

**Southern California Priority Corridor
Showcase Program Evaluation**

**Costs
Cross-Cutting Evaluation Report**

FINAL

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Disclaimer

The contents of this report reflect the views of the author who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California, Caltrans or the U.S. Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

Abbreviations & Acronyms

ATIS	Advanced Traveler Information System
ATMIS	Advanced Traffic Management & Information System
ATMS	Advanced Transportation Management System
AVL	Automatic Vehicle Location
Caltrans	California Department of Transportation
CCTV	Closed-circuit Television surveillance camera
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CHP	California Highway Patrol
CM	Configuration Management
CMP	Configuration Management Plan
CMS	Changeable Message Sign
CORBA	Common Object Request Broker Architecture
COTS	Commercial Off-the-Shelf
CTC	California Transportation Commission
CVO	Commercial Vehicle Operations
CW	Corridor-wide
CWATIS	Corridor-wide Advanced Traveler Information System Project
CWATMS	Corridor-wide Advanced Transportation Management System Project
CWCVO	Corridor-wide Commercial Vehicle Operations Project
CWSIP	Corridor-wide Systems Integration Project
CWSPP	Corridor-wide Strategic Planning Project
DOIT	Department of Information Technology
DRI	Caltrans Division of Research & Innovation (formerly NTR)
EAP	Evaluation Activity Plan
EP	Evaluation Plan
FHWA	Federal Highway Administration
FSR	Feasibility Study Report
FTA	Federal Transit Administration
FTE	Full-Time Equivalent (one full-time employee)
GPRA	Government Performance and Results Act
GUI	Graphical User Interface
HP	Hewlett-Packard
HQIT	Headquarters - Information Technology (division of Caltrans)
IDL	Interface Definition Language
IPP	Implementation Phasing Plan
IPR	Intellectual Property Rights
ISP	Information Service Provider
ISSC	Information Systems Service Center (division of Caltrans)
ISTEA	Intermodal Surface Transportation Efficiency Act (of 1991)
ITS	Intelligent Transportation Systems
LACDPW	Los Angeles County Department of Public Works
LADOT	City of Los Angeles Department of Transportation

LAN	Local Area Network
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
MTA	Los Angeles County Metropolitan Transportation Authority
MTBF	Mean Time Between Failure
NDA	Non-Disclosure Agreement
NET	National Engineering Technology Corporation
NTCIP	National Transportation Communications for ITS Protocol
NTR	Caltrans Division of New Technology & Research (now DRI)
OCMDI	Orange County Model Deployment Initiative
OCTA	Orange County Transportation Authority
O&M	Operations and Maintenance
OS	Operating system (such as Windows™, Unix, Linux, et. al.)
PC	Personal Computer (Windows™-based)
PoP	Period of Performance
RAMS	Regional Arterial Management System (aka. Traffic Signal Integration)
RAVL	Regional AVL (aka. Transit Management System)
RCTC	Riverside County Transportation Commission
RFP	Request for Proposals
RTP	Regional Transportation Plan
RTPA	Regional Transportation Planning Agency
RWS	Remote Workstation
SANBAG	San Bernardino Association of Governments
SANDAG	San Diego Association of Governments
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCPCSC	Southern California Priority Corridor Steering Committee
TEA-21	Transportation Equity Act for the 21st Century
TIC	Traveler Information Center
TMC	Transportation Management Center
TOC	Traffic/Transportation Operations Center
USDOT	United States Department of Transportation
VCTC	Ventura County Transportation Commission
VDS	Vehicle Detector Station
VMT	Vehicle Miles Traveled
VOS	Volume/Occupancy/Speed
WAN	Wide Area Network

Executive Summary

This cross-cutting report aggregates and summarizes the cumulative knowledge gained from the several Showcase Program projects with regards to costs. The report looks at their combined experiences and synergistic impacts, as opposed to the experiences and impacts of any one system in isolation. Each Showcase cross-cutting report addresses one of the Showcase Program's five evaluation goals:

- ✓ System Performance
- ✓ Costs
- ✓ Institutional Impacts
- ✓ Transportation and Traveler Information Management
- ✓ Transportation System Impacts

Background

As required by federal law, all Intelligent Transportation System (ITS) projects that receive federal funding must undergo an evaluation to help assess the costs and benefits of ITS. This document is one of 23 reports produced as part of the Southern California ITS Priority Corridor Showcase Program Evaluation to help planners and decision-makers at the federal, state and local levels make better-informed decisions regarding future ITS deployments.

In 1993, the U.S. Department of Transportation designated Southern California as one of four Priority Corridors in which Intelligent Transportation System (ITS) could have particular benefit. Southern California suffers from extreme traffic congestion, limited room for expanding transportation facilities, and above-average air pollution levels. The Southern California Priority Corridor is one of the most populated, traveled, and visited regions in the country, and consists of four adjoining regions:

- ▶ Los Angeles/Ventura
- ▶ Orange County
- ▶ San Diego County
- ▶ Inland Empire (San Bernardino and Riverside Counties).

The ITS Showcase Program is one of several programs that have been implemented in Southern California's Priority Corridor to help aid mobility and mitigate traffic congestion and its associated environmental impacts. The Showcase Program consists of 17 ITS projects that collectively form a corridor-wide intermodal transportation management and information network between Los Angeles, Orange County, San Diego, and the Inland Empire. Each Showcase project deploys a piece of this corridor-wide ITS network, including regional Advanced Traveler Information Systems (ATIS), regional Advanced Transportation Management Systems (ATMS), and regional and interregional communications infrastructure. Eleven of the projects are specific to a particular region, while the remaining six provide

Corridor-wide services and inter-regional infrastructure. The projects are listed in the table below.

PROJECT	DESCRIPTION
<i>Corridor-wide Projects (6)</i>	
Scoping & Design (Showcase Kernel)	Designs and implements four “Kernel” servers that help manage the interregional Showcase Network. These Showcase Kernels will be installed in each of the four Southern California Caltrans Districts.
Strategic Planning/System Integration (CWSPP)	Works to ensure that the systems of the Priority Corridor are interoperable and sustainable by developing a Configuration Management process.
CWATIS	Will provide Concept of Operations (ConOps), System Requirements and High Level Design for an Integrated Workstation (IWS).
CWATMS	Intended to build on the high-level planning efforts of the CWATIS project and will develop and implement the IWS.
Interregional Rideshare Database	The goal is to link San Diego's transit database with the transit database at Southern California Association of Governments (SCAG) in order to make SCAG's transit based Itinerary Planning tool more robust. The change will broaden the system's coverage from the LA/Orange County area to include San Diego as well.
CWCVO	Primarily intended for Commercial Vehicle Operations (CVO), the Showcase portion of CWCVO develops a server that fuses transportation data and provides an interface for partner Information Service Providers (ISPs) to access it for value-added redistribution.
<i>San Diego Regional Projects (5)</i>	
IMTMS/C	This project optimizes and coordinates freeway and surface street operations with public and private transportation systems by integration of intermodal transportation information, and intermodal transportation management systems.
InterCAD	Improves incident management by linking the Computer-Aided Design (CAD) systems of law enforcement and emergency response agencies in San Diego.
Mission Valley ATMIS	This project optimizes traffic and transit operations in the vicinity of the Qualcomm Stadium. The project coordinates with the ITMS/C project.
Transit Management System (RAVL)	Installs Automatic Vehicle Locator (AVL) on San Diego Transit buses, as well as provides traffic signal priority at a number of downtown intersections.
Traffic Signal Integration (RAMS)	This project will integrate remote management of traffic signals across multiple jurisdictions in San Diego County.

<i>Los Angeles/Ventura Regional Projects (3)</i>	
IMAJINE	Creates an integrated network comprising four transportation management systems in Los Angeles County: Caltrans District 7 freeway management system, Los Angeles County Metropolitan Transit Authority (LACMTA) fixed route transit database, Access Services Inc. (ASI) demand-based paratransit services, and the City of South Gate arterial traffic signal control system.
Integrated Mode Shift	Provides transit related traveler information in response to major accidents. This will be developed in close cooperation with the IMAJINE project and the Los Angeles/Ventura Regional ATIS project and may provide the Caltrans District 7 connectivity to the regional Kernel.
LA/Ventura ATIS	Implements an ATIS for LA County and some Ventura County commuters. In the future, the system may also bundle public data from various sources and make it available to ISPs.
<i>Orange County Regional Projects (2)</i>	
TravelTIP	This project is the Showcase model of data fusion for ATIS. TravelTIP fuses data from multiple sources and disseminates it to travelers via a website, a Highway Advisory Telephone (HAT) system, and three kiosks.
OCMDI	Extends the dissemination of traveler information in Orange County by providing data to private sector ISPs through a non-profit data broker. The data broker is called the Traveler Advisory News Network (TANN). TANN's goal is to be the single interface for traveler information in California. TANN establishes connections with public and private data sources, and then acts as a broker to provide data and/or information services to ISPs and other media outlets.
<i>Inland Empire Regional Projects (1)</i>	
Fontana-Ontario ATMIS	Built a Traffic Management Center (TMC) for the City of Fontana and a regional ATIS to help manage traffic from sources such as the Ontario Convention Center, Ontario Mills Mall, Ontario International Airport and the California Speedway in Fontana. Additionally, the project integrates the new TMC with the Showcase Network via the Inland Empire Kernel located at Caltrans District 8.

The Showcase Evaluation studied each of these 17 projects, and a project evaluation report has been prepared for each one.

This cross-cutting report summarizes the cumulative knowledge gained over all of the projects with regards to costs.

Evaluation Findings, Conclusions, and Recommendations

One of the credos of the Showcase Program was “Design Once, Deploy Many Times,” which seeks system standardization, program efficiency and cost savings through software reuse. There are clear examples of software reuse within individual projects (such as TravelTIP) and between projects awarded to the same contractor. However, one of the Showcase Program’s greatest accomplishments was the development of its Corridor-wide system interface standards, which allow developers to use a “black box” approach to independently design and build interoperable systems. As long as the systems conform to the standard interfaces, they should be able to work together without having to reveal the details of their inner workings. This is an ideal solution that supports diverse innovative approaches while protecting a contractor’s intellectual property rights and supporting the Corridor-wide goal of “Design Once, Deploy Many Times.”

From a cost perspective, the Showcase Program carried out its objectives within the allotted budget. Actual funds expended to complete projects in excess of initial Program funding were less than 0.02 percent. For several projects that experienced time delays – such as Rideshare, IMAJINE, and LA/Ventura ATIS – budgets were not impacted due to the use of fixed price contracts. Two exceptions were InterCAD and Fontana-Ontario ATMIS project in which excess funds were utilized to complete or enhance the original project.

During the last three years of the Showcase Program, hardware and software upgrade costs were estimated to be the largest cost component, comprising 64% of total O&M costs. The hardware and software maintenance costs, however, were impacted by a vendor’s new software version release that would have required an unanticipated \$1.8 million outlay to upgrade the four Kernel servers. This cost was not indicative of all hardware investments; however, it highlights a risk that would need to be managed in future projects.

The next largest O&M cost component was utilities, which represented 27% of total O&M costs. Within utilities, telecommunication charges far outweigh electricity costs as a cost driver.

Due to the suspension or non-completion of many of the Showcase projects, the O&M costs of the Showcase Program under-represent the true O&M costs that would be incurred if the original objectives of the Program were realized. In addition, if projects were considered ongoing, it is conceivable that Caltrans and other local agencies would factor in additional labor to maintain those efforts.

1 Introduction

1.1 Purpose and Scope of this Report

As required by federal law, all ITS programs that receive federal funding must undergo an evaluation to help assess the costs and benefits of ITS. For the Showcase Program, this includes:

- ▶ 17 individual project evaluation reports that each address:
 - ✓ System Performance
 - ✓ Costs
 - ✓ Institutional Impacts
 - ✓ Transportation and Traveler Information Management
 - ✓ Transportation System Impacts

- ▶ 5 cross-cutting evaluation reports that aggregate data and lessons learned from across the individual projects for each of the five topic areas listed above.

- ▶ 1 Summary Evaluation Report to summarize the cumulative knowledge and lessons learned from the Showcase Program.

The complete collection of reports produced by the Showcase Evaluation is listed below.

Document Type/Title	Date	Document Number
17 Individual Project Evaluation Reports		
Corridor-wide ATIS Project Report	7/16/2003	65A0030/0033
Corridor-wide ATMS Project Report	10/28/2004	65A0030/0049
Corridor-wide CVO Project Report	10/29/2004	65A0030/0051
Corridor-wide Rideshare Project Report	11/1/2004	65A0030/0048
Corridor-wide Strategic Planning Project Report	10/29/2002	65A0030/0028
Fontana-Ontario ATMIS Project Report	11/30/2004	65A0030/0047
IMAJINE Project Report	3/17/2003	65A0030/0029
IMTMC Project Report	11/24/2004	65A0030/0054
InterCAD Project Report	4/2/2003	65A0030/0030
Kernel Project Report	5/30/2003	65A0030/0031
LA ATIS Project Report	3/15/2004	65A0030/0038
Mission Valley ATMIS Project Report	11/12/2004	65A0030/0050
Mode Shift Project Report	10/28/2004	65A0030/0052
OCMDI Project Report	2/20/2004	65A0030/0040
Traffic Signal Integration (RAMS) Project Report	11/23/2004	65A0030/0055
Transit Mgt System (RAVL) Project Report	11/30/2004	65A0030/0053
TravelTIP Project Report	2/16/2004	65A0030/0036
5 Cross-Cutting Evaluation Reports		
System Performance Cross-Cutting Report	11/30/2004	65A0030/0056
Costs Cross-Cutting Report	11/30/2004	65A0030/0057
Institutional Impacts Cross-Cutting Report	11/30/2004	65A0030/0058
Information Management Cross-Cutting Report	11/30/2004	65A0030/0059
Transportation System Impacts Cross-Cutting Report	11/30/2004	65A0030/0060
Final Summary Evaluation Report		
Showcase Program Evaluation Summary Report	11/30/2004	65A0030/0061

The Costs evaluations of the individual Showcase projects are based on the costs associated in developing, installing, operating and maintaining the system. The evaluations were based on quantitative and qualitative data gathered from interviews and project documentation, depending on the particular objective and measure being evaluated.

The Costs Cross-cutting Evaluation aggregates and summarizes information from the individual Showcase projects that have been completed to-date. More specifically, this evaluation aggregates and summarizes information from across the individual Showcase projects with specific regards to Evaluation Goal 2, which includes the following supporting evaluation objectives:

Objective 2.1 – Estimate the costs associated with the showcase Programs’ “Design Once, Deploy Many Times” philosophy.

Objective 2.2 – Estimate Showcase Programs’ Operations and Maintenance (O&M) costs.

These objectives have been refined to the set of evaluation measures and data elements found in Exhibit 4.

Exhibit 1 – Basis of the Costs Evaluation

Objective 2.1 Estimate the costs associated with the Showcase Programs’ “Design Once, Deploy Many Times” philosophy

Measures	Supporting Data
2.1.1 Estimated cost savings from software reuse and “economy of scale.”	<ul style="list-style-type: none"> • Unit costs for “seeds,” kiosks, etc. • Proportionate cost of system planning & design versus implementation

Objective 2.2 Estimate Showcase Programs’ operations and maintenance (O&M) costs

Measures	Supporting Data
2.2.1 O&M costs annually, based on actual costs six months after system operation start-up	<ul style="list-style-type: none"> • Labor hours for Operations staff • Labor hours for maintenance staff • Training costs • Config. Mgt. costs • Utility cost • Office space cost • Hardware/software replacement cost

Objective 2.1 documents each project’s costs including software, hardware/software installation and integration, operations and maintenance. The cost evaluation will resort to a higher-level view due to the unavailability of detailed labor and hardware cost information per task. This

cross-cutting evaluation will provide cost comparison and cost effectiveness of all the projects. Documenting cost of each of these categories is important for the following reasons:

- *System Design* – one of the credos of the Showcase Program is “design once, deploy many times.” This is an effort by the public sector to standardize system architectures and software applications in order to 1) achieve regional and statewide consistency, and 2) save money through system and/or software reuse. As the regions and districts of the State merge on a common architecture and standardized software applications, future design costs for upgrades and modifications should decrease. This evaluation will establish the baseline from which to monitor that decrease.
- *Software Development* – Another potential benefit of a common system architecture and standardized software applications is the reduction in complexity of future software developments. Progress towards common interfaces and protocols will reduce the need for certain types of software such as customized “bridges” that translate data between otherwise incompatible systems.
- *Hardware and Software Installation* – This cost element is not expected to be impacted by “design once, deploy many times” as much as the former two. Although there may be a time savings experienced as an installation becomes more routine, the savings probably will not be as significant as that experienced by the reduction in development time.

Objective 2.2 documents all costs in terms of either labor hours or U.S. Dollars, as appropriate – associated with operating and maintaining the system. The cost data is derived from each agency’s payment records. The costs include labor, utilities, office leases, replacement parts, etc. Each item is described in greater detail below.

- *Labor* – both operations and maintenance. Operations Labor includes the total hours spent by agency staff using or overseeing the system. This involves system operators/system administrator/supervisors for these staffs. Maintenance Labor includes the total hours spent troubleshooting and repairing system failures.
- *Training* – the cost for ongoing, periodic training of new or reassigned personnel. This cost includes time and materials, and will be estimated based on projections obtained during interviews with agency supervisors/managers.
- *Configuration Management* – the cost associated with software version control and maintaining backups of software applications, databases and documentation.
- *Utilities* – the cost for electricity, leased phone or telecommunications services, etc. This cost is estimated based on a proportion of the larger utility bill.
- *Office Space* – the cost for the physical space occupied by equipment or staff. This cost is estimated as a proportion of the total lease or mortgage payment based on the square footage occupied by system components.

- *Replacement Parts* – the cost for replacement hardware or software in the event of necessary preventative maintenance or an unexpected failure. This does not include the cost for voluntary hardware or software upgrades.

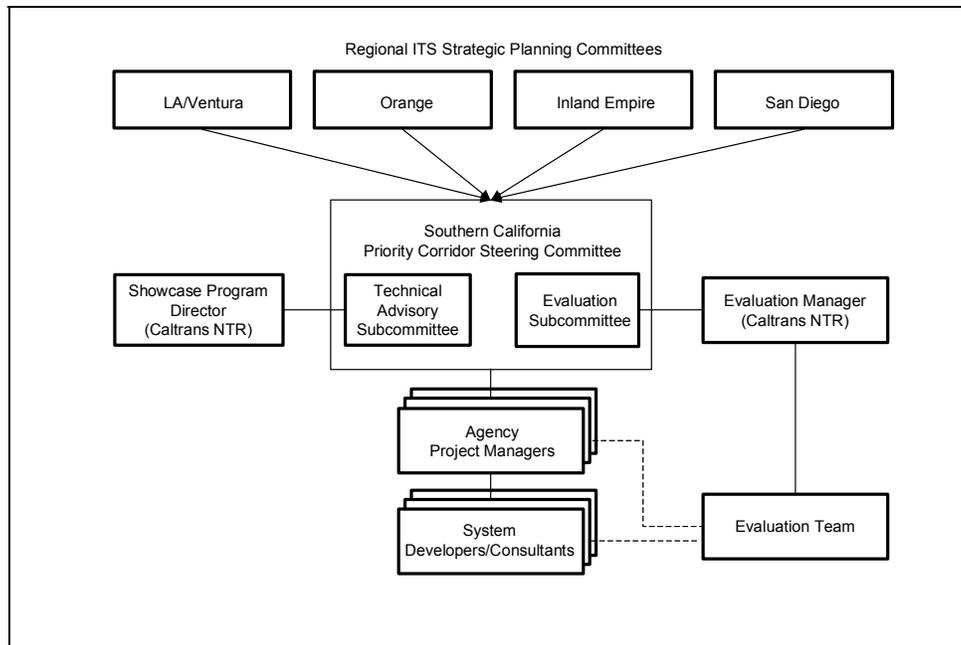
1.2 Evaluation Design and Approach

The Showcase Program’s Evaluation Design is based on a set of evaluation Goals and supporting Objectives and Measures that were developed by the Evaluation Team in partnership with federal, state and local stakeholders (shown in Exhibit 2), and documented in the “Showcase Program Evaluation Approach” in 1998. Each individual Showcase project is evaluated based on an applicable subset of these goals, objectives, and measures in order to help ensure that summary evaluation results can be aggregated from across the multiple Showcase project evaluations. The Showcase Program’s five evaluation Goals include:

- ▶ Evaluate System Performance
- ▶ Evaluate Costs
- ▶ Evaluate Institutional Issues and Impact
- ▶ Evaluate the Use and Management of Transportation/Traveler Information (i.e., Evaluate User Acceptance)
- ▶ Evaluate Transportation System Impacts.

The evaluation is responsive to the needs and suggestions of the Priority Corridor Steering Committee and Evaluation Subcommittee. As shown in Exhibit 2, both groups are comprised of stakeholders from the federal, state, and local levels.

Exhibit 2 – Management Structure and Organization of the Showcase Program



The Steering Committee's member agencies reflect wide representation from the Southern California Priority Corridor in terms of federal and state highway agencies, public safety, cities and counties, transit, air quality and regional planning entities, including:

- ▶ California Highway Patrol (CHP)
- ▶ Caltrans, Division of Traffic Operations (headquarters)*
- ▶ Caltrans, District 7*
- ▶ Caltrans, District 8*
- ▶ Caltrans, District 11*
- ▶ Caltrans, District 12
- ▶ City of Irvine*
- ▶ City of Los Angeles Department of Transportation (LADOT)
- ▶ City of San Diego
- ▶ Federal Highway Administration (FHWA)*
- ▶ Federal Transit Administration (FTA)
- ▶ Los Angeles County Metropolitan Transportation Authority (MTA)
- ▶ Orange County Transportation Authority (OCTA)
- ▶ Riverside County Transportation Commission (RCTC)
- ▶ San Bernardino Association of Governments (SANBAG)
- ▶ San Diego Association of Governments (SANDAG)
- ▶ South Coast Air Quality Management District (SCAQMD)
- ▶ SCAG

* Indicates an Evaluation Subcommittee member

The Evaluation Subcommittee consists of Caltrans' Evaluation Contract Manager and representatives from FHWA, Caltrans headquarters, and each of the four regions of the Priority Corridor. The Evaluation Subcommittee reviews evaluation issues and products. All draft evaluation documents are submitted to the Evaluation Subcommittee for review and comment before being finalized.

1.3 Privacy Considerations

Some of the information acquired in the interview and discussion process could be considered sensitive and has been characterized in this report without attribution. The Evaluation Team has taken precautions to safeguard responses and maintain their confidentiality. Wherever possible, interview responses have been aggregated during analysis such that individual responses have become part of a larger aggregate response. The names of individuals and directly attributable quotes have not been used in this document unless the person has reviewed and expressly consented to its use.

1.4 Constraints & Assumptions

Not all of the Showcase Program projects have been completed. Those that have been completed, or are sufficiently close to completion, and have been included in this report include:

- ▶ CWATIS
- ▶ CWATMS
- ▶ CWCVO
- ▶ CW Rideshare
- ▶ CWSPP
- ▶ Fontana-Ontario ATMIS
- ▶ IMAJINE
- ▶ InterCAD
- ▶ Kernel
- ▶ LA/Ventura ATIS
- ▶ Mission Valley ATMIS
- ▶ Mode Shift
- ▶ OCMDI
- ▶ TravelTIP
- ▶

Those projects that were not used to prepare this report include:

- ▶ IMTMS/C
- ▶ RAMS
- ▶ RAVL

1.5 Background

1.5.1 The Southern California Priority Corridor

In 1993, the U.S. Department of Transportation designated Southern California as one of four Priority Corridors in which Intelligent Transportation Systems (ITS) could have particular benefit. The Southern California Priority Corridor, illustrated in Exhibit 3, is one of the most populated, traveled, and visited regions in the country. Roughly two-thirds of the state's population – about 20 million people – resides in or around the Southern California Priority Corridor. It suffers from extreme traffic congestion, limited room for expanding transportation facilities, and above-average air pollution levels.

The Southern California Priority Corridor consists of four distinct regions that correspond with the four Southern California Caltrans districts:

- ▶ Los Angeles/Ventura (Caltrans District 7)
- ▶ Orange County (Caltrans District 12)
- ▶ San Diego (Caltrans District 11)
- ▶ Inland Empire (Caltrans District 8)

Exhibit 3 – The Southern California Priority Corridor and Vicinity



Exhibit 4 – Population and Number of Registered Vehicles by County

County	Population ⁱ (as of 1/1/2003)	Registered Vehicles ^{ii*} (as of 12/31/2002)	Caltrans District
Los Angeles	10 million	6.7 million	7
Orange	3 million	2.2 million	12
San Diego	3 million	2.3 million	11
San Bernardino	1.8 million	1.3 million	8
Riverside	1.7 million	1.2 million	8
Ventura	0.8 million	0.7 million	7
Imperial	0.15 million	0.1 million	11
Total	20.5 million	14.5 million	

*Includes autos, trucks, and motorcycles. Trailers not included.

1.5.2 The Southern California Priority Corridor’s ITS Showcase Program

The ITS Showcase Program is one of several programs that have been implemented in Southern California’s Priority Corridor to help aid mobility and mitigate traffic congestion and its associated environmental impacts.

The Southern California ITS Showcase Program consists of 17 individual ITS projects that collectively form a corridor-wide intermodal transportation management and information network between Los Angeles, Orange County, San Diego, and the Inland Empire. Eleven of the projects are regional in nature, while the remaining six are corridor-wide in scope. The 17 Showcase projects are listed by region in Exhibit 5. Eight of the projects were fast-tracked and

designated "Early Start" projects because of their importance as base infrastructure and potential to act as role models for the rest of the Showcase Program.

Exhibit 5 – The 17 Showcase Projects and their Status as of October 2004

Project	RFP Issued	Contractor Selected	Contract Executed	Project Underway	Project Complete
Corridor-wide					
Scoping & High Level Design (Kernel)*	✓	✓	✓	✓	✓
Strategic Planning/Systems Integration	✓	✓	✓	✓	✓
CVO☞					
ATIS	✓	✓	✓	✓	✓
ATMS☞					
Rideshare	✓	✓	✓	✓	✓
Los Angeles Region					
IMAJINE*	✓	✓	✓	✓	✓
Mode Shift*	✓	✓	✓	✓	✓
LA ATIS	✓	✓	✓	✓	✓
Inland Empire Region					
Fontana-Ontario ATMIS	✓	✓	✓	✓	✓
Orange County Region					
TravelTIP*	✓	✓	✓	✓	✓
OCMDI	✓	✓	✓	✓	✓
San Diego Region					
InterCAD*	✓	✓	✓	✓	✓
Mission Valley ATMIS*	✓	✓	✓	✓	✓
IMTMS/C (ATMSi)*	✓	✓	✓	✓	
Traffic Signal Integration (RAMS)	✓	✓	✓	✓	
Transit Management System*	✓	✓	✓	✓	

* Indicates an "Early Start" project.

☞ CWCVO and CWATMS do not yet have approved workplans.

Exhibit 6 – Projects Contributing to Cross-Cutting Evaluation

ITS Project	Cross-Cutting Evaluation/Objectives																		
	System Performance			Cost		Institutional Impacts & Issues					Transportation & Traveler Info Mgt.			Transportation System Impacts					
	System Development Process	System Reliability	Showcase Program Integration	Estimate Costs Associated w/Program's Philosophy	Estimate O&M Costs	Impact on O&M Procedures & Policies	Impact on Staffing/Skill Levels and Training	Impacts of Emerging Standards	Participation by Private Sector in Mgmt of Trans and Traveler Info	Impact on Local Planning Process, Policy Dev. & Mainstreaming of ITS Projects	Utilization of Regional/Interregional Information Integration	Utilization of Regional/Interregional Information & Traveler Information	Extent of Traveler Information Disseminated and Used by Travelers	Mode Shift & Intermodal Impacts	Safety Related Impacts	Impact on Traffic Congestion	Environmental Impacts	Impact on Transit Operations	Impact on Commercial Vehicle Operations
1.1	1.2	1.3	2.1	2.2	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	5.6	
CWATIS				X															
CWATMS				X															
CWCVO				X															
CW Rideshare	X			X						X	X								
CWSPP				X		X			X										
Fontana-Ontario	X	X	X	X	X	X	X		X		X	X	X						
IMAJINE	X		X	X	X		X	X			X	X							
IMTMC				X							X	X							
InterCAD	X			X	X							X							
Kernel	X		X	X	X			X			X								
LA/Ventura ATIS	X			X	X			X			X		X						
Mission Valley ATMIS	X			X	X	X			X	X	X	X	X						
Mode Shift	X			X	X							X							
OCMDI	X	X		X	X				X	X		X							
RAMS				X															
RAVL				X															
TravelTIP	X		X	X	X	X	X	X			X	X	X	X	X			X	

2 Evaluation Findings

This chapter provides the Showcase Program's aggregated findings regarding program funding and costs broken out by evaluation objective.

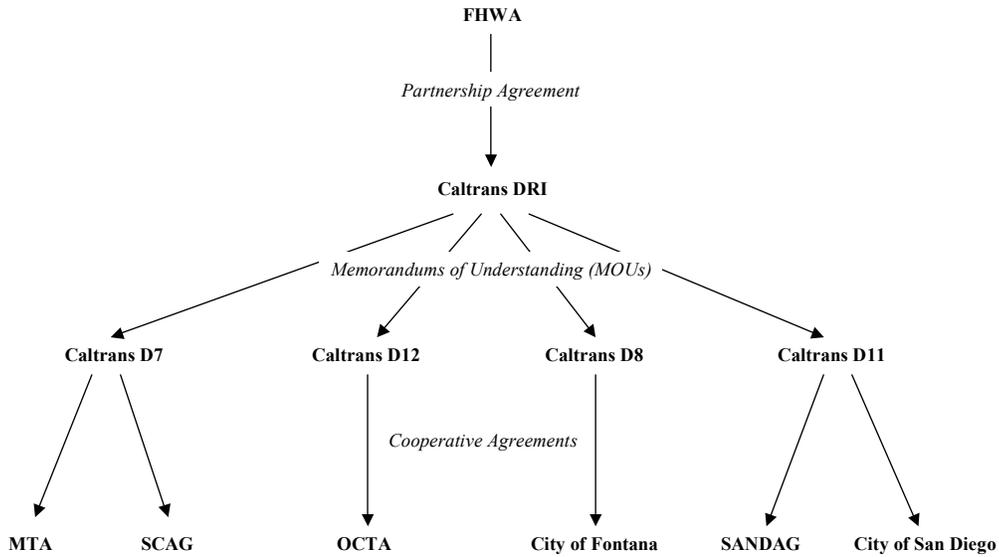
Background: Federal Funding

In March 1993, the U.S. Department of Transportation selected Southern California as one of four Priority Corridors in which Intelligent Transportation Systems (ITS) could have particular benefit. As a result, the Federal Highway Administration (FHWA) signed a Partnership Agreement in July 1994 with Caltrans' Division of New Technology & Research (currently the Division of Research & Innovation), and authorized a total of \$7.355 million in federal money over fiscal years 1993-1995ⁱⁱⁱ to fund several initial activities, including:

- ▶ Corridor-wide Plan
- ▶ Four regional Early Deployment Plans (Los Angeles/Ventura, Orange County, San Diego, and Inland Empire)
- ▶ Early Deployment Plan for the U.S.-Mexico Border
- ▶ Initiation of the Showcase Program through the Scoping & Design (Phase 1) project^{iv}

The federal funds were then matched with state dollars and passed along through a series of *intra*-agency and *inter*-agency agreements to the individual Caltrans districts and then to the local agencies that, in some cases, provided additional local matching funds. In most cases, the professional services of consultants were procured by the local agencies. The paths of various contracts and agreements are depicted in Exhibit 7 below.

Exhibit 7 – Paths of Agreements and Funding for Showcase Program Projects



Additional funds were provided by FHWA to the Priority Corridor through successive amendments to the initial Partnership Agreement with Caltrans’ Division of New Technology & Research (now DRI). These amendments are described in Exhibit 8:

Exhibit 8 – Listing of Amendments to the Priority Corridor Partnership Agreement

	Date	Value	Scope
Amendment 1	7/7/1995	\$3,428,000	Funding for TravelTIP, Phase 2
Amendment 2	9/1/1995	\$5,000,000	Funding for four San Diego “Early Start” projects, including: <ul style="list-style-type: none"> ▪ InterCAD, Phase 2 ▪ Transit Mgt System ▪ Mission Valley ATMIS ▪ IMTMS, Phase 1
Amendment 3	7/8/1996	\$7,850,000	Funding for: <ul style="list-style-type: none"> ▪ Scoping & Design, Phases 2 - 3 ▪ Mode Shift ▪ IMAJINE ▪ LA/Ventura ATIS (\$1.3M) ▪ Fontana-Ontario ATMIS (\$2.3M)

	Date	Value	Scope
Amendment 4	9/3/1997	\$8,560,000	Funding for: <ul style="list-style-type: none"> ▪ CWATMS (\$2.3M) ▪ CWATIS (\$0.5M) ▪ CWSIP (\$0.5M) ▪ CW Rideshare (\$0.1M) ▪ OCMDI (\$2.1M) ▪ San Diego Traffic Signal Integration (\$1.1M) ▪ CWCVO (\$0.6M) ▪ Evaluation (\$1.36M)
Amendment 5	6/4/1997	(\$112,000)	Deobligates \$112,000 for interim Evaluation
Amendment 6	11/17/1997	(\$130,974)	Deobligates \$130,974 for interim Evaluation
Amendment 7	6/13/1998	(\$130,000)	Deobligates \$130,000 for interim Evaluation

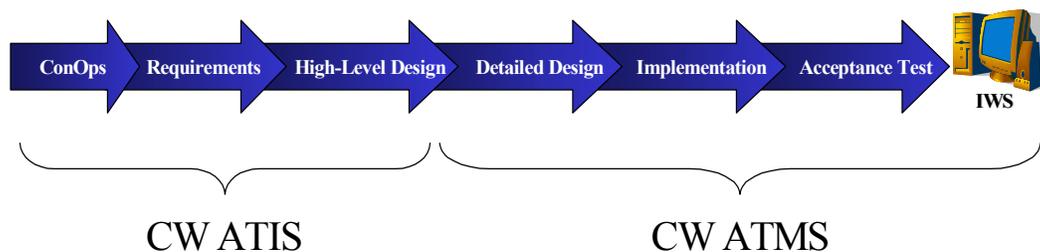
Based on the initial Partnership Agreement and subsequent amendments, the total federal funding for the Showcase Program was \$32,193,000. Of this amount, roughly \$28 million was made available for consultant contracts.

Objective 2.1 – Estimate the costs associated with the Showcase Program’s “Design Once, Deploy Many Times” philosophy.

“Design Once, Deploy Many Times” is the Priority Corridor’s credo for achieving cost efficiency through a modular system design, software re-use, and “economy of scale.” The Showcase Program had many successes towards achieving the “Design Once, Deploy Many Times” goal. Highlights include:

- ▶ IMAJINE’s design was based on Showcase’s high-level architecture and object-oriented software design developed under the Scoping & Design project. This architecture specifies the use of standard objects and interfaces to help ensure system-to-system interoperability. Some of the object definitions used by IMAJINE, particularly the Vehicle Detector Station (VDS) object, were developed under the TravelTIP project and ported to IMAJINE. Similarly, several object definitions developed under IMAJINE were utilized in the Los Angeles/Ventura ATIS project. These object definitions include the transit bus object, CCTV object, and CMS object.
- ▶ A unique aspect of the Mission Valley ATMIS project is its vital role in the development of the regional Integrated Workstation (IWS). This project was the first project in the San Diego area to deploy the workstations that are planned for use throughout the region as part of the regional network. This workstation, as designed in the Mission Valley ATMIS project, is currently being deployed in cities and agencies throughout the region to support additional traffic management activities such as shared traffic signal information and control. The cooperative design of the workstation and the operation of regional field devices were due largely to continuous coordinated planning at inter-agency meetings, and the development of the Event Traffic Management Operating Procedures.
- ▶ Showcase’s CWATIS project may have saved the Showcase Program over \$1 million by catching and eliminating a redundant development effort. The CWATIS project had been rescoped to develop the Concept of Operations (ConOps), Requirements, and High-Level Design for an Integrated Workstation (IWS) that would consolidate many of the features of the various regional systems into a single workstation that could be distributed as the Corridor-wide standard. Whereas CWATIS would prepare the high-level design, the CWATMS project would refine the design and ultimately build the IWS. This planned sequencing of the CWATIS and CWATMS projects is depicted in Exhibit 9.

Exhibit 9 – Planned Sequencing of the CWATIS and CWATMS Projects



Through the CWATIS project, however, it was determined that San Diego’s IMTMC/S project was already developing a system (called ATMSi) that had most of the desired features of the planned IWS. This made further development of the CWATMS IWS unnecessary. By choosing to utilize ATMSi in place of the IWS, the Steering Committee was able to redirect the funds budgeted for CWATMS to other pressing needs within the Priority Corridor.

Perhaps the Showcase Program’s greatest accomplishment was the development of its system interface standards, which allow developers to use a “black box” approach to independently design and build interoperable systems. As long as the systems conform to the standard interfaces, they should be able to work together without having to reveal the details of their inner workings. This protects a contractor’s intellectual property rights while supporting ITS integration and the goal of “Design Once, Deploy Many Times.”

Project Capital Costs

The Southern California ITS Priority Corridor Showcase Program expended \$35,478,000 over a period of 6-9 years. Exhibit 11 shows the breakdown of funding by project, region, and total Program. If available, information was provided to show budget variations.

The majority of Showcase projects were awarded as fixed price contracts. As a result, the total funds expended to complete the projects remained within 0.02 percent of initial Program funding despite Showcase’s long duration. Some of the various cost-saving measures employed during the Showcase Program deployment include:

- ▶ When developing the Kernels and supporting network, SANDAG procured the hardware itself in order to save money on the Materials and Handling (M&H) fee often charged by contractors. The amount of this fee varies between contractors, but can be on the order of 10% of the hardware purchase price.
- ▶ Strategic use of non-government entities. The OCMDI project spent two years developing a server for \$1 million. During this time – and impatient with the OCMDI project’s progress – TANN developed, operated and upgraded its own

server (plus initiated its Marketing/Information Broker tasks) for a total of \$560,000.

- ▶ IMAJINE took a three-month hiatus to stop project spending until it could synchronize with the Scoping & Design project’s development of the Kernel.

However, not all projects were carried out to completion as envisioned when the Showcase Program was initiated. The following projects experienced deviations from their original concept:

- ▶ CWATMS - A total of \$2,875,000 in federal (\$2.3 million) and state (\$575K) funds were set aside for the CWATMS project. However, over time, portions of this money were diverted to other critical needs in the Priority Corridor (see Exhibit 10). As of today, all of the CWATMS funds have been redirected.

Exhibit 10 – How CWATMS Funds have been Used

Date	Item	Credit/(Debit)	Balance
9/1997	Initial allocation	\$2,875,000	\$2,875,000
1999	Divert funds to Scoping & Design Phase 3 project	(\$920K)	\$1,955,000
7/2000	Divert funds for TravelTIP migration to Kernel v1.0	(\$150K)	\$1,805,000
4/2001	Divert funds to pay for use of Caltrans WAN	(\$300K)	\$1,505,000
4/2001	Divert funds to pay for software warrantees	(\$62K)	\$1,443,000
4/2001	Divert funds for troubleshooting/contingency	(\$200K)	\$1,243,000
4/2003	Divert funds to SCAG for regional ITS architecture	(\$600K)	\$643,000
2004	Divert funds for XML interface study	(\$643K)	\$0

- ▶ Rideshare - After the completion of Stage I of the Rideshare project, the TranStar database was sold to The Partnership (TANN). Due to the absence of dedicated funding to support Rideshare, SANDAG decided not to continue its role as coordinator of transit data for the seven San Diego-area transit operators beyond the Stage I demonstration. No memorandum of understanding between SANDAG and The Partnership regarding the continuation of Corridor-wide Rideshare has been established.
- ▶ CWCVO – Although this project has not yet kicked off, the project funds still reside with SANDAG. The agency currently plans to use these funds for the CVO component of its upcoming 5-1-1 project.

Exhibit 11 – Accounting of Showcase Program Funds

Corridor-Wide Projects (6)						
Program	Funding Source			Total Funded Amount	Total Spend	Budget Variation
	FHWA	Caltrans	Local			
Scoping & Design (Showcase Kernel)	\$5,006,000	\$1,252,000	\$0	\$6,258,000***	\$6,258,000	\$0
CWSP	\$500,000	\$125,000	\$0	\$625,000	\$625,000	\$0
CWATIS	\$500,000	\$125,000	\$0	\$625,000	\$625,000	\$0
CWATMS	\$1,353,750	\$451,250	\$0	\$1,805,000	\$1,955,000	\$0
Rideshare	\$100,000	\$0	\$25,000	\$125,000	\$125,000	\$0
CWCVO	\$600,000	\$150,000	\$0	\$750,000	\$750,000	\$0
CW Totals	\$8,059,750	\$2,103,250	\$25,000	\$10,188,000	\$10,188,000	\$0
San Diego Regional Projects (5)						
Program	Funding Source			Total Funded Amount	Total Spend	Budget Variation
	FHWA	Caltrans	Local			
IMTMS/C	\$1,460,000	\$365,000	\$0	\$1,825,000	\$1,825,000	\$0
InterCAD	\$600,000	\$150,000	\$0	\$750,000	\$877,000*	\$127,000
Mission Valley ATMS	\$540,000	\$68,000	\$68,000	\$676,000	\$676,000	\$0
Transit Management System	\$2,400,000	\$300,000	\$300,000	\$3,000,000	\$3,000,000	\$0
Traffic Signal Integration (RAMS)	\$1,100,000	\$138,000	\$138,000	\$1,376,000	\$1,376,000	\$0
San Diego Totals	\$6,100,000	\$1,021,000	\$506,000	\$7,627,000	\$7,754,000	\$127,000
Los Angeles/Ventura Regional Projects (3)						
Program	Funding Source			Total Funded Amount	Total Spend	Budget Variation
	FHWA	Caltrans	Local			
IMAJINE	\$2,400,000	\$300,000	\$300,000	\$3,000,000	\$3,000,000	\$0
Integrated Mode Shift	\$1,056,000	\$264,000	\$0	\$1,320,000	\$1,320,000	\$0
LA/Ventura ATIS	\$1,300,000	\$163,000	\$163,000	\$1,626,000	\$1,626,000	\$0
LA/Ventura Totals	\$4,756,000	\$727,000	\$463,000	\$5,946,000	\$5,946,000	\$0
Orange County Regional Projects (2)						
Program	Funding Source			Total Funded Amount	Total Spend	Budget Variation
	FHWA	Caltrans	Local			
TravelTIP	\$3,428,000	\$508,000	\$429,000	\$4,515,500**	\$4,515,000	\$0
OCMDI	\$2,100,000	\$263,000	\$263,000	\$2,626,000	\$2,626,000	\$0
Orange County Totals	\$5,528,000	\$771,000	\$692,000	\$7,141,000	\$7,141,000	\$0
Inland Empire Regional Projects (1)						
Program	Funding Source			Total Funded Amount	Total Spend	Budget Variation
	FHWA	Caltrans	Local			
Fontana-Ontario ATMS	\$2,300,000	\$288,000	\$288,000	\$2,876,000	\$3,356,000	\$480,000
Cumulative Totals All Showcase Projects (17)						
Program	Funding Source			Total Funded Amount	Total Spend	Budget Variation
	FHWA	Caltrans	Local			
Project Totals	\$26,743,750	\$4,910,250	\$1,974,000	\$33,778,000	\$34,385,000	\$607,000
Program Evaluations	\$1,360,000	\$340,000	\$0	\$1,700,000	\$1,700,000	\$0
Program Total	\$28,103,750	\$5,250,250	\$1,974,000	\$35,478,000	\$36,085,000	\$607,000

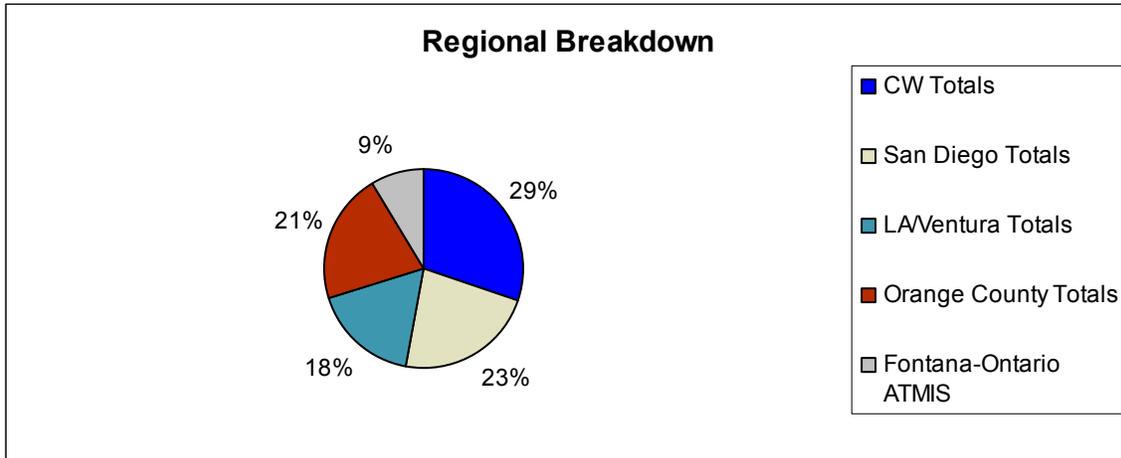
*Contractors indicated that actual funds expended totaled \$877K

**Includes \$150K transfer from CWATMS

***Includes \$920K transfer from CWATMS

As seen in Exhibit 12, Corridor-wide projects utilized 29% of available funds with the remaining 71% of funds expended within the individual Southern California regions.

Exhibit 12 – Regional Breakdown of Showcase Program Spending



Objective 2.2 – Estimate Showcase Program’s Operations and Maintenance (O&M) costs

The Evaluation segmented the Operations costs into three contributing components: labor, utility, and office space costs. Maintenance costs were further segmented into labor and hardware/software replacement costs. Operations costs and Maintenance costs are discussed separately in the following subsections.

Operations

Labor

The Evaluation segmented Operations costs into three contributing components: labor, utility, and office space costs.

In terms of Labor costs, the Showcase projects generally have not impacted the partner agencies. For those agencies that already had dedicated staff working in a TMC environment, the Showcase systems were provided as additional tools to help manage the local transportation network.

To aid in the adoption of the new technologies, most Showcase projects provided initial training and demonstrations to familiarize agency staff (operators and system maintainers) with their system’s full range of capabilities. Ongoing training for new operators will be provided on-the-job by the agencies themselves. However, by design, users with general computer skills can operate Showcase-developed workstations. The workstations have an intuitive Windows™-like user interface, which also reduces the need to hire more expensive labor.

Those agencies that were new to ITS or did not have dedicated staff already working in a TMC environment tended to be smaller agencies with limited O&M budgets. These agencies generally cannot afford to hire additional full-time staff and depend on either the systems being fully automated or receiving O&M subsidies from their larger regional partners. Several agencies have assigned the duty of posting traffic advisories to part-time student interns who are under the oversight of a full-time traffic engineer.

In the case of the new Fontana TMC, the City of Fontana reassigned an Assistant Traffic Engineer from conducting signal and traffic operations work in the field to performing similar duties from the TMC. He is in the TMC daily to monitor traffic conditions and check and post events to the ATMIS traveler information system.

The City of Fontana reports that the Fontana-Ontario ATMIS project has enabled it to save time and money because traffic signal adjustments are now made at the new TMC. Fontana has contracts with traffic signal maintenance companies to update timing plans and make other adjustments. Many tasks that used to require a call to one of these

consultants can now be done from the TMC. Although Fontana reports that it is paying about the same total cost for its signal maintenance consultant, the City is getting more for its money. The number of signals being maintained has increased from 83 to about 100 (and will rise to 120 by 2004/05), resulting in a near-term 17% reduction in cost per signal being maintained.

Overall, by having the TMC, and reducing the amount of fuel and time necessary to go into the field, the City of Fontana estimates a 20% cost savings over its previous configuration of centralized master controllers. Fontana further estimates that the savings are probably 50% over its older configuration, which had traffic signal field masters even more distributed throughout the city.

Utilities

Most of the utility costs of the Showcase systems were absorbed within the larger aggregate utility costs of the agencies; so specific accounting could rarely be achieved. As a result, the specific utility costs attributable to each Showcase system had to be estimated based on technical data (equipment specification sheets) and certain key assumptions, which include:

- ▶ The average electricity rate is \$0.16 per kW-hour (the actual rate varies seasonally)
- ▶ Servers operate 24 hours per day, 365 days per year
- ▶ PCs, workstations, and monitors operate 8 hours per day, 250 days per year (the other 115 days reflect weekends and holidays)

Estimated annual electricity costs for running typical hardware deployed by the Showcase projects are provided in Exhibit 13.

Exhibit 13 – Estimated Annual Electricity Cost for Selected Hardware

Hardware Item	Model	Power Draw	Power Cost	Est. Annual Cost
Application Server	HP K220	1250W	\$0.16/kW-hr	\$1752
Web Server	HP D230	350W	\$0.16/kW-hr	\$491
Operator Workstation	PC	250W	\$0.16/kW-hr	\$80
Operator Workstation	Sun Ultra 5	250W	\$0.16/kW-hr	\$80
Operator Workstation	Sun Ultra 10	250W	\$0.16/kW-hr	\$80
Typical 15" color monitor	various	110W	\$0.16/kW-hr	\$35
Typical 21" color monitor	various	135W	\$0.16/kW-hr	\$43

Telecommunications costs varied widely between projects depending on whether the service was leased from a private vendor or made available on agency-owned fiber. In those cases where the service had to be leased, telecommunications costs far outweighed other O&M cost contributors.

Consider the Los Angeles region’s IMAJINE project, which was completed in October 2001. To achieve the lowest possible telecommunications cost, IMAJINE chose to use separate services for its low-cost, low-bandwidth data needs and its high-cost, high-bandwidth video needs. These are broken out in the following exhibits.

Exhibit 14 – Monthly and Annual Telecommunications Costs (Data only)

Description	One-time Installation Fee	Ongoing Monthly Cost	Ongoing Annual Cost
Leased 56Kbps data connection from South Gate to Caltrans D7.	\$1260	\$149	\$1788
Leased 56Kbps data connection from MTA to Caltrans D7.	\$1260	\$100	\$1200
Leased 56Kbps data connection from ASI to Caltrans D7.	\$1260	\$100	\$1200
			\$4188

The monthly cost for the ISDN service at South Gate, MTA and ASI is based on actual number of hours of usage. For Exhibit 15, the estimated monthly cost for these agencies assumes a 22-working-day month with one hour of use per workday. Caltrans, however, pays a flat monthly rate that was previously negotiated by the State of California.

Exhibit 15 – Monthly and Annual Telecommunications Costs (Video only)

Description	One-time Installation Fee	Est. Ongoing Monthly Cost	Est. Ongoing Annual Cost
Leased 128Kbps ISDN video connection for South Gate.	\$220	\$61	\$732
Leased 128Kbps ISDN video connection for MTA.	\$220	\$61	\$732
Leased 128Kbps ISDN video connection for ASI.	\$220	\$61	\$732
4 Leased 128Kbps ISDN video connections for Caltrans D7.	\$880	\$116	\$1392
			\$3588

Exhibit 16 combines the estimated annual costs for data and video telecommunications to arrive at an estimated total annual telecommunications cost per IMAJINE partner agency and overall.

Exhibit 16 – Estimated Annual IMAJINE Telecommunications Costs per Agency

Description	Data Connection	Video Connection	Est. Ongoing Annual Cost
South Gate	\$1788	\$732	\$2520
MTA	\$1200	\$732	\$1932
ASI	\$1200	\$732	\$1932
Caltrans D7	\$0	\$1392	\$1392
			\$7776

Similarly, telecommunications costs make up the greatest portion of the monthly operating cost for Orange County’s TravelTIP system. Exhibit 16 breaks down TravelTIP’s telecommunications costs. However, unlike with IMAJINE, the project sponsor, OCTA, entirely subsidizes these costs for the project partners.

Exhibit 17 – Monthly and Annual Telecommunications Costs

Description	Monthly Unit Cost	Total Monthly Cost	Total Annual Cost
16 leased Frame Relay connections between the local agencies and the TravelTIP hub.	\$220-\$230 each	\$3520-\$3680	\$42,240-\$44,160
3 leased Frame Relay connections between kiosks and the TravelTIP hub.	\$220-\$230 each	\$660-\$690	\$7920-\$8280
LAN connection between hub and TravelTIP Server.	\$700-800	\$700-\$800	\$8400-\$9600
ISDN-PRI connection to handle incoming calls to HAT.	\$220-\$230	\$220-\$230	\$2640-\$2760
A single shared T1 connection to handle web traffic to/from the two web servers.	\$600	\$600	\$7200
		\$5700-\$6000	\$68,400-\$72,000

The Frame Relay service cost does not include a one-time \$900 set up fee. OCTA was able to negotiate a special monthly rate of \$600 (the usual monthly rate is \$2000) for the T1 line. However, the communications upgrade also required OCTA to upgrade one of its routers for \$4500.

Office Space

As with the utility costs, any costs associated with utilizing office space for Showcase-related systems were absorbed within the larger aggregate costs of the agencies. Agencies reported no additional costs for office space since the equipment tended to be installed in existing TMC facilities or available vacant spaces.

Maintenance

The evaluation attempted to segment Maintenance costs into labor and hardware/software replacement costs; however, several agencies have chosen to outsource the system maintenance using general support contracts.

In the case of TravelTIP, OCTA has budgeted \$40,000 per year for system support. This includes both labor and replacement hardware, but not software upgrades.

The City of Fontana has hired the ATMIS developer under contract to provide on-call maintenance at a cost of roughly \$10,000-15,000 per year.

All reported O&M costs from the Showcase Program are summarized in Exhibit 17 and broken out by project, region, and total Program in Exhibit 18. During these last three years of the Showcase Program, hardware and software upgrades costs were estimated to be the largest component, comprising 64% of total O&M costs. The hardware and software maintenance costs, however, were impacted by a vendor's new software version release that would have required an unanticipated \$1.8 million outlay to upgrade the four Kernel servers. This cost was not indicative of all hardware investments; however, it highlights a risk that would need to be managed in future projects.

The next largest O&M cost component was utilities, which represented 27% of total O&M costs. Within utilities, telecommunication charges far outweigh electricity costs as a cost driver.

Due to the suspension or non-completion of many of the Showcase projects, the O&M costs of the Showcase Program under-represent the true O&M costs that would be incurred if the original objectives of the Program were realized. In addition, if projects were considered ongoing, it is conceivable that Caltrans and other local agencies would factor in additional labor to maintain those efforts.

Exhibit 18 – Operations & Maintenance Cost Breakdown

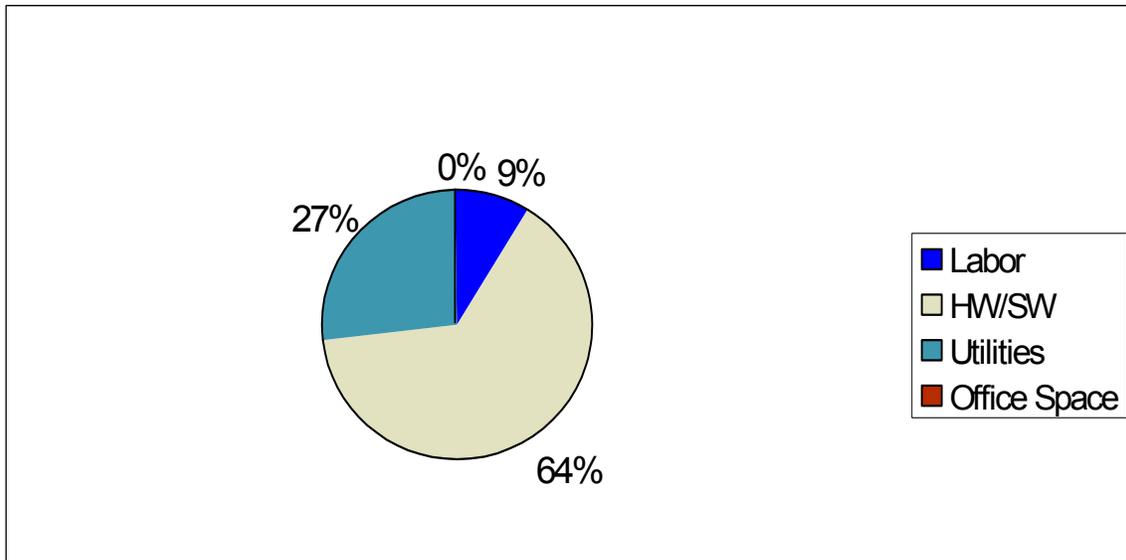


Exhibit 19 – Estimated Annual Operations & Maintenance Costs

Corridor-Wide Projects (6)						
Program	Operational Costs			Maintenance		Total Costs
	Labor	Utility	Office Space	Labor	HW/SW	
Scoping & Design (Showcase Kernel)	\$0	\$127,000	\$0	\$175,000**	\$1,800,000*	\$2,102,000
CWSPP	NA	NA	NA	NA	NA	NA
CWATIS	NA	NA	NA	NA	NA	NA
CWATMS	NA	NA	NA	NA	NA	NA
Interregional Rideshare Database	NA	NA	NA	NA	NA	NA
CWCVO	NA	NA	NA	NA	NA	NA
CW Totals	\$0	\$127,000	\$0	\$175,000	\$1,800,000	\$2,102,000
San Diego Regional Projects (5)						
Program	Operational Costs			Maintenance		Total Costs
	Labor	Utility	Office Space	Labor	HW/SW	
IMTMS/C	Inc	Inc	Inc	Inc	Inc	Inc
InterCAD	\$0	\$18,889***	\$0	\$0	\$0	\$18,889
Mission Valley ATMIS	\$0	\$477	\$0	Inc	Inc	\$477
Transit Management System	Inc	Inc	Inc	Inc	Inc	Inc
Traffic Signal Integration (RAMS)	Inc	Inc	Inc	Inc	Inc	Inc
San Diego Totals	\$0	\$19,366	\$0	\$0	\$0	\$19,366
Los Angeles/Ventura Regional Projects (3)						
Program	Operational Costs			Maintenance		Total Costs
	Labor	Utility	Office Space	Labor	HW/SW	
IMAJINE	\$0	\$8,169	\$0	NA	NA	\$8,169
Integrated Mode Shift	\$0	\$24,441	\$0	NA	NA	\$24,441
LA/Ventura ATIS	\$0	\$6,706	\$0	\$3,000	\$1,500	\$11,206
LA/Ventura Totals	\$0	\$39,316	\$0	\$3,000	\$1,500	\$43,816
Orange County Regional Projects (2)						
Program	Operational Costs			Maintenance		Total Costs
	Labor	Utility	Office Space	Labor	HW/SW	
TravelTIP	\$0	\$75,000	\$0	\$30,000	\$10,000	\$115,000
OCMDI	\$0	\$500,000	\$0	\$0	\$0	\$500,000
Orange County Totals	\$0	\$575,000	\$0	\$30,000	\$10,000	\$615,000
Inland Empire Regional Projects (1)						
Program	Operational Costs			Maintenance		Total Costs
	Labor	Utility	Office Space	Labor	HW/SW	
Fontana-Ontario ATMIS	\$45,000	\$12,000	\$0	\$10,000	\$3,000	\$70,000
Cumulative Totals All Showcase Projects (17)						
Program	Operational Costs			Maintenance		Total Costs
	Labor	Utility	Office Space	Labor	HW/SW	
Totals	\$45,000	\$772,682	\$0	\$218,000	\$1,814,500	\$2,850,182

Inc: Incomplete

NA: Not Applicable

*Unexpected vendor h/w upgrade required

**Includes Systems Administration Costs (Estimates from Caltrans Showcase Sustainability Whitepaper)

***Includes one time installation fee of \$10,768

Conclusions

One of the credos of the Showcase Program was “Design Once, Deploy Many Times,” which seeks system standardization, program efficiency and cost savings through software reuse. There are clear examples of software reuse within individual projects (such as TravelTIP) and between projects awarded to the same contractor. However, one of the Showcase Program’s greatest accomplishments was the development of its Corridor-wide system interface standards, which allow developers to use a “black box” approach to independently design and build interoperable systems. As long as the systems conform to the standard interfaces, they should be able to work together without having to reveal the details of their inner workings. This is an ideal solution that supports diverse innovative approaches while protecting a contractor’s intellectual property rights and supporting the Corridor-wide goal of “Design Once, Deploy Many Times.”

From a cost perspective, the Showcase Program carried out its objectives within the allotted budget. Actual funds expended to complete projects in excess of initial Program funding were less than 0.02 percent. For several projects that experienced time delays – such as Rideshare, IMAJINE, and LA/Ventura ATIS – budgets were not impacted due to the use of fixed price contracts. Two exceptions were InterCAD and Fontana-Ontario ATMIS project in which excess funds were utilized to complete or enhance the original project.

During the last three years of the Showcase Program, hardware and software upgrade costs were estimated to be the largest cost component, comprising 64% of total O&M costs. The hardware and software maintenance costs, however, were impacted by a vendor’s new software version release that would have required an unanticipated \$1.8 million outlay to upgrade the four Kernel servers. This cost was not indicative of all hardware investments; however, it highlights a risk that would need to be managed in future projects.

The next largest O&M cost component was utilities, which represented 27% of total O&M costs. Within utilities, telecommunication charges far outweigh electricity costs as a cost driver.

Due to the suspension or non-completion of many of the Showcase projects, the O&M costs of the Showcase Program under-represent the true O&M costs that would be incurred if the original objectives of the Program were realized. In addition, if projects were considered ongoing, it is conceivable that Caltrans and other local agencies would factor in additional labor to maintain those efforts.

References/Endnotes

ⁱ California Statistical Abstract, Table B-4. California Department of Finance, Sacramento, CA. December 2003.

ⁱⁱ California Statistical Abstract, Table J-4. California Department of Finance, Sacramento, CA. December 2003.

ⁱⁱⁱ “Implementation of the National Intelligent Transportation Systems Program – A Report to Congress 1994-1995”, Appendix VI.

^{iv} “Implementation of the National ITS Program – 1996 Report to Congress”, Appendix D, pp. 5-6.