Southern California Priority Corridor
Showcase Program Evaluation

Fontana-Ontario Advanced Traffic Management & Information System (ATMIS) Evaluation Report

FINAL

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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
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)
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

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. This report presents the experiences, costs, and lessons learned from Southern California's Fontana-Ontario ATMIS project.

In 1993, the U.S. Department of Transportation designated Southern California as one of four Priority Corridors in which 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 regional in nature, while the remaining six are corridor-wide. The Inland Empire's Fontana-Ontario Advanced Traffic Management & Information System (ATMIS) project is one of the eleven regional projects within the Southern California Priority Corridor ITS Showcase Program.

The Fontana-Ontario ATMIS provides state-of-the-art traffic management and traveler information for a portion of the Inland Empire Region. The project installs a new Traffic Management Center (TMC) in the City of Fontana, as well as additional cameras and changeable message signs (CMSs) in the Fontana and Ontario areas. Traveler information, including video images and incident advisories, is provided on a new website and the City of Fontana's existing community access cable television channel.

The unexpected obsolescence of an important third-party software component caused integration issues between the Showcase Kernels – the backbone of the corridor-wide network – and all of

the regional deployment projects, including the Fontana-Ontario ATMIS. As a result, and after careful consideration, the Fontana-Ontario ATMIS project partners chose to defer integration with the Showcase Network indefinitely.

Evaluation Findings, Conclusions, and Recommendations

One notable benefit of the project is the development of the Fontana TMC, which has reduced the labor cost on some of the City's traffic engineering consultant contracts. Fontana has contracts with traffic signal maintenance companies to update timing plans and make other adjustments. Many functions 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 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.

Traffic management is currently provided by the Fontana TMC Monday through Friday, 9am-5pm. Outside these hours, traffic management functions are handled remotely from the Fontana Police Dispatch Center by the Fontana Police Department. In an interview, the Fontana Police Dispatch Center indicated that it was still getting accustomed to the new system and experimenting with its usefulness. The ability to view incidents on CCTV in order to assess severity and respond appropriately seemed to be a key benefit.

The project also developed both a website and public access cable television program to provide traveler information to the public; however, it is not clear how much usage these services currently receive. The evaluation recommends that the City continue to promote and encourage the use of these services.

1 Introduction

1.1 Purpose and Scope of this Report

As required by federal law[1], all Intelligent Transportation System (ITS) projects that receive federal funding must undergo an evaluation to help assess the costs and benefits of ITS. The information provided in this report is intended to help planners and decision-makers at the federal, state and local levels make better-informed decisions regarding future ITS deployments based on the experiences of Southern California's Fontana-Ontario ATMIS project.

This document is one of 23 reports produced as part of the Southern California ITS Priority Corridor Showcase Program Evaluation, and covers only the events and findings resulting from the Fontana-Ontario ATMIS evaluation. The complete set of findings from the Showcase Program Evaluation are found in the following collection of documents:

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-Ventura 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 Issues 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

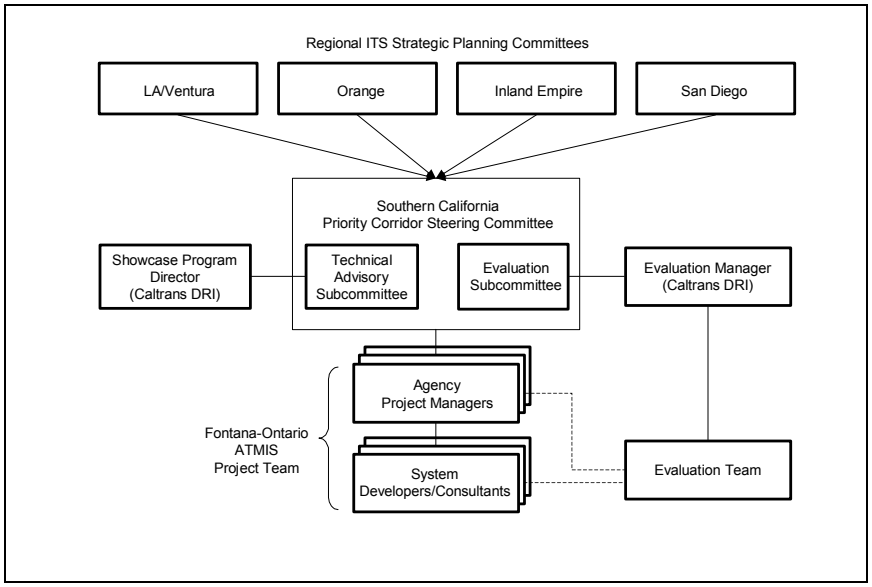
"TBD" indicates a future deliverable that is not yet available.

1.2 Evaluation Design and Approach

The findings outlined in this report are based on over four years of direct observations at project meetings, reviews of released project documents and agency memos, as well as formal and informal interviews and discussions with project partners.

The evaluation is responsive to the needs and suggestions of the Priority Corridor's Evaluation Subcommittee, which reports to the Priority Corridor's Steering Committee. As shown in Exhibit 1, both committees are comprised of stakeholders from the federal, state, and local levels.

Exhibit 1 – Management Structure and Organization of the Showcase Program



The Steering Committee's member agencies reflect wide representation from the region 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)
- Southern California Association of Governments (SCAG).

* Indicates an Evaluation Subcommittee member

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, 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 Impacts
- Evaluate the Use and Management of Transportation/Traveler Information
- Evaluate Transportation System Impacts.

As the Fontana-Ontario ATMIS evolved, project-specific refinements to the evaluation design were documented in a high-level Evaluation Plan (EP) and a detailed Evaluation Activity Plan (EAP). In general, the EP describes the project and/or system under evaluation, and lays the foundation for further evaluation activities by developing consensus among the Evaluation Subcommittee and project partners as to which of Showcase's evaluation Goals, Objectives, and Measures best apply to the project.

As the project matured, and after the EP had been approved, an EAP was developed to plan, schedule, and describe specific activities (e.g., interviews, surveys) and step-by-step procedures for conducting the evaluation. Data collection began after both plans had been reviewed and subsequently approved by the Evaluation Subcommittee and the project's partners.

1.3 Organization of this Report

The Fontana-Ontario ATMIS Evaluation Report provides a background description of the Southern California Priority Corridor and the transportation challenges facing the Inland Empire region. This is followed by descriptions of the Showcase Program and the Fontana-Ontario ATMIS project, including a detailed technical description. In general, each Showcase evaluation report is subdivided and ordered into the five topic areas described below:

System Performance — where appropriate, provides important benchmark information regarding system availability, reliability, scalability and compatibility. The evaluation discusses those items in order to help identify any needed improvements or help develop specifications for future systems.

Cost — provides important benchmark information regarding project budget, funding sources, software licensing, development costs, costs to re-deploy elsewhere or expand the system, and operations and maintenance (O&M) costs. This section includes an estimate of how much it might cost to re-deploy the system "from scratch" elsewhere, and also looks at the incremental costs for integrating additional partners and/or peripherals into the existing system.

Institutional Impacts — provides important information regarding the administrative, procedural and legal impacts resulting from the project. Such impacts include changes in operator workloads, responsibilities and job turnover rates, as well as changes and limitations of agency-wide policies, procedures and guidelines.

Transportation & Traveler Information Management — provides important benchmark information on system usage and user acceptance (by both agency operators and the general public). This report provides both quantitative and qualitative findings on those items and can be used to identify user demand, needed improvements and potential areas of future growth.

Transportation System Impacts — where appropriate, provides important information regarding the project's impacts on transit usage, traffic congestion, air quality, and traffic safety.

The report concludes with a summary, final remarks and recommendations for next steps. Several appendices contain supporting documentation such as technical designs and copies of evaluation data collection instruments (blank questionnaires and survey).

1.4 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.

1.5 Constraints & Assumptions

The Fontana-Ontario ATMIS evaluation is subject to the following constraints and assumptions:

- The project's consultant was not required to disclose actual project expenses, so the project's cost is based on the fixed-price budget stipulated in the Fontana-Ontario ATMIS contract and its amendments. The budget reflects the expenses and costs for services paid by the client agency, but not necessarily the actual detailed costs for goods and services comprising the project.

1.6 Project Background

1.6.1 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 2, 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 2 – The Southern California Priority Corridor and Vicinity

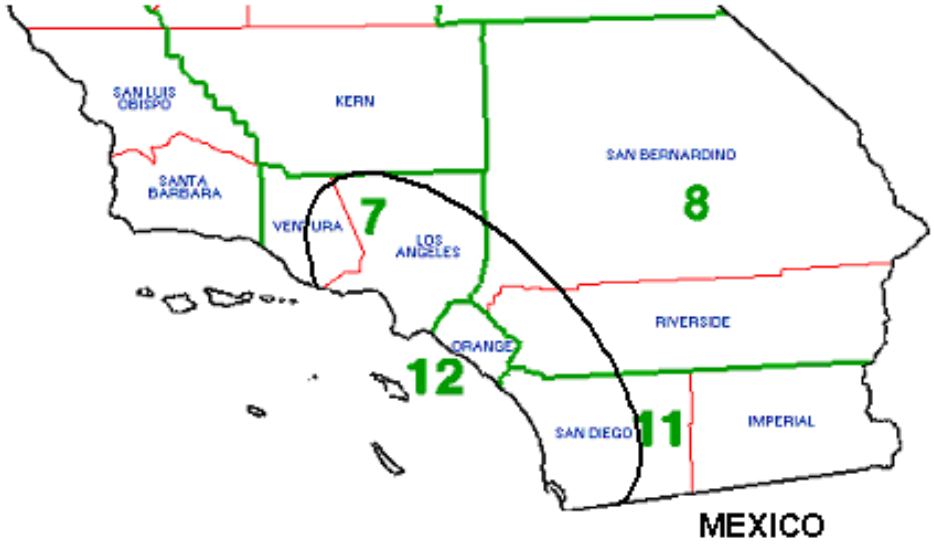


Exhibit 3 – Population and Number of Registered Vehicles by County

County	Population[2] (as of 1/1/2003)	Registered Vehicles[3]* (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.

1.6.2 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 Fontana-Ontario ATMIS project is one of the eleven regional projects.

The 17 Showcase projects are listed by region in Exhibit 4. 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 4 – The 17 Showcase Projects and their Status as of September 2004

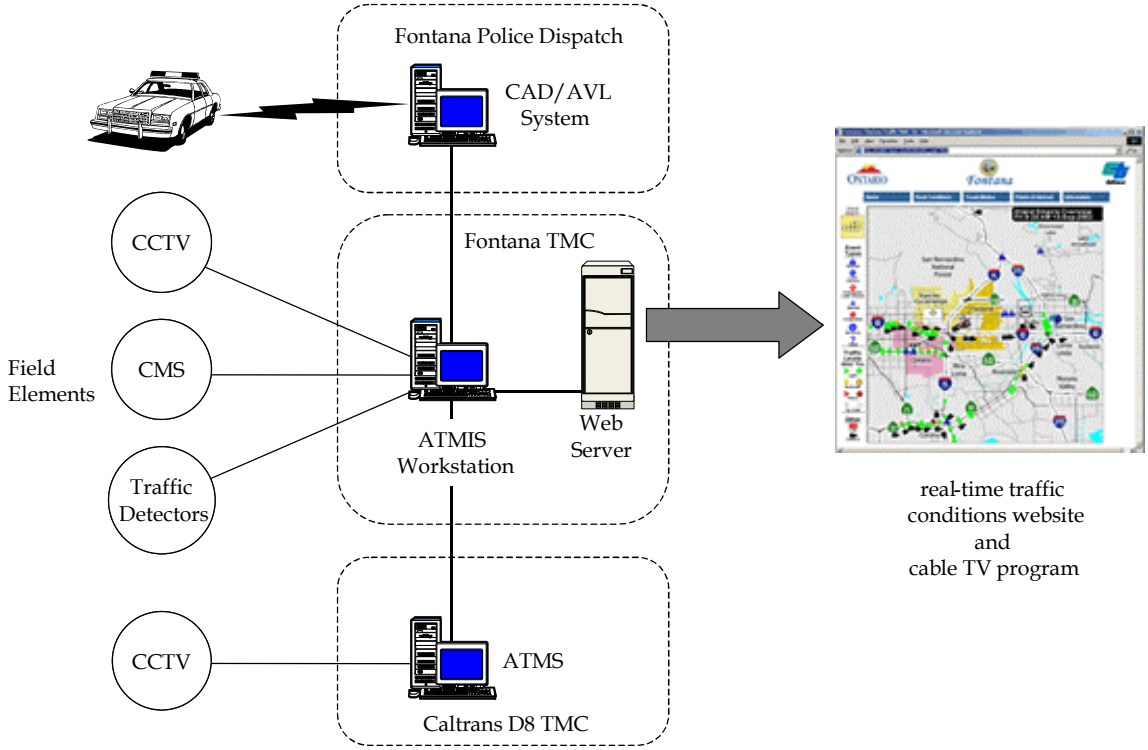
Project	RFP Issued	Contractor Selected	Contract Executed	Project Underway	Project Complete
Corridor-wide					
Scoping & High Level Design (Kernel)*	✓	✓	✓	✓	✓
Strategic Planning/Systems Integration	✓	✓	✓	✓	✓
CVO🗎					
ATIS	✓	✓	✓	✓	✓
ATMS🗎					
Rideshare	✓	✓	✓	✓	✓
Los Angeles Region					
IMAJINE*	✓	✓	✓	✓	✓
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.

2 Project/System Technical Description

The Fontana-Ontario ATMIS is the Inland Empire's first arterial traffic management project. The project installs a new Traffic Management Center (TMC) in the City of Fontana, as well as additional cameras and changeable message signs (CMSs) in the Fontana and Ontario area. The system connects the Fontana Police Dispatch Center to the Fontana TMC in order to share incident alerts and CCTV video images. The system also enables the Fontana TMC and Caltrans District 8 TMC to share each other's CCTV video feeds, but not device control. Real-time traveler information, including video images and incident advisories, is provided on a new website and the City of Fontana's existing community access cable television channel.

Exhibit 5 – High Level Fontana-Ontario ATMIS System Description



3 System Performance Evaluation

3.1 The Project/System Development Process and Timeline

The Fontana-Ontario ATMIS project followed an iterative systems development process and was completed in a little over four years.

Federal funding for the Fontana-Ontario ATMIS project was provided to Caltrans in July 1996 as part of Amendment 3 to the Showcase Program's Federal Partnership Agreement. The Fontana-Ontario ATMIS RFP was issued 16 July 1997 and Iteris (formerly Odetics ITS) was selected and approved by Council action on 7 October 1997 – specifically to begin the Project Work Plan. The contract between the City of Fontana and Iteris was signed on 24 November 1997.

According to the original November 1997 contract between Fontana and Iteris, the project would consist of six phases:

- Phase 1A – Prepare federal workplan
- Phase 1B – Develop Conceptual Design, including Needs Assessment and Requirements
- Phase 2A – Prepare High-Level Design
- Phase 2B – Prepare Detailed Design
- Phase 3A – Implement and Integrate
- Phase 3B – Conduct Acceptance Testing

The project workplan was completed 27 February 1998, but delays in executing a Memorandum of Understanding (MOU) between the City of Fontana and Caltrans pushed back the kickoff of Phase 1B to 13 May 1999.

The contract was modified (prior to the Phase 1B kickoff) on 11 April 2000 with Amendment 1, resulting in the following new work breakdown:

- Phase 1A – Prepare federal workplan
- Phase 1B – Develop Conceptual Design, including Needs Assessment/Inventory, Requirements, and High-Level Design
- Phase 2 – Prepare Detailed Design
- Phase 3 – Implement and Integrate
- Phase 4 – Provide Training, Support, and O&M

Drafts of the Phase 1B deliverables were completed by Iteris by August 1999 and reviewed and revised by the project team throughout the fall. Iteris presented these Phase 1B results on 21 December 1999 to the Fontana City Council, which ultimately approved them and authorized the necessary local funding to continue to Phase 2. However, Memorandums of Understanding (MOUs) or Letters of Commitment (LOC) from the project partners were required before Caltrans could release the federal and state shares of the funding. As part of the effort to obtain the MOUs/LOC, the City's project manager called for the development of a Concept of

Operations (ConOps) document to help build consensus among all of the partners regarding what the system would do and how it would be used.

In February 2000, due to a shortage of staff with ITS experience, the City of Fontana hired the consulting firm, Kimley-Horn, to provide additional Project Management support on behalf of the City of Fontana.

The project's management team spent much of 2000 reaching out to major activity centers in the region, including the Ontario airport, Ontario Mills mall, Ontario Convention Center, and California Speedway, to advertise the project and solicit their participation. By the end of August 2000, Iteris had also prepared the draft LOC and a revised Needs Assessment document and was awaiting approvals.

An Advisory Committee workshop involving the project partners and representatives from the region's major activity centers was held in September 2000 to present and reach consensus on the draft ConOps. Once consensus was reached, the draft MOU/LOC and Needs Assessment were again revised.

Iteris replaced its Project Manager in late (October-December) 2000. When work resumed after the holidays in January 2001, the project declared the ConOps and Needs Assessment/Inventory documents final.

During early 2001, the project focused on the completion of the Requirements and high-level design in order to complete Phase 1B and move to Phase 2. The revised draft User Requirements document was distributed on 28 February 2001, and finalized by 20 March 2001. The final draft of the System Requirements document was distributed for review on 30 March 2001, and comments were discussed at the 30 April 2001 project meeting.

By 18 June 2001, the User Requirements, System Requirements, and Conceptual Design had been completed, and work on the Detailed Design was underway.

In Summer 2001, the project adopted an "Incremental Build" approach under which the originally planned Phase 2 and Phase 3 would be replaced by a new Phase I (30% design), Phase II (updated design), and Phase III (final design and integrated system).

In September 2001, the Incremental Build strategy was modified as follows:
Phase I – Implement Local Traffic Control (LTC)/TMC
Phase II – Implement LTC/Traveler Information Center (TIC)
Phase III – Implement LTC, TIC, Regional Traffic Control (RTC), and Kernel Services
Phase IV – LTC, TIC, RTC, Distributed Kernel Services & Acceptance Testing

At the 27 November 2001 meeting, a Phase V was added to implement the Ontario TIC functions. Renovation of the city's engineering building to accommodate the new TMC began in late 2001 and was completed by January 2002.

In January 2002, Caltrans informed the project that Iona, the supplier of key CORBA software used throughout the Showcase architecture, would stop supporting its Orbix 3.x product by summer 2002. As a result, some projects in the Priority Corridor had decided to switch to the newer Orbix 2000, which would require a major modification of the Kernels and impact all Showcase integration efforts.

Installation of equipment into the Fontana TMC was completed in April 2002, along with ATMIS software Build 1. Build 2 was already underway. Builds 3 and 4 were intended to integrate the ATMIS with the Showcase Network, but the Orbix 2000 issue prompted the project to research other integration options such as using XML.

By July 2002, it was becoming less likely that the project would attempt to integrate to the Showcase Network, and by November 2002, the decision was final. Instead, the project submitted a proposal to FHWA to use the funds set aside for software Builds 3 and 4 to instead document the Inland Empire's regional ITS architecture. The proposal was accepted in January 2003.

The Fontana TMC was fully completed and operational by February 2003, along with the traffic conditions website. The pubic access cable TV program was operational, but not yet on air pending review and approval by the Fontana City Council. The program was subsequently presented and approved at the city council's May 2003 meeting and went on air in June 2003.

The project concluded with the completion of the Inland Empire's regional ITS architecture document in July 2003.

The list below summarizes the Fontana-Ontario ATMIS project's progression:

- July 1996 – Caltrans receives federal funding authorization for Fontana-Ontario ATMIS
- July 1997 – Fontana-Ontario ATMIS RFP issued
- November 1997 – Contract signed between Fontana and Iteris (formerly Odetics ITS)
- February 1998 – Project's federal workplan completed
- December 1999 – Fontana-Iteris contract modified
- May 1999 – Phase 1B kicks off
- August 1999 – Drafts of Phase 1B deliverables completed
- December 1999 – Fontana City Council approves Phase 1B deliverables and authorizes local Phase 2 funding. Phase 2 delayed by federal requirement to obtain Letters of Commitment (LOC)/Memoranda of Understanding (MOUs) from project partners.
- January 2000 – The project's steering committee renames itself the Project Development Team (PDT). The Fontana Project Manager calls for the development of a ConOps as part of the LOCs/MOUs to help build consensus among the project participants.
- February 2000 – Fontana hires Kimley-Horn to provide project management support
- August 2000 – Draft LOC/MOU prepared
- September 2000 – Contracted modified to include Phase IC at the request of Caltrans.
- December 2000 – final Concept of Operations and Needs Assessment
- June 2001 – final User Requirements (version 5), System Requirements (version 3), and Conceptual Design (version 2). Phases 2 and 3 replaced with new Phases I-III.

- November 2001 – Start of renovation of city engineering building to accommodate new TMC.
- January 2002 – Building renovation completed. Iona announces that it is discontinuing Orbix 3.x, which significantly impacts Showcase's integration efforts.
- April 2002 – Installation of equipment into Fontana TMC complete. ATMIS software Build 1 complete. Software Build 2 underway.
- November 2002 – Due to the Orbix 2000 issue, the project decides not to integrate to the Showcase Network. Remaining funds will be spent documenting the Inland Empire's regional ITS architecture and additional software builds agreed to with the project team.
- February 2003 – Implementation completed. Fontana TMC and real-time traffic conditions website are complete and operational. Cable TV program is operational, but not yet on air pending review and approval by Fontana City Council.
- May 2003 – Fontana City Council reviews and approves real-time traffic conditions cable TV program. Iteris completes all additional functionality Builds.
- June 2003 – Real-time traffic conditions cable TV program goes on air. Iteris completes Inland Empire ITS Architecture.

3.2 System Reliability, Availability, Compatibility, and Scalability

3.2.1 System Reliability and Availability

There has been no evidence of any system failures.

One of the interesting design features of the Fontana TMC is that it utilizes Windows©-based workstations. Until recently, it has been traditional for similar projects to rely on UNIX-based workstations because of their relatively superior reliability over older versions of Windows©. However, gradual improvements in the Windows© operating system has made the reliability of PC workstations comparable to that of their UNIX counterparts.

In roughly one year of operation, there have been only two situations that have caused at least a partial failure of the TMC. Both cases were caused by computer viruses. In the first case, an employee accidentally brought in an infected disk. In the second case, the City server was infected and a computer "worm" made its way through the network to the TMC. Virus protection software has since been installed.

3.2.2 Compatibility

There are no indications of any system incompatibilities.

Compatibility is the ability of two or more systems or components to perform their required functions while sharing the same hardware or software environment. After repeated interviews with project staff from the City of Fontana, there have not been any reported system failures or

anomalies that would indicate an incompatibility with the existing software/hardware environment.

3.2.3 Scalability

In terms of software, the system is limited only by the hardware involved. The database is robust enough to grow any of the City's (or Caltrans) projected growth and additional field elements. Maps on the website and operator workstations include not only Fontana, but also the entire Inland Empire. The addition of new neighboring cities requires the simple addition of devices to the database/map (obviously with communications in place). All of these functions require no software modifications – just addition of devices through the Device Management GUI.

In terms of the hardware and software interactions, the Server Architecture is distributed across multiple servers. Software processes may reside in any of the servers, allowing them to be relocated and/or expanded as the system grows with the City.

3.3 Impact of Showcase Integration on Project Deployment and System Performance

The Fontana-Ontario ATMIS is one of 17 projects that make up the Showcase Program and Network. As such, many interdependencies developed between the projects as plans were made for eventual regional and corridor-wide integration. This section describes how these interdependencies may have impacted the Fontana-Ontario ATMIS and other Showcase projects.

3.3.1 Impact of the Fontana-Ontario ATMIS on other Showcase Projects

The Fontana-Ontario ATMIS project is the only Showcase Program project in the Inland Empire.

The Fontana-Ontario ATMIS project is the only Showcase project in the Inland Empire region. Although it advances ITS in that region, the project was not able to integrate with the Showcase Network, and, therefore, has had little or no impact on Showcase projects in other regions of the Priority Corridor.

3.3.2 Impact of other Showcase Projects on Fontana-Ontario ATMIS

The unexpected obsolescence of Iona's Orbix 3.x CORBA Orb caused integration issues with the Showcase Kernel that rippled out to all of the regional deployment projects, including the Fontana-Ontario ATMIS.

The Showcase Architecture is based on object-oriented software design and the use of CORBA for sharing data and calling procedures remotely. All of the systems developed under the Showcase Program, including the Kernels and the regional systems, use third-party COTS

software from Iona to implement their CORBA services. In late 2001, Iona announced its plans to discontinue its Orbix 3.x products and release a new version called Orbix 2000. Unfortunately, Orbix 2000 would not be backwards-compatible with its Orbix 3.x predecessors.

Several of the regional projects that were still in design or very early into implementation chose to utilize Orbix 2000; however, the Kernels and several other more mature systems were already too far into development and, therefore, committed to Orbix 3.x. Due to the incompatibility between Orbix 2000 and Orbix 3.x, the newer systems based on Orbix 2000 would not be able to integrate to the Orbix3.x-based Kernels. This threatened the Showcase Program's goal to develop a corridor-wide, inter-regional transportation management and information network.

The Priority Corridor Steering Committee began researching options to upgrade the Kernels and the other Orbix 3.x-based systems. With the future of the Kernels unclear, the Fontana-Ontario ATMIS project partners chose to defer integration with the Showcase Network indefinitely.

4 Cost Evaluation

The cost evaluation draws information from documented costs and personal interviews. Budget information was taken directly from the project's contract and amendments, while operations and maintenance costs were obtained from discussions with agency personnel. Informal interviews were conducted to verify information and fill in any "holes" that were discovered during analysis.

4.1 Constraints & Assumptions

There are two primary considerations for the Cost Evaluation:

- Since Fontana-Ontario ATMIS was funded through a firm fixed price contract, the project's budget information reflects the expenses and costs for services paid by the client agency, but not necessarily the actual costs for the goods and services borne by the contractor to complete the project.
- Operations and maintenance (O&M) costs have been estimated based on available information and certain assumptions indicated later in this section.

4.2 Project Budget & Estimated Development Costs

This section addresses the project's contracted tasks and budget, as well as its role in supporting the Showcase Program's "design once, deploy many times" philosophy.

4.2.1 Project Budget

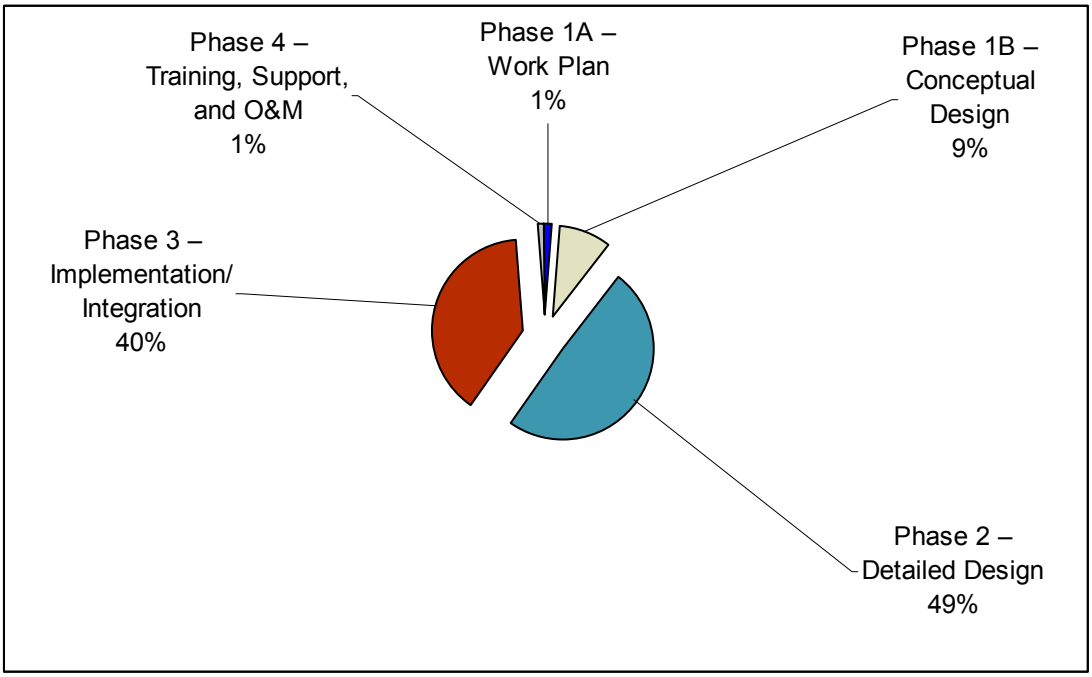
The Fontana-Ontario ATMIS project cost $2,568,000 but the total cost to arrive at the completed system was $3,356,000.

A total of $2,568,000 in federal, state and local funds were made available through the City of Fontana for the Fontana-Ontario ATMIS project. The budget breakdown per task, as identified in the 1999 contract amendment is shown in Exhibit 6.

Exhibit 6 – Project Budget per Task[4]

Task	$	%
Phase 1A – Work Plan	38,050	1.5
Phase 1B – Conceptual Design		
Task 0 – Project Management	34,470	1.3
Task 1 – Needs Assessment/Inventory	22,610	0.9
Task 2 – Requirements	22,610	0.9
Task 3 – Conceptual Design	150,110	5.8
Phase 2 – Detailed Design		
Task 0 – Project Mgt/System Engineering/Test Procedures	113,369	4.4
Task 1 – Communications	100,000	3.9
Task 2 – Fontana Integrated Workstation	582,048	22.7
Task 3 – Traffic Mgt Center	61,950	2.4
Task 4 – Caltrans District 8 Interface	174,614	6.8
Task 5 – Ontario Traveler Information Center	227,969	8.9
Phase 3 – Implementation/Integration	1,015,200	39.5
Phase 4 – Training, Support, and O&M	25,000	1.0
TOTAL	**2,568,000**	**100**

Exhibit 7 – Distribution of Fontana-Ontario ATMIS Budget by Task



In addition, roughly another $788,000 was spent outside the contract on associated items such as:

- Project management,
- Support by Kimley-Horn,
- Relocation of office space and building remodeling to accommodate the new TMC, and
- Installation of wireless cameras.

The Fontana TMC utilizes PC workstations, as opposed to the more traditional UNIX-based workstations. At the time of purchase, PC workstations provided a substantial cost savings over comparable UNIX-based systems. However, with the economic downturn of the technology sector, the cost of UNIX systems has fallen considerably and is now in line with Windows™-based PCs. The cost of some of the ATMIS' major hardware items is listed in Exhibit 8 below. This is not an exhaustive list. The list includes servers and workstations, but does not include associated cabinetry, shelving, cabling, or network switching equipment.

Exhibit 8 – Fontana-Ontario ATMIS Major Hardware Items

Hardware Item	Model	Quantity	Unit Cost ❶	Total Cost
TMC workstations	Compaq DeskPro 3000 PC	2	$2051	$4102
TMC workstation monitors	22" color monitors	4	$1135	$4540
PD workstation w/monitor	Compaq Evo D510 PC	1	$2954	$2954
ATMIS Server	Compaq ProLiant DL360	1	$5460	$5460
Database Server	Compaq ProLiant DL380	1	$7691	$7691
Video Server	Compaq ProLiant DL360	1	$5460	$5460
NAS Server	Maxtor Maxattach 4100	1	$4275	$4275
TIC Server	Compaq ProLiant DL360	1	$5905	$5905
Web Server	Compaq ProLiant DL360	1	$5460	$5460
CATV Server	Compaq ProLiant DL360	1	$3888	$3888
Wall-mounted Displays	Panasonic 42" HDTV	2	$6760	$13,520

❶ Cost at time of purchase in 2001-2002.

A brief description of the function of each of these items follows:

There are two operator positions in the TMC. Each consists of a workstation with two 22" video monitors. There is also one ATMIS workstation position in the Fontana Police Department's (PD) dispatch area.

The ATMIS server is the primary server responsible for polling status and system detector data from the master intersection controllers.

The Database server's primary function, running MS SQL Server 2000, provides the underlying support for storage, access, and management of ATMIS data.

The Video server can network up to four analog video inputs. The purpose of this device within the Fontana TMC is to make live streaming video available over TCP/IP for remote workstations.

The Network Attached Storage (NAS) server is a new generation Maxtor Maxattach 4100; a proprietary device with no video or keyboard interfaces. It contains 160 GB capacity in RAID 5 configuration. Backups are made to the archive directory in the NAS from processes running on

the other servers. These backups are available for Fontana IS to copy over the network to tape via standard data backup procedures to be included in their disaster recovery tape rotation.

The TIC server is used to generate traffic maps for dissemination to the public. It communicates with the ATMIS and Database servers to collect the data that is used to populate the traffic maps. The TIC server populates its SQL Server 2000 database engine with data from the ATMIS and Database servers and uses this data to create appropriate icons on the traffic map. The server uses Arcview GIS 3.3 to generate the traffic maps. The completed maps are then transferred via FTP to the web server for traffic information dissemination to the public.

The Web server handles user requests for the traveler information web page. It also acts as a firewall to protect the system from hacking.

The CATV (community access television) server displays traffic maps and live video in a single screen format suitable to provide traffic information to the public. Caltrans video/images are retrieved directly from the Caltrans website, and traffic data is collected over the LAN from the Fontana Web server for display on the CATV screen.

4.2.2 Design Once, Deploy Many Times

The Fontana-Ontario ATMIS project supported the "design once, deploy many times" philosophy through the use of the Showcase Program's high-level Kernel-Seed architecture, object-oriented technology, and standardized objects and interfaces.

"Design Once, Deploy Many Times" is the Priority Corridor's philosophy for achieving cost efficiency through a modular system design, software re-use, and "economy of scale." In general, the Fontana-Ontario ATMIS supported the "design once, deploy many times" philosophy through the use of object-oriented technology and standardized objects and interfaces (CORBA IDL).

The Fontana-Ontario ATMIS's design specifies the use of standard objects and interfaces to help ensure system-to-system interoperability between project partners and, eventually, the Showcase Network.

4.3 Estimated Operations & Maintenance Costs

The Fontana TMC could cost up to $57,000 per year to operate and maintain, but provides benefits in increased safety and efficiency.

4.3.1 Operations

The operations cost for Fontana-Ontario ATMIS has been broken down into three contributing components: labor costs, utility costs, and office space costs.

4.3.1.1 Labor

The Fontana TMC is staffed Monday through Friday from 8am-5pm. An Assistant Traffic Engineer runs the TMC by periodically monitoring system performance and checking and posting events. This labor is estimated at one-half of an FTE, or approximately $45,000 a year.

Separately, the Fontana Police Department monitors and operates its workstation on a 24/7 basis.

4.3.1.2 Utilities

The utility costs that are most attributable to the addition of the Fontana-Ontario ATMIS are electricity (for powering the needed servers and workstations) and telecommunications (for interagency communications). Exhibit 9 estimates the additional annual electricity cost impact produced by the ATMIS hardware. These estimates are based on the following assumptions:

- An average electricity rate of $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, 350 days per year

Exhibit 9 – Estimated Marginal Annual Electricity Costs for ATMIS

Hardware Item	Model	Power Draw	Power Cost	Est. Annual Cost
ATMIS server	DL360	190W	$0.16/kW-hr	$266
Database server	DL380	275W	$0.16/kW-hr	$385
Video server	DL360	190W	$0.16/kW-hr	$266
NAS server	Maxattach 4100	150W	$0.16/kW-hr	$210
TIC server	DL360	190W	$0.16/kW-hr	$266
Web server	DL360	190W	$0.16/kW-hr	$266
CATV server	DL360	190W	$0.16/kW-hr	$266
2 Operator Workstations	PC	200W ea.	$0.16/kW-hr	$179
4 typical 22” color monitors		140W ea.	$0.16/kW-hr	$251
				$2357

Although Exhibit 9 estimates the annual electricity cost of the TMC at $2357, the City estimates that its cost is closer to $12,000.

The City of Fontana reports that there is no additional ongoing telecommunications cost associated with the operation of the ATMIS. All data and video communication is carried over fiber that is owned by the City. Similarly, the traveler information cable television program is broadcast over the City-owned public service channel.

4.3.1.3 Office Space

Since the TMC was constructed within an existing City-owned facility, the City reports that there is no new ongoing cost for the TMC's or ATMIS' utilization of that space.

4.3.2 Maintenance

The project financed the first six months of the ATMIS' operation and maintenance. Since then, the City of Fontana has hired the system developer, Iteris, under contract to provide on-call maintenance at a cost of roughly $10,000-15,000 per year. This maintenance contract covers "bug" fixes, but not routine hardware or software upgrades.

A benefit of the TMC is that it reduces the labor cost on some of its traffic consultant contracts. For example, Fontana has contracts with traffic signal maintenance companies to update timing plans and make other adjustments. Many functions 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 for its signal maintenance consultant, it is also 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 reduction in cost per signal being maintained of 17%.

Overall, by having the TMC and reducing the amount of fuel and time necessary to go into the field, the City estimates a 20% cost savings over their previous configuration of centralized master controllers. Fontana estimates that the savings is probably 50% over an older configuration in which traffic signal field masters were more distributed throughout the City.

5 Institutional Impacts Evaluation

5.1 Impacts to Operations and Maintenance Procedures and Policies

There have been no noted changes to operations or maintenance procedures or policies

Although the TMC has provided efficiency improvements, the City of Fontana has not had to modify its O&M procedures or policies.

5.2 Impacts to Staffing/Skill Levels and Training

An Assistant Traffic Engineer was reassigned to run the TMC.

As stated in Section 4.3.1.1, the City reassigned one of its Assistant Traffic Engineers 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.

System training and a Users Manual were provided on a one-time basis as part of the ATMIS contract for a cost of $25,000. The City has also contracted the system developer, Iteris, to provide ongoing system O&M support at a cost of roughly $10,000-$15,000 per year.

5.3 Impacts to the Competitive Environment

At this time, the information collected by the ATMIS is distributed free of charge on a publicly supported website and public access cable TV channel.

Although the Caltrans District 8 website has already been providing color-coded traffic flowmaps and camera images for the region free of charge, the Fontana-Ontario ATMIS is the first free public service in the area to provide traveler information down to the level of local arterials. The ATMIS is also the only service in the Inland Empire to provide traveler information via cable TV.

The system competes with at least two commercial traveler information services:

- Sigalert.com – Provides a traveler information website with color-coded flowmap of local highways. Access to camera images and personalized traffic alerts via email are available only to paying subscribers.

- Traveler Advisory News Network (TANN) – Provides a traveler information website with color-coded flowmap of local highways. Many of TANN's flowmaps are shown during local television news programs.

5.4 Impacts to Local Planning Processes, Policy Development, and the Mainstreaming of ITS

The Fontana-Ontario ATMIS helps bring traveler information into the homes of everyday commuters.

The Fontana-Ontario ATMIS is the first ITS project in the Inland Empire to focus on arterial traffic management. The development of the Fontana TMC enables city traffic engineers to more closely monitor conditions and remotely adjust signal timings and CMS messages.

In addition, the project documented the Inland Empire's regional ITS architecture, which is necessary for future federal ITS funding eligibility.

6 Traveler and Transportation Information Management Evaluation

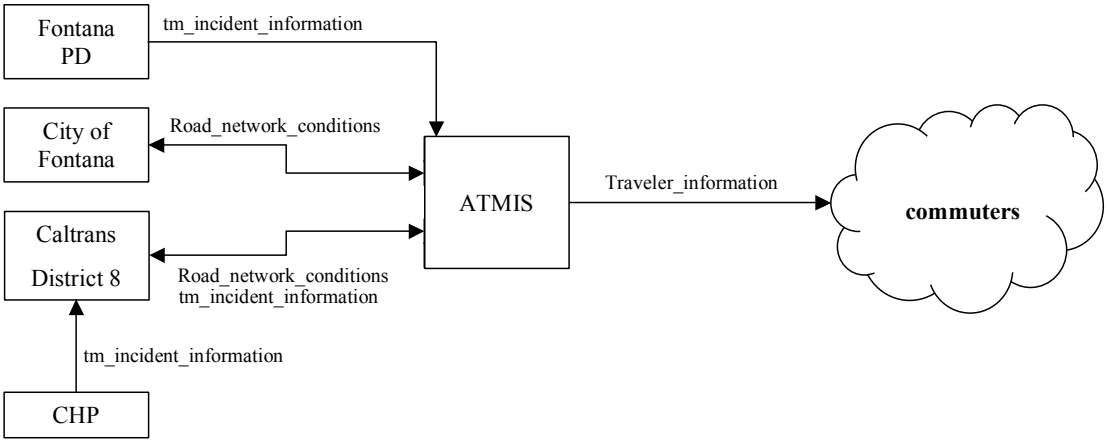
6.1 Extent of Regional and Interregional Transportation and Traveler Information Integration Between Agencies

6.1.1 Fontana-Ontario ATMIS Impact on Data Flows

Although the ATMIS is not integrated with the Showcase Network, it uses the Internet and other leased services to connect regional partners.

Exhibit 10 is a simple depiction of the ITS data flows implemented by the Fontana-Ontario ATMIS (see definition of 'data flow' in the National ITS Architecture). *Traffic_sensor_data* from Caltrans District 8 and the City of Fontana include inputs from roadway traffic sensors (primarily loop detectors). *Tm_incident_information* is passed to the system from the California Highway patrol (CHP) through Caltrans District 8, and contains filtered information regarding current incidents that is suitable for distribution and use by media systems.

Exhibit 10 – ITS Data Flows Implemented by Fontana-Ontario ATMIS



6.1.2 Operators Perceptions on Impact to Communications

What do the partner agencies say about the system?

The Fontana Police Department has an ATMIS workstation in their dispatch facility, and are able to view and control traffic cameras. Fontana PD reports that it likes having the video available to verify calls regarding traffic incidents and to help estimate the level of response necessary.

6.2 Utilization of Regional and Interregional Transportation and Traveler Information by Public Agencies

Fontana's partner agencies, such as the Fontana Police Department report that they are still learning the benefits of the system.

Traffic management is provided by the Fontana TMC Monday through Friday, 9am-5pm. Outside these hours, traffic management functions are handled remotely from the Fontana Police Dispatch Center by the Fontana Police Department. In an interview, the Fontana PD Dispatch Center indicated that it was still getting accustomed to the new system and experimenting with its usefulness. The ability to view incidents on CCTV in order to assess severity and respond appropriately seemed to be a key benefit.

6.3 Extent to which Comprehensive and Seamless Traveler Information is being Disseminated to – and Used by – the Traveling Public

Both an online survey and a return postcard survey were conducted during a seven-month period to obtain user feedback regarding the ATMIS website and Cable TV Program. Copies of the postcard survey were inserted in the City of Fontana's quarterly events brochure, which is mailed to all city residents. The postcard survey briefly described the ATMIS website and CATV program, and asked users about their frequency of use and the quality of the services compared to other ATIS. Response to the surveys was low with only four users responding to the online survey and only eight postcard responses being returned.

6.3.1 Fontana-Ontario ATMIS Website

The Fontana-Ontario ATMIS website provides useful information, but might not yet get enough use to significantly impact traffic conditions.

Usage statistics are not available from the City of Fontana, but the low response rate to the online survey might indicate low overall usage. There is no high-speed Internet service provider in the Fontana area, so users would have to access the system via relatively slow dial-up services.

6.3.2 Fontana-Ontario ATMIS Cable TV Program

The Fontana-Ontario ATMIS CATV program provides useful information, but may not get enough use to significantly impact traffic conditions.

The ATMIS CATV program is probably Fontana's most promising outlet for traffic information; however, supporting statistics on the number of viewers are not available from the City.

7 Transportation System Impacts Evaluation

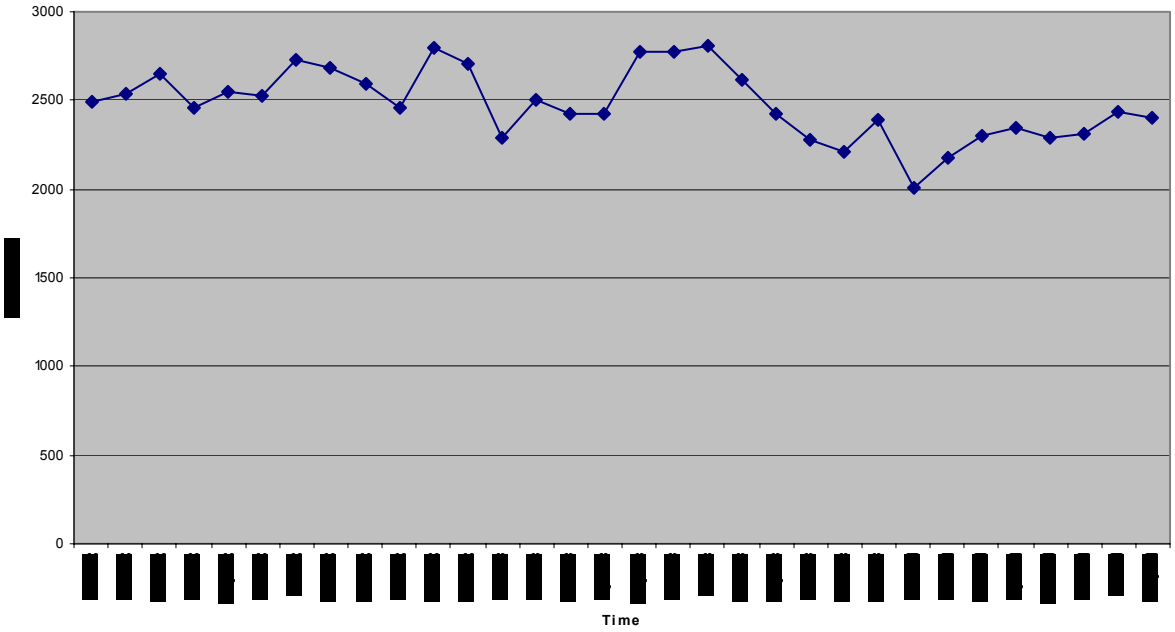
This chapter describes the possible impacts that the Fontana-Ontario ATMIS might be having on the surface transportation network in the Inland Empire. However, due to the vast amount of other possible contributing factors, it is impossible to draw any direct correlation between the ATMIS and the trends reported below.

The trends in the Inland Empire's transportation system performance were calculated using archived data from California's Highway Performance Measurement System (PeMS), which is the result of a joint effort between Caltrans and the Partnership for Advanced Transit and Highways (PATH) at UC-Berkeley. PeMS collects, validates, and archives incident statistics and real-time loop detector data for highways around the state, as well as provides access to various analytical tools via a web-enabled interface. The study looked for a change in transportation system performance before and after the Fontana-Ontario ATMIS went live in February 2003.

7.1 Impacts to Traffic Safety and Accident Reduction

An analysis of archived California Highway Patrol (CHP) incident data was conducted using PeMS. Exhibit 11 shows the average number of daily *incidents* on Inland Empire highways between the months of January 2002 and August 2004. The term *incident* refers to any situation that impacts traffic, including accidents, debris in the roadway, bad weather, non-recurring congestion, etc. For the month of January 2002, there was an average of 2500 incidents per day. The data shows that the incident rate has decreased in the past year to a daily average of 2300 incidents. Although many factors, including road improvements, may have contributed to this change, the ATMIS cannot be ruled out as one of them.

Exhibit 11 – Average Daily Incidents on the Inland Empire's Highways

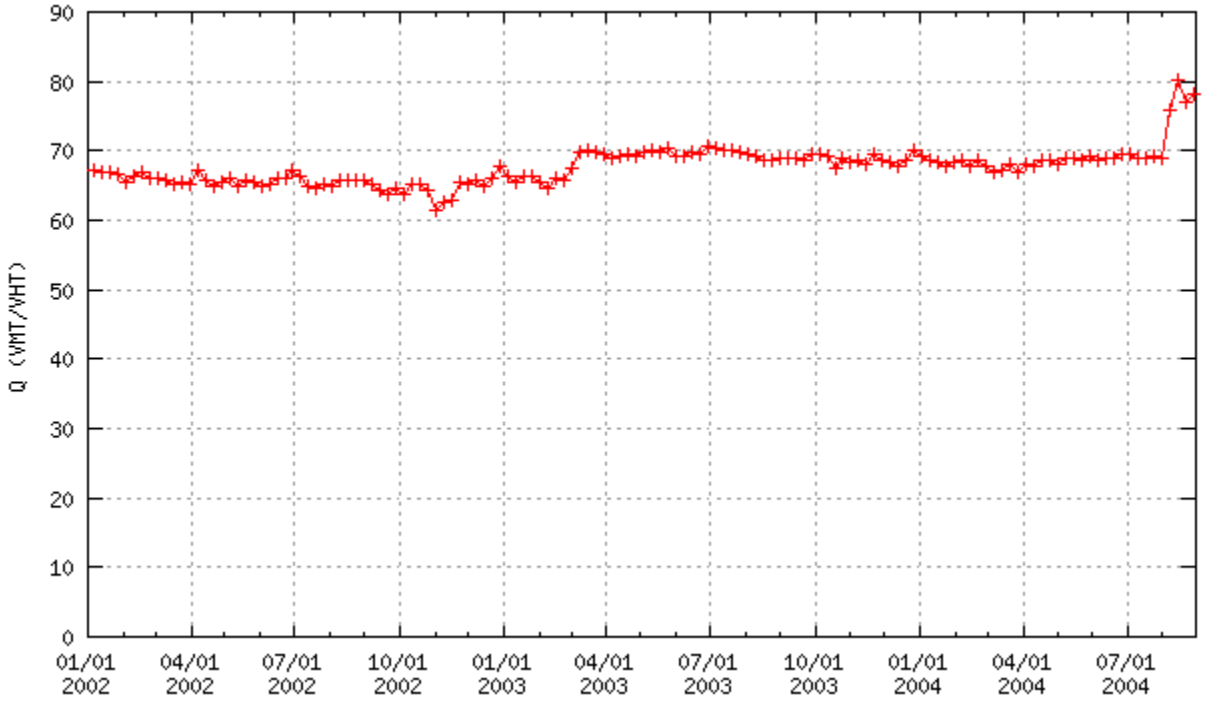


7.2 Impacts to Traffic Congestion

To investigate the impacts of traveler information use on overall traffic conditions, a before-and-after analysis of archived traffic data was conducted using PeMS. The data was studied for the period January 2002 through August 2004.

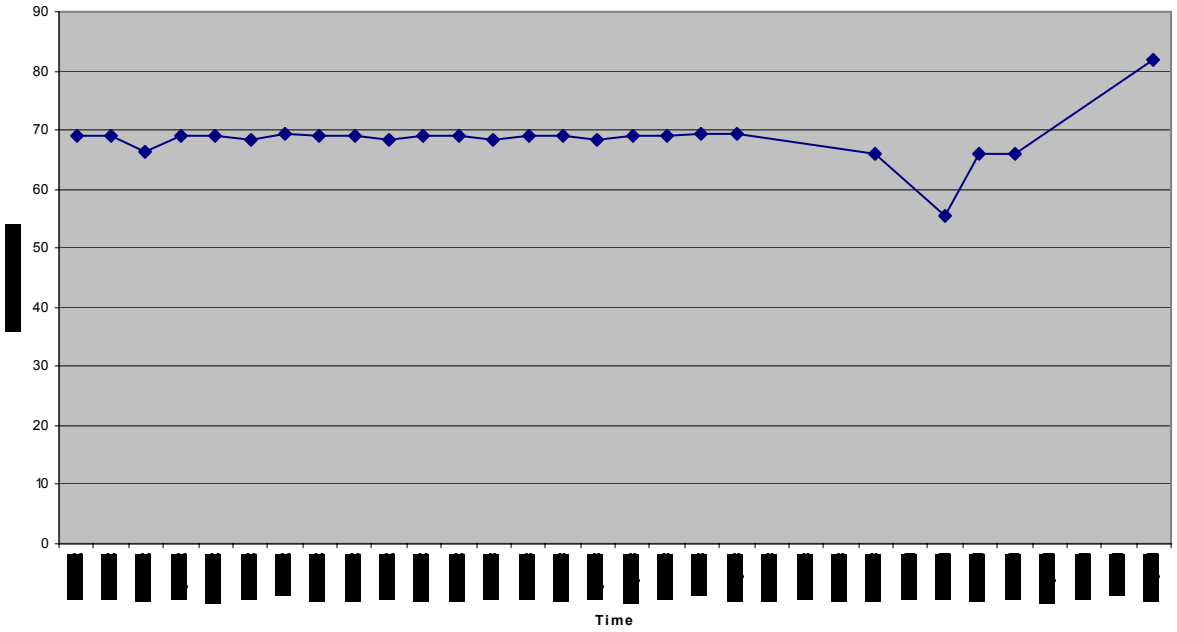
Exhibit 12 shows Vehicle Miles Traveled (VMT) divided by Vehicle Hours Traveled (VHT) – represented as "Q" – aggregated over all highway miles in the Inland Empire for the given time period. At the time the Fontana-Ontario ATMIS went live in February 2003, Q rises approximately 4.5% from roughly 66 to 69. Although many factors, including road improvements, may have contributed to this change, the ATMIS cannot be ruled out as one of them.

Exhibit 12 – Q (VMT/VHT) over Time for Caltrans District 8



However, Fontana represents only a small portion of the entire Inland Empire. To focus more specifically on the Fontana area, data for Interstate 15 between post miles 106.7 – 115.5 were analyzed separately from other Inland Empire data. Exhibit 13 shows these results.

Exhibit 13 – Q (VMT/VHT) for I-15 near Fontana between Jan. 2002 and Aug. 2004



It is not clear why VMT/VHT dropped and then shot up so significantly in the past year. One interpretation of the data is that traffic might have slowed and then greatly improved due to the construction and subsequent opening of a new exit or an added lane. As of the writing of this report, the evaluation is awaiting confirmation as to whether such construction took place during that time near this stretch of Interstate 15.

Although Interstate 10 also passes close to Fontana, there are no detectors in that vicinity (between post miles 57.61 – 65.56) on which to base an analysis.

7.3 Impacts to Environmental Effects of Traffic

Although automobile traffic can impact the environment in several ways, this section theorizes specifically about the potential impacts of traveler information on automobile emissions and air quality.

Through the combustion of fossil fuels and air, automobile engines produce carbon monoxide (CO), nitrogen oxides (NOx), and water vapor. In the presence of sunlight, these CO and NOx emissions contribute to the formation of ground level ozone and smog. The amount of CO and NOx emitted by an automobile engine varies by its age and condition, the amount of load on the engine (whether it is idling or not), and the ambient temperature. The United States Environmental Protection Agency (EPA) publishes average "exhaust emission factors" for engines under various conditions, and these factors can be used to roughly estimate the amount of exhaust emissions produced or mitigated under various scenarios.

Exhibit 14 – Exhaust Emissions Factors in Grams/Mile at Various Vehicle Speeds at Low Altitude and 75°F Ambient Temperature[5]

	2.5MPH (Idle)	35MPH	55MPH	65MPH
Carbon Monoxide (CO)	83.58	9.80	7.45	15.90
Nitrogen Oxides (NOx)	3.14	2.04	2.65	3.51

Consider a scenario in which a vehicle encounters an incident that has caused traffic to back up for one mile. According to the EPA's Exhaust Emissions Factors, that one vehicle would generate roughly 84 grams of CO and just over 3 grams of NOx while inching through the backup at 2.5 MPH. A total traffic standstill would generate even more emissions.

The emissions factors in Exhibit 14 imply certain emissions-related benefits to using traveler information to avoid traffic congestion. These benefits are described in general below. Since there are virtually endless scenarios to consider, the reader is invited to use the information provided in this section to quantify his own specific benefits.

Exhibit 15 – Anticipated Air Quality/Emissions Benefits of Using Traveler Information

Mitigating Action	Benefit
Change Departure Time	Enables vehicle to travel at higher speed by picking a time when congestion is less severe. Consider a scenario in which an "average" vehicle typically travels 30 miles between home and work, with 7 miles of travel on local streets at 35MPH and 23 miles of travel on freeways at 65MPH. On a typical day, CO output from this trip might be roughly 434.3 grams. However, a one-mile delay (travel at 2.5MPH) on the arterial portion of the trip would inflate the total CO production to 508.08 grams, while a one-mile delay on the freeway portion would result in the production of 501.98 grams. Under this scenario, each vehicle that avoids the traffic congestion could avoid producing as much as 17% greater CO emissions.
Cancel Trip	At best, canceling the trip means that no emissions are generated. At worst, the emissions that would have been generated during the trip are simply deferred to another time.
Take Alternate Route	Since the amount of CO produced at idle is so much more than that produced at higher vehicle speeds, a vehicle could take an alternate route that is longer than the normal route taken and still produce less total exhaust emissions in the process. Using the scenario above, this vehicle could travel up to twice as far on an alternate set of arterials, or roughly 20% farther on an alternate set of freeways.
Take Transit/Carpool	One less vehicle on the road means that much fewer emissions generated. The fewer the vehicles on the road, the higher the travel speeds, which can also reduce emissions further.

Conclusions and Recommendations

The Inland Empire's Fontana-Ontario Advanced Traffic Management & Information System (ATMIS) project is one of the eleven regional projects within the Southern California Priority Corridor ITS Showcase Program.

The Fontana-Ontario ATMIS provides state-of-the-art traffic management and traveler information for a portion of the Inland Empire Region. The project installs a new Traffic Management Center (TMC) in the City of Fontana, as well as additional cameras and changeable message signs (CMSs) in the Fontana and Ontario areas. Traveler information, including video images and incident advisories, is provided on a new website and the City of Fontana's existing community access cable television channel.

The unexpected obsolescence of an important third-party software component caused integration issues between the Showcase Kernels – the backbone of the Corridor-wide network – and all of the regional deployment projects, including the Fontana-Ontario ATMIS. As a result, and after careful consideration, the Fontana-Ontario ATMIS project partners chose to defer integration with the Showcase Network indefinitely.

A notable benefit of the project is the development of the Fontana TMC, which has reduced the labor cost on some of the City's traffic engineering consultant contracts. Fontana has contracts with traffic signal maintenance companies to update timing plans and make other adjustments. Many functions 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 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.

Traffic management is currently provided by the Fontana TMC Monday through Friday, 9am-5pm. Outside these hours, traffic management functions are handled remotely from the Fontana Police Dispatch Center by the Fontana Police Department. In an interview, the Fontana Police Dispatch Center indicated that it was still getting accustomed to the new system and experimenting with its usefulness. The ability to view incidents on CCTV in order to assess severity and respond appropriately seemed to be a key benefit.

The project also developed both a website and public access cable television program to provide traveler information to the public; however, it is not clear how much usage these services currently receive. The evaluation recommends that the City continue to promote and encourage the use of these services.

Endnotes/References

[1] ISTEA requires that "operational tests utilizing federal funds have a written evaluation of the Intelligent Vehicle Highway Systems technologies investigated and the results of the investigation." Although Showcase is not officially an operational test, it deploys and demonstrates ITS services, functions, and technologies under "real world" conditions, similar to an operational test.

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

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

[4] The budget numbers come from copies of the project contract (November 1997) and its amendment (1999), which were obtained by the Evaluator from the City of Fontana.

[5] United States Environmental Protection Agency, Office of Mobile Sources, AP-42, Air Pollutant Emissions Factors, Tables 1.08-1.21, 1998.