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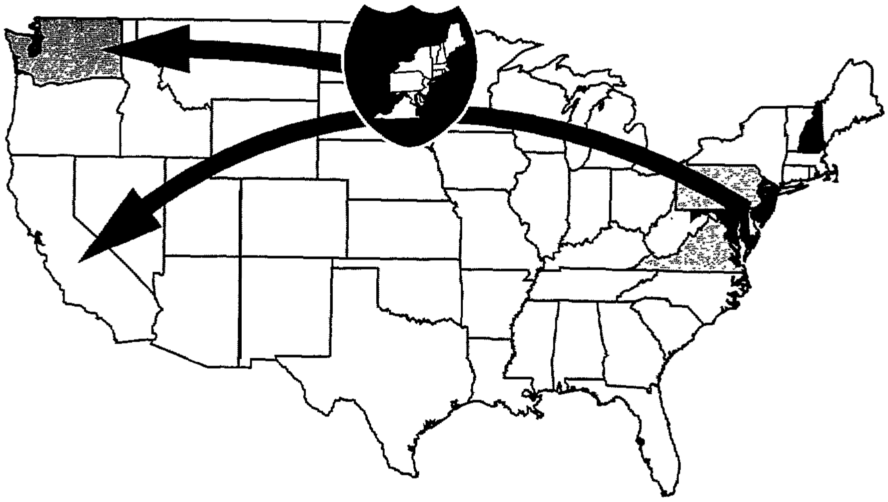
I-95 Corridor Coalition Goes West



I-95 Corridor Coalition West Coast
Training Seminar
July 25-28, 1995

I-95 Corridor Coalition

December 1995

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Proceedings of

The I-95 Corridor Coalition
West Coast Training Seminar
July 25-28, 1995

I-95 Corridor Coalition

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I-95 CORRIDOR COALITION

I-95 Corridor Coalition
c/o New York City DOT
34-02 Queens Boulevard
Long Island City, N.Y. 11101

Dear Colleague:

The I-95 Corridor Coalition's West Coast Training Seminar report was compiled with the help of the participants, host-agencies, and coalition staff. This report has two basic purposes: to share the observations and experiences at TMC facilities, and to transfer knowledge and techniques to Coalition agencies.

The increased level of participation by police agencies in West Coast operations to manage local and regional incidents, was noted by all Seminar participants. We hope that the techniques learned - especially institutional arrangements - will be shared and utilized by Coalition agencies to create greater awareness in the Northeast Corridor and foster cooperation, communication, and coordination.

On behalf of the Coalition, our thanks to all those who participated in the preparation of this report and Seminar-especially Seminar guide Walter Kraft and associate editor Janet Ricci.

Very truly yours,

Raman Patel, P.E.

Technical Coordinator

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EXECUTIVE SUMMARY

EAST COAST TO WEST COAST: DEPLOYMENT OF INFORMATION TECHNOLOGY

By: Raman Patel, PE
Technical Coordinator
I-95 Corridor Coalition

When Governor Ronald Regan inaugurated Caltrans' first Traffic Operation Center (TOC) on November 23, 1971, at District 7 in Los Angeles, it covered a basic surveillance system on 42 miles of the freeway system. Today, the system includes 27 freeways that stretch for 615 miles. The District's 500 employees, with 100 engineers among them, manage traffic operations with a budget of $262 million.

Forced by the reality of time, Caltrans has placed an urgency on strategies to manage its freeway system, which is clogged by 50 percent recurring congestion (hourly, daily basis) and 50 percent by nonrecurring (incident related) congestion.

A congestion management strategy was deployed in two steps. First, Caltrans District 7 (Los Angeles and Ventura Counties included) and the California Highway Patrol (CHP) have jointly developed a strategy to rapidly detect and respond to incidents. A rapid detection and prompt response concept was also apparent throughout California as demonstrated by Lt. Dwight McKenna in Caltrans, District 12-Orange County. Our group witnessed and heard, first hand, about some of the best practices devised by traffic management teams (TMT) in the country.

The second step to managing congestion on California's congested freeways, both in time congestion (most of the 24 hours) and in space congestion (everywhere, nothing is spared), reiates to the use of the latest electronic technologies--from freeway ramp meters, cameras, surveillance, loop detection, variable message signs (VMS), etc. to sophisticated traffic management systems such as smart systems and Pathfinder. This latest generation of computer-based systems, although still in the making, has captured the imagination of many researchers and traffic managers throughout the profession. The expert system, a thinking computer, is a near term reality in our field. Our team was very interested in this practical mix of prevailing technologies and up-and-coming real world systems.

Congestion management and the use of information-age technologies require a sharing of information and coordination across multijurisdictions. The I-95 Corridor Coalition realized that incident management strategies (Project 2), surveillance requirements (Project 3) and VMS/HAR strategies (Projects 9 and 9A) are essential program elements, which touch many aspects of California's approach. The Coalition's foundation is laid on the mutual benefits and common interests to be realized through cooperation, coordination, and communication.

Such requirements are included in our first project, the Information Exchange Network (IEN), which deploys prevailing technologies-much like what has been done in West Coast facilities. The great interest shown by the Coalition's TMC operations in California's $50 million Smart Corridor project parallels interest shown for a fully automated IEN with expert system elements for Corridor-wide application. Our ongoing examinations of IEN features deal with multimodal requirements deployed in multi-jurisdictional settings. Intermodal information management issues faced by the eastern states and cities are also prevailing in West Coast facilities, although with reduced intensity. For example, the transit element, with approximately 40 percent of the Nation's ridership in the Northeast, is only fractionally present in the West Coast.

Caltrans provides the "Freeway Vision," graphic display which replicates the Transportation Management Center (TMC) map, to 500,000 homes in Los Angeles through public access cable channel Cityview-35. The real-time software-driven map displays green for freeflow (speed over 35 mph), red for congested traffic (speed below 25 mph), and flashing red to indicate a possible incident that has stopped traffic.

Caltrans is working to transmit TMC-generated traffic information to the public through a number of projects. In the "Pathfinder" experiment, cars were equipped with in-vehicle navigation systems to help motorists avoid congestion. With "commuter TV,,, monitors are stationed at various locations that display traffic information in a text-format. Dozens of "Smart Kiosks" have been stationed at various locations around the region providing congestion information, bus schedules, and car/vanpool information.

At the I-95 Corridor Coalition, our goal is to assemble local information first at the TMC level and then make it available at regional and Corridor levels through TMC to TMC interconnectivity as well as providing traveler information. Intermodal exchange of information and dissemination of traveler information to public and CVO facilities will also be incorporated in our Corridor-wide activities.

Smart Corridor Projects

Al Ari of New Jersey DOT raised the question: "Will one jurisdiction allow the joint use of devices by other agencies? Is it possible that the City of Santa Ana will allow Caltrans TMC to take control of its facilities during off-hours? Could a co-located or co-operated TMC help reduce personnel costs in these times of budget cutting and lack of personnel to operate high technology based ITS?" The following response to that question was provided.

In the "Smart Corridor" project that covers 542 surface street traffic signals (Los Angeles), 14.5 miles of the Santa Monica Freeway, 20 VMS, 40 ramp meters (Caltrans District 7)' and other adjacent cities, an expert system-based "incident manager" is emerging. The computer, using its own software, monitors and controls itself, and assigns the appropriate incident manager within the jurisdictional area.

The fundamental objective of the Smart Corridor demonstration project is to maximize the efficiency and throughput of the existing freeway (state) and surface street network (local). The joint operation between adjacent jurisdictions and expert system reliance to provide appropriate response is most noteworthy because ITS depends on such integration under wider ATMS.
The project relies on a three-pronged objective:

- To coordinate and maximize the efficiency of existing monitoring and control systems of participating agencies.
- To provide dynamic, real-time traffic information to motorists in the Corridor.
- To provide timely and effective accident/incident management within the Corridor.

In a significant step, Caltrans' real-time traffic information is also available on the Internet by accessing the World Wide Web at URL - http://www.scubed.com:/caltrans.The I-95 Corridor Coalition is also considering use of the Internet to provide Corridor-wide construction information, reports, surveys, findings, documents, project status, RFPs, and related information. Figure 1 illustrates the Smart Corridor.

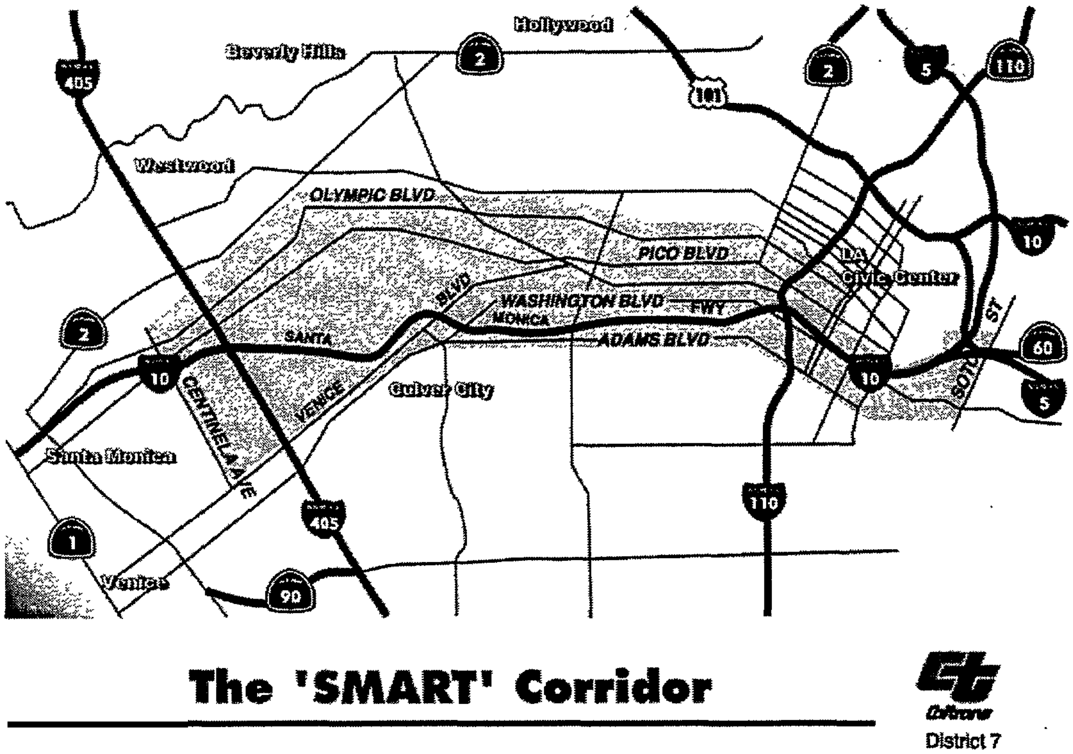

Figure 1. Caltrans Smart Corridor

Noteworthy California Details

FSP - Freeway Service Patrol Assist stranded motorists, free-of-charge, by changing tires, adding a gallon of fuel, jump-starting a dead battery, taping radiator hoses or other "quick" repairs. The program is funded by a half-cent sales tax. Coalition staff has full reports/agreements on this subject.

Freeway to Freeway Ramp Meters A familiar sight, making its debut in 1966, is now expanding, and allows freeway flow control through automatically adjusted meters based on embedded sensors. Caltrans has over 1,000 ramp meters in operation statewide.

Changeable Message Signs (CMS or VMS) Unlike many parts of country, Caltrans does not allow use of CMS for public service messages. This shift in policy is due to the fear of lost credibility. Motorists who continually travel a specific route can become so accustomed to the sign message that real-time traffic messages are ignored. Only real-time information that conveys current traffic safety and congestion information is displayed. CMS messages displayed are early warning, advisory messages, and alternate route messages. Recommending specific local streets as alternate routes is not advised, unless severe conditions exist and local agencies are involved. LA's Smart Corridor project will shed more light on such multi-jurisdictional issues.

HOV - High Occupancy Vehicle More than 300 miles of HOV facilities will be in place at a cost of $1.0 billion by the year 2000 in the LA area alone. The concept of moving *more people* rather than more cars may remind many that both HOV and AHS (Automated Highway System- moves more cars also) could find some balance on California's freeways.

Various Observations

The Seminar group raised many questions facing ITS professionals in carrying out their day-to-day responsibilities. These questions addressed practical, process oriented issues including:

- "Who pays for maintenance and operations?"

- "How do you allocate proper funding?"
- "Do you have to buy using a low-bid process?"
- "Can someone else control your signs?"
- "Can you jointly operate facilities?"
- "How was CHP cooperation obtained?"
- "Can the private sector have access to your database?"
- "Does your Mayor or politicians help?"
- "VMS sign messages - how do people react to them?"
- "HAR message - public reaction, is it good?"
- "How is the right-of-way issue handled?"

Seminar participant reports address some of these questions, particularly the multi-jurisdiction and procurement issues.

Throughout the Seminar, issues related to traffic control software, timing plans, coordination, turf issues, and incident management and public information dissemination were all tied to the operation of TMCs. As we move along in the Northeast, close to a dozen TMCs are likely to take shape in the next few years. Many states in our Corridor are concerned with the practical issues facing them. At the I-95 Corridor Coalition, efforts are being made through several projects to create a greater awareness and understanding of a regional and corridor wide seamless transportation network that meets intermodal and multimodal needs.

Both Los Angeles and Anaheim stressed the need for real-time information. Link time calculations are dependent on volume/occupancy data from locations most affected by traffic patterns. One-second, real-time communication in the UTCS system allowed Anaheim's 250 traffic signals (170, NEMA) to make it possible for Anaheim Stadium traffic movement to clear in 16 minutes against the 60 minutes it would take otherwise, says Jim Paral, traffic engineer. Over 20 million visitors pass through the Anaheim Disney area with 200 special events a year. This is a great burden on a city with a full-time staff of two, supplemented by three to four part-time interns and it does require a technology-based response, says Paral. His other problem, the business community's unwillingness to accept VMS structures, was solved after making signs "more garden-like". Business owners realize how critical it is to move traffic in small areas for visitors to enjoy their tours and attractions without getting lost and wasting time driving around.

Los Angeles, California DOT, and Washington DOT are supporting the development of National Transportation Control/ITS Communications Protocol (NTCIP) and early implementation of ITS interoperatibility and interchangeability requirements for existing (legacy) systems, and new subsystems. Their representatives, Anson Norby (LA), Chuck Perry (Caltrans), and Mike Phobias (WASDOT) are serving with me on a national steering committee that directs US efforts to produce a family of NTCIP standards. Our Coalition agencies are also involved in such efforts that will make it possible for all types of devices, manufactured by multi-vendors, to co-exist on the same communications channel.

The Seattle region is in the process of developing an ATMS that will allow local jurisdictions to exchange transportation information. The overall goal of the North Seattle ATMS (NSATMS) is to promote agency coordination and cooperation throughout the Seattle region in order to manage traffic efficiently. The figure below displays the communication coverage provided by the wide-area ATMS.

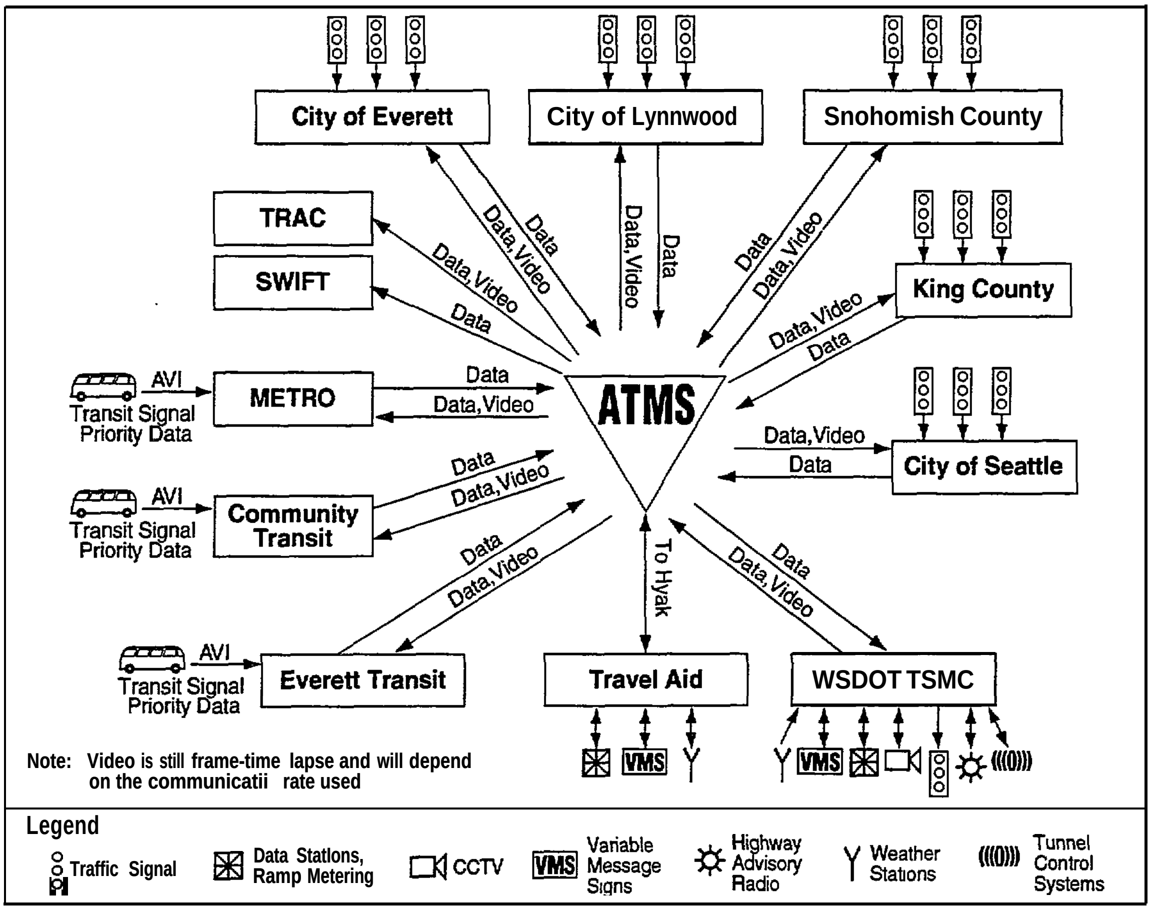

Figure 2. Seattle ATMS Architecture

The Seattle District TMC deploys 120 color cameras, 35 ramp meters, 30 VMS along its 50 freeway miles slated to expand to 110 miles. The center is open from 6 AM to 7 PM, after which the state police operations center oversees the network. TMC operations are conducted with 5 full time engineers and with part-time students from Washington State University.

The participation of students - during the “making of ATMS” is a powerful concept of training future transportation professionals - not yet practiced in the Northeast even though many university centers exists. Our team was impressed with a young student demonstrating “tomorrow’s technology-in experiment”. The city of Anaheim has also produced several interns- who are now functioning as ITS professionals serving FHWA.

Data fusion software - an element that is a high priority in the National Architecture and I-95 Corridor Coalition work - is also apparent in Washington DOT’s architecture, which currently uses 200 data stations. The data fusion software accumulates, organizes, and disseminates speed data from several sources within the system. Examples of these sources are: arterial computer-controlled systems, freeway systems, electronically-equipped vehicles, historical data, system operators, and modeling techniques. The output of such fusion is obviously the link speed that must be displayed in real-time.

Washington DOT staff has shown a great deal of understanding in the public perception of ITS and the political process, both elements necessary for the successful implementation of ITS technologies. Les Jacobson, the current chairperson of ITS America’s ATMS Committee, and his staff have organized a significant effort in the advancement of technologies and creating grounds of public acceptance in his role as traffic services manager for Washington DOT. The combination of ATMS efforts by public agency personnel, system integrators, and federal policy makers is obviously working as shown by Puget Sound Help Me - Push Me (click www.wsdot.wa.gov/eesc/ATB/a+b/)Mayday project.

Push Me is an operational test of Mayday technology (similar in concept to I-95CC’s new project-19) sponsored by the FHWA, and Washington DOT. Operational tests are a transition between R&D and full-scale deployment of ITS technologies. The test, conducted in a real-world environment involves human factors and institutional assessment, controlled field testing of

Emergency Notification Device (END) in test vehicles, 250 participants, and evaluation (compare with 911 and cellular call-in).

Core Issues Addressed by PushMe:
♦ Institutional Arrangements
♦ Police-Agencies Involvement
♦ Incident Management/Mayday
♦ ATMS-Architecture-Elements
♦ Public information-Dissemination
♦ Private Sector Involvement
♦ Operational Tests
♦ TMC Operations-Staffing, Training
♦ Procurement
♦ System-Communication Technologies
♦ Benefits/Costs Assessment
♦ Overall ITS-Framework

The Public/Private Cooperative Partnership operational test is expected to cost $2.3 million, which includes private costs (19% contribution). The team members are shown below:

Push Me Participants	
Public Sector	Private Sector
♦ FHWA	♦ David Evans & Associates (DEA)
♦ Washington DOT	♦ IBI Group
♦ University of Washington Lab for Userability Testing	♦ Response Systems Partners, Inc.
♦ Washington State Patrol	♦ Sentinel Communications, Inc.
♦ Evaluator - University of Washington	♦ Motorola
	♦ AT&T Wireless Communications (Free cellular time)

Among the other ITS developments in the state, a joint ventures concept between the public and private sectors has won the approval of state legislators. The bill allows up to six projects under an arrangement that involves users fees, private funds, revenue generation, a business-climate, and private ownership with lease-back option (The staff has full details on file on the subject).

BACKGROUND

The I-95 Northeast Corridor, from Virginia to Maine, represents the center of the nation's financial, business, and political activity. It contains four of the nation's ten largest urban centers with a population of over 51 million people, 20 percent of the total U.S. population. It is among the nation's most congested highway and travel corridors, with nearly the entire corridor in non-attainment of national air quality standards. The Corridor is highly urban and multimodal, with transportation provided by 14 state and city DOT's, 12 toll authorities, AMTRAK, several freight railroads, intercity buses, several major airlines and numerous public and private transportation suppliers.

In 1992, the I-95 Corridor Coalition was formerly established to unite agencies in the Northeast Corridor. An executive board, a steering committee and working groups were desginated and a mission, set of objectives, and vision were defined.

Coalition members strive to provide a state-of-the-art, multimodal transportation system for travelers and goods movement in the Northeast Corridor. Representatives participating in the West Coast Training Seminar were able to explore technologies and practices of agencies in another part of the country that also has highly congested corridors. The knowledge they gained can be transferred to their work in the Northeast.

GOALS AND OBJECTIVES OF SEMINAR

The main objective of the Training Seminar was technology transfer. Participants received technical training about facilities and technologies employed by their counterparts on the West

Coast. These individuals can now share this information with their associates through literature and presentations.

Another objective of the Seminar was to compile a document that describes the West Coast facilities visited. At the beginning of the Seminar, each participant was assigned a particular subject that they were to focus on such as communications, maintenance, etc. Each individual was then asked to write a chapter of this proceedings to share the knowledge they gained on their assigned subject. At a time when dozens of TMCs are expected to take shape in the Corridor, the Coalition hopes that such timely information will help agencies in achieving their goals.

OVERALL OBSERVATIONS

California, America's most populous state (10 million in 1950, 30 million in 1990), has an economy which is the eighth largest in the world - after the United States, Russia, Japan, West Germany, France, Italy, and China. It leads in agriculture, manufacturing, and tourism and is second in fishing, fourth in petrolum production--all sectors are heavily dependent on its freeways. It is entirely appropriate that Sourthern California, which leads the world in congestion and pollution problems, should also depend on ITS technologies to make transportation systems more efficient to safeguard its economic vitality. With resurgence in Pacific trade, the entire Pacific Coast will benefit from intermodal transportation.

Several features and characteristics were identified that aided the West Coast agencies in deploying ITS programs. Among those noted, it appeared that the West Coast agencies have a close working relationship with political leaders and elected officials. In addition, the transportation management centers and TOCs work with local and state police to facilitate incident management and maintenance strategies. A variety of disciplines are employed (such as systems engineers, traffic engineers, electrical engineers and technicians, planners, public relation representatives) for optimal operation and maintenance of the facilities.

The West Coast agencies also appeared to have a strong desire and willingness to try new and innovative techniques in deploying ITS. Tony Augustin of the New York City DOT expressed the view “I was very impressed with the level of commitment toward ITS deployment and research, especially in relation to the Smart Corridor projects.” Smart Corridor projects are underway in Los Angeles (Santa Monica Freeway), and San Jose. The goal of the Smart Corridor projects is for all transportation facilities in a corridor to be utilized at their maximum efficiency during periods of both recurring and nonrecurring incidents.

Based on the responses of the participants, the Seminar was informative and beneficial both to the individuals who attended, and to those they work with. Don Hubicki of the New York State Thruway Authority wrote “it cannot be emphasized enough the enormous learning potential realized through this Training Seminar, as it provided a personal education not just on technology but also on transportation in general.” In conclusion, the West Coast Training Seminar was a huge success!!

1. FACILITIES AND EQUIPMENT

1.1 TRAFFIC OPERATIONS CENTERS

By: Lee McMichael
Statewide Operations Center Team Manager
Maryland SHA

The following is a summary of observations made in regard to the Traffic Operations Centers (TOC) visited on the West Coast Training Seminar. The training encompassed tours of the following facilities:

- Caltrans District 7 TOC & Emergency Prevention & Information (EPI) Center, Los Angeles
- City of Los Angeles Automated Traffic Surveillance & Control (ATSAC) Center
- City of Anaheim Transportation Management Center (TMC)
- City of Santa Ana TMC
- Caltrans, District 12 TOC
- City of Irvine TMC
- Oakland Bay Bridge Maintenance Facility, Oakland
- Bay Area Rapid Transit (BART) Control Center, Oakland
- City of San Jose TMC
- Seattle Metro Transit, Washington
- City of Bellevue TMC, Washington
- Washington State DOT Transportation System Management Center (TSMC), Seattle

This section briefly describes the TOCs visited including notes on hours of operation, security, staffing, facilities, integrated devices, and communication.

Caltrans District 7 TOC & EPI-Center

Hours of Operation: 24 hours per day, 365 days per year

Security: CardKey

Staffing: Peak 8-10, midday 5-6, nights & weekend 3-4 individuals, includes Emergency Response and CHP Liaison Dispatch

Systems Support: 8-10 dedicated

Facilities: Open floor architecture, modular furniture, video integration with monitors and large screens.

Integrated devices: Smart Corridor, CCTV (24 presently/400 future) CMS (73 presently/100/ future) four per interchange and on approaches.

Communications: Slow scan, compressed (128kbs), limited fiber optic cable, and microwave.

City of Los Angeles Automated Traffic Surveillance & Control (ATSAC Center

Hours of Operation: 06:00-18:00 Monday-Friday

Security: CardKey

Staffing: 12 Systems integrators/engineers

Facilities: Open floor amphitheater architecture with glass support offices, modular furniture, video integration with large screens.

Integration devices: Adaptive Traffic Management Systems on 486PC based computers (9 Sun Systems/11 workstations), Smart Corridor with total integration of CCTV, CMS, HAR. Automated Incident Command Structure monitors the system, assigns and controls devices.

Communication: Fiber optic cable, twisted pair

City of Anaheim TMC

Hours of Operation: 07:00-17:30 Monday-Friday and Special events

Security: CardKey

Staffing: 2 full time individuals and 3-4 part time student interns

Facilities: Conference Room with glassed control room console

Integrated devices: CCTV (18), CMS (6 full matrix LED w/CCTV backup), HAR single 1500 AM.

Communications: Citywide fiber (12 strands) to expand to 100, HUB multiplexing on T1

Figur1.1.1 lustrates the layout of the Anaheim TMC showing the large projection screen with the smaller monitors on either side. Most of the other centers visited had similar setups with some variation in the number of projection screens and monitors.

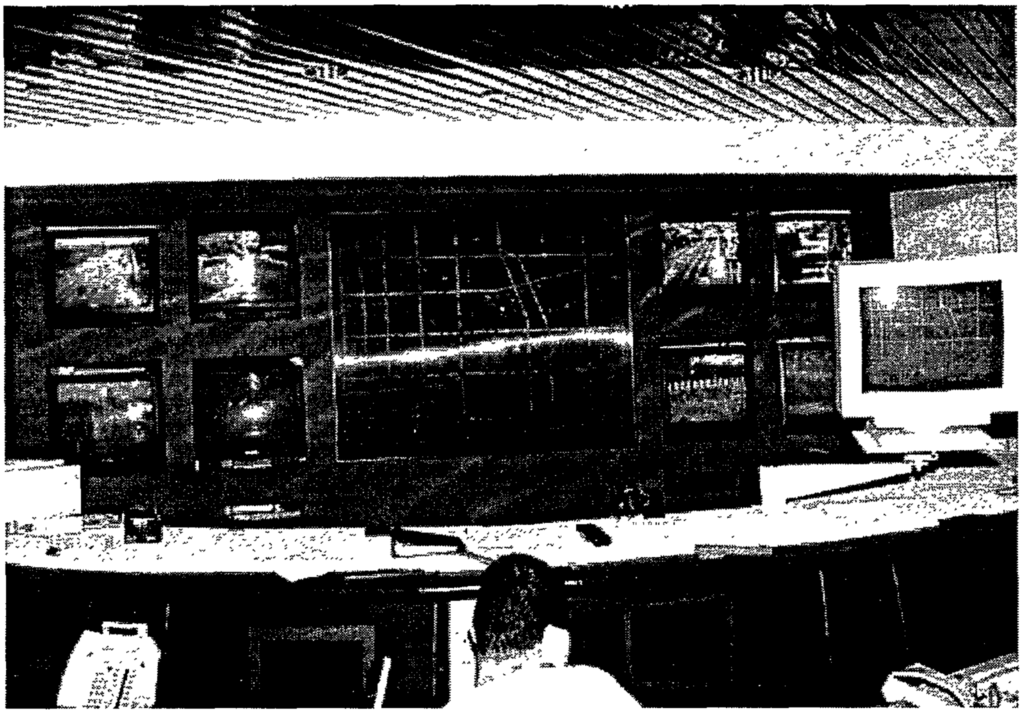

Figure 1 1.1 Anaheim TMC

City of Santa Ana TMC

Hours of Operation: 07:00-18:30 Monday-Friday and Special events

Security: Co-located with City PD

Staffing: 4 full time individuals and 2 interns 20 hours per week
Facilities: Conference Room w/glassed control room console
Integrated devices: CCTV (16), 4 AutoScope
Communications: Fiber optic cable

Caltrans, District 12 TOC

Hours of Operation: 24 hours per day 365 days per year
Security: Sign in and Keypad
Staffing: 4 full time (2 Caltrans, 1 CHP, 1 Incident Mgr) three shifts.
Facilities:Glassed operations room open floor architecture, modular furniture, video integration with monitors and large screens, status display boards. An exceptional new facility is under construction.
Integrated devices: CCTV (30),CMS (32) Portable HAR (2) 540 AM, Ramp Meters (278) with HOV by-pass, Freeway service patrols (dispatched by CHP during AM/PM peak hours).
Communications: Shared Fiber optic and twisted pair.

City of Irvine TRAC (Traffic Research & Control Center)

Hours of Operation: 07:00 - 18:00 Monday-Friday
Security: Keypad
Staffing: One
Facilities: Glassed operations room small open floor architecture, video integration with monitors and large screens, Video Conferencing. Integrated Devices: CCTV (19),VMS, HAR coupled to signal systems for 210 intersections. All city systems tied to Caltrans data base for signal timing and ramp meters.
Communications: Fiber optic

Oakland Bay Bridge Oakland

Hours of Operation: 24 hours per day, 365 days per year

Security: Secure Toll Facility

Staffing: n/a

Facilities: Monitoring dispatch facility in maintenance area.

Integrated Devices: CCTV,VMS (bold matrix)

Communications: Twisted pair

Figure 1.1.2 illustrates the control board at the Oakland Bay Bridge.

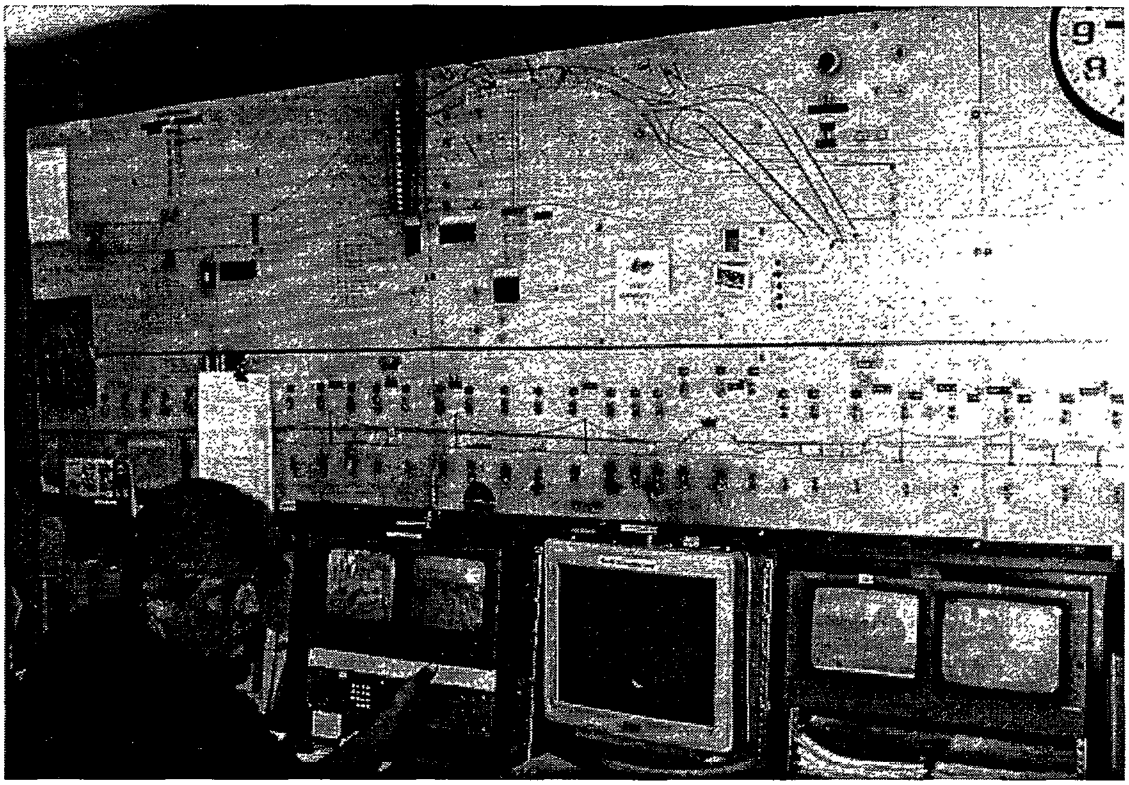

Figure 1.1.2. Oakland Bay Bridge Control Board

BART Control Center, Oakland

Hours of Operation: 24 hours per day, 365 days per year

Security: CardKey

Staffing: 21 Train controllers

Facilities: Glassed operations room, open floor architecture, modular consoles, front projection screen, rail schematic, electrical status display boards.

Integrated devices: na

Communications: Telephonic information to Shadow and Metro Traffic.

Figure 1 .1.3 displays the BART Control Center.

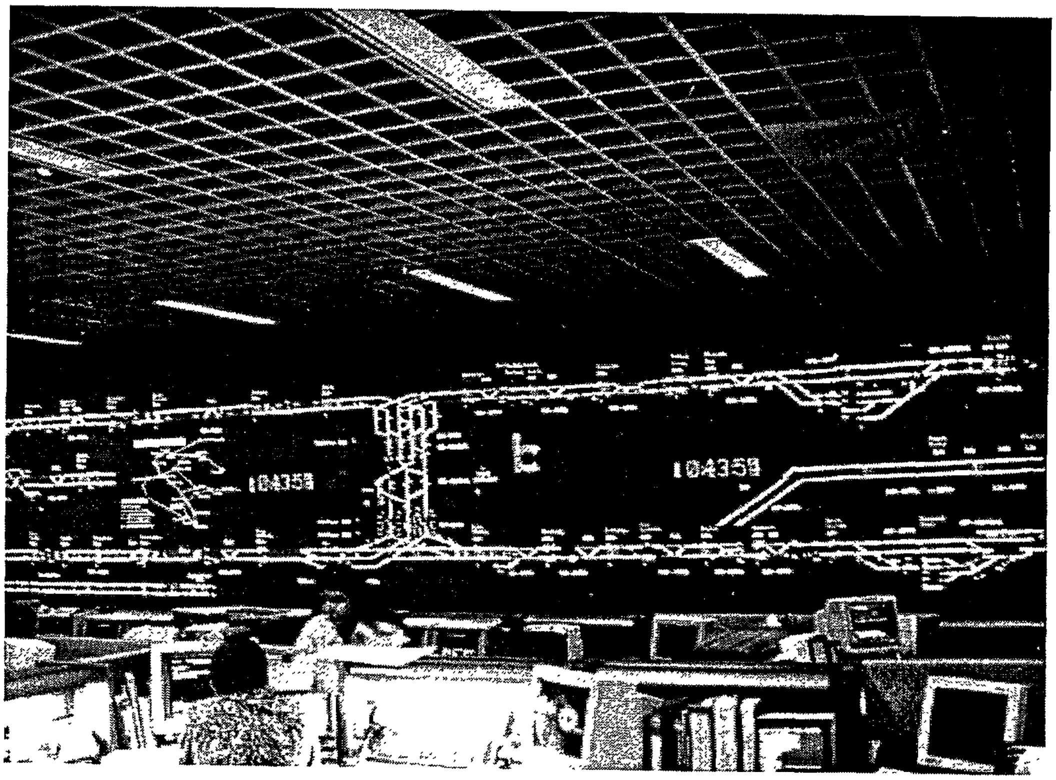

Figure 1.1.3. BART Control Center

City of San Jose TMC

Hours of Operation: As needed basis.
Security: Co-located within City facilities
Staffing: 4 maintenance technicians to support field system, 5 engineer/technical staff for systems development/ integration.
Facilities: Conference room glassed wall view of four position console.
Integrated devices: CCTV (19), VMS (9), HAR (one 1570 AM)
Communications: Fiber optic

Seattle Metro Transit Communications Coordination Center, Washington

Hours of Operation: 24 hours per day, 365 days per year.
Security: Keypad
Staffing: Limited night-time services: 3-4 individuals, midday 7 and evening 5 employees
Includes Emergency Operations Center
Systems Support: na
Facilities: Open floor architecture, modular consoles, video integration with extensive wall monitors.
Integrated devices: CCTV(40) in tunnel, AVL sign/mile post data reference.
Communications: Data assisted radio (6-450mhz & 2 800mhz) and fiber optic for CCTV in tunnel.

City of Bellevue TMC

Hours of Operation: As needed basis.
Security: Keypad
Staffing: Do not staff, no IM
Facilities: Closed operations room, video integration with monitors.
Integrated Devices: CCTV (9), Signals (140) with loops.
Communications: Fiber optic for CCTV and twisted pair for signals.

Washington State DOT TSMC, Seattle

Hours of Operation: 06:00-19:00 Monday-Friday, 09:00-18:00 Saturday and Sunday.

Security: Keypad

Staffing: Peak 2-3 Operators, six maintenance, one radio operator per shift.

Systems Support: 5 Engineers

Facilities: Glassed observations to operations room, open floor continuous console, video integration with monitors and large screens, independent communications area.

Integrated devices: CCTV (120) CMS (30), Detector stations (200), Ramp Meters (35). Incident response units (2)

Communications: Shared Fiber optic

Summary

The scope of the Traffic Operation Centers observed appeared to be divided between the DOT and local municipal TMCs responsibilities. The DOT TMCs usually included freeway surveillance, incident response, and motorist information and traffic management. The local municipality consistently concentrated on traffic signal system management. Even though many of the operation centers operated by local municipalities were quite extravagant, they were not regularly staffed to serve a traffic management function except during special events. Typical configurations included operator stations (up to twelve) and complete multi-function video integration. Over-design appeared to be the norm for signal systems centers. Those centers that considered multiple aspects of traffic management were carefully designed and encompassed mutual operational functions. The DOTS that focused on the total operations concept, multiple aspects of freeway/highway operations, appeared to be most successful.

In Southern California, through the Smart Corridor program, the local municipalities and Caltrans are bridging the gap between the Traffic Signal Operations Centers and the DOT Operations Centers. In Caltrans District 7 (Los Angeles area), they are developing an “expert” software which will hand-off responsibility and provide control to the proper authority. Through this mechanism, some of the institutional issues associated with jointly operated systems should be overcome.

The majority of operations centers observed have installed dedicated fiber optic communications. Although many of the sites visited were local municipalities operating in a limited geographic area, the majorii elected to own and operate a dedicated fiber optic network. Centers typically owned or shared State owned fiber.

Final Observation - What's in a name?

Not all ITS Traffic Operations Centers are truly a TOC. A large percentage of the toured facilities were sophisticated Signal System Centers that were packaged as conferencing facilities (conference rooms and consoles) that were not regularly staffed. The facilities that were truly a functional Traffic Operations Center combined surveillance, incident response, signal systems, traffic management, travelers information, maintenance, and enforcement functions at a single integrated facility staffed appropriately.

1.2 SURVEILLANCE TECHNOLOGIES AND APPLICATIONS

By: Glenn McLaughlin
Senior ITS Staff Engineer
Maryland SHA

In general, the transportation operations centers (TOCs) we visited utilized inductive loops as the detector of choice and included a moderate level of Closed Circuit Television (CCTV) camera coverage at strategic locations to monitor special events and incidents. Table 1.2.1 summarizes the numerical information on West Coast CCTV and detection deployments obtained during the Seminar. The unique aspects of detection and monitoring systems employed by each center are described in greater detail in this section.

Table 1.2.1 West Coast CCTV and Detector Technologies

Center Visited	Scope of System	Number of CCTV Cameras	Detector Type and Quantity
Caltrans, Dist #7, TMC	600 centerline miles	24 (400 planned)	Inductive Loop 1200 sites
Caltrans, EPI-Center	Earthquake damage region	8 full motion 10 slow scan	Loops 20 VIDS 2
LA City, ATSAC TOC	4000 intersections	67 (+35 being built)	Inductive Loop 2000 signals
City of Anaheim, TOC	250 intersections	18	Inductive Loop 250 signals
City of Santa Ana, TOC	250 intersections	16	Loops 250 signals WDS 4
Caltrans, Dist #12, TOC	280 centerline miles	30	Inductive Loop 360 sites
City of Irvine, TOC	400+ intersections	19 (100 planned)	Inductive Loop 210 signals
Oakland Bay Bridge	5 mile bridge upper/lower decks	16 on upper deck (40 planned)	Magnetic 40+ Optical 20+
BART Control Center	BART facilities	At each station	n/a
City of San Jose, TMC	2000 miles 660 intersections	19	Inductive Loop 200 signals
Seattle Metro Transit	Metro Bus lines	At each underground station	Sign post AVL 250 sites
City of Bellevue, TMC	140 intersections	9	Inductive Loop 140 signals
Wash DOT, TSMC	50 centerline miles	120	Inductive Loop (200 sites)

Caltrans District 7, Traffic Management Center

For monitoring traffic flow on the Los Angeles roadways, this system utilizes inductive loops, spaced at approximately 1/2 mile intervals, to detect vehicle speeds. The data is processed in the field by a Type 170 controller, which is polled by the central computer every 30 seconds. The system then identifies speed “bins” and assigns a color for display: 0-20 mph: red, 20-35 mph: yellow, 35+ mph: green. These colors are displayed on an LED map board at the Traffic Management Center to show general conditions.

The center also utilizes CCTV cameras, at strategic locations, for monitoring conditions. Video signals are returned to the center through a variety of media; slow-scan compression, 10 frames/second compression over a T-1 line, coax hardwire, and 120 kbs compression over a VSAT satellite. Most of the cameras provide a color display. Some of these cameras are used to verify messages displayed on VMS’s.

Additionally, Caltrans District 7 operates a call box system for emergency notification and leases helicopters from the LA City DOT to expand and enhance their traffic monitoring program.

Caltrans, District 7, Emergency Planning and Information (EPI) Center

Monitoring systems installed for the EPI center were not extensive because they were intended to supplement the existing TMC monitoring devices. The operation of the EPI Center traffic detection system is essentially identical to the Caltrans District 7 TMC. As part of the EPI Center deployment, Caltrans installed five weather stations in the surrounding mountains, to provide information on roadway surface conditions. Another unique feature of this system is the application of two video imaging detectors (VIDS) on I-10 and I-110 near the heart of Los Angeles.

City of Los Angeles LA DOT, Automated Traffic Surveillance and Control (ATSAC) System

From the ATSAC center, IA DOT can monitor and control traffic signals at 2000 intersections throughout the city. This system uses inductive loops for detection, polled by central minicomputers through type 170 controller interfaces in the field. LA has standardized loop installation, requiring all loops to be placed 200 feet from the intersection stop line. This placement keeps the loops out of the queue area, allowing them to measure free-flow speeds most of the time. From these data, the system derives vehicles per hour (VPH) and creates a dynamic time-space diagram, to constantly optimize the timing of the entire system. The ATSAC team is also developing a PC based system to perform the same tasks as the mini-computer based system, only with a lower cost architecture. This PC system will be capable of processing inputs from 512 detectors and controlling 256 signals, for every operating 486 PC.

The ATSAC system also incorporates 67 color CCTV cameras. An additional 35 cameras are being installed for the Smart Corridor project. These cameras are used to verify data coming back from the detectors and support traffic management during special events. Also, as a diagnostic tool, the video image can be superimposed on the graphical intersection displays generated by ATSAC to verify the data being returned to the center. The video coming into the center is a mix of 15 frames per second compressed and full motion. Figure 1.2.1 is a color monitor displaying an intersection monitored by a CCTV camera. Dectector locations are indicated by colored dots.

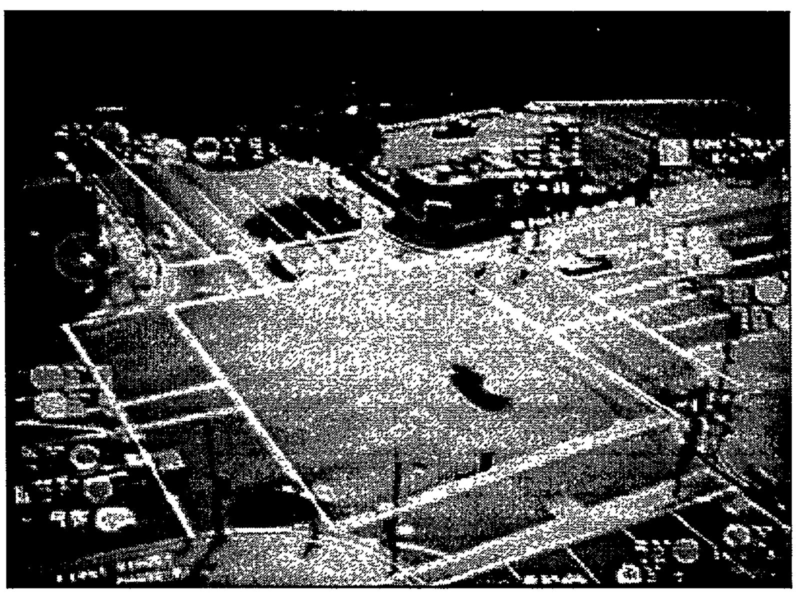

Figure 1.2.1. Intersection Monitored by CCTV Camera

City of Anaheim. Traffic Management System (TMS)

In many ways, the Anaheim system mirrors LA's ATSAC system. Traffic signals are controlled through a central mini-computer, using enhanced Urban Traffic Control System (UTCS) software. The detectors are all inductive loop type and the field controllers are type 170 microprocessors. Figure 1.2.2 illustrates a color display of the Anaheim roadway system displaying the locations of detectors, and controllers, and the current average speeds on the roadways. The 18 color cameras in the system are used primarily for monitoring traffic during special events. Each camera is mounted on a 45 foot tall pole, each has full pan, tilt and zoom capability, capable of 10X zoom.

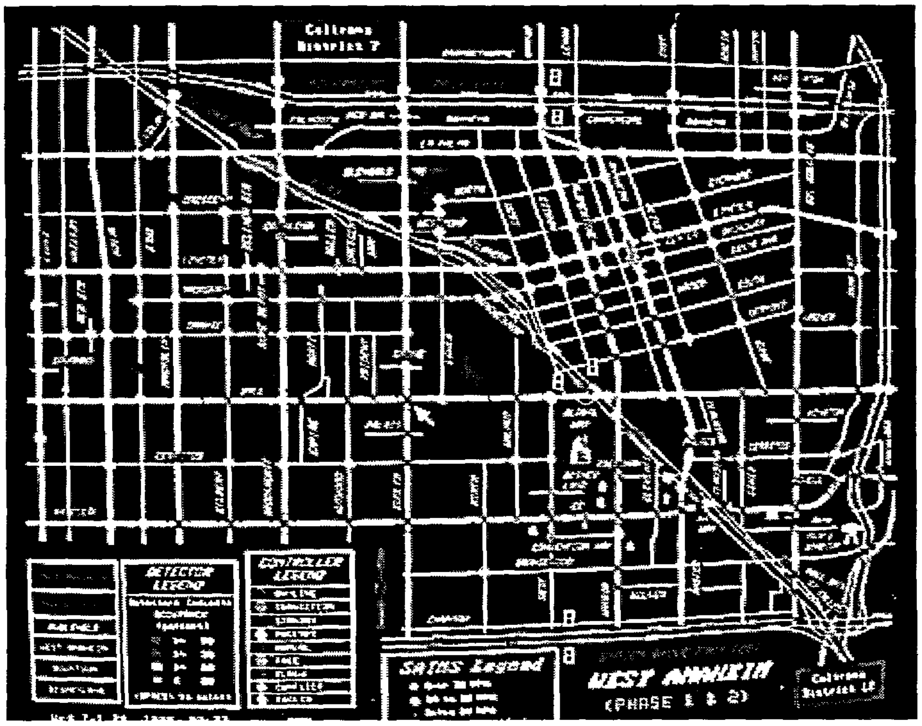

Figure 1.2.2. Anaheim Roadway Network

City of Santa Ana, Traffic Operations Center (TOC)

Although the architecture of the system was similar to other centers we visited, Santa Ana had some unique features, including the use of Multisonics IDC field controllers, instead of type 170 controllers. Santa Ana was also investigating the application of AutoScope Video Vehicle Detection Systems (WDS) for traffic signal operation. However, the application was deemed unsuccessful at replacing loops. Santa Ana also used color CCTV cameras to monitor traffic signal operations, but more emphasis was placed on using the cameras to confirm and report accidents. Of the 16 cameras in their system, three provided compressed video, at 15 frames per second, over T-l lines. The remaining 13 provided full-motion video.

Caltrans, District 12, Traffic Operations Center (TOC)

In many ways, the Caltrans, District 12 system is similar to the Caltrans, District 7 system. They use inductive loops, with type 170 field controllers to provide speed “bin” information (using the same demarcations as District 7; Red 0-20 mph, yellow 20-35 mph, and green 35+ mph). They use 30 color CCTV cameras for verification of detector data and identification of incidents. All cameras provide full motion video through a fiberoptic backbone. They also depend on privately contracted service patrols to provide live, on-the-scene incident reports. Also, similar to District 7, they are obtaining a helicopter for aerial surveillance.

City of Irvine, Irvine Traffic Research and Control (ITRAC) Center

Similar to Santa Ana, Irvine uses MultiSonics IDC field controllers to return data from inductive loops to the control center on a second-by-second basis. Traffic signal control is centralized, based on a UCTS architecture. Irvine uses 19 color CCTV cameras primarily for monitoring traffic signal operations, rather than incident management. All 19 of Irvine’s cameras are full-motion, brought back over their dedicated fiberoptic network. Irvine also maintains a test bed for a Video

Imaging Detection System (VIDS). In conjunction with this VIDS test, they are investigating artificial intelligence algorithms for incident identification at intersections.

Caltrans District 4. San Francisco, Oakland Bay Bridge Operations

The Oakland Bay Bridge Operations facility uses mainline metering, in the westbound direction, to regulate the flow of vehicles across the bridge. Caltrans could not install loops to monitor operations on the bridge because of the damage it would cause to the bridge deck. Instead, the system uses a combination of infrared optical beam detectors, providing data on general traffic flow and stopped traffic. Magnetic probes are installed under the bridge deck for each lane to provide lane specific data. The infrared beam detectors are spaced at 600 foot intervals and operate simply on the principle of vehicles breaking the beam. The magnetic probes are spaced at 1200 foot intervals and operate on the principle of detecting changes in the ambient magnetic field. Additionally, the system uses inductive loops prior to the mainline metering facility, in order to monitor the queue. All data is processed by type 170 controllers and is polled at a rate of 30 times per second. Data is displayed in the center on an LED mapboard, showing red or green, depending on conditions. Currently, the system includes 16 black and white cameras providing surveillance for the upper deck only. Plans are underway to install 35 to 40 cameras on the lower deck. The cameras are hardwired to the center (because they are so close) using standard coax cable. Also, the bridge has emergency call boxes installed at 600 foot intervals. These detection systems allow the operators to respond to incidents (have someone on the scene) within three to six minutes of their occurrence.

Bay Area Rapid Transit (BART) Control Center

Detection and camera surveillance on BART are not comparable to those used for highway facilities. Determining train locations is accomplished through continuity circuits in the rails and CCTV cameras are used only to monitor passenger activity at the stations.

San Jose, Traffic Management Center

Like other traffic signal control centers visited, the architecture is centralized, using a 4000 DEC VAX minicomputer for control. Unlike other centers, the San Jose system uses NEMA Traconex 390 units for local signal control and inductive loop detection. The central computer polls these units once per second. Figure 1.2.3. shows an intersection displayed on a TMC monitor that indicates the locations of dectectors, and controllers, intersection configuration, and real-time traffic conditions. Also, unlike other centers, the operators indicated that they were not happy with the performance of their inductive loop detectors. The San Jose traffic management center uses 19 full motion closed circuit cameras. The cameras provide an additional source of feedback, beyond the schematical data provided by the detectors.

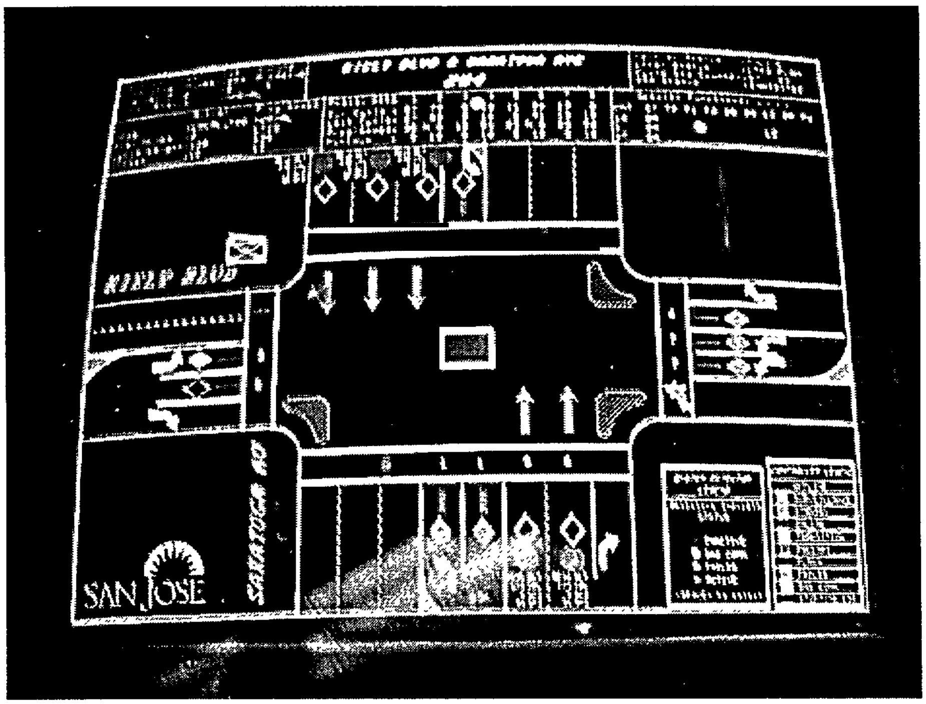

Figure 1.2.3. San Jose Intersection

Seattle Metro Transit

Similar to the BART system, Seattle Metro Transit has unique detection needs that differ from those of traffic management systems. Metro Transit manages as many as 950 buses in the AM and PM peak periods. Seattle uses a sign post transmitter system to provide Automated Vehicle Location (AVL) for their buses. The sign posts are broadcast-only radio beacons, which signal on-board systems in the buses of their proximity. This information, combined with dead-reckoning and a Data Assisted Radio System (which transmits data back to the central computer), allows operators to locate the transit vehicles within 250 feet 95 percent of the time, and within 400 feet 99 percent of the time. These signposts operate in the 49 MHz band and have a range of 300 to 500 feet. It is interesting to note that, because the system measures distance by the bus' odometer, tire wear can cause a 130 to 150 foot variance in the calculated vehicle location. There are between 225 and 250 signposts spaced at an average of three miles. The central computer is designed to poll 1800 buses in three minutes to determine their location. This capacity is not currently needed but is provided for expansion. Seattle Metro Transit also operates 40 black and white CCTV cameras in their terminals to monitor passenger activity.

City of Bellevue, Traffic Management Center

Bellevue uses a UTCS type signal control system, providing centralized control and monitoring of 120-130 signalized intersections. The system uses inductive loop detectors placed, on the average, 300 feet back from the intersection stop line. Traconex field controllers are polled on a second-by-second basis by the central computer. There are nine (9) cameras in the system, connected to a dedicated fiberoptic network, primarily used to monitor conditions around and approaching the central urban shopping complex. One unique on-going effort in Bellevue is the application of an air quality detector system. The operators have had some problems with this system because it reads higher concentrations of particulates at night due to thermal inversions and fewer vehicles displacing the air (even though overall emissions are down).

Washington DOT, Traffic Systems Management Center (TSMC)

Similar to the other jurisdictions on the West Coast, the Washington TSMC in Seattle employs inductive loop detectors (which they call "data stations") to monitor highway speeds and operate their ramp meters. The central computer polls the field controllers every 20 seconds. The system uses the loops for three types of applications: ramp demand detectors, ramp queue detectors, and mainline flow detectors. The system also uses CCTV cameras to monitor operations and verify incidents. The video switching is programmable to suit the operators preference. At the time of our visit, the system was programmed to sequence through all the camera images, displaying them on the main screen one at a time. Although this mode of operation is distracting, it does allow operators to monitor the entire system (at least part of the time). Of the 120 cameras in the system, 40-50 monitor operations in the tunnels, the remaining 70-80 are located at approximately one mile spacings along the freeway. The CCTV images are full motion, color video from the freeway, and compressed black and white video from the tunnels.

Summary

In general, the detection and surveillance systems for the TOCs visited were similar. All used a centralized architecture, most used inductive loops (where possible), and all used CCTV cameras. In some cases, the application of the various elements differed (for example cameras were used for incident verification by some centers and for traffic signal monitoring by others). Through the Smart Corridors program, however, California agencies are taking the next evolutionary step in joint control of operating systems (and sharing of detection data). Their progress should be monitored so lessons can be learned from their successes.

1.3 COMMUNICATIONS

By: Donald Hubicki
Director Transportation Systems Research and Development
New York State Thruway Authority

Communications on the West Coast varied by agency. Many utilize city-owned fiber optic cables while others use twisted pair phone lines. Fiber is in the future for several agencies. The following sections describe the communication hardware utilized by each of the agencies and facilities visited during the Seminar.

Caltrans

Caltrans District 7 is preparing to install fiber optics along highway right-of-way. They did an in-house design and went out to bid as a standard construction job for installation.

All communications for Caltrans District 12 is currently done via twisted pair phone lines. There is a desire to install fiber optic cables. Presently, the District is searching for private partners but are only in the early stages. A consultant has studied communication alternatives, which led to the recommendation to utilize fiber optics.

The Oakland Bay Bridge, District 4, uses coaxial cable for communications. Based on a study, future communications will be a combination of spread spectrum and frame relay, not fiber optics based on a calculated savings of $110 million over 10 years. Other agencies such as BART and Pacific Bell, however, are running fiber optic cables along the Bridge.

City TOCs and TMCs

The City of Los Angeles is currently utilizing a fiber optics backbone installed in 1984 in preparation for the Olympics. It was installed by the City for its use. Sonet OC-3 rings with several hubs/multiplexers are connected to intersection controllers by copper cable. Currently, the City is looking at OC-12, but they are waiting for other government partners to define needs and contribute funding.

Anaheim currently has two fiber loops around the City (12 strands of fiber) in loop configuration for redundancy. Seven hub locations have twisted pair wiring to intersections from the hubs. The system is T1 based, as Sonet was not yet a standard when they did installation in 1993. There has been some discussion about leasing fiber lines and/or right-of-way, but more with other government agencies than with private companies (as a local utility firm is planning to install a 100-strand fiber optic backbone in the City soon). In addition, there is a dedicated phone line connection with Caltrans to connect systems and share graphics/data.

A Fiber optics backbone is installed around the City of Santa Ana. The backbone uses twisted pair from the hubs out to the signal controllers and VMS locations.

The City of Irvine handles communications via city-owned fiber optic cables. There are future plans to install more fiber. Existing fiber is 24 multi-mode and 12 single-mode strands at major arterials, and 12 multi-mode and six single-mode strands at other locations.

San Jose has their own fiber optics installed around the City for use in CCTV connections. They are using twisted pair cables from the hubs out to intersections. There is also one microwave connection between units over the highway.

Bellevue has a similar system to San Jose. They utilize city-owned fiber optics for CCTV. Traffic signals are connected via twisted pair cable. Also, they have one microwave connection for one camera location.

Washington State DOT

Fiber optics is installed in Seattle, WA. The DOT is utilizing Sonet OC-1 with six hubs now in place. There are plans to upgrade three and add two hubs. They are looking to OC-12 with expansion. OC-12 was chosen because the funds are available and the difference between OC-1 and OC-3 is small.

Seattle Metro

Each bus operated by Seattle Metro has a Mobile Data Terminal (MDT) --a modified GE Delta-S radio installed that operates at.450 MHz. There are currently 1,147 MDT in the system. MDTs operate with data on a separate channel from voice. In conjunction with MDTs is an Automatic Vehicle Locator (AVL) system. At the time of the RFP in 1989, Global Positioning Systems (GPS) were not commercially viable. Therefore, it is a signpost-based system with 255 signposts in place throughout the Seattle bus route system. Signposts are typically mounted on bus stop posts and are spaced every three miles. They communicate to MDTs at 49 MHz, and have a range of 300 to 500 feet, and an interrogation time of one second.

1.4 HIGHWAY ADVISORY RADIO (HAR) AND VARIABLE MESSAGE SIGNS (VMS)

By: Steve Clinger
Urban Mobility/ITS Specialist
FHWA - Region 3

Highway Advisory Radio (HAR) and Variable Message Signs (VMS) are devices presently being used in many areas to disseminate traffic infromation to travelers. HAR broadcasts messages to travelers usually via an AM radio station. VMS can be permanent or portable and are placed strategically to provide motorists with information on incidents, poor traffic conditions, delays, and detours. Messages can be changed as needed. Not all of the agencies visited on the Seminar are presently utilizing HAR or VMS. A description of the systems are provided in this section for those agencies that have implemented one or both of these devices.

Caltrans District 7 TOC

Caltrans District 7 has 73 ground mounted VMS. They have plans for up to 100 more in the future. Existing VMS are located just prior to interchange off-ramps, where motorists can make a decision to detour. The type of VMS used are full bulb matrix. They also use flip disc VMS at a few locations on an experimental basis. Caltrans competitively bids for VMS in bulk, and stockpile, then deploy on a state-wide basis.

The HAR transmits over 1610 AM from 12 towers. They hope to eventually have 100 percent coverage of the freeway system with three more towers under construction and seven under design. Operators send routine and up-to-the minute traffic reports, including congestion limits, freeway lane closures and incidents. Teletype messages are instantly received by more than a dozen commercial radio stations.

When the Northridge earthquake struck, and the EPI Center was placed into operation, 20 additional VMS and 12 HARs were installed. These are still operational.

LA ATSAC TOC

The LA ATSAC operates seven VMS, of which five are located along the Santa Monica Freeway (Smart Corridor).

Anaheim TOC

The City of Anaheim operates six full matrix VMS and five more are planned for future installation. The VMS assist in mitigating traffic congestion, providing motorists with route guidance, current parking, and traffic conditions. Details of VMS include: 56 inch x 192 inch size, displays one to three lines of text, and two phase message displays. The City has an HAR tower located at the Anaheim Stadium to provide traffic information. The 10 Watt transmitter broadcasts over a two mile range on 1500 AM radio. Travelers can tune into pre-recorded messages and when necessary, live “on-the-air” broadcasts that are presented 24 hours a day. Two separately licensed stations provide information on local events, route guidance, and roadway conditions.

Santa Ana TOC

The City currently operates 13 VMS. They are investing a total of $8 million in a new ATMS. Future plans include the deployment of 15 more VMS and one to two 10 Watt antennas to provide HAR. Various types of VMS are now used including bulb matrix, LED, and flip-disc.

Caltrans District 12 TOC

Caltrans operates 32 ground mounted and 24 truck-mounted VMS. They have two transmitters in operation for HAR, and broadcast over 530 AM. Future plans call for two more transmitters. They also have one portable HAR that can be quickly transported to an incident scene or special event to provide motorists with traveler information.

Oakland Bay Bridge

Caltrans uses a single line dot-matrix VMS, made of 336 three-inch diameter lights arranged in seven horizontal rows of 48 lights each for the Oakland Bay Bridge. The characters are 24 inches high and readable from 1800 feet. Messages are presented using two or three displays of one or two words each. These displays are flashed in sequence at average reading speed. Each message is presented three or four times while a driver approaches the sign. Using this concept, the signs can be small, relatively inexpensive, lightweight, and highly visible. Small, light weight message signs are necessary because of the limited space and the weight limitations of support structures available for mounting. The message signs are about 30 inches high, 17 feet wide, and weigh about 700 pounds. Three VMS are placed in advance of the toll plaza to advise of HOV restrictions during peak hours. There are five VMS located on the upper deck (for in-bound traffic) to provide real-time information concerning the location of accidents, stalled cars, stopped traffic, and lane closures. Several VMS will be placed on the lower deck in the future.

BART Control Center

There are no VMS/HAR within the BART system. However, a “talking sign” system was installed at the Powell Street stop. The system uses programmable directional infrared transmitters to provide “way finding” for passengers carrying small receivers, which allow them to hear the messages through the transmitters.

San Jose TOC

San Jose operates nine VMS and one HAR to provide motorists with up-to-the-minute information on traffic conditions from the TOC. Control of the VMS is through a twisted-pair communications cable. Messages are displayed on 6 feet by 10 feet overhead sign panels using high powered five millimeter LED amber colored lights. Motorists approaching the San Jose Arena are given up-to-date transportation and parking information via the HAR. The HAR is broadcast over 1570 AM, and uses the 0.1 Watt transmitter technology. There are six transmitters mounted near VMS on supports. While the low power system does not require FCC licensing, and allows targeted messages to specific areas, the City stated in hindsight they would have rather gone with higher power due to the range of broadcast.

Seattle TSMC

Washington DOT operates 30 VMS along their 50 center line miles of Freeway. The signs are used to direct people into the I-5 express lanes and/or displaying the DOT highway (368-4499) commuter information line. Preprogrammed and tailor-made messages can be displayed and controlled either on-sight or remotely by TSMC operators.

Seven low-powered AM radio transmitters are used to broadcast highway advisory messages on 530 AM. (One HAR broadcast on 1610 AM). The transmitters are activated when Washington DOT wants to inform motorists about major accidents, significant road closures, or other relevant information. Personnel from the TSMC radio dispatch unit record and monitor the message, and activate large yellow blinking lights on the HAR signs to tell motorists when messages are being broadcast.

1.5 PORTABLE TRAFFIC CONTROL DEVICES

By: Ed Roberts
Supervisor - ITS Units
New York State DOT

Introduction

Use of portable traffic control devices for real-time traffic management purposes has increased tremendously in the last several years. Improvements in cost and reliability of portable devices such as highway advisory radio (HAR) and variable message signs (VMS) make it practical to incorporate these devices into more and more applications, including applications that extend over a considerable period of time. The West Coast Seminar was used as an opportunity to assess the current state-of-the-practice in the use of these devices.

It was of particular interest to the author to assess the extent to which portable traffic control devices might be used on a fairly extensive, semi-permanent basis to establish an “interim” freeway management system where none exists, or to extend an existing system until permanent devices could be installed. This approach has been discussed within the New York State DOT as an option to jump-start ATMS deployment in our upstate metropolitan areas.

Findings

Virtually all of the highway agencies visited indicated they use portable traffic control devices for some traffic management purposes. However, most applications fell into the following categories:

- Special events
- Maintenance and protection of traffic during construction projects
- Spot maintenance projects

In this context, there was one unique further application of portable devices that deserves more detailed discussion. That is the use of portable devices by Caltrans incident management teams.

Caltrans has established incident management teams that respond to significant incidents on the freeway system. Each team consists of three vehicles, two sedans and one pick-up truck. The pick-up truck is equipped with a truck-mounted portable VMS. Figure 1.5.1 is a photo of a pick-up truck with a portable VMS. One type of VMS is basically a large orange fabric-type sign with velcro strips that allow an operator to fasten on appropriate warning legends. Other trucks are equipped with truck-mounted electronic portable VMS.

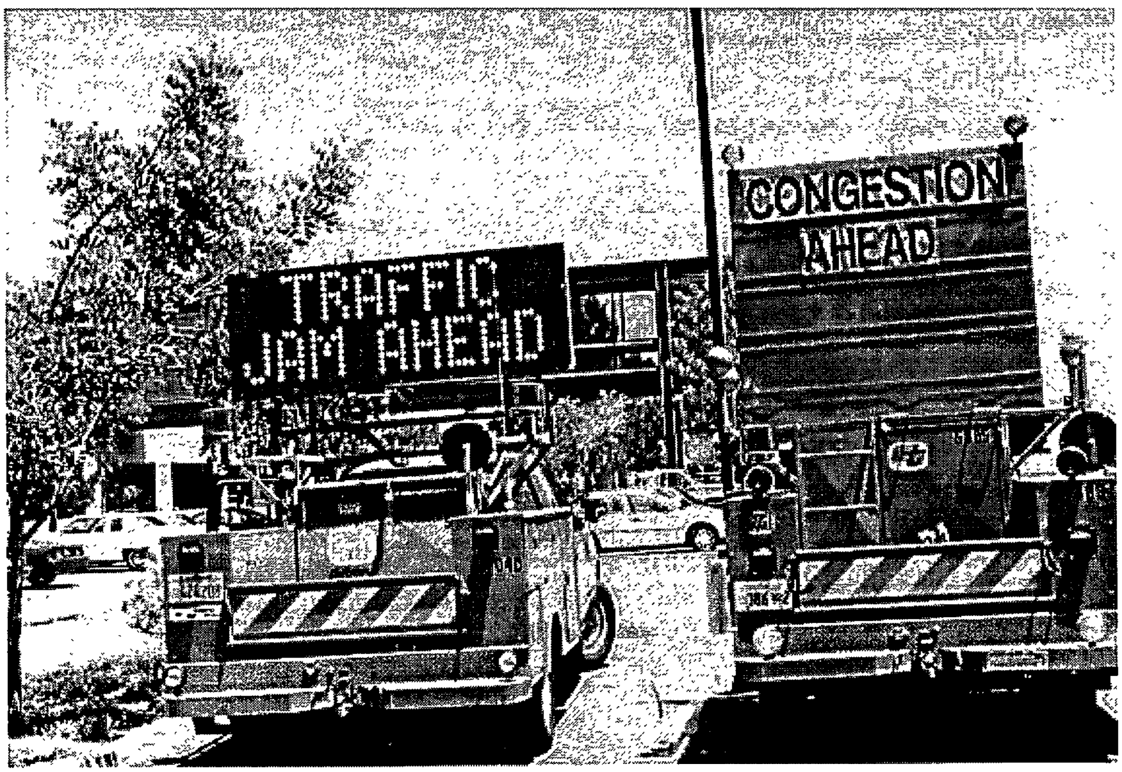

Figure 1.5.1 Portable VMS

Equipment on the sedans includes a radio for communications, a lap-top computer, and standard fold-up type warning signs and stands.

A pick-up truck and one of the sedans respond directly to the site of the incident. The pick-up truck is responsible for placing and maintaining itself in advance of the end of the traffic queue at a point where it can warn oncoming traffic of the existence of a back-up.

The accompanying sedan supplies support to the pick-up and coordinates field management of the team. This sedan may post warning signs at nearby ramps (such as ramp closed) if needed. The lap-top computer allows operators in the sedan to change messages on electronic VMS. The sedan maintains close contact with the traffic management center (TMC) and the California Highway Patrol (CHP) to provide input into system-wide traffic management and traveler information activities.

The other sedan roams about in the near vicinity of the incident, acting as the TMCs eyes and ears in terms of assessing the impact of the incident on the broader network and recommending incident management strategies and actions. It also maintains close contact with the TMC and CHP through its communications radio.

With regard to this activity, Caltrans personnel were careful to point out that the operators who are involved in manning the incident response team vehicles are all engineers who have been trained in incident response and management techniques. This ensures that reliable personnel are in the field for this important task. They also took care to point out one other detail that they consider to be critical in the way that the team operates. They have found that care must be taken when determining when it is desirable to use the portable electronic VMS. Its use is usually limited to situations where the incident has already had a severe impact on the system. This is because experience has indicated that this type of VMS can be distracting to motorists to the extent that the sign can actually contribute to the negative effects of an incident if not used properly.

While these applications represent effective use of the devices, they are not representative of the longer term, area-wide use that was of special interest to the author. When questioned further about use of the devices in the longer-term mode, the various agencies indicated they had considered this but had not done so to any significant degree. The following issues were brought up:

- There was a concern about the equipment reliability of the devices in a longer term application.
- Some were concerned about additional operations and maintenance costs and felt that when these are considered the portable devices might not really be cost-effective.
- Several felt that it would be much more difficult to ensure proper messages were being displayed or played at all times.
- Positioning of portable VMS to ensure effective visibility was a concern.
- Some agencies had poor experiences with the range of portable HAR.
- There was widespread concern about the ability to integrate portable devices into a comprehensive system that would provide the operational reliability needed.

Conclusions

Portable traffic control devices are getting widespread use by the agencies visited, but mostly in short term or special event type situations. The lack of use in a longer term scenario may be partly due to the fact that many agencies have extensive systems built already, and there seemed to be sufficient funding to allow agencies to program capital projects to install needed expansions rather than make-do with portable devices for any extended period of time. The NYSDOT's Albany Regional Office has had reasonable success in experiments using portable devices in this context. While it appears that portable devices can be successfully used in longer term situations, the concerns raised by the various agencies are valid and will need to be carefully considered as deployment proceeds.

2. SYSTEMS MANAGEMENT

2.1. INTEGRATED TRAFFIC MANAGEMENT SYSTEMS

By: Tony Augustin
Assistant Commissioner
New York City DOT

Introduction

Integrated Traffic Management Systems (ITMS) can be defined as systems that incorporate all of the different functions related to a region's existing transportation facilities. An ITMS receives and disseminates real-time transportation information to all modes in a region. It allows for the interaction between different modes by providing an "information pool". The system can provide different levels of control depending on the particular jurisdictional agency's desire ranging from limited access to information to full control of systems during all or part of the day.

Caltrans District 12 and Santa Ana

Several of the agencies visited are working toward ITMS. Caltrans District 12 in Orange County is the most sophisticated system and will be completed in 1997. There was no literature available about the facility but Figure 2.1.1 illustrates the overall concept.

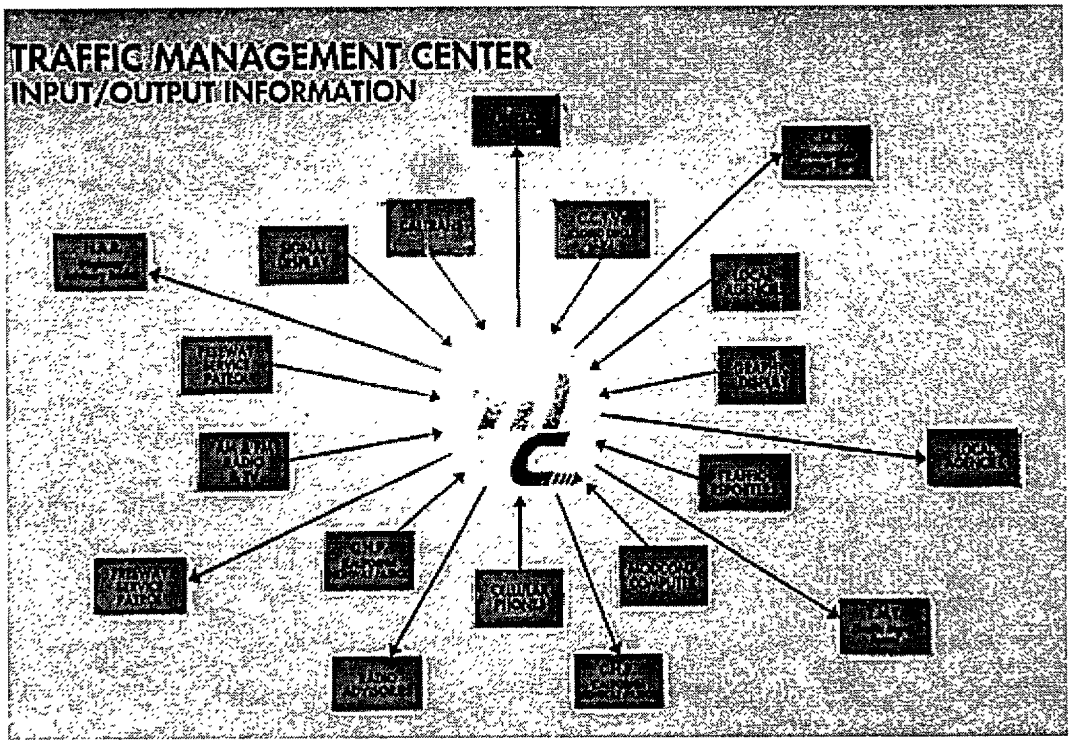

Figure 2.1 .1. Caltrans District 12 TMC ITMS

The City of Santa Ana is implementing several ITS projects to increase mobility and ease congestion in the area. They are closely tied to Caltrans District 12. Two ITMS projects in the planning stages are an Advanced Traveler Information System (ATIS) and a Mobility Enhancement Project for the Downtown/Main Place Corridor.

Santa Ana's joint ATIS project with Caltrans District 12 will consist of several components including a public information database, a highway advisory telephone, a voice responsive system for digitized HAR/HAT, community access television, and interactive kiosks. The main objective is to provide real-time transportation information to travelers before, and during their trip. Travelers can use the information to plan their trips so they may select alternate routes and avoid unnecessary delays.

The Mobility Enhancement Project for the Downtown/Main Place Corridor is a future $2.1 million project. It is intended to implement ITS technologies to improve mobility and reduce congestion by managing localized traffic flow and encourage the use public transit. The elements to be included are: kiosks providing transit information at bus shelters, interactive multimodal kiosks at Mainplace Regional Mall, parking and route guidance system in downtown Santa Ana and at the Mainplace Regional Mall, and a public advisory database.

Los Angeles Projects

Caltrans District 7 in Los Angeles County is planning to build a complete ITMS Transportation Management Center by the end of the century. Figure 2.1.2 illustrates the proposed network. The system will incorporate all modes including bus, rail, and air, and ITS components such as HAR, VMS, CCTV, and many others. Presently, Caltrans is working toward providing traffic information to the public through the "Pathfinder" ATIS experiment, "Commuter TV" monitors at various activity centers, and "Smart Kiosks" that provide congestion, bus schedule, and car/vanpool information. In addition, a component of the future system that has already been implemented is the Los Angeles Automated Traffic Surveillance and Control (ATSAC) system.

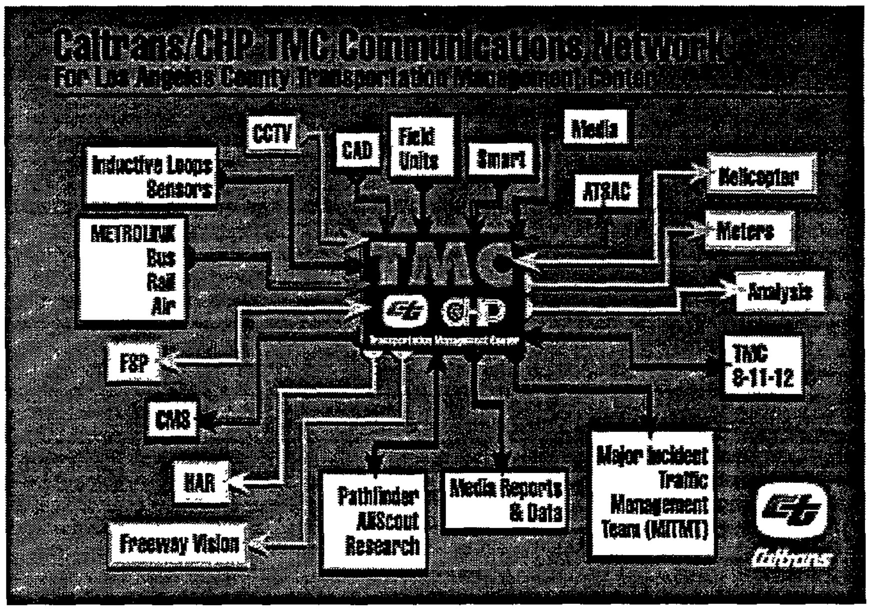

Figure 2.1.2. Future Caltrans ITMS

The ATSAC system is housed in a TOC located separately from the District 7 TOC. It is a computerized adaptive traffic signal control system that optimizes signal timing according to changing traffic flows. Other features of the system include[1]:

- automatically identifies equipment malfunctions
- responds to unusual traffic conditions caused by incidents
- allows centralized operational control of individual intersection timing during special events and emergencies
- automatically develops optimal signal timing plans customized for each area
- automatically collects traffic data for planning purposes
- automatically computes system evaluation measures (delay, stops, speed, etc.)
- automatically implements new signal timing plans from Control Center
- automatically activates changeable message signs, peak period lane controls, and turn restrictions whenever warranted.

This type of system works well for networks operating under marginal conditions, LOS D and E.

Smart Corridor Projects

There are several Smart Corridor Projects in progress in California. Each can be considered a subsystem of the respective ITMS. Two projects underway are the Los Angeles Smart Corridor (Santa Monica Freeway) and the San Jose Smart Corridor. The goal of these projects are to bring together all existing transportation facilities in a corridor, including freeways, expressways, surface streets, and public transit modes, for maximum operational efficiency, especially in relation to incident management, congestion management, and special event planning. It also includes cooperation between adjacent agencies for joint control and decision making.

The Santa Monica Smart Corridor is focused on the freeway and surface street system to maximize efficiency and throughput in Los Angeles County. It is a test bed for ATMS and ATIS strategies including:

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1 *Automated Traffic Surveillance and Control Evaluation Study. Department of Transportation, City of Los Angeles. June 1994*.

integrated software for incident detection, correlation and confirmation of incidents, multi-agency database development and response plans

detectors for monitoring and dynamic control of ramp meters and signal timing

utilization of HAR, highway advisory telephones, VMS, dynamic routing trailblazer signage, computer bulletin boards and cable TV

provision of accident investigation sites

emergency response teams and roving service patrols

CCTV

The San Jose Smart Corridor is part of the Silicon Valley Smart Corridor Plan. Unlike the Santa Monica Corridor, San Jose incorporates a light rail transit (LRT) component. There are eight major elements currently being designed for the Corridor. These elements include:

- Traffic Operations System (TOS) for surface streets
- Traffic responsive signal timing plan selection
- Diversion timing plans
- Interconnection of traffic signal systems, freeway TOS, and the Transit Agency
- Incident management procedures
- Study of improved Park & Ride lots known as Smart Parks
- Additional TOS elements on the freeway
- Establishment of corridor management and incident response teams

One of the most interesting components of the project is Smart Parks. These are park and ride lots located along the freeway that provide links to transit modes and car/van pools. In addition to providing these traditional services, they will provide real-time transportation information and other services such as dry cleaners, day care, fiiness centers, etc. Figure 2.1.3 illustrates the Smart Parks concept. A separate study is underway to evaluate the feasibility of implementing along the Corridor.

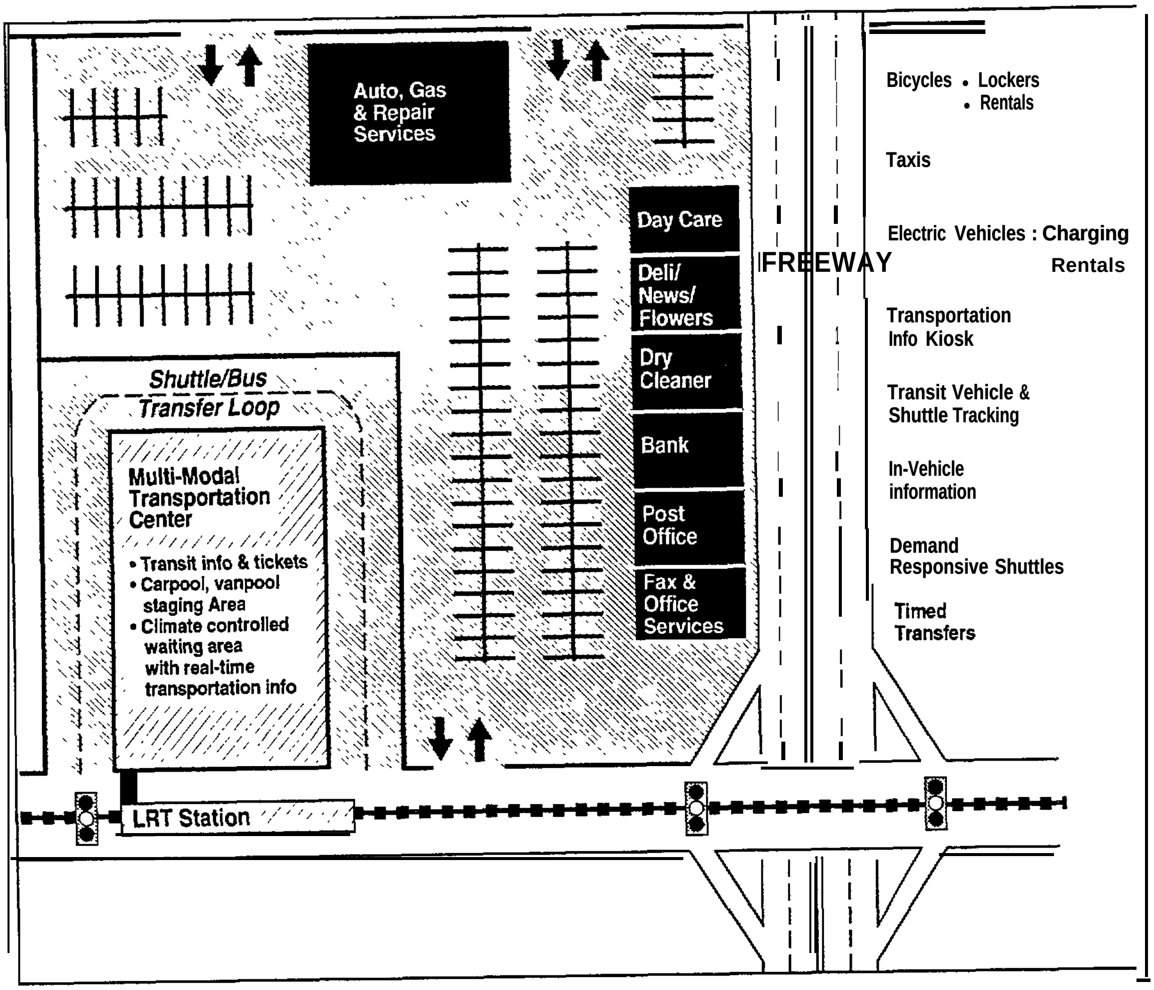

Figure 2.1.3. San Jose Smart Parks Concept

Summary

The level of commitment toward ITS deployment and research on the West Coast was very impressive, especially with systems such as Smart Corridors. In terms of ITMS, they had different levels and ranged from adaptive signal systems (LAATSAC) to Smart Corridors. These corridors will be able to monitor facilities in a large region and respond quickly and efficiently to incidents. The I-95 Corridor Coalition should seriously consider identifying potential sub-corridors where Smart Corridors can be tested and deployed. In the New York region there are three potential candidates for Smart Corridor projects that should be seriously considered.

1, The Cross Bronx Expressway section of the l-95 Corridor
2. The Van Wyck Expressway/Grand Central Parkway Corridors
3. The Long Island Expressway Corridor

It should be noted that there are a number of studies that have been undertaken or are proposed, which will look into the possibility of developing an Integrated Traffic Management System for this region. The New York City ITS Early Deployment Plan and the TRANSCOM Regional Architecture study both support the development of ITMS for this region.

It is rather disappointing when comparing the level of ITS deployment between the East Coast and West Coast to realize how far behind we are on the East Coast. It is even more disappointing when one realizes that the Northeast Region of the United States stands to benefit most from the implementation and deployment of ITS technologies because it suffers more from traffic congestion and has very little space for additional roadway capacity. Regions such as the Tri-State area must be more aggressive and proactive in ITS deployment. It is important to note that one of the main reasons the Northeast economy has been steadily declining is because of the level of congestion experienced on the roadways. Our economic survival depends on reducing the level of congestion and improving mobility in the region.

2.2. INCIDENT MANAGEMENT

By: Emilio Sosa
Construction Supervisor
New York State DOT

The visits made during the West Coast Training Seminar revealed a wide range of needs, views and attitudes with respect to Incident Management. They ranged from what is the general belief on the East Coast, where a great deal of effort is made to identify incidents and take the necessary steps to mitigate their impact, to the attitude on the other side of the spectrum of “it’s only traffic, it will eventually clear up.” The following are the insights gained from each of the sites visited.

Downtown Los Angeles Area

Caltrans District 7

The TOC is staffed 24 hours a day by Caltrans personnel. In addition, a CHP officer also mans the TOC. This has proven extremely helpful during incident management efforts by improving coordination between the two agencies. The TOC is currently being upgraded from a system that used a static map with different colored LED's to one that displays the system using color graphics. The new surveillance and control system is temporarily operating out of Caltrans Earthquake Planning and Implementation Center, (EPI-Center), while the TOC is being upgraded. Incidents are identified through detection algoriihms based on loop detector information and verified through CCTV observations. Information is also received through motorist call boxes. Incident and Freeway information is transmitted to the public through a variety of mediums. these include VMS (CMS), HAR, an 800 number, the media receives real-time information on a workstation based system through which graphically displays traffic information (Traffic Vision).

Public access to Traffic Vision is available through a cable television station or through INTERNET access. Closures and diversions in response to serious incidents are preplanned in order to minimize confusion and delays in implementation. In addition, Traffic Management Teams (TMT) are set up to respond and assist during incidents. The teams are equipped with portable VMS (CMS) as well as manually changeable signs using Velcro and pre-printed messages and cones. These are used to setup diversions and inform motorists of incident related information.

Caltrans also has Highway Service Patrols to assist stranded motorists. This helps by minimizing the effects that stranded vehicles have on traffic flow as well as the possibility of secondary incidents caused by driver inattention.

City of Los Angeles DOT

The TOC is manned during regular work hours and is primarily used to monitor and control the 1170 traffic signals under their jurisdiction. This is accomplished by the use of their Automated Traffic Surveillance and Control System (ATSAC). The system uses Critical Intersection Control (CIC) in order to optimize signal splits as well as the use of data from extensive detectorization for the selection of optimum timing plans **in** order to operate in a traffic responsive mode. The TOC also has CCTV for surveillance. The system does not have automatic incident detection capabilities. Incident information is received from Law Enforcement and the necessary steps are taken to modify timing parameters in order to meet the need of the situation.

The City of Los Angeles and Caltrans as well as CHP and other agencies are partnered under the Federally Funded Santa Monica Freeway “Smart Corridor.” Under this project responses to incidents are coordinated between the agencies via an automated incident response system. This “Smart” system analyzes incident information and generates recommendations for a coordinated response from the involved agencies. This project enhances the ability to manage incidents by ensuring that an effective, preplanned response is implemented in a timely fashion across jurisdictional boundaries.

Orange County

City of Anaheim:

The City has jurisdiction over 250 signals which are controlled from the TOC. The TOC is manned during regular work hours and during special events or planned incidents, as they like to call them. These planned incidents are due to the proximity of Disneyland, the Anaheim Ducks, California Angels, and the Anaheim Convention Center. There are approximately 200 planned incidents per year. During these events, preplanned responses are implemented through the use of timing plans, HAR, VMS, CCTV as well as coordination with Caltrans. During these events a CHP officer also mans the TOC in order to have enhanced dispatch capabilities. Unplanned incidents are rare and when they do occur have minimal effect due to the spare capacity on the surface streets. Due to these conditions, incident response is rarely needed. Traffic information is available to the public through a cable television station which displays color coded maps, kiosks, and INTERNET access to the color coded maps.

City of Santa Ana:

The City has jurisdiction over 250 signals. The TOC, as in most of the previous sites is used to monitor the operation of the City’s signal system and has the use of CCTV, VMS and HAR at their disposal for daily operations, as was the case in previous TOCs. The system’s detection is accomplished through the use of video detectors. However, after hours the local Caltrans District has full access to their signs, cameras, and signals. This is a departure from most of the other TOC's which protected their autonomy and were apprehensive of the larger agency.

Caltrans District 12

A new TOC is currently under construction. Currently, Freeway information is received from the District 7 office. District 12's incident management strategies are virtually identical to District 7 except that District 12 has to respond to the planned incidents from the Anaheim area. A situation that is different here than in any other site visited is the construction of a private toll road on State right-of-way (l-91). The private operator will be giving money to Caltrans in order to have them monitor the roadway during non-daylight hours. As in District 7, the relationship between the Caltrans engineers and the CHP was seen to be of great importance for incident management.

City of Irvine

The City has jurisdiction over 210 signalized intersections and the TOC is manned during regular work hours. System Video detectors are part of their ITRAC signal control system are used for incident detection and verification is done by CCTV. Signal timing parameters are then changed based upon incident needs. In order to improve operations, signals in the vicinity of Caltrans ramp meters are integrated for safety and efficiency. The City is currently exploring ways in which to allow Caltrans to control the cameras and signals in the vicinity of the freeways during after hours periods, similar to Santa Ana.

San Francisco Bay Area

Oakland Bay Bridge

The incident management system consists of CCTV an optical detector system, VMS and motorist callboxes. This system is monitored form the Toll Collection Plaza which is located on the Oakland side of the bridge. The Plaza is equipped with a lane metering system. The system controls the flow rate of 12 general use lanes at the Plaza which must merge to use the five lanes on the bridge. The Plaza also has three HOV lanes (3 or more occupancy) which are not metered. When incidents require it, they have tow trucks on site 24 hours a day in order to remove vehicles. Travel and incident information is transmitted via the VMS and the California Highway Information Network (CHIN). An incident management tool that they have at their disposal is the use of the lane metering. When an incident occurs they are able to reduce the metering rate in an attempt to reduce the congestion on the bridge which also assists the emergency services units as well as the tow truck in reaching the incident. If the incident involves the spillage of cargo, the cargo is left until the hauler can remove it. This seemed incredible since we were previously informed that a one land blockage could cause up to a seven mile backup. When questioned further we were told "Congestion, 1/2% only a traffic backup not an emergency. It will eventually clear up." (The group consensus was that this would be a good place to come to work and retire.) One incident type which most of us will not be involved with is that of a person attempting to commit suicide by jumping off a bridge. The Caltrans personnel are trained to handle these situations and frequently do with a great deal of success.

Bay Area Rapid Transit (BART)

The operations center is manned 24 hours per day. The center is equipped with a color graphic projection system which covers their entire network. The status of all their equipment is displayed by the system as well as the location of all the trains. The system can detect equipment and train failures which are subsequently shown on the graphic display. Appropriate action is then taken by the operator to remedy the failure alert. The system also monitors ventilation levels in the Cross Bay Tunnels as well as a fire alarm system. There is a well though out power distribution and redundancy architecture in place in the event of an earthquake. This allows power to be maintained in order to maintain appropriate ventilation levels in the tunnels as well as allow trains to reach stations and maintain internal communication.

City of San Jose

The operation of the TOC is similar to that of Anaheim where special events (planned incidents) are of primary concern. San Jose is the home of the Sharks hockey franchise. Currently 200 of the City's 660 signals have been brought on line. The rest are in the process of being brought into the system. The TOC is manned only during incidents otherwise the system is left to run in an automatic mode. Incidents are detected through calls from the public, police, or field personnel, At this point the appropriate timing changes are made, appropriate messages are displayed on their VMS and the situation is monitored via CCTV. The City is beginning discussions with Caltrans to set up protocols for a more global perspective and response to incidents.

Seattle, Washington

WashDOT

The Traffic Systems Management Center (TSMC) uses a loop detector system as well as CCTV and motorist callboxes to identify incidents. Traffic and incident information is relayed to the motorists via VMS and HAR In addition, the Department has a commuter information line, an interactive real-time color graphics representation of the roadway network is available over the Internet (FLOW MAP). The FLOW MAP is also directly linked to all major radio stations. Local television stations transmit WashDOT CCTV signals during peak hour broadcasts. The Department also has ramp metering at their disposal for incident management and daily traffic flow control. As was the case in California incident teams are available 24 hours per day for major incidents. The one difference is that they also act as service patrols during peak traffic periods.

Conclusions

The clearest point brought home was that in order to be effective in managing incidents one must take a global approach. It is important to form mutually cooperative relationships with other jurisdictions so that incidents can be managed properly. This will allow appropriate preplanned actions to be implemented in a timely and effective manner by the different agencies when an incident occurs. One thing to keep in mind when exploring relationships with smaller agencies is that some have a fear of being overpowered by the larger agency and may be less cooperative if not handled respectfully and as an equal partner.

2.3. MAINTENANCE

By: Ken Wester
Assistant District Administrator, Operations
Virginia DOT

Maintenance is an important component of the operation of transportation systems. This section describes the maintenance practices of each of the sites visited on the Seminar where maintenance issues were discussed. Although each of the systems have control rooms, it appears that use is limited to infrequent special events. The real benefits of the signal systems are maintenance monitoring and response, and the ability to establish signal timings quickly. It also appears that much of the maintenance on the systems is being contracted out.

Caltrans District 7

Caltrans District 7 employs eight people to deal with hardware maintenance of their 400 centerline freeway miles. A supervisor is on call 24 hours per day and State forces are also used for maintenance of the District's facilities. The California Highway Patrol, communications and maintenance personnel, and Caltrans (TMS) maintenance personnel are located in one facility. The Emergency Planning and Information (EPI) Center was established to handle maintenance and operations during emergencies.

LA ATSAC

The Los Angeles Traffic Surveillance and Control (ATSAC) Center has the capability to monitor the signals from a maintenance perspective. Alarms are used and response is from the central control room. If a problem cannot be handled from the control room, a field technician is dispatched.

LA employs eight traffic engineers, three system engineers and one technician to maintain and operate the system from the ATSAC TOC. In addition, if a fiber optic line is cut, the System has the capability to pinpoint the location of the cut so resources can be dispatched as quickly as possible. The ATSAC has become a dispatch center for signal maintenance, however, much of the outside signal work (i.e. replacing bulbs, removing downed poles) is contracted out.

Caltrans District 12

Due to the extreme traffic conditions in the district, the freeways cannot be closed during the day. A privatized Freeway Service Patrol is employed under the direction of the California Highway Patrol and the Center is connected to the local signal/traffic management systems in Irvine.

Irvine TOC

Caltrans has the ability to control Irvine's signals during off hours. The focus of the TOC is optimizing signalized intersections and overseeing operational support including maintenance and dispatching technicians.

BART

The BART Control Center monitors the movement of trains, maintenance problems, and the power grid, and dispatches technicians for maintenance problems.

San Jose TOC

San Jose built a TOC to optimize traffic signal timing and provide more efficient maintenance. The City Council provides funding for five traffic engineers and four maintenance staff. San Jose is looking for funds for ATMS hardware including CCTV, and VMS.

Seattle METRO

Radio transmissions are received in the order they come in and if the computer fails, the system falls back to voice. There are three priority categories for calls: lowest - request to talk; mid - request for a mechanic; and high - emergency alarm. Dispatchers must participate in a six week training period to learn to use the radio system.

The AVL is a sign post-odometer based system and requires seven radio technicians in the field for operation. Sign posts are maintenance intensive and there is a lot of equipment on the buses. An automatic rider counter is also installed on the buses.

Bellevue TOC

Bellevue, Washington has an automated traffic signal system encompassing 140 traffic signals and nine CCTV at critical intersections. The Center is used mostly for major events and incidents and the signals are traffic responsive most of the day. Retiming is the focus to improve traffic flow. Staffing includes one assistant traffic engineer, one maintenance foreman, two technicians, and two signal crews with two people each.

The communications backbone in Bellevue is city owned fiber/copper which has been nearly flawless. They are presently exploring the use of microwaves for communication. In addition, more conduit is being installed for future use. The City of Bellevue waives fees working with any company and pays only for conduit boxes. There is no incident response by the City - all problems are reported to the Police department and, in turn, the Police call the signal technicians.

Washington DOT TSMC

Washington DOT's system in the Seattle District encompasses 120 cameras, and 35 ramp meters on 50 miles of roadway. Student operators are employed at the TOC as well as five engineers, and six people in the field to maintain the field equipment. The Statewide Radio System is located in the Center as well as control of the tunnel during off hours. The tunnels have their own TMC and their cameras cannot be controlled by the Center.

2.4 PROCUREMENT

By: Stever Koser
Manager, ITS Coordinator
Pennsylvania DOT

Procurement has become a major challenge in the design, construction, operation, and maintenance of transportation facilities. Low-bid and invitation-to-bid has traditionally been the norm. As ITS expands, new innovative methods of obtaining services and equipment may be needed. Alternatives such as Requests for Proposals (RFPs), design-build, and design-build/warranty are examples of new methods. New products for ITS are on the market, however, their effectiveness may not be proven. In addition, there may only be one manufacturer for a particular product that is needed. Thus, requiring sole-source acquisition. This situation makes it difficult to determine if the best product is being selected. Many of the sites visited on the Seminar have used RFPs and design-build methods of procurement as well as low-bid and invitation-to-bid. This section provides a brief summary of the procurement methods used by the centers visited.

Caltrans

District 7 of Caltrans uses competitive bids for procurement of VMS. RFPs are issued for the functional specifications of these devices. All other equipment is obtained through low-bid or invitation-to-bid processes. The EPI center was design-build and a RFP was issued.

Caltrans District 12 obtains all equipment through low-bid or invitation-to-bid.

City TOCs

The LA ATSAC primarily uses both low-bid and sole source for procurement. Sole-source is used where compatibility is a concern. Low-bid is used when compatibility is not a problem. However, they have used the functional specifications (RFP) process to obtain some equipment. For example, their 14 inch monitors were purchased through low-bid. For their four foot projection screens, an RFP was issued. This center has some flexibility in not selecting low-bid everytime.

Anaheim also uses sole-source procurement and functional specifications (RFP) for some equipment. The design of their TOC was performed by a contractor selected through the RFP process. Most equipment was obtained through design-build.

The Santa Ana TOC was constructed through a two step process. Design was performed via RFP. Construction was low-bid. Bellevue, Washington used this process as well but has also used sole-source procurement for traffic signal controllers. San Jose contracted for the design of their facility.

Transit Control Centers

The design of the BART control center was performed through an open-ended contract with a consultant and in-house staff. Construction was low-bid. Seattle's $5.0 million automated vehicle identification system was designed and constructed through an RFP.

Washington DOT TSMC, Seattle

The TSMC in Seattle, Washington uses several methods of procurement including sole-source, RFP, and design-build. Sole-source is used for obtaining certain types of equipment such as VMS and HAR. The center was designed by a consultant selected through an RFP process. Construction was design-build and was funded using Interstate construction funds

3. POLICIES AND ISSUES

3.1. INTER-AGENCY COORDINATION

By: Micheal Eadicicco
Operations Coordinator
I-95 Corridor Coalition

Background

Throughout the four day West Coast Seminar we visited several installations that included Caltrans District offices 7 and 11, the BART rail system and Oakland Bay Bridge, the City of Los Angeles Automated Traffic Surveillance Center (ATSAC) and freeway system and the cities of Anaheim, Santa Ana, Irvine, and San Jose in California. In addition, the small town of Bellevue, Washington provided an opportunity to appreciate first hand that the value of ITS technology is clearly evident in a location that reflects the needs of small town America. By contrast to the City of Seattle, whose Transportation System Management Center and Metro Transit Operations are extensive and sophisticated, it became clear that large or small the need to manage our diversely complicated transportation systems both intelligently and in a cost efficient manner is both critical and necessary.

Los Angeles and Ventura Counties, CA-District 7

This was our first scheduled stop and immediately upon entering the TOC, the California Highway Patrol Officer (CHP) on duty was clearly evident. Sparsely staffed at the time, the absence of others seemed to underline the importance of his presence. Unlike some other locations on the Seminar, the Caltrans District 7 Operations Center is the site of extensive coordination activities. At the time of our arrival the reason for the lack of personnel on duty was not quickly evident. However, as we were escorted across the hall we were invited to the Department's Emergency

Planning and Information Center (EPI). Created in the wake of the 1989 disaster, this room was alive with energy. Work stations were provided for several key representatives from other agencies. The aforementioned CHP officer acts as a liaison between his department and Caltrans to provide on-site police personnel at accident scenes, dispatch authorized towing services, and work in cooperation with Caltrans maintenance and construction personnel. Combined with the use of computer aided dispatching, helicopter surveillance, a service patrol program sponsored by the Los Angeles County Metropolitan Transportation Authority and advanced ITS technologies; Caltrans has developed a sophisticated Traffic Management Operations Center that effectively handles both routine traffic signal control and overall district wide emergency incident management. Most notable among the relationships developed by Caltrans is one that automates the transfer of both traffic and congestion related information to the traffic reporting services directly via computer from the EPI Center's graphic display devices. Plans currently underway to combine the scope and responsibilities of the EPI center with the District 7 TOC will provide optimal service for their constituencies.

City of Los Angeles, CA.

Our visit to the City of Los Angeles' Traffic Center reflected some distinct differences regarding the management of control centers throughout the State. This center, staffed from 6:00 am to 6:00 pm, seven days a week, is primarily designed for the monitoring and control of the city's extensive traffic signal system. An outgrowth of the need to prepare for the 1984 Olympic Games, a network of over 500 signalized intersections have been automated as a result of that $220 million dollar project. Although direct contact is maintained with California Highway Patrol personnel, no liaison officer is directly assigned on-site at the center. Concerned primarily with routine traffic congestion and planned events such as construction, primary response is managed by the Department of Transportation's Traffic Operations officers; a contingent of civilian employees who are the responders to non-criminal activity throughout the city's signalized traffic network. While Caltrans monitors arterial highway activities, the City of Los Angeles is primarily responsible for the network of city streets and pedestrian related activity. Off-hour incidents related to the operation of the signalized traffic network are handled by Transportation Department personnel on an as needed call-in basis.

City of Anaheim, CA.

As a city, which hosts in excess of 20 million visitors per year, the traffic congestion generated by Disneyland, Anaheim Stadium and the surrounding network of hotel/motels requires substantial coordination. Although no local law enforcement personnel are assigned to the TMC, the center utilizes a computer aided dispatch system to contact the local Police Department during both planned events and emergency situations.

City of Santa Ana, CA.

Organized for the purpose of monitoring, managing and controlling the 250+ traffic signals throughout the City, Santa Ana works closely with, but independently of Caltrans. In the near future, Caltrans will have control of the TMC during off-hours inclusive of its signalized systems, VMS, and HAR. Additionally, Santa Ana will be able to access the Caltrans network but will not have overriding control. Like most of the systems we observed in the smaller cities, they operate on a limited hour basis and are primarily structured to only monitor traffic system operations. Taking a lesson from their Caltrans counterparts, the city will soon provide a work station at the TMC for a Santa Ana police officer. This will not only solidify their relationship with the local police department but will permit a transfer of information between the Santa Ana Police Department Emergency Operations Center and the city TMC.

Orange County, CA-Caltrans District 12

This visit represented for me the most informative of the trip. It was here that the positive aspects of the relationship between the California Highway Patrol and Caltrans were most evident. Many municipalities both large and small work closely with their local and State police agencies but in California one cannot avoid the overwhelming sense that the relationship is honestly embraced by both sides. It simply reflects a common sense approach to good transportation management.

Most interesting is the advancement of extensive public/private partnerships for the management of miles of toll roads that traverse Orange County to San Bernardino. With automated toll collection and HOV lanes for three or more people, the principals of congestion pricing are utilized under the watchful eye of Caltrans and the California Highway Patrol. Hired for both maintenance and law enforcement, the presence of the State remains constant. Active freeway service patrols, which cover some 90 miles of roads, work stations staffed by both civilians and police personnel, and the support of the FHWA reflect the perfect marriage of many diverse agencies mutually cooperating for the public good and the advancement of Intelligent Transportation Systems.

As a result of our meeting with the Caltrans personnel, Lt. Dwight McKenna of the California Highway Patrol was invited to speak at our next HOGS meeting in Bedford, New Hampshire on September 28, 1995. He discussed the principles of inter-agency cooperation.

The Cities of Irvine and San Jose, CA.

Both of the cities of Irvine and San Jose operate TOC's, which were developed for the express purpose of controlling their signalized traffic networks. Although meaningful communication exists between the respective operations personnel and local police authorities, no emergency management for unplanned events is coordinated under direct control of either center; that responsibility rests with law enforcement and the respective TOC's provide only signalized traffic management assistance. San Jose has developed both an Inter-Jurisdictional Traffic Systems Committee to address technical issues and the South Bay Transportation Committee to coordinate police, fire and Emergency Medical response activities. However, what sets San Jose apart from their neighbors is an extensive program to promote "Smart Parks" at developing inter-modal locations. These parks would encourage strong public/private partnerships by promoting the business community to encourage investment in small and medium size businesses such as food stores, dry cleaners, child care centers and automotive service outlets at those locations. Although much more needs to be done, by all accounts this program has the potential to develop into a lucrative relationship for all concerned parties.

Oakland Bay Bridge, Oakland, CA.

The Oakland Bay Bridge, managed by Caltrans, reflects both the operational requirements and organizational structure of many of the toll authorities who are members of the I-95 Corridor Coalition. As a heavily traveled transportation facility, extensive inter-agency coordination is required to deal efficiently with everyday operational occurrences. In-house personnel are specially trained to handle all towing and fire-fighting requirements including the handling of hazardous material incidents. They require daily assistance from agencies such as the CHP, the Oakland City Fire Department, local EMS, the Coast Guard, and at times the U.S. Navy and Army. Although these agencies do not have staff permanently assigned to the facility, they are by nature of the frequency of events always close by. I found the facility to be very manual intensive because the use of ITS technology is only beginning to be explored. With the exception of plaza and ramp metering, very little state-of-the-art technology was in place. A program is currently underway to advance the use of a more sophisticated electronic toll collection system.

Metro System- Seattle, WA.

Managed by the King County Department of Metropolitan Services, the city surface transit system utilizes Automated Vehicle Location (AVL) System technology. Monitoring the activity of some 950+ buses during peak periods their TOC houses several civilian dispatchers who work closely with the system's drivers to ensure a safe, on-time operation. The coaches are capable of operating using both gas and electric power, and are constantly monitored on a 24-hour basis. Activity of an emergency nature is coordinated with the Seattle Police, Fire and EMS Departments, and additional traffic congestion information is gathered from the Washington State DOT. Currently under development is a more formal and sophisticated Inter-Agency coordination plan involving all appropriate State and City agencies.

Washington State, DOT

Washington State has supported development of an extensive TSMC. Through the use of radio-based communications, video cameras, and a VMS network, the two year old center works closely with the State Police who patrol the system for breakdowns and assist the State's Hazardous Response Team when required. It relies on the State Police Operations Center to oversee the network during off-hours and, on an as needed basis, DOT personnel are called to respond as required.

Conclusions

Without exception every agency visited clearly embraced the critical importance of solid inter-agency cooperation. In California, the leadership of both Caltrans and the California Highway Patrol report directly to the same gubernatorial appointee. This has most definitely contributed to the development of excellent relationship building between both parties. When a management philosophy is supported at the top of an organization, it is more easily accepted by those charged with making it work. But make no mistake, periodic frictions do exist among those most closely responsible for incident management but those counter-productive interactions are both infrequent and most importantly are used as case studies to improve on a system that by most accounts works well for all concerned.

Their approach is simple- "preserve an individuals operational responsibility and work cooperatively by embracing established Incident Command philosophies that recognize both the expertise and experience of the various agencies involved to mitigate both planned and unplanned events."

3.2. INTER-JURISDICTIONAL CONSTRAINTS

By: Charles Ukegbu
ITS and Mobility Program Coordinator
New York State DOT

It seems that agencies on the West Coast have a major advantage due to the existence of a high level of recognition of the necessity for coordinated traffic control and a public willingness to channel resources to the solution of transportation problems. However, the agencies themselves have been innovative in their approach to addressing transportation issues.

One of the major strategies that the agencies have adopted to advance their shared transportation vision is the pooling of resources. What is unique about their arrangement is the minimization of formal legal ties in the form of Memorandums of Understanding (MOU). The overall emphasis is on working at the staff level to build up the required trust, which, in their assessment, is one of the most important ingredients required for the success of their transportation systems. Such proactive communications is something that needs to be encouraged within the I-95 Corridor, and between sub-systems of the Corridor, especially because there are so many jurisdictions. Agencies within the I-95 Corridor should build on their existing relationships to define strengths and options in coordination with all agencies.

A critical issue in multi-agency environments is how to address the issue of “control” of ITS systems. The approach along the West Coast has been to develop “incident manager” concepts, protocols and expert systems software to facilitate the sharing of resources among agencies to maximize transportation system efficiency, while respecting agency autonomy and limiting liability exposure. This is a concept that would be invaluable to the I-95 Corridor agencies.

Several kiosk projects have also been developed along the West Coast through collaborative efforts between several agencies for data sharing, HOV network plans, lane operations and enforcement (legislative approved fines starting from $271.00 for HOV lane violations), Bus/HOV bypass operations along HOV lanes, ramp as well as mainline metering operations, Rapid Transit Control Center and Automated Vehicle Location Systems, Electric car (Bus)/Trolley operations, surveillance, Highway Advisory Radios, incident management systems, ferry operations, etc.

The following is a summary of strategies that have aided in the progress of the ITS program along the West Coast:

- The encouragement of police presence in the Transportation Management Centers (TMCs) and the use of agency “traffic agents” as first line of incident detection, before Traffic Action Teams are dispatched. In addition, cooperation with other city agencies such as the utility companies has led to shared communications infrastructure such as the joint use of fiber-optic lines. The TMCs sometimes assist in the dispatch of utility maintenance operations equipment and police addressing emergencies. In fact, in San Francisco, the fire department equipment is sometimes dispatched from the Bay Area Rapid Transit (BART) Control Center.

- "Champions" or individuals with a vision and a desire for success are encouraged to foster cooperation and confidence.
- Definition of the need for traffic systems management in terms of the impact on economic development and quality of life.
- Let each agency do what they normally do best - use all talents optimally.
- Partnerships have been developed based on professional acquaintance and informal contacts. Meetings are held very often to keep a dialogue going and solicit the opinion of each of the parties as decisions are made to ensure consensus and ease of implementation.
- There is a general willingness to try innovative and new ideas to solve critical transportation issues.
- One strategy to ensure innovation has been the active involvement of local universities and research institutions in most of the traffic operations (Centers for Urban Transportation Research), including live data feed to universities and research institutions for experimentation, training, and operational testing. This includes active use of university students as TMC personnel with staff supervision by agency employees.
- Not all items purchased through "low-bid".
- Use of different disciplines in the TMC - systems, electrical, planning, public relations, etc.
- Outreach is a built-in component of each TMC operation - in terms of the types and availability of brochures, design of the TMC to provide for proximity to the conference center and glass partitioning for visitors (without disrupting normal operations).
- Close affiliation and support by political leaders and constant information to elected officials.

Constraints include:

- Several complaints that the sources and application of funds were too rigidly defined in some cases. In Los Angeles for example, the new TMC (the Emergency Planning and Implementation Center) could not be instantly merged with the old TMC because the approved fund sources had to be kept separate.

- Some agencies considered as latecomers to the traffic management environment and have to be brought up to speed on various concepts and practices. This sometimes leads to delays while efforts are expended to make everyone comfortable.

Planning and Implementation of "Smart Corridor" Programs on the West Coast

The major key to success is the development of consensus on a shared vision and cooperation among personnel from various agencies. In Los Angeles, for example, the "Smart Corridor" project was started by LADOT, detail design was done by the MTA, public advisory elements were done by CALTRANS, etc. Each agency has one vote. No one agency has "the lead", but meetings are mostly chaired by the MTA as the umbrella transportation agency in the Los Angeles metropolitan region.

- There are no Memorandums of Understanding. The strategy is to bring in policy makers and legal staff later in the process, after the staff-level working relationships have been established and the level of trust is built up. This implies that some degree of staff empowerment is encouraged to optimally utilize each agency's strengths. However, conceptual executive support was obtained for the program ahead of time, and periodic briefings to executive management are held.
- The Metropolitan Planning Organization (MPO) has no direct role in the project in the Los Angeles area but MTA required that each participating agency should develop ITS to have an interface capability with other agencies' systems (open architecture concept). In the San Francisco and San Jose area however, the MPO played critical coordinating roles in the success of the ITS program. The same occurs in the Seattle, WA area. Therefore, each location should develop a process that recognizes its uniqueness and optimally utilizes/involves all key stakeholders.
- Instead of a "Corridor Manager" concept, the agencies along the West Coast (especially in Los Angeles), adopted the idea of an "Incident Manager". This means that each agency controls systems located in their area of jurisdiction. The software however monitors the overall system and when an incident occurs, it assigns

responsibility/authority without prompting. The “incident manager” does not have the authority to implement any plans without the responsible agency’s prior approval through confirmatory commands. The “Incident Manager” also suggests/generates a response plan and identifies who is responsible for the area within its jurisdiction. This would be an appropriate concept for such a diverse area as the l-95 Corridor.

- There is a need for continuous public outreach to businesses prior to and after installation of ITS. This was a critical component of the success of the TMC in Santa Ana, CA because it ensured that the businesses understood the goals of the transportation program and supported the initiatives. Outreach should be built into every stage of ITS implementation to ensure that through the feedback that is obtained, necessary modifications could be made to ensure that what is implemented meets the needs of the users of the transportation system.

3.3 JOINT USE OF DEVICES

By: Al bet-t Ari
Executive Director Regional Operations
New Jersey DOT- Region II

One objective of the Seminar was to determine if there is any joint use of devices and, if so, to what extent. A number of the agencies visited allowed other agencies to monitor their operation via wide area networks, providing an opportunity to implement operational decisions based on the information obtained. An issue raised was, were they also allowing those agencies’ transportation management systems to issue commands to the monitored agency’s system.

It was not surprising to learn that the joint use of devices by any of the agencies visited was nonexistent; there usually is a reluctance on the part of most agencies to give control of their operations to another. However, the city of Santa Ana is in the final stages of negotiating an agreement to allow Caltrans operation of their signal system and CCTV cameras during the hours their personnel are unavailable. Other cities currently considering authorizing Caltrans to operate their systems after normal business hours are Irvine and San Jose. Most of the municipalities visited, when questioned, were not adverse to the possibility of sharing their devices with Caltrans because of the high regard for Caltrans' traffic operations expertise. A similar situation existed with the one municipality visited in Washington and the Washington State DOT. However, neither Caltrans nor the Washington State DOT was interested in allowing joint use of their devices.

3.4. BENEFIT/COST ASSESSMENT

By: Michael Castellano
Transportation Management Engineer
FHWA - PA

Introduction

The I-95 Corridor Coalition ITS West Coast Training Seminar covered a wide range of transportation centers in Southern California, San Francisco, and Seattle. Seminar participants visited highway, bus, and subway operations centers and were given the opportunity to interact with management and other personnel from these centers. The Seminar was a rewarding experience for myself as I will be able to share the ideas and lessons learned and apply them to my daily work activities.

One of the most critical issues facing ITS professionals is the development of reliable benefit-cost information to use in promoting ITS technologies to key transportation decision makers. Benefit-cost ratios (B/C) and related data are effective tools in ensuring the efficient use of project funding and assessing the benefits gained from the investment of money in a particular project. Whenever public funding is used for any type of public works project, regardless of the funding sources, it is important to show that the investment of dollars will provide a return for the taxpayer.

This report will provide a short summary of benefit-cost information reported by the traffic management centers (TMC) operated by both state and city transportation departments. The information presented was obtained during visits to each TMC, and in most cases an analysis supporting the data was not obtained during the short visit. There does not appear to be a standard method of calculating and reporting benefit-cost information. Due to the variable nature of data received from each TMC, results will be provided in a narrative format, rather than a tabular one.

Benefits and Costs

The California Department of Transportation (Caltrans) District 7 TMC covers Los Angeles and Ventura Counties and is responsible for monitoring 400 centerline miles of freeway. Their current operating costs are $2.2 million per year, but they will be expanding their system coverage in the near future. The estimated B/C of the expanded system is 15:1 Caltrans District 7 is also the lead agency for a project called the SMART Corridor. This project was developed to test the effectiveness of various Advanced Traffic Management Systems (ATMS) and Advanced Traveler Information Services (ATIS) strategies along a 14.5 mile stretch of the Santa Monica Freeway and five parallel arterials in Los Angeles, Culver City, and Beverly Hills. It is a five year effort that began in 1990. The goal of the project is to achieve an 11 to 15 percent reduction in total travel time and it is estimated that the annual savings to the motorist in reduced travel time, fuel consumption, and vehicle maintenance will be $24 to $32 million. Total cost of the SMART Corridor is $48 million.

Caltrans District 12 covers the Orange County area and has jurisdiction over 140 centerline miles of freeway. Orange County is characterized by the absence of a major central business district; heavy traffic is distributed over the entire region, at all times of the day. Therefore, the TMC is in operation 24 hours per day. They are currently in the process of expanding to a larger facility. The new 7,000 square foot TMC will cost $1 million for the facility and $2.5 million for the support equipment. An estimate of their current annual operating costs is $0.5 million for maintenance and $2 million for staffing.

The City of Los Angeles' Automated Traffic Surveillance and Control System (ATSAC) currently operates 2,000 of the 4,000 traffic signals within the city limits of LA. ATSAC is regularly operated from 6:00 am to 6:00 pm with a total staff of twelve, including eight traffic engineers. In the *ATSAC Evaluation Study,* June 1994, a B/C of approximately 32:1 is reported. This was calculated from an estimated $899 million annual benefit and $28 million annualized cost. Travel time, delay, fuel consumption, and air emissions are included in the benefits, and construction, engineering, operations, and maintenance are included in the costs.

ATSAC Evaluation Study gives the best supporting analysis of B/C than any of the other TMCs visited on the Seminar. An explanation of how factors such as travel time, fuel usage, and emissions are converted to dollar savings is provided. The benefit-cost assessment in the report is an excellent justification for the investment in ITS technologies. None of the other TMCs provided similar information.

Four smaller-city TMCs in California were visited on the Seminar including Anaheim, Santa Ana, Irvine, and San Jose. These TMCs are similar because they all control 200-250 traffic signals, closed circuit television cameras (CCTVs), and changeable message signs (VMS) In addition, none of them have staffing that is solely dedicated to the operation of the TMC. Anaheim and San Jose are both heavily involved in traffic management during special events due to the large special event traffic generators in these cities. The benefit and cost data gathered from these four TMCs is varied and is not conducive to comparison between each TMC. However, it is presented for informational purposes.

The City of Anaheim reported a reduction in travel delay by 33 percent due to the TMC, but no cost data was available. Santa Ana's TMC opened in June 1995 and the city spent $8 million to replace 250 signal controllers, install a new traffic signal system, 65,000 ft. of fiber optic trunk lines, 13 VMS, 16 CCTVs, Highway Advisory Radio (HAR), and equipment for the TMC. Santa Ana's estimated B/C is 4:1, The Irvine Traffic Research and Control Center (ITRAC) estimates their operating costs including staff and equipment to be $1.5 million, and a B/C of 12:1. The City of San Jose lists a number of estimated annual benefits including fuel savings of 3.2 million gallons, vehicle operating costs of $10.7 million, harmful emissions reduction of 830 tons, and a reduction in stops and delays of 16 percent. San Jose's estimated B/C is 6.4:1.

Conclusion

It is evident that in each of the above cases, there are positive returns to the taxpayer from the investment of public dollars. From participating in the ITS Seminar, it is clear that Caltrans places a great emphasis on traffic management due to the severe congestion and volumes experienced on their highways. They are clearly a national leader in the field and have been practicing advanced traffic management techniques since 1971. This has filtered down to the local governments as medium-sized cities such as Irvine and Santa Ana have control centers dedicated to traffic management within their city limits.

The City of Los Angeles' *ATSAC Evaluation Study* is a good model of the type of benefit-cost assessment required to justify the need for ITS funding. Estimates of B/C for ITS projects are necessary in the early stages so that funding does not prevent an idea from becoming reality. There is also a need to develop a uniform methodology for benefit-cost assessments so that ITS professionals can be confident in the reported benefits and B/C for existing TMCs on the west coast can be compared to an estimated B/C for a proposed project in the I-95 corridor. One could expect the value of benefits to vary depending on the geographical area, but the method of establishing B/C should be uniform.

For those of us in the I-95 Corridor, it will be more difficult to achieve an extensive implementation of traffic management strategies. The primary reason for this is budgetary constraints. From my experience in the state of Pennsylvania, ITS projects struggle to compete with the "traditional" highway projects for federal-aid funding. There is also a reluctance to commit the significant financial resources required for operations and maintenance of these technologies. We must be prepared to develop accurate benefit-cost estimates for proposed projects to justify our funding needs. Once the decision makers see the solid returns that ITS can offer, they will be more willing to step away from "tradition" and move towards "innovation".

4. MARKETING AND OUTREACH

4.1. PUBLIC INVOLVEMENT

By: Stephany Hanshaw
TMS - System Manager
Virginia DOT

It is clearly evident that public involvement in ITS projects is not only a good idea, but a critical element of planning, design, and continual operation. Local and State government can reap significant benefits from well-planned public involvement activities that include public education, public awareness, and public input/feedback. ITS technologies have the potential to bring the driver a great amount of new information in forms which are often unfamiliar to him. This makes the public education category of public involvement absolutely critical.

Caltrans District 7 ITS public involvement activities focused on public education. A critical part of their SmartTraveler and Smart Corridor demonstration projects is the marketing campaign. A marketing consultant was selected to develop a public campaign to reach the segment of the public who are the users of the freeway network. Their marketing campaign seemed to have two primary functions: 1) create public "buy-in" or support for ITS projects by bringing to light the public benefit, and 2) educate the driver in how to use and interpret the new information now available for maximum benefit.

Marketing campaigns consisted of:

- Town Hall meetings/presentations
- Distribution of videos
- Distribution of information brochures
- Civic League presentations
- Internet

Public involvement at the Santa Ana TOC included both public awareness, public education and public input in the conception and planning of the system. It began in 1988 with input from the general public through public surveys which identified traffic mobility as the top priority. Armed with the results of the survey, the city began undertaking design of their TMS.

The City of Irvine's TRAC system is a model of continuing public education and general public awareness. By employing a Seminar coordinator for the City and including the TMS Center as one of the sites on the City's Seminar, the public has the opportunity and easy access to witness the actual operations of the TMS Center. This provides an opportunity for learning how the TMS operates as well as becoming familiar with the kind of information the traffic management system provides and how they, as drivers will benefit. The operators of the TRAC system also utilizes a model of the system as a public education tool.

It is also critical for the mass transit systems, BART and Seattle Mass Transit, to provide public information on a continual basis to disseminate information on current operations and schedules. Dissemination of this information is accomplished via brochures/pamphlets, information centers, and information kiosks.

Of all the TMS sites visited, there appeared to be no public involvement during the design phase of the ITS project. There was also an apparent lack of public feedback on system operation and actual customer service. The public's perception of the benefits of these traffic management systems is a question that is not currently being answered. One way to obtain this feedback is to incorporate a quick survey into the information kiosks, which provide traveler information. The City of Anaheim is currently in the early implementation stages of such a kiosk system. However, the City has no plans to obtain public feedback.

The potential benefit of a well-planned public involvement program has not been fully realized by any of the sites visited. As mentioned earlier, a well-planned public involvement program, from ITS project planning to ongoing operations, will produce significant benefit for the project. Public awareness of the benefits of ITS creates public "buy-in" or public support. This public support often translates into political support, which, in turn enhances support for funding. ITS technology produces information available to the driver, which will require education on the driver's part to interpret and use correctly. This public education allows the driver to make intelligent decisions based on information produced by the intelligent transportation system; resulting in increased effectiveness of the applied technology. In order for ITS projects to continue to gain public support, it is imperative that the public awareness and education process also continue.

4.2. PUBLIC/PRIVATE PARTNERSHIPS

By: Christine Cox
Administrative Manager
I-95 Corridor Coalition

Public/Private Partnerships are an important component of ITS deployment. The following is a brief summary of the public/private partnership practices of the West Coast agencies visited during the Seminar. Only those agencies with established or planned partnerships or practices are discussed.

Caltrans District 7 TOC

There are currently no public/private partnerships underway. The state is doing a traditional bid for a fiber optic infrastructure designed and paid for by the public sector. Traveler information is not marketed yet.

LA ATSAC TOC

No public/private partnerships currently exist for the LA ATSAC. However, they have concentrated on public/public partnering to accomplish many of their past goals.

Anaheim TOC

The City of Anaheim has installed and maintains a fiber optic backbone in redundant loops. Any excess capacity will be used for other city functions. The City's utility is putting in 100 strands of fiber (in different locations from the traffic system) that will be marketed for private sector use. In response to the question about the TOC's fiber, it was explained that the location of the rings is not desirable for commercial use. The local cable TV company takes graphical images and puts them on local access cable programs. This is an informal public/private partnership for which there is no revenue generated.

Caltrans District 12 TOC

The growth in this district is incredible. There are 66 miles of identified toll roads under construction by design-build. The first solely private freeway, Route 91, will be opening in November 1995. Its construction is financed by private investors. Travel will be free for 3+ HOVs. For carpools of less than three, the driver will pay congestion pricing rates. After 35 years, the road reverts to Caltrans and the California Highway Patrol for traffic management, maintenance, and enforcement. Until then, Caltrans and CHP have been chosen to perform those functions under a paid contract. Electronic toll and traffic management systems are installed along the entire roadway. Another privatization corridor, Route. 57, has been identified but investors have not been identified.

The new Traffic Management Center is also an operational test and research center in cooperation with the University of California/Irvine, the City of Irvine, and FHWA. If a private company wants to test elements of ITS, a test bed is set up and data is submitted to the academic researchers to develop the results. They are currently exploring partnering (sharing space) with a fiber optic communication backbone.

The California Highway Patrol keeps a media bulletin board on PC about traffic and incidents. Media subscribers pay for this service.

Irvine Traffic Research and Control Center

Information is shared with research institutions in a cooperative approach to partnerships for exploring and testing advanced transportation management techniques. The City of Irvine owns its own cable, and has some grants from the University.

Oakland Bay Bridge, Caltrans

MFS will be installing electronic toll collection on all bridges, using a debit card system, but there is no sharing of revenue. Caltrans will be getting some “free” capacity on a fiber backbone being installed by BART and Pacific Bell. BART will be leasing or selling space on their fiber system, and there will be revenue-sharing after an agreed upon threshold is met.

San Jose TOC

San Jose is undertaking a feasibility study for a “smart-park,, concept. This would make private/public opportunities available at parking locations for services to be provided such as jiffy lube, or exercise centers. Smart cards would be used as the payment medium.

Seattle METRO

There are no public/private partnerships for the traffic management and bus tracking aspects of- Metro’s operation. They are part of a consortium called SWIFT- Seattle Wide Area Information for Travelers. This is a public/private partnership involving Washington DOT, METRO, King County, Seattle, Seiko, IBM, and Delco. There will be an operational test in 1996 for traveler information to be provided by Seiko watch, through PDAs (personal digital assistants) and car radio/screen status messages (Delco). The test will try to link loop detection information with other information into a micro-chip.

City of Bellevue

Currently, some conduit is being installed in partnership with a private sector telecommunications interest in Bellevue. The City is waiving some fees in return for low cost installation, and sharing the space to sell or lease. There is no ongoing annual payment because the telecommunications company has the legal right to be there, so an actual charge cannot be incurred.

Washington DOT

A Mayday System Operational Test called Puget Sound Help Me (PUSHME) is being demonstrated. This is a public/private partnership including nine partners. It is presently in a simulation only phase. A GPS plug-in to the cigarette lighter, and a Motorola device to add to a car phone will be tested. Twenty percent is supported by private funds. The State of Washington Legislature unanimously passed legislation allowing the solicitation and negotiation of proposals for public/private partnerships for transportation projects. Unfortunately, the projects picked for this process received tremendous public objection, resulting in other legislation in response. The newest law allows that if a petition exceeds a threshold number of signatures, a public vote is needed on the project. Developers of projects are also required to go out and talk to the public about the projects.

5. SEMINAR NOTES

By: Waiter H. Kraft
Technical Coordinator
I-95 Northeast Consultants

Tuesday, July 25,1995

Caltrans District 7
Off ice of Operations
120 S. Spring Street
Los Angeles, California 90012

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Gregory B. Damico, P.E., Traffic Systems Branch
Phone (213)897-5579 Fax (213)897-0894

Al Martinez, IVHS Development Branch
Phone (213)897-0292 Fax (213)897-0894

Hector Obasa, Senior Transportation Engineer, Office of Operations
Phone (213)897-7053

- The Traffic Operations Center (TOC) has temporarily been moved to the EPICENTER until the TOC building is retrofitted. The EPICENTER was established after the last earthquake. It includes satellite communications for CCTV.

- Presently have 24 CCTV installations and will eventually have 400. Are using compressed video and some lines. Also are using slow scan video at about three dozen locations.
- There is a bulb matrix VMS up stream of each interchange. About four signs per interchange, which display two lines of text per sign.
- TOC staffing is 8-10 persons during peak hours, 5-6 persons during midday, and 3-4 persons at night and on weekends.
- 400 centerline miles of freeway are under surveillance, which will eventually be expanded to 550 miles.
- We viewed a video about Los Angles freeways, which include 600 centerline miles in Los Angeles and Ventura Counties used by four million daily vehicles. The population of Los Angles county increased from three million in 1940 to nine million in 1990. A 10 year ITS master plan has been developed.
- The Smart Corridor includes five local streets and the Santa Monica freeway with detectors and VMS. The Los Angeles DOT will provide incident response information. There is an active PR program. There will be good communications between Caltrans and the City of Los Angeles DOT.

Los Angeles ATSAC TOC
City Hall East
P4/EOC Level
200 N. Main Street
Los Angeles, CA
(213)485-2815

Anson Nordby, Division Engineer
Phone (213)580-5359

Max Paetzold, Senior Systems Analyst
Phone (213)485-2815 Fax (213)485-8143

Sean Skehan, Transportation Engineer, Signal Systems and Research
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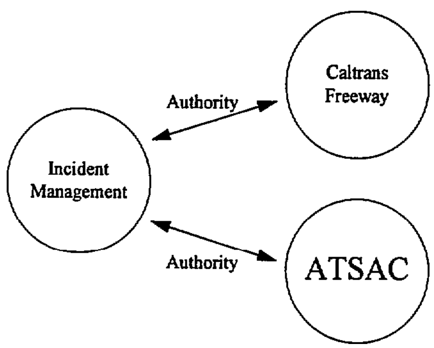
Dave Roseman

Phone (213)580-5387

- We viewed the new control center that is still under construction. Spread spectrum radio is being used for some communications. They are using new display devices and new technologies including an expert system for the Smart Corridor, a PC based traffic management system, and Sinalec (sp?), which is a French product to manage different images on video.
- Most purchases are low bid; some are sole source for a special need.
- The system is operated 24 hours per day and is staffed between 6:30 am and 6:30 pm from Monday to Friday
- Incident reporting on arterials is by word-of-mouth
- Coordination with other jurisdictions varies. Information is shared but the rule is autonomy. In some cases the priorities of other jurisdictions (Beverly Hills, Culver City) are different.
- Control center staff consists of 8 traffic engineers, 3 systems engineers, and 1 tech..
- The adaptive Traffic Control System that Sean Skehan developed for the 488 computer was discussed. It has a graphic screen with a network overview and detailed intersection maps that are updated once per second. The system adjusts traffic signal timing based on the volumes arriving during the cycle. The green phase is given when the platoon arrives. Arrivals control the offset. The are currently 64 intersections in the system with 512 non-loop detectors. One 486 computer can handle 256 intersections. One presence detector is needed on each heavy approach.
- The Smart Corridor includes 540 traffic signals, 14.7 miles of freeway, 40 metered ramps, 14 CCTV cameras, 14 VMS on the freeway, 5 VMS on surface streets, 9 SUN workstations (Unix), and 11 OS/2 workstations. HAR and highway advisory telephone will be added. There is an active media interface The core agencies are LADOT, CHP, and Caltrans and will have dynamic response.
- Smart Corridor institutional issues have been most interesting. There is no lead agency. A marketing consultant is presently being selected to inform the public about the corridor project. Each agency uses their specific expertise - key to success is having traffic engineers work together. No one is being forced to work on this project, they work on it because they want to. The MTA is the umbrella agency. (LACTC + bus authority = MTA)

- Incident Management Concept for the smart corridor is for each agency to retain control of their own devices. The software detects, monitors and assigns authorii to an agency to deal with the incident. The system gives everyone the same information.
  - 1989 Conceptual Design
  - 1995 On line arterial incident detection and management system
  - Phase 2 Manual Control
  - Phase 3 Automated Response Plans



<u>Wednesday, July 26.1995</u>

Anaheim TOC
City Hall, 5th Floor
201 South Anaheim Blvd.
Los Angeles, CA

Jim Paral
Phone (714)254-5183

- In November, 1988, the Anaheim TOC was opened. Previously, a survey had been done and found that traffic was the number one problem.
- Anaheim has a unique traffic challenges including a conference center, Disneyland, a stadium, and arena. The City receives 20-30 million visitors per year.
- A traffic study indicated that a real-time traffic signal system was needed. The City of Anaheim wanted to follow LA’s lead however, UTCS 2 was not their best choice.
- Presently a main frame computer (Concurrent)is used and is located on the 4th floor. The computer should be located next to the control center. Communication is once per second.
- The communications system has a twisted pair and a fiber optic backbone with 12 strands of single mode fiber and multi-mode tails for local distribution. This is basically a T1 system.
- Hours of operation are from 7:00 am to 5:30 pm and is staffed with 2 full-time and 3-4 part-time persons.
- Have an intertie with District 7, District 12, City of Irvine, UCI, OCTA (mass transit information, vehicle location, schedules, and route conditions). Anaheim is the hub.
- Benefits: 33% reduction in delays.
- The system consists of:
  - 250 signals
  - Type 170 and NEMA controllers
  - 18 CCTV
  - 6 full matrix VMS on City streets
  - cable TV
  - 2 remote kiosks
  - an Internet connection
- There was initial concern from businesses about the VMS on city street. However, after installation, the VMS have been popular.
- Parking information system with manual input
- Highway Advisory Radio - 1500 AM - updated once daily
- A special event is considered a planned event
- RR lines have preemption signal control and are not treated like an event
- TOC has become a dispatch center for maintenance
- NTCIP - open architecture
- They are developing a public information data base

Santa Ana TOC
City Hall
20 Civic Center Plaza
Santa Ana, CA 92702
(714)647-6776

T.C. Sutaria
Phone (714)647-5604 Fax (714)647-5670

- Seminar group watched a video that included:
    - VMS/CCTV/detectors,
    - HAR 620 AM, and
    - Dynamic trail blazers.
- The TOC includes
    - Remote access kiosks,
    - Santa Ana ITIS,
    - multi-sensor and IDC controllers,
    - 13 VMS will be controlled by the City and Caltrans,
    - Intersection controllers at freeway ramps can be controlled by the City and Caltrans.
    - Communications is twisted pair between controllers and the VMS. Fiber optic backbone uses T1 lines for some links
    - 16 cameras
    - Four Autoscope installations. Do have a problem with buses. Will not replace induction loops with Autoscope.
- TOC is staffed by four individuals plus an intern from 7:00 a.m. to 6:00 p.m.
- $8M for the 1,400 sq. ft. TOC and field equipment including the replacement of 250 controllers and master system, 65,000 feet of fiber trunk lines, VMS, CCTV, and HAR.

Caltrans District 12 TOC
2501 Pullman Avenue
Santa Ana, CA 92705

Joe Hecker, District Division Chief, Operations and Maintenance
Phone (714)724-2659

Farhad E. Khosravi, Branch Chief, Traffic Management & System Development
Phone (714)724-2453 Fax (714)724-2472

Lt. Dwight McKenna, Commander, California Highway Patrol
2031 E. Santa Clara Avenue
Santa Ana, CA 92701
Phone (714)547-8311 Fax (714)547-8344

- Caltrans has 12 districts. District 12 was formed in 1988 by an act of the state legislature.
- District 12 includes:
  - 31 cities in Orange County
  - 2.5 million people
  - 140 miles of freeway
  - 114 miles of HOV lanes operated 24 hours per day (planned or under construction)
  - 140 miles of state highways
  - 66 miles of planned toll roads
- The Route 91 Freeway is being built by private funds and will be four lanes wide in each direction, including three all purpose lanes and one car pool lane. The care pool lane can be used by single occupant vehicles for a higher toll than the all purpose lanes. Completely automated toll collection will open in November 1995. This is a good opportunity for congestion pricing.
- It is not possible to close any freeway lanes during the daytime in Orange County without causing at least a 5-7 mile back-up.
- Law enforcement and traffic work together in the TOC.
- I-95 is being widened from 6 to - lanes
- A new TOC will be tied into 3 universities and new technology lab. They will have a test bed on the freeway to have the private sector test their systems.
- Freeways in District 12 include 32 VMS and 70 miles of instrumentation. 30 CCTV are planned as well as the development of a fiber optic backbone. Phone lines are now being

used. The freeways have 258 metered ramps with approximately 95% coverage. 158 ramps have HOV bypass lanes without metering.

- There is a service patrol for 89 center line miles of the freeway funded by state dollars (sharing by local transit authorities). It is done by private companies under contract with OCTA.
- TOC is staffed by technicians 24 hours/day, 7 days per week.
- of construction is done at night with very little nighttime maintenance. The freeway can be closed for construction from 11 pm to 5 am.
- They have two permanent and one portable HAR transmitters (530 AM).
- They will get a helicopter for surveillance.
- We viewed a video of the new TOC, which will be 7000 sq. ft. The cost for an interim facility is $3M.

Thursday, July 27, 1995

Oakland Bay Bridge
Oakland Bay Bridge Toll Plaza
Oakland, CA

Caltrans District 4
111 Grand Avenue
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Terry Costa, Area Supervisor
Phone (510)923-4444

H.P. Hensley, District Division Chief, Operations
Phone (510)286-6250 Fax (510)286-6194

- $300 Million traffic system underway. Initially the system will be 200 miles long and ultimately 500 miles. The control center is under construction. Included in the system will be detectors, VMS, CCTV, and HAR
- There are a total of nine toll bridges in the state of California, seven are in District 4.
- Traffic volume on the Oakland Bay Bridge is approximately 250,000 vehicles per day resulting in $130-140 million in revenue per year. The Bridge has a 24 hour/day, 7 day/week towing service. MFS is installing a new toll collection (ETTM) system using debit cards with 100 mph maximum speed specifications.
- The Oakland Bay Bridge has 22 lanes including 4 HOV lanes. The speed limit on the bridge is the same as the approaching roadways. Mainline metering is used to balance capacity of the exiting roadway. All of the tolls are $1 .OO.
- Towing of vehicles on the bridge is contained in vehicle code. There is medium service normally - some light service patrols.
- Heavy rigs are used under contract.
- They have a good relationship with the California Highway Patrol and good coordination with neighboring Police Departments.
- Manual metering: 240 to 12,000 vehicles per hour
- Automatic ramp metering was affected by the earthquake: 9500 to 10,000 vehicle per hour.
- 3.5% grade on the bridge affects meters
- There are 16 B&W cameras on the upper deck (co-axial cable communications), 5 CMD and optical detectors. They will put 35-40 CCTV with co-axial communications on lower deck. Using spread spectrum radio and frame relay would save about $110 M over 10 years.
- We toured the tow dispatch center.

BART Control Center
800 Madison Street
Oakland, CA
Phone (510)464-6119 Fax (510)464-6146

Vic Rivera, Manager Operations Control Center
Phone (510)464-6358

- The Bay Area Rapid Transit (BART) system runs a 43 train schedule: 10 car trains during peak period and 5 car trains during off-peak.
- Computer supervises and maintains schedule and makes adjustments as needed.
- Equipment in station controls train operation-- this is good if supervisory computer fails the system can still operate. If the equipment fails the system stops and must be operated in manual mode. The maximum speed in manual mode is 27 mph.
- There are two display screens - traction display and train movements. Display screens are forward projection from about 50 feet. The display is software driven.
- There is one operator and one conductor per train, and 57 people in the control center.
- Staffing
    - Train controller operator
    - Communication specialist (public info)
    - Vehicle supervisor
    - Technicians
    - Power person
    - Central manager
- Train on-time performance - 5 minute variance
- There are 2 train radio frequencies.
- BART has tie lines with each fire department and interface with the media.
- There are 155 sworn police officers both uniformed and non-uniformed. 35 new cadets are being trained.
- Revenue service is from 4:00 am to 1:30 am. Maintenance is done from 1:30 am to 4:00 am.

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- Regional Smart Corridor - focuses on transit
  - Caltrans and 6 other local agencies
  - Arterial signal control
- Smart Parks - intermodal parking lots
  - easy ingress and egress from freeway to transit system
  - GPS trading of buses
  - Looking for private partnership but a consultant has not yet been chosen
  - Will use HAR for on road information
- San Jose's population is approximately 850,000 persons. It is the third largest city in California. The city's area is 174 square miles and has 2000 miles of roadway with 660 signalized intersections.
- In 1989, a feasibility study was performed on traffic signal systems. The study indicated a need for appropriate personnel to maintain and operate the system.
- In 1990, the system was approved for $12M of City funding with no federal funding. Initially it was a 6 year program. Since then $17M was added. In the future there will be CCN and VMS.
- Public relations is an important component of the system.
- A video was viewed:
- Operations and maintenance are done in-house.
- City had a fiber optic communications system in place around city hall.
- The fiber optic communications system for CCTV in city owned.
- Maintenance personnel have good training.

- Three of six phases are complete. Benefit-cost projections have been exceeded as measured by before and after surveys.
- Smart Corridor was started by local agencies. Phase one has just started Two projects are funded county and local sources for $5.4 M which includes some federal funding. The freeway portion should be funded during the week of August 1, 1995.
- Operations of Center
  - Incident detection: Caltrans, police, cellular phone, and Public Works personnel
  - Thought of as much as a maintenance facility as an operations system.
  - Has second-by-second monitoring.
  - Timing plans are stored in controllers-- no second-by-second control
  - 19 CCTV
  - 9 VMS
  - HAR 1570 AM - 0.1 Watt microcells
  - Command and Control: under discussion as to who can operate what
  - Communications for signals include twisted pair, leased lines, and short-range microwave links

Friday, July 28, 1995

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- Met in the emergency center
- Coordination center for communications is operational 24 hours/day, 7 days/week. Staffing consists of a maximum of 5 persons and a minimum of 1 person.
- Transit operators call in incidents. DOT has preplanned diversions.
- 950 buses on road during am and pm peak.
- 450 MHz radio, Two-800 MHz channels
- Uses a data assisted radio system. It can fall back to voice mode in case of a power failure. Driver puts his ID and run # in the radio. The driver can be tracked by his identification, bus and run number.
- The system has 3 levels of priority on radio
  - Lowest - voice request to talk
  - Emergency nature - priority request to talk
  - Highest - Emergency alarm
- Coordinators are selected from the ranks. Information from the AVL system is used to develop better schedules.
- The AVL system was started in 1988 or 1989 before GPS was readily available. It is a sign post and odometer system, which cost about $15 million. Each sign post has an identification number that is picked up as a bus passes it. The identification number is passed to central when the bus is polled by central. There are two 450 data channels, each for one half the fleet. Programming is centralized although there is a 186 processor on each bus. The system can locate a bus within 250 feet 95 percent of the time and within 400 feet 99 percent of the time. There is some difficulty if a bus is lost or off route. Sign posts are mounted on top of bus stop signs and are 49 MHz battery powered units. They have a range of 300 to 500 feet and are polled once per second. An error correction algorithm is used to correct for tire wear. The system is maintenance intensive since there is much equipment on a bus. Sign post antenna need periodic tuning. There are seven radio technicians in the field and two persons in the office for data summary. There are 225 to 250 sign posts in the system at about three mile spacing. The entire fleet can be polled in about one and one half minutes.
- Buses have an automatic passenger counter that uses a transmitter with a three year battery life.
- Most routes have a 30 minute headway. A few are on 7 to 10 minute headways.
- There is 24 hour service on a few bus routes
- On time performance occurs if a bus is less than two minutes early and less than 10 minutes late

- The Seattle - Information For Travelers (SWIFT) is a traveler information system that is being installed and includes a Seiko watch that picks up information from an FM sideband, an IBM personal assistance device, and a Delco radio. Metro traffic is also involved in the project. Katherine Bradshaw (206-684-1720) is the project manager.
- A tunnel under downtown provides direct access for dual mode buses - diesel power outside and electrical power inside. There is a fiber optic backbone from the tunnel to the Emergency Center. The tunnel control system monitors all systems including elevators, air flow, power, CCTV, etc. Operators are first line supervisors that have had eight weeks of training.
- We toured the emergency center.

APPENDICES

APPENDIX I - PERSONS MET WITH DURING SEMINAR

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Los Angeles, CA

Anaheim TOC
City hall, 5th Floor
201 South Anaheim Blvd.
Los Angeles, CA

Santa Ana TOC
City Hall
20 Civic Center Plaza
Santa Ana, CA

Caltrans District 12 TOC
2501 Pullman Avenue
Santa Ana, CA

Irvine TOC
City Hall
One Civic Center Plaza
Irvine, CA

LA Freeway System (HOV lanes, freeway to freeway ramp metering)

Oakland Bay Bridge
Oakland Bay Bridge Toll Plaza
Oakland, CA

BART Control Center
800 Madison Street
Oakland, CA

San Jose TOC
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San Jose, CA
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APPENDIX IV SEMINAR EVALUATIONS

1. How valuable to you personally was the Seminar?

Very valuable	13
Valuable	1
Not very valuable	

2. How valuable to your organization was the Seminar?

Very valuable	10
Valuable	3
Not very valuable	

3. Please explain how your participation in the Seminar has benefited you and/or your organization.

- Enhanced vision of traffic management from a regional perspective.
- Successful regional traffic management goes beyond the integration and linking of technologies-it's building good relationships and communications between people, operation centers, and jurisdictions.
- Got to know other I-95 Corridor Coalition members.
- Personal education
- Development of contacts in the industry (3 responses)
- Helped me to understand the breadth and variety of interjurisdictional issues and possible solutions for "corridor" travel.
- Broadened my exposure and understanding of the use of various technologies for managing transportation systems.(3 responses)
- As I visit other state and local agencies in the region, the experience gained from the Seminar will help me to promote ITS deployment.
- Share information with colleagues to improve activities and methods.
- Gained new ideas/knowledge useful for current and future projects in home region or organization.(5 responses)

- The Seminar provided enormous insight into how a congested priority corridor both addresses its traffic management issues and deals with inter-agency coordination.
- The Seminar provided a quick look at a wide variety of TMCs varying in complexity in terms of the problems they deal with, the space/equipment required, and the level of operations provided for. (2 responses) It made me realize that there are different solutions to different conditions and every ATMS/TMC doesn't have to be large/extensively staffed/operated 24 hours/day to be effective.
- We were able to talk with a cross section of people/agencies about how they handle the overlapping inter-jurisdictional issues of area-wide ITS systems. The message was that things work best if the initial approach is based on each agency controlling its own systems, and do what is does best, while participating in a cooperative effort to coordinate operations/operation strategies on an area-wide basis. When this approach is taken, it seems that fears of unwanted "take overs" are reduced, and, in fact, agencies even begin to volunteer to turn over control of some system elements where it makes the most sense.
- First, the Seminar provided me personally with a broader perspective on the status of ITS programs outside my own state. I gained some insight on different approaches to ITS deployment. It was particularly interesting to visit local municipalities and state DOT's, to see their common concerns and observe how they were overcoming their institutional barriers. Also, our visit to the transit authorities provided me with some exposure to their operating methods and concerns (since I have had limited exposure to transit). A lot of these insights I brought back with me, and I am sharing them with my colleagues.
- It gave me an opportunity to compare the TMC in NYC, which I am in charge of, with other TMCs and to evaluate and appreciate the system that we have here. I was also impressed by the level of commitment that planners and engineers had devoted to its deployment on the West Coast.

4. Please describe how you will be able to apply any ideas or applications that you gained from the Seminar.

- Hampton Roads region: Concepts involving seamless incident and traffic management will be started. Smart Corridor and corridor management type activities will be increased. Local cities will be urged to update signal and traffic management technologies.
- Picked up a lot of information such as issues to overcome, staffing, mission/purpose, focus, etc. that will be useful to the current installation of a computerized signal system.
- Detailed ideas will go into specifications for new TOC facility at NYS Thruway

- Will help me to understand the results of some of the studies better, and to relate the Coalition projects to each other.
- The North Seattle ATMS system architecture will help guide Virginia/Maryland/DC in their development of the Capital Beltway ITS showcase.
- Information provided on the Seminar will provide a basis for determining the facilities, equipment, and staff required to achieve our department's traffic and- incident management objectives.
- I will discuss and present the applications and ideas gained from the Seminar to various ITS personnel in the State DOT and FHWA and assess the feasibility of applying some of these methods to our state highways.
- This opportunity was valuable for networking and can be used as a reference in dealing with public agencies regarding the positive aspect of working together.
- I will not only use the insights I have gained on the Seminar in refining our statewide ITS policy and strategies, but will also bring these insights out to our Regional Offices as they develop their own Regional ITS strategic plans and implementation projects.
- The Seminar provided food for thought on many subjects, including:
- The "expert" system being developed for the Santa Monica smart corridor
- Santa Ana and Irvine's operational experience with AutoScope
- The beacon based AVL used in Seattle and it's possible application for fleet management
-
- Any of these applications may be instituted in our state, or possibly none of them. However, exposure to new and different ideas suggests better solutions to our transportation challenges.
- I made a presentation to the NYS Region's ITS Policy Committee focusing on observations from the Seminar concerning institutional issues in ITS planning and operations on the West Coast. Recommendations were made based on these observations.
- This Seminar has given me the opportunity to consider expanding the control functions of the existing system and exploring ways of integrating other transportation systems with the eventual goal of developing and implementing an integrated traffic management system.

5. What suggestions do you have for future Seminars.

- Not enough time for questions to be asked and answered at most traffic control centers. (3 responses) Perhaps schedule dinner meetings with one agency each night for a detailed Q&A session.
- It was suggested that the number of sites visited be reduced to 10 or less.

- The Seminar was well organized and focused.
- Length and number of stops was just right
- Excellent coordination of logistics
- Showcase the Northeast (2 responses)
- Focus less on traffic signal systems, and more on freeway management, private/public successes, traveler information services, incident management cooperation--the whole menu!
- Provide a list of references/sources of publications where the traveler can do some preliminary reading.
- Should focus to a greater extent on state department of transportation operations.(2 responses)
- Seminars of San Antonio, Atlanta, and Florida. (3 responses)
- Possibly a bit more time between locations. Other than that, it was "perfect".
- Visit less sites with more time per site.
- Send the sites to be visited a briefing packet, in advance, explaining what the group will want to see.
- Schedule a little downtime to help foster relationships between participants and avoid burnout.
- The focus and concept were good.
- Consider more frequent Seminars.
- Find different sites to visit in order to get a wide cross section of information.
- The Seminar was very fast-paced and rather hectic.
- Repeated visits to TOCs/TMCs made it seem, after a while, that "we have seen it all."
- It was difficult to isolate the transit elements of the Seminar.
- Make a more multimodal pitch for future program announcements.
- There needs to be subarea trips within the Coalition area itself.
- Let's go to Europe next year and Asia the year after.
- Let's cut out the small TMCs. I would be more interested in integrated traffic management systems or other modal transportation systems, such as airports, seaports, motor rail control systems.