Planning and the Regional Architecture | Concept Exploration and Benefits Analysis | Project Planning and Concept of Operations Development | System Definition and Design | System Development and Implementation | Validation, Operations and Maintenance, Changes & Upgrades | System Retirement / Replacement |

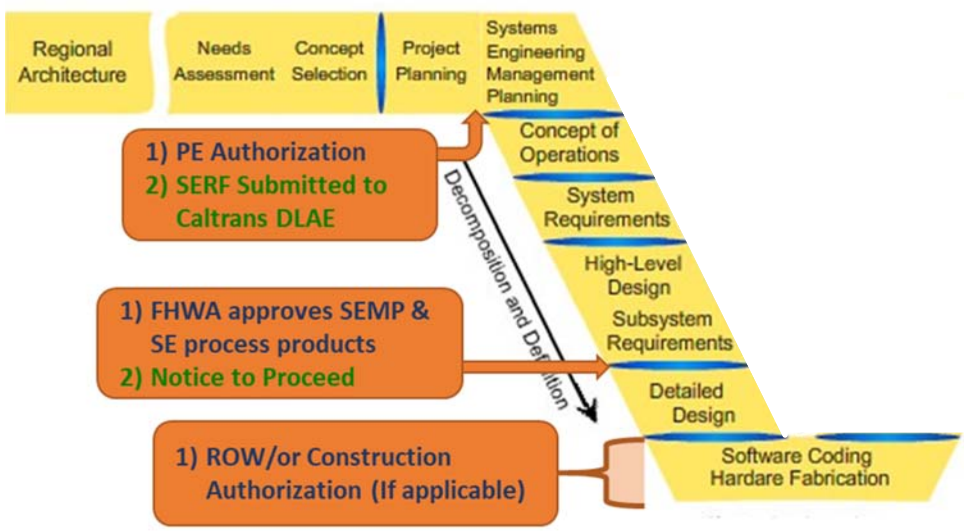


Note: To learn more about the Systems Engineering process, see the USDOT ITS Professional Capacity Building Program website: http://www.pcb.its.dot.gov, and FHWA/Caltrans "Systems Engineering Guidebook for ITS" at: http://www.fhwa.dot.gov/cadiv/segb/views/process/index.htm.

### 9-4.2. High-Risk

For **High-Risk** (formerly "Major") ITS PE obligation and authorization is followed by two approval actions for project development to proceed. **Figure 9.3** shows where each approval occurs. A separate construction obligation and authorization will be needed for traditional roadway (infrastructure) improvements that accompany system development.

**Figure 9.3 Funding Steps for High-Risk ITS Projects**




Early determination of risk leads to early determination of type of ITS project, which leads to an early determination of budgeting approach. The systems engineering Vee process concentrates more time and cost on the up-front engineering activities relative to the traditional road building process that typically concentrates funding and scheduling priorities to the construction (backend) phase.

## 9-5. NEXT STEPS

As mentioned previously, based on our risk assessment from the SERF in **Appendix A**, it is determined that the Coachella Valley Regional TSI Master Plan and Phase I improvements will be a classified as a "**Low-Risk**" project – each agency will operate and maintain their respective systems, and all new equipment and software will be commercial off-the-shelf (COTS) products and will be upgrading/integrating with existing technologies for the local agencies.

The design team and their sub-consultants will work with the state department of local assistance through the system requirements process to help minimize any potential delays or impacts to the project.

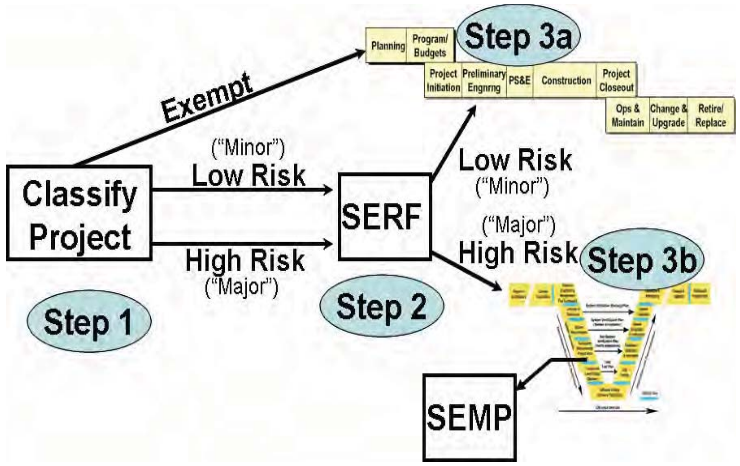
The SERF will be submitted from CVAG for submittal to the Caltrans District Local Assistance Engineer (DLAE) for their review and approval along with the Coachella Valley Regional TSI Master Plan to illustrate our compliance for **Low-Risk** ITS projects, and conformance to 23 CFR 940 “Roadmap of ITS Compliance”.

# Appendix A

# SYSTEMS ENGINEERING REVIEW FORM (SERF)

## Part 1. General Project Information

The SERF is normally submitted as part of the E-76 package when initial funding is requested. A full description of funding steps for ITS projects appears in Section 13.1 of the LAPG. The SERF must be filled out for **all** ITS projects unless they are "**Exempt**." For definitions of an Exempt ITS project, see LAPG Section 13.2. A full discussion of how a local agency uses the SERF during the programming and funding steps is in LAPG Section 13.4, in the section titled "Local agency (include consultants in project management role)". That process is summarized in the figure at the right.




Please provide the following background information. In most cases, 1-3 sentences will be sufficient for each item, but you may include as much as you feel needed. If you need more space, the field will expand automatically.

**A. Project Contact** – Name, position, phone, email.

Mr. Eric Cowle, Project Manager
Coachella Valley Association of Governments
(760) 346-1127
ecowle@cvag.org

**B. Project Objectives** – What is the purpose of the project? What needs (deficiencies) are being addressed?

The objective of this project is to reduce traffic congestion and its associated negative impacts by deploying advanced technologies to facilitate the region's local jurisdictions to operate their traffic signals and ITS efficiently. Local and Regional improvements include updates to existing traffic signal systems to include Fiber Optic & Wireless communications, ATC Controllers, HD IP CCTV cameras and Arterial Management Systems. Interconnection of these systems will be deployed for each agency's TMC to provide command and control of their traffic signal network remotely. All systems and communication will be proven COTS systems - which will upgrade and integrate with their existing technologies/systems. Additionally, all TMC sub-systems will provide two-way connection to a Regional TMC.

**C. Project Summary** – What solutions will address the needs? What major elements will be installed? What major function(s) will be performed?

The updated traffic signal systems will provide Ethernet IP communications, advanced traffic operations and signal synchronization. Commercial Off-The-Shelf ITS technologies will be deployed including roadside edge devices such as traffic controllers, Ethernet switches, CCTV cameras, CMS signs etc. - which will upgrade and integrate with their existing technologies/systems. The roadside elements will be managed by TMC core systems; ATMS systems, VMS systems, Arterial Management Systems etc.

**D. Work to Date** – Any preliminary planning, investigation of options, associated internal or external systems examined, etc.?

The System Engineering Management Plan (SEMP) and Concept of Operations (ConOps) provide for preliminary planning and feasibility of integration at a local and regional level. Review of existing traffic signal systems and proposed equipment have been determined. Recommendations for readily available and tested equipment will be deployed on this project. Commercial Off-The-Shelf (COTS) hardware and software have been recommended for all local existing traffic signal locations, hub cabinets and TMC central locations - which will upgrade/integrate with their existing technologies/systems.

**E. Risk Assessment Guidance –** Although this assessment is not a regulatory requirement, the answers to these questions will help you understand the extent of risk involved in this project. A full discussion of risk factors is available in LAPG Section 13.2, with a summary in Table 13-1.
For each question, check Yes or No or Not Sure.

| Question: | Yes | No | Not Sure |
|---|---|---|---|
| 1. Will the project depend on ***only your agency*** to implement and operate? | ☑ | ☐ | ☐ |
| 2. Will the project use only software proven elsewhere, with ***no*** new software writing? | ☑ | ☐ | ☐ |
| 3. Will the project use only hardware and communications ***proven*** elsewhere? | ☑ | ☐ | ☐ |
| 4. Will the project use only ***existing interfaces*** (no new interfaces to other systems)? | ☑ | ☐ | ☐ |
| 5. Will the project use only ***existing system requirements*** that are defined in writing? | ☑ | ☐ | ☐ |
| 6. Will the project use only ***existing operating procedures*** that are defined in writing? | ☑ | ☐ | ☐ |
| 7. Will the project use only technologies with service life ***longer*** than 2-4 years? | ☑ | ☐ | ☐ |

If all of the above are Yes, that is a preliminary indication that your project is **Low-Risk**.

## Part 2. Regulatory Compliance Information

Please answer each question briefly (often one paragraph is enough). If the question cannot be fully answered *now*, but will be answered during the project implementation, please indicate the step at which it will be answered. As you respond to each question on this form, the field will expand as you type. Examples of SERF's can be found at: http://www.fhwa.dot.gov/cadiv/segb/examples/del.htm (then click on "FHWA Rule/FTA Policy Compliance Documents").

**1. Identification of portions of the Regional ITS Architecture (RA) being implemented:**

The Coachella Valley is represented within the Southern California Coalition of Governments (SCAG) Regional Architecture (RA). Located within the SCAG RA, the service packages that are being implemented include; ATIS 01(Broadcast Traveler Information), ATIS 03 (Interactive Traveler Information), AD 02 (ITS Data Warehouse), AD 03 (ITS Virtual Data Warehouse), ATMS 01 (Network Surveillance), ATMS 03 (Surface Street Control), ATMS 06 (Highway Information such as CMS or HAR) and ATMS 07 (Regional Traffic Control). These service package descriptions can be found within the SCAG Regional Architecture (latest edition).

**2. Identification of participating agencies roles and responsibilities:**

The stakeholders involved in the project include the local agencies of; Cathedral City, City of Coachella, City of Desert Hot Springs, City of Indian Wells, City of Indio, City of La Quinta, City of Palm Desert, City of Palm Springs, City of Rancho Mirage, Caltrans District 8 and the County of Riverside. Coachella Valley Association of Governments (CVAG) will be responsible for administering the project. The associated City's will provide input during the design phase of the project. The local City's will also be responsible for the Operations and Maintenance (O&M) of their respective traffic signal system(s) after completion of the project.

**3. Procedures and resources necessary for operations and management of the system:**

The operations, management and maintenance of the traffic signal system(s) will be the responsibility of the local Agencies. CVAG will be responsible for administering the entire project, including the design-bid-build PS&E phase, signal synchronization phase and monitoring phase after completion of the contract. A Systems Integrator will be brought on to perform the installation and integration of the COTS ITS technology systems - which will upgrade and integrate with their existing technologies/systems. The local Agencies will help be responsible for the project definition and acceptance testing during project deployment and through project completion. Additional training will be required for local agency staff to repair and maintain the system. However, it is anticipated a reduced maintenance effort will be required since the project will utilize in-kind COTS products.

**4. Requirements definitions:**

Preliminary high-level project requirements have been described within the SEMP and ConOps portion of the project. The following objectives are: the system shall support advanced traffic signal operations; the system shall provide HD IP closed circuit television (CCTV) surveillance; the system shall provide Ethernet/IP communications; the system shall provide arterial management system performance measures; and the system shall provide centralized TMC operation using COTS systems - which will upgrade and integrate with their existing technologies/ systems. Further project requirements will be defined and included under a separate "Participating Agreement" between each agency.

**5. Identification of applicable ITS standards and testing procedures:**

The project will utilize industry standard equipment and communications protocols similar to other deployments in surrounding areas and adhere to the Regional ITS Architecture. The project will be NTCIP compliant using Ethernet IP communications. These protocols are defined via NTCIP 1202 and 2306, TMDD v.3.0, ATC v5.2b and other general NTCIP & IEEE standards. These improvements will be implemented across both NEMA and State Standard Type 33(x) applications. All systems and communication will be proven COTS systems - which will upgrade and integrate with their existing technologies/systems.

**6. Analysis of alternative system configurations and technology options to meet requirements:**

A preliminary project analysis has been performed for communication alternatives to proposed fiber optic cable. Due to the environmental impacts and enhanced cost associated with the installation of new underground conduit + fiber optic cable, alternatives have been identified as; (1) wireless Ethernet broadband and (2) Ethernet-over-Copper (VDSL) utilizing existing copper signal interconnect (SIC) cable. Dependent on the geographic location and use case of each signal, alternatives may be utilized. All systems and communication will be proven COTS systems - which will upgrade and integrate with their existing technologies/systems. Overall, the project goals, objectives and requirements remain.

**7. Procurement options:**

The procurement phase of the project includes a "Design-Bid-Build" process, which a Contract/Systems Integrator will be brought on to perform the installation and integration of the various ITS components. The project will utilize Commercial Off-The-Shelf (COTS) hardware and software using existing interfaces, system requirements, and operating procedures (there will be no new interfaces or specifications are required). The project improvements will be administered through a competitive bidding process and fixed-price contract.

**Comments or Additional Information (if needed):**

**Note: If you were able to answer all seven questions above completely and with certainty, then please self-certify this project as "Low-Risk" in the E-76. Otherwise, it should be classified as "High-Risk." However, if you feel this is not justified, you may request a review of this SERF by Caltrans and FHWA.**