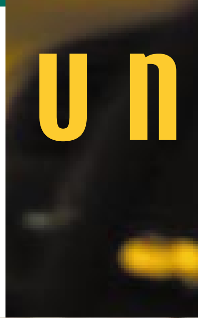

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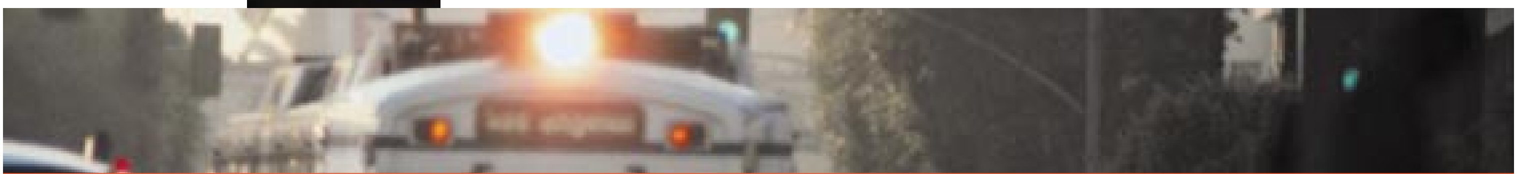
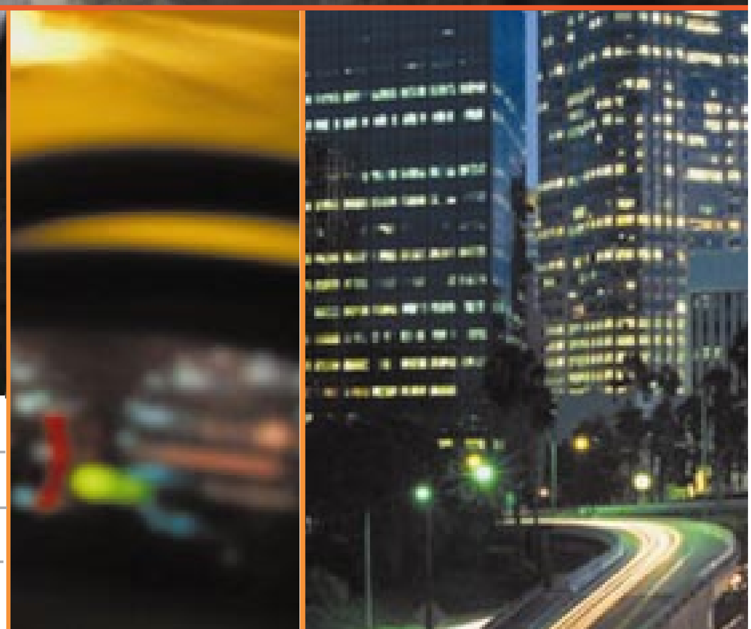
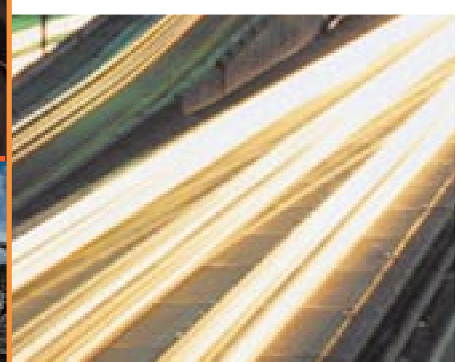




PRESCRIPTIONS FOR
RELIEVING CONGESTION AND
IMPROVING SAFETY
ON MAJOR LOCAL ROADWAYS

PTI
PUBLIC TECHNOLOGY, INC.

U.S. Department of Transportation
Federal Highway Administration



Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-OP-03-069		

4. Title and Subtitle Unclogging Arterials Prescriptions for Relieving Congestion and Improving Safety on Major Local Roadway	5. Report Date 6. Performing Organization Code
7. Author(s) Public Technology, Inc.	8. Performing Organization Report No.
9. Performing Organization Name and Address Public Technology, Inc. 1301 Pennsylvania Avenue, N.W. Washington, D.C. 20005-1793	10. Work Unit No. (TRAIS) 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Federal Highway Administration – Office of Operations U.S. Department of Transportation 400 Seventh Street, S.W., Room 3404 Washington, D.C. 20590	13. Type of Report and Period Covered 14. Sponsoring Agency Code FHWA, HOP-1

15. Supplementary Notes

16. Abstract

Because arterial roadways handle a growing share of traffic, effective arterial management strategies play a critical role in congestion relief. In fact, arterial roadways need the most management, because they perform the dual function of serving through traffic and providing access to abutting properties.

Some of the management options in this guidebook involve Intelligent Transportation Systems (ITS) technologies, road condition sensors, automated traffic signals, changeable message signs, and video surveillance cameras. The interstate highways surrounding most major metropolitan areas in the United States are served by ITS technologies that state highway departments have installed within the last decade. ITS is still relatively rare on arterial roadways. Some ITS technologies may be too expensive for many local governments to consider, but some are within reach, and all eventually will yield major benefits for your community.

In this document some specific strategies for unclogging your community's arterial traffic flow will be discussed in detail.

17. Key Word	18. Distribution Statement
Arterials, Congestion, Traffic Congestion, Signal Timing, Signal Coordination, Access Management, Arterial/Freeway Coordination, Reversible Lanes	No restrictions. This document is available to the public from: The National Technical Information Service Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	76	

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ACKNOWLEDGMENTS

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Unclogging Arterials: Prescriptions for Relieving Congestion and Improving Safety on Major Local Roadways was produced by Public Technology, Inc. (PTI) with funding from the U.S. Department of Transportation's Federal Highway Administration.

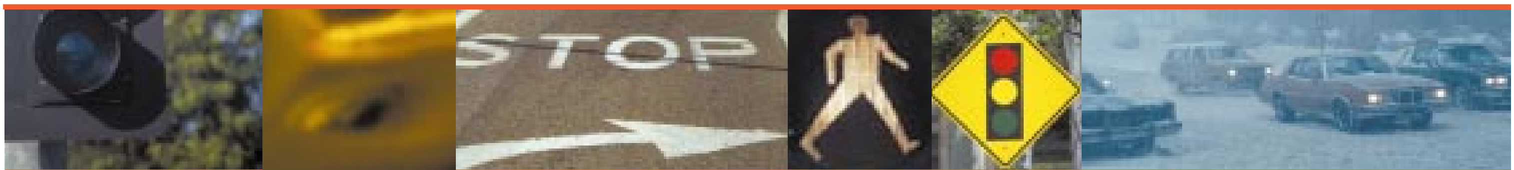
As congestion on local arterials reaches crisis proportions, local officials must find new ways to stem the rising tide of traffic. Yet most information about congestion management is written for highway engineers and geared toward freeway management. This guidebook, developed as a result of a need identified by PTI's Urban Consortium Transportation Task Force, offers a compendium of techniques and information for local officials who want to decrease congestion on their vital local arterials. Task force members provided valuable information and guidance as the guidebook was developed.

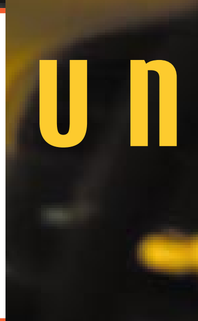
Special thanks to members of the PTI Urban Consortium and others who contributed success stories and photos. At PTI, Robert Hicks oversaw the project from concept to completion.

Thanks go to Karen Haas Martin, President of Editor's Ink, who researched and wrote the guidebook, and to research assistant and editor Anita Blumenthal, also of Editor's Ink. Taly and Patrick Walsh provided copyediting and design services.

PTI is the nonprofit technology R&D organization affiliated with the National League of Cities, the National Association of Counties, and the International City/County Management Association. Since 1971, PTI has tapped the collective knowledge of its member jurisdictions and partnerships with private industry to create and advance technology-based products, services, and enterprises in cities and counties nationwide.

The Urban Consortium Transportation Task Force guides PTI's Local Government Intelligent Transportation Systems (ITS) Outreach and Technology Transfer Program, which ties advanced transportation technology research, planning and implementation activities to the needs of local governments.





UNCLOGGING ARTERIALS

PRESCRIPTIONS FOR RELIEVING CONGESTION AND IMPROVING SAFETY ON MAJOR LOCAL ROADWAYS

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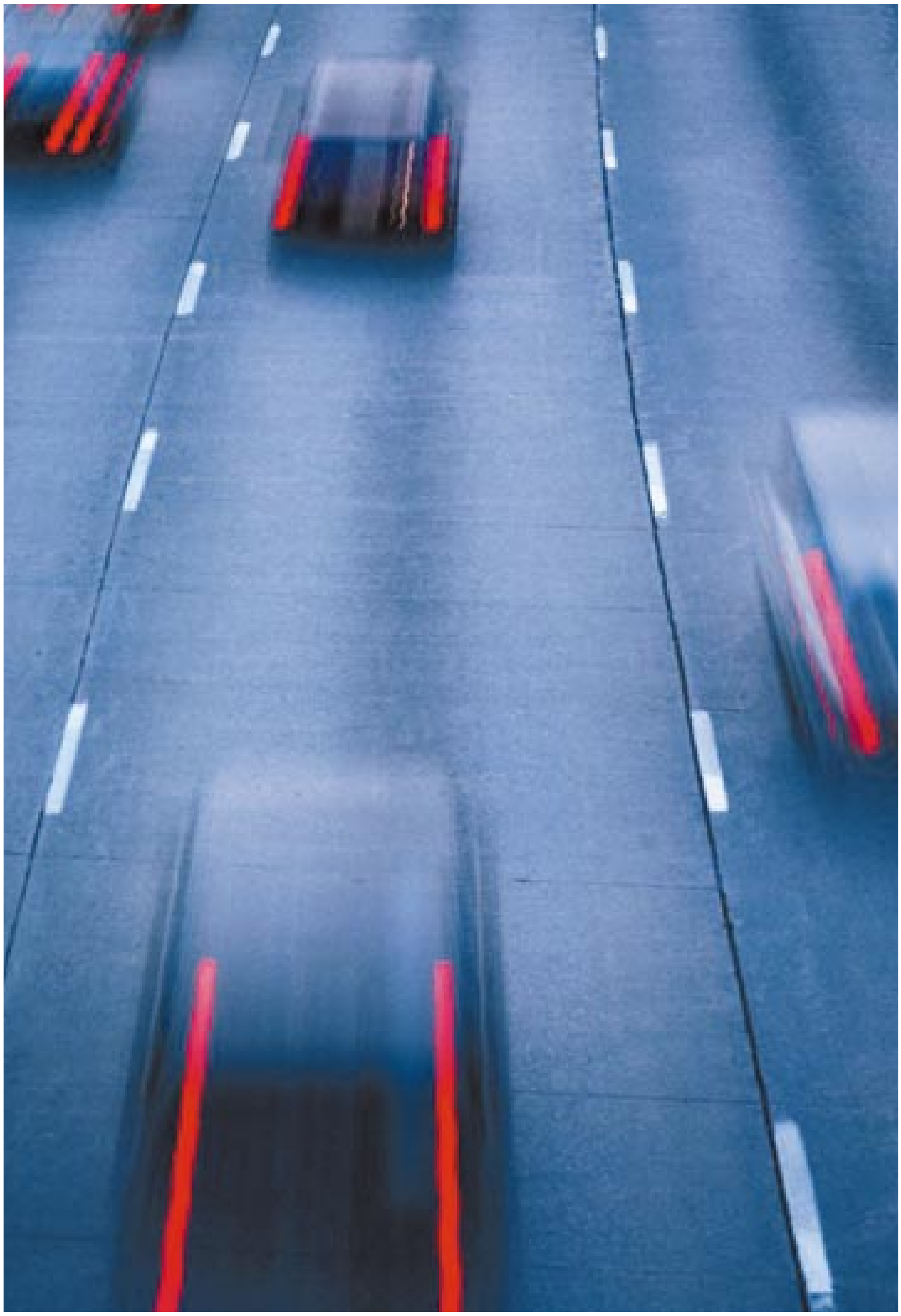

CONTENTS

How do you respond when your constituents ask, "What are you going to do about all this traffic?"

Traffic congestion is a growing concern and a hot political issue in communities large and small across the nation. Is your community really doing all it can to alleviate traffic congestion on the local roadway network?

This guidebook is about what your community can do to better manage existing arterial roadways so traffic will flow more smoothly and safely.

The first section offers justification for obtaining funds and support to improve management of traffic flow on arterial highways—from the political, social, economic, and technical perspectives. It also gives an overview of what specific arterial management strategies your community might consider, ranging from low-cost improvements such as re-timing traffic signals, to higher-cost technology, to improved working relationships among various agencies and jurisdictions that must cooperate to clear the road after highway incidents.

The case studies in Section II of this document illustrate how other large and small communities have successfully alleviated congestion through improved management of arterial roads. Each study lists a contact person who can offer peer guidance and answer questions.

We hope that, as a leader in your community, you will become an advocate for improving operation of your local roadways and transit systems. It can be done. Section III of this guidebook provides an action checklist suggesting how you can work within your jurisdiction and with neighboring jurisdictions to optimize transportation operations.

The appendices contain sample documents that other jurisdictions have used, which may serve as models for your locality.

We have drawn from a wide range of excellent publications and web sites, which have been listed along with many additional resources in the "For More Information" section at the end of the guidebook.

Sincerely,
Dr. Costis Toregas, President
Public Technology, Inc.


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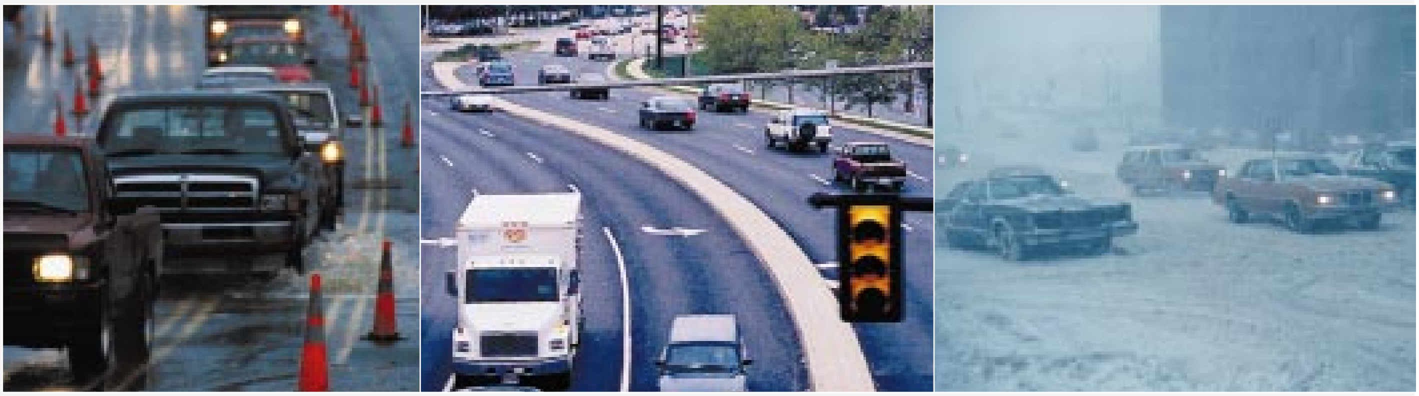
SECTION I

INTRODUCTION



I. INTRODUCTION

Lead Your Community to a Comprehensive Solution to Traffic Congestion

Transportation agencies have traditionally focused on road building and maintenance more than on operations. Political decision-making and agency funding and staffing tend to revolve around new construction projects. Operations and management strategies tend to be behind-the-scene issues, receiving little public debate or scrutiny. That's changing fast. Traffic congestion is a major and growing concern, and no longer can communities simply build their way out of the problem. Solutions must be comprehensive, including improved transportation systems operations and planning, with an eye toward more livable communities and a cleaner environment.

Because arterial roadways handle a growing share of traffic, effective arterial management strategies play a critical role in congestion relief. In fact, arterial roadways need the most management, because they perform the dual functions of serving through traffic and providing access to abutting properties.

Some of the management options in this guidebook involve Intelligent Transportation Systems (ITS)—technologies such as mobile wireless voice and data systems, location technologies, road condition sensors, automated traffic signals, changeable message signs, and video surveillance cameras. The interstate highways surrounding most major metropolitan areas in the United States are served by ITS technologies that state highway departments have installed within the last decade. ITS is still relatively rare on arterial roadways. Some ITS technologies may be too expensive for many local governments to consider, but some are within reach, and all eventually will yield major benefits for your community.

Why should you care about traffic operations management on your community's arterial highways?

- *Traffic congestion is a major issue;*
- *Arterials handle a growing share of traffic;*
- *Arterial management strategies offer bang for the buck;*
- *Arterial management strategies will improve your community's safety, health, security, economic competitiveness, environmental quality, and livability.*

We'll explore each of these points in detail, and then discuss some specific strategies for unclogging your community's arterial traffic flow.

TRAFFIC CONGESTION IS A MAJOR POLITICAL ISSUE

When Public Technology, Inc. (PTI) asked local government officials about transportation issues in their communities, 93 percent of the 234 respondents said traffic congestion was an important issue, and about 25% ranked it as "extremely important."[1]

Indeed, congestion tops the list of transportation issues that people say affect their communities and their choices about where to live and where to do business.[2] *Just over 75 percent of 2,000 people surveyed by the Federal Highway Administration (FHWA) in 2000 reported that traffic congestion was an important or a very important consideration in choosing a place to live.*[3]

The same survey revealed a sharp increase in public dissatisfaction with traffic flow and with roads. Forty-three percent of the FHWA survey respondents were not satisfied with traffic flow in 2000, compared to 23 percent in 1995. Not surprisingly, those who were delayed the most in traffic were the most dissatisfied with the roads they used.

The traffic congestion crisis will not go away by itself. As a nation, we are growing much faster than the transportation network. The FHWA

Did You Know?

In 2002, the Texas Transportation Institute reported that traffic congestion cost the nation $67.5 billion, representing 3.6 billion hours of extra travel time and 5.7 billion gallons of fuel wasted while sitting in traffic.

The average delay was 27 hours per person per year—82 hours for commuters who are on the road during peak traffic hours.

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1 *Public Technology Inc., Frequency Report for PTI, Washington, D.C., August 3, 2001.*
2 *Federal Highway Administration, Moving Ahead: The American Public Speaks on Roadways and Transportation in Communities, Washington, D.C., February 2001, FHWA-OP-01-017.*
3 *op cit Margin of error +/- 2 percentage points.*

reports that, between 1990 and 1998, the number of licensed drivers in the United States rose nearly 11 percent and vehicle miles traveled increased 22 percent. During the same period, the number of lane-miles on roadways increased by only 1 percent.

Nor can we build our way out of traffic congestion. Even if our local, state, and federal transportation agencies could afford massive new capacity-building programs, there is growing political pressure insisting that approaches to ease congestion cannot simply consist of construction—they must also improve transportation system operations and planning. Citizens concerned about livable communities and a healthier environment are demanding more holistic approaches to solving mobility issues.

Cities large and small are grappling with traffic problems. In fact, traffic congestion is growing at a faster rate in smaller cities. According to the FHWA, in 1982, only one-third of peak period travel was congested in smaller urban areas (with populations under 500,000); by 1997, two-thirds of peak-period travel was congested.

ARTERIALS HANDLE A GROWING SHARE OF TRAFFIC

In many major metropolitan areas, the freeway system is functioning at, or beyond, the capacity for which it was designed. Frustrated drivers are avoiding the freeway and using the arterial system instead. But the arterial system also is stressed by growth in local traffic demand. The result is growing gridlock on the thoroughfares that define our cities and suburbs.

According to a study of 75 metropolitan areas, an average of 33 percent of daily travel on principal arterials in 2000 occurred under congested conditions. In 1982, the average was 17 percent. In 2000, 61 percent of the lane-miles on principal arterials was congested in the peak period, up from 27 percent in 1982.[4]

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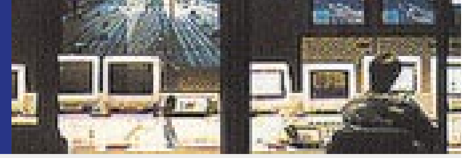
[4] *Texas Transportation Institute, 2002 Urban Mobility Study. http://mobility.tamu.edu/*



In 1993, the latest year for which statistics are available, approximately 41 percent of all annual roadway travel in the United States was on urban arterials and local streets.

ARTERIAL MANAGEMENT STRATEGIES OFFER BANG FOR THE BUCK

Improving the timing and coordination of traffic signals is one of the most cost-effective strategies available for improving traffic flow and reducing congestion-related delay. Interconnecting traffic signals and optimizing traffic signal timing can reduce travel time by 8 to 25 percent along a corridor or artery.

In Texas, for example, a statewide signal synchronization program reduced traffic delay 15 to 16 percent and saves about $2 million a year in fuel costs alone.[5]

More than half of all traffic congestion and travel delay is caused by traffic incidents. Depending on traffic volumes, a 15-minute lane closure can cause a one-hour traffic back-up. Incident management programs aim to clear the road quickly, reducing travel delay while maintaining public safety and security. The most effective of these programs include automated surveillance to detect incidents, interagency and interjurisdictional cooperation in traffic management and incident response, and service patrols to manage traffic at incident scenes. When Boston implemented a traffic relief program—an interagency effort of the Boston Transportation Department and the Boston Police Department to relieve congested roadways in downtown Boston—travel times on three major corridors decreased by 28-30 percent.

Traffic surveillance technology (using sensors, videos, and closed-circuit television) is a powerful tool for detecting incidents more quickly. Only 1 percent of urban arterials have surveillance cameras installed, and only 9 percent of urban freeway miles have been instrumented for incident detection.[6]

Did You Know?

More than half of all traffic congestion and travel delay is caused by traffic incidents. A 15-minute lane closure can cause a one-hour traffic back-up, depending on traffic volumes.

5 *Texas Transportation Institute. PASSER maximizes progression along roadways. Abstract. http://tti.tamu.edu/product/ror/passer.stm*

6 *Ann P. Canby: "Managing the Urban Transportation System: The Need for a New Operating Paradigm," Federal Highway Administration, August, 2001. http://ops.fhwa.dot.gov/nat_dialogue.htm*

Automated red light enforcement programs, with cameras installed at intersections, detect red light running, a traffic violation that causes almost 100,000 accidents a year. A drop in red light running means some of those accidents—and the traffic backups they cause—are avoided. San Francisco conducted a public awareness campaign about the red light running problem when it began operating red light enforcement cameras. Between the first and sixth months of the program, red-light running dropped 42 percent at the intersections where the cameras were in place. Oxnard, Calif., implemented an automated enforcement program very similar to that in San Francisco and also achieved a 42 percent reduction after several months.[7] Howard County, Md., and New York City also have had successful experiences with red-light enforcement programs.

Transit signal priority (TSP), which gives green light priority to transit vehicles, reduced transit trip times by 5 to 15 percent, according to European studies. These reductions improved operating efficiency and significantly lowered costs for transit operators.[8] A growing number of cities in the United States are introducing transit signal priority (TSP). Tri-Met in Portland, Oregon, activated TSP on a pilot corridor in July 2000 and has added several major arterial lines since then. On pilot routes, TSP reduced peak period/peak direction travel time by 10 percent.[9]

King County (Seattle, Wash., area) installed its first TSP system in 2000, and extended it in 2001. TSP was found to reduce bus delay by 34 percent. Traffic signal-related stops by buses dropped between 24 and 43 percent, and estimated transit travel time dropped 8 percent. Meanwhile, side street delay caused by TSP was less than four seconds per vehicle.[10]

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7 *Federal Highway Administration. Intelligent Transportation Systems Benefits. 2001 Update. (FHWA-OP-024) Washington, D.C.. p. 15.*

8 *European Commission Report, Telematics Applications Programme—Transport Areas' Results (4th Funding Programme), July 2000. http://www.trentel.org/transport/frame1.htm*

9 *Callas, S. "Tri-Met's Transit Signal Priority System and Evaluation." Tri-Met. January 13, 2002. http://signalsystems.tamu.edu/archive.html*

10 *"Transit Signal Priority Successes." http://transit.metrokc.gov/programs_info/tsp/successes.html*

ARTERIAL MANAGEMENT STRATEGIES WILL IMPROVE YOUR COMMUNITY'S SAFETY, HEALTH, SECURITY, ECONOMIC COMPETITIVENESS, ENVIRONMENTAL QUALITY, AND LIVABILITY

Safety, Health, and Security

As the events of September 11, 2001 demonstrated so unforgettably, local fire and rescue, law enforcement, emergency medical services (EMS), and transportation agencies are the backbone of our domestic safety, health, and security system. Improved operational coordination and communication among public safety and transportation agencies improves the efficiency and efficacy of emergency response.

Because highway incidents cause more than half of traffic congestion, a key strategy for managing arterial traffic flow is to form inter-agency and inter-jurisdictional operational partnerships with the goal of achieving the most efficient response to incidents. The same partnerships, procedures, and technologies that foster improved response to everyday incidents form the foundation of a stronger national public safety and security system. By integrating operations through institutional agreements supported by shared, real-time voice and data communications, public safety and transportation agencies can respond more quickly to traffic incidents and clear the road more quickly. At the same time, emergency medical services (EMS) and broader security and disaster response capabilities are enhanced through faster incident detection and notification, faster emergency response times, and operational partnerships backed by advanced wireless data communications links among emergency responders.

Did You Know?

The same partnerships, procedures, and technologies that foster improved response to everyday incidents are the foundation for a stronger national public safety and security system.

Economic Competitiveness

When you keep traffic moving through your community, you keep money flowing into it. Transportation is a key factor in business location decisions. For manufacturers and wholesale suppliers, efficient freight movement is a key consideration. Retail and service businesses consider

ease of access for employees, customers, and delivery services; availability of parking; and the overall attractiveness of the community as a shopping and entertainment destination. Real estate values in your community also depend on effective traffic congestion management. As noted above, 75 percent of respondents in the Federal Highway Administration survey said traffic congestion is a primary factor in their home location decisions.

Environmental Quality

Transportation demand management (TDM) tackles congestion by motivating drivers to take transit, carpool, walk, or bicycle. Fewer vehicles on the road mean lower emissions and better air quality. Reducing trip time also reduces emissions, so strategies such as better signal timing and coordination or traveler information systems also have environmental benefits. The federal Congestion Mitigation and Air Quality (CMAQ) program can be used as a funding source for congestion relief projects that have environmental benefits.

Did You Know?

If you only do one thing as a result of this guidebook, ask your traffic engineers how often they re-time the traffic signals . . . it is one of the most cost-effective investments available for congestion relief.

Livability

Another important way to manage traffic flow and traffic safety on arterial highways is by access planning—a plan for providing access to land development, while preserving the safety and capacity of the transportation system. For example, collisions and congestion can both be prevented by using medians, curbs, turning lanes and driveway regulations to limit the options for turning movements. These access management strategies also provide opportunity for landscaping and streetscape design, which can transform the appearance of the roadside from an unattractive strip mall to a community area with character and charm.

Getting Down to Specifics: How to make arterial highways less congested, safer, and more environmentally friendly

Here is a menu of arterial management tools. Not every option is right for every community, but becoming more aware of what's possible is a first step toward determining what's best for your locality.

SIGNAL TIMING

If you only do one thing as a result of this guidebook, ask your traffic engineers how often they re-time the traffic signals. Signal systems should be re-timed at least every three years to respond to changes in traffic volumes and patterns.

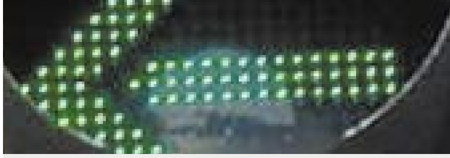
Most agencies responsible for signal systems either do not have a regular program to maintain signal timings or do it so infrequently that the benefit is lost. According to a 1987 FHWA study, more than half of the 240,000 urban signalized intersections in the United States need their physical equipment upgraded and their signal timing optimized.

Improving signal timing plans costs about $500-$3000 per signalized intersection. According to a Federal Highway Administration (FHWA) video released in 2002, re-timing traffic signals is one of the more cost-effective techniques available to state and local agencies in their efforts to manage congestion and growing travel demand.

The video, "It's About Time, Traffic Signal Management: Cost-Effective Street Capacity and Safety," demonstrates how signal timing on roads can improve air quality while reducing fuel consumption, decreasing traffic congestion, and saving time for commercial and emergency vehicles. It also shows that re-timing can reduce aggressive driving behavior and the number of severe accidents. (To obtain a copy, consult the listing in Appendix E, Publications/Resources–General of this guidebook.)

Did You Know?

According to a 1987 FHWA study, more than half of the 240,000 urban signalized intersections in the U.S. need their physical equipment upgraded and their signal timing optimized.



Because idling at traffic signals produces unnecessary emissions, signal re-timing is good for the environment. In July 2002, the Metropolitan Washington Council of Governments' Transportation Planning Board adopted an extensive signal re-timing program as part of a $38 million plan to cut vehicle emissions in the national capital region in order to meet Clean Air Act requirements. The stakes are high: if Clean Air Act requirements are not met, Maryland, Virginia, and the District of Columbia will not be able to continue to use federal-aid highway funds for new road and transit projects in the Washington metropolitan region. Supporters say the re-timing also will reduce commuting times by 10 percent.[11]

Did You Know?

The spacing between arterial signals is one of the most critical factors in determining vehicle speed between intersections.

SIGNAL COORDINATION AND INTERCONNECTION

Coordinating and interconnecting signals is a powerful congestion management tool. At the most basic level, pre-timed signals are interconnected. More sophisticated systems include traffic-actuated signals that can respond to dynamic and changing traffic conditions.

The most critical and sensitive elements of signal coordination are the spacing between signals, the operation of left turn signal arrows, and the timing of pedestrian crossings.

Signal Spacing The spacing between arterial signals is one of the most critical factors in determining vehicle speed between intersections. The spacing of arterial signals in one-half-mile intervals will allow for a 35-40 mph progression of traffic in all directions. Uneven signal spacing will negate the best efforts of the most sophisticated control equipment and virtually guarantees the creation of extra stops.

Left Turn Arrows The use of left turn arrows will significantly reduce the through capacity of any intersection. Arrow signals must be designed to allow traffic to turn during the through traffic green interval.

[11] Katherine Shaver. "Traffic Signal Re-Timing Approved to Help the Air." Washington Post. August 1, 2002: B1

Pedestrian Crossing Time Wider roadways with media strips should be designed to accommodate a pedestrian safe haven in the center of the roadway to protect and assist crossing pedestrians.

CROSS-JURISDICTIONAL COORDINATION

Traffic doesn't recognize city, county, or regional boundaries. Cross-jurisdictional signal coordination optimizes traffic flow through local arteries. The city of Greenwood, Colo., achieved a 13 percent reduction in travel time and a 17 percent improvement in travel speed after launching a new timing plan that was coordinated among all local agencies. Philadelphia, Penn.; Monroe County, N.Y.; Montgomery County, Md.; and Tucson, Ariz., are other examples of the many large and small communities where agencies involved in traffic planning have cooperated and communicated to bring the benefits of traffic signal coordination to their regional arterials. Costs for signal coordination and inter-connection range from $5,000 to $13,000 per signalized intersection. (See Section II Case Study, "San Diego Region Uses CMAQ Funds for Cross-Jurisdictional Signal Coordination," p.30.)

WAVE OF THE FUTURE: ADAPTIVE SIGNAL CONTROL SYSTEMS

Automation of real-time, dynamic signal control is called adaptive signal control. Sophisticated software programs enable adaptive signal control systems to automatically adjust traffic signal timing in response to current traffic demands. Based on real-time data on the volume and speed of traffic in each travel lane, the system continuously selects the most appropriate signal timing for existing conditions and implements it within one signal cycle. Adaptive signal control systems are relatively expensive and cutting-edge, but they show great promise, particularly for managing unpredictable, non-recurring congestion caused by traffic incidents, weather events, special events, and highway work zones. Lower-cost adaptive signal control systems now in the early stages of development could soon place this technology within the reach of smaller communities. (See Case Study, "Adaptive Traffic Signal Control System Improves Post-Event Travel Time by 19 Percent," p.31.)

Did You Know?

Access management programs combine traffic engineering with land use planning and regulation

FREEWAY/ARTERIAL COORDINATION

New ITS technologies for monitoring real-time traffic flow, detecting incidents, and remotely adjusting signal timing make it possible to manage traffic dynamically. For example, when a crash occurs on a parallel freeway and causes traffic to divert to an arterial, signals can be adjusted to favor additional traffic flow on the arterial. Unfortunately, only 30 percent of freeway management agencies share traffic information with agencies managing the arterial systems, and agencies responsible for arterial management rarely share information with others, possibly because they do not have it to share. Traffic surveillance equipment is installed on less than one percent of the nation's arterial roadways.[12] Yet studies predict integrated freeway and arterial traffic flow management could reduce travel time by 18 percent.[13] (See Case Study, "San Antonio Uses Technology to Alleviate Incident-Related Travel Delay," p.40.) As a local official, you might ask how your jurisdiction is working with neighboring jurisdictions and with the state highway agency to coordinate freeway and arterial operations.

ACCESS MANAGEMENT

Through traffic often needs to slow down for vehicles entering, exiting, or turning across the roadway. At least half of all crashes on the urban street system are related to these access-related movements. Unrestricted development along an arterial can lead to dangerous traffic conditions and frustrating gridlock.

Every community should have a good access management program to improve traffic flow and safety. Access management programs combine traffic engineering with land use planning and regulation. Typical elements of an access management plan include:

Fewer access points Limiting turning movements and through movements from cross-streets by use of roadway design features such as medians and curbs, and/or traffic regulations.

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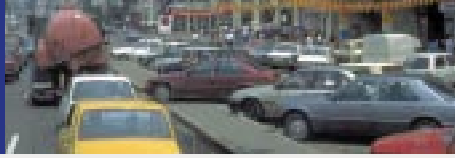
[12] *Canby, 2001*
[13] *Brist, Shawn and Ayman Smadi, "An Evaluation of ITS for Incident Management in Second Tier Cities: A Fargo, ND Case Study," presented at the ITE 2000 Annual Meeting, Nashville, TN, August 2000.*



Greater separation of access points—for example, assuring adequate spacing between driveways and street intersections.

Better driveway and parking area design—for example, regulations requiring driveways and parking areas to have adequate turning radii, or, in commercial zones, requiring adequate off-street loading areas.

Local officials may need to convince property owners and taxpayers of the benefits of access management. Without an explanation of how the access management plan will benefit their lives, homes, and businesses, property owners may see driveway and parking regulations as needless intrusions on their home ownership and land development rights. The benefits to traffic flow and safety may not be compelling "selling points" for access management in the community, although community beautification has broad appeal to landowners. The opportunity to install streetscaping and landscaping improvements may provide a primary incentive for landowners to cooperate with an access management program. (See Case Study, "Access Management: Finding Benefits for Everyone," p.35.)

Did You Know?

Local officials may need to convince property owners an taxpayers of the benefits of access management.

NOT YOUR FATHER'S CITY BUS: BUS RAPID TRANSIT

Bus Rapid Transit (BRT) aims to ease congestion by transforming bus travel into an attractive choice for urban travelers. The BRT concept includes many elements to select, combine, or add incrementally, according to your community's needs and budget. These elements include:

- *signal transit priority and other ITS technology;*
- *dedicated bus lanes or separate bus ways;*
- *cleaner and quieter low-floor vehicles that take advantage of compressed natural gas and other clean-air technologies;*
- *rapid and convenient fare collection;*
- *more frequent service with fewer stops; and*
- *operating speeds nearly double those of conventional buses.*

Because it can operate on exclusive busways, HOV lanes, expressways, or ordinary streets, BRT supporters say that the system combines the best features of subways with the flexibility of over-the-road vehicles, thus offering outstanding service at a fraction of the cost of rail.

Support for BRT is growing. In the spring of 2002, the Federal Transit Administration's (FTA's) BRT Initiative published a vision statement and action plan that called for deployment of 10 BRT projects by 2004. The planned projects included: Los Angeles, Alameda-Contra Costa Transit District, San Diego, and Santa Clara in California; Hartford, Conn.; Miami, Fla.; Eugene, Ore.; Boston, Mass.; Albany, N.Y.; and Montgomery County, Md., as well as an additional 12 projects to be deployed by 2008. FTA believes BRT can reduce travel time by 20 percent, increase ridership by 20 percent, reduce capital costs by 25 to 75 percent, and reduce operating costs per revenue mile by up to 60 percent.[14]

Among the early BRT successes is the Metro Rapid system in Los Angeles, Calif. The buses follow an express route along the Wilshire Boulevard and Ventura Boulevard corridors. They have wider spaces between stops than regular buses, as well as traffic priority signal interaction. The system began operating in June 2000, and in the first seven months, it cut commuter travel time by as much as 25 percent. Ridership on the Wilshire corridor rose by 32.6 percent and on the Ventura corridor by 26.4 percent.[15] *Approximately one-third of those additional riders are new to public transit of any kind. Future plans call for use of dedicated lanes and for expansion from the current route coverage of 40 miles to approximately 400 miles, with 23 new routes.*[16]

REGIONAL INCIDENT MANAGEMENT PARTNERSHIPS

A highly effective strategy for alleviating traffic congestion—and its impact on our economy and safety—is to clear the roadway more quick-

[14] Pdf of slide presentation available at http://www.gobrt.org/BRT_Vision_Action_Plan.pdf

[15] Los Angeles Metropolitan Transit Authority news release "MTA Board Approves Wilshire Bus Rapid Transit, Exposition Light Rail Projects for Mid-City/Westside Corridor." June 28, 2001. http://www.mta.net/press/2001/06_june/mta_094.htm

[16] "LA Success Story: Go Metro Rapid!" Bus Rapid Transit NewsLane newsletter produced by Westart-CAL-START, June 2002.

ly after crashes and other roadway incidents. As anyone who lives in an urban area can attest (and 80 percent of Americans live in urban areas), and as recent U.S. DOT surveys bear out, it is the unpredictability of travel times that most interferes with our lives. We can schedule around or through routine rush hour traffic. But having to pad our daily commute time to allow for the unpredictable traffic jam is what most frustrates commuters. More than half of the time we sit in back-ups is attributable to traffic incidents.

When we take a close look at the way most communities respond to traffic incidents, we clearly see room for improvement. Very few localities, regions, or states have standardized procedures or established practices to efficiently clear roadway incidents. One reason is that institutional responsibility is dispersed. Law enforcement agencies typically are the first on the scene of a crash, where their primary responsibilities are enforcement and investigation. While law enforcement officers may manage traffic control at the scene before the transportation agency responders arrive, maintaining traffic flow is not part of their mission at incident sites. Very few officers have been trained in traffic control equipment and procedures as defined by the U.S. DOT's Manual of Uniform Traffic Control Devices (MUTCD). Fire and rescue units and emergency medical services may also respond to the incident. But clearing the incident scene and restoring normal traffic flow is not a key objective for anyone except the transportation agency.

That's why a growing number of states have developed Incident Management Service Patrols. These are teams with special training and equipment. Their vehicles are equipped with traffic control devices, and they are trained in MUTCD, Unified Command, and other applicable procedures. Service patrols are designed to provide faster incident response and to clear the road more quickly, while freeing law enforcement officers from traffic control duties at incident sites. Many states have Incident Management Service Patrols on freeways. Using them on arterial roadways is a relatively new concept that local transportation

Did You Know?

Very few localities, regions, or states have standardized procedures or established practices to aggressively clear roadway incidents. One reason is that institutional responsibility is dispersed.

Did You Know?

Local governments can play a vital leadership role in overcoming institutional inertia and political self-interest, which prevent transportation and public safety agencies from forming regional operational partnerships.

agencies should consider. (See Case Study, "Regional Emergency Action Coordinating Team (REACT) Coordinates Arterial Incident Management," p.24.)

Coordination challenges arise with incidents involving several types of responders from different jurisdictions or levels of government. One solution is to establish crosscutting regional incident management partnerships, where public safety and transportation agencies create joint operational policies and procedures. The partnerships can develop joint operational plans for various emergency scenarios, ranging from traffic crashes to major disasters. Ideally, partnerships foster good working relationships, encourage resource sharing, and enable participating agencies to leverage their resources and create joint, interoperable information and communications systems. Under the Unified Command concept all incident responders would be trained in traffic control techniques. Also, procedures call for representatives of responding agencies to weigh competing incident management objectives at the scene and to establish joint strategies for reaching agreed outcomes.

Local government officials can play a vital leadership role in overcoming institutional inertia and political self-interest, which prevent transportation and public safety agencies from forming regional operational partnerships.

- *Ask how your community's transportation, law enforcement, fire and rescue, and EMS agencies are working together to clear the road more quickly after traffic incidents.*
- *Ask how they coordinate with neighboring jurisdictions and with state and federal agencies to plan and prepare for weather-related incidents and disasters.*
- *Think about how you can provide the leadership needed to build regional cooperation. Section III of this guidebook provides suggested leadership techniques.*

EVENT MANAGEMENT

Special events—from ballgames to the Fourth of July parade to the county fair and everything in-between—play a vital role in community

life. These events bring the community together, stimulate civic pride, and boost the local economy . . . unless people stop attending because they can't tolerate the traffic.

Managing traffic flow, public safety, and security at public events is a growing concern for local officials. Effective event management requires advance planning and teamwork. The same operational partnerships that are needed for effective incident management can improve event management in your community. In fact, major events (such as the Olympics) are one of the few situations where, historically, public safety and transportation organizations have fully integrated their operations. In your community, consider working toward ongoing operational coordination, for incidents and events, large and small. *(See Case Study, "With 2000 Events a Year, Los Angeles Has Special Event Management Down to a Science," p.27.)*

Did You Know?

A fifteen-minute lane closure can cause an hour-long backup.

CONSTRUCTION WORK ZONE MANAGEMENT

Suddenly, orange cones are everywhere. The good news is that investment of federal highway funds for rebuilding, resurfacing and widening existing roads more than doubled between 1995 and 1999, even as communities updated water, sewer, and communications infrastructure. The bad news is that construction-related traffic delays are a serious problem across the country.

Many strategies are available to minimize work-zone-related traffic delays. Scheduling work for off-peak hours is an obvious first step. Other steps include requiring contractors to file traffic control plans, to comply with traffic control regulations, and to provide for parking, transit, pedestrian and bicycle access. *(See Case Study, "In the Wake of the Quake: Seattle Manages Construction Zone Challenges," p.38.)*

AUTOMATED ENFORCEMENT

Red light running: One need only hear the number of accidents attributable to red light running in this country—100,000 a year—to understand how many back-ups and bottlenecks they cause. A fifteen-minute

lane closure can cause an hour-long backup. Red light running also causes about 950 deaths a year. To curb these avoidable crashes, more municipalities are turning to automated enforcement of red-light regulations. In these programs, cars entering the intersection during the red light signal phase are photographed. Vehicle owners receive tickets in the mail, along with a photograph documenting the time, date, and place of the incident.

Automated Speed Enforcement (Photo Radar) works on the same principle. Because speed causes collisions, less speeding on streets and highways will reduce the number of collisions and injuries. Photo radar speed enforcement is designed to slow the speed of traffic, keeping it within the posted limits, thereby reducing the number of collisions and the resultant backups and bottlenecks.

Automated enforcement has proven very effective in reducing red-light running at the intersections where cameras are installed, and it frees law enforcement officers for other duties. In Howard County, Md., for example, the red light violation rate dropped approximately 53 percent across all intersections with photo enforcement systems. In New York City, a 20 percent reduction in red-light running was reported as a result of automated enforcement between 1993 and 1997. However, only one percent of urban arterials have surveillance cameras installed for either photo enforcement or speed enforcement. Think about whether this system is appropriate for your community.

Did You Know?

Automated enforcement has proven very effective in reducing red-light running at the intersections where cameras are installed, and it frees law enforcement officers for other duties.

TRANSPORTATION DEMAND MANAGEMENT (TDM)

Transportation Demand Management (TDM) is a general term for strategies designed to reduce number of trips and number of vehicles on the road. Examples include carpooling, vanpooling, transit subsidies, encouragement of walking, bicycling, and telecommuting. In some communities, local businesses partner with public transportation agencies to provide subsidized shuttle buses, carpools or vanpools for their employees. These transportation options may be partly funded through CMAQ (Congestion Mitigation and Air Quality) and other federal programs.

(See Case Study: "Lake Cook 'Shuttle Bug' Gives Commuters an Alternative to Traffic Back-Ups," p.33.)

ARTERIAL/RAIL GRADE CROSSINGS

Where railroad tracks cross arterial highways at grade, traffic can back up when trains pass, particularly during the hours of peak traffic flow. ITS technologies can warn travelers when trains are approaching through variable information signs and other traveler information systems, allowing them to choose alternative routes. Also, traffic signals can be coordinated to favor traffic flow along the arterial to clear the traffic back-up after the train passes. Automated enforcement of grade crossing regulations is another option for increasing safety at railroad crossings.

TRANSIT AND EMERGENCY VEHICLE SIGNAL PRIORITY

New technologies are available that allow green light priority for transit and emergency vehicles. Transponders on the vehicles tell the traffic signal that the transit or emergency vehicle is approaching, and the signal responds by providing a green signal for the priority vehicle until it clears the intersection. These systems are relatively new and are being tried in many localities where traffic congestion is a growing concern for transit and emergency operations.

FOOTING THE HIGH-TECH BILL

While few municipal governments would question the usefulness of the new ITS technologies, even fewer are able to easily fund them. Local officials can play a leadership role in seeking creative funding arrangements and forging partnerships among government agencies and with the private sector. For example, the city of Tucson, Ariz., is paying for its live traffic flow video feed by selling the video feed to a local private business. That company resells the traffic update spots to radio, television, and other private concerns. *(See Case Study, "Selling a Traffic Jam, Paying for the Cameras," p.42.)*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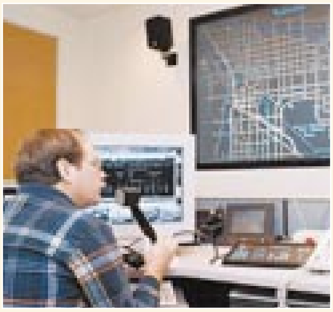
SECTION II

CASE STUDIES



MARICOPA COUNTY, ARIZONA



Incident Management Teams

Regional Emergency Action Coordinating Team (REACT) Manages Emergency Traffic on Arterials

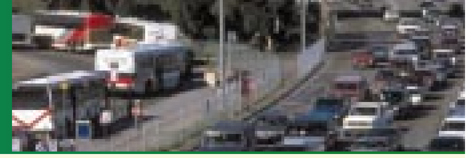
Traffic congestion and traffic incidents are significant challenges in Maricopa County, Ariz., which includes the Phoenix metropolitan area. Maricopa County has many different local jurisdictional areas, which means that a closure in one city often will affect traffic in surrounding cities. The Arizona Local Emergency Response Team (ALERT), supported by the Arizona Department of Transportation, provides emergency traffic management on freeways. The Maricopa Department of Transportation (MCDOT) and AZTech, the regional transportation partnership, launched the Regional Emergency Action Coordinating Team (REACT) in January 2001 to address the problem of emergency traffic management on arterial roadways. REACT is the nation's first regionally coordinated team for emergency traffic management on arterials.

REACT is being implemented in phases. The cities of Glendale and Peoria are participating in the pilot phase under verbal agreements. During the first year of the pilot program, the team responded to 102 incidents, an average of 8.5 incidents a month. The cost/benefit ratio for more than 100 call-outs of REACT is 6:1, according to a study by Battelle Memorial Institute completed in 2002.

"Traffic incidents on arterials are dynamic situations," said Barbara Hauser, ITS Incident Management Program Manager for MCDOT. "Arterial traffic control requires more people and more equipment than freeway traffic control. It takes four or five trucks and five people to close an intersection where two major arterials intersect. In addition, there are public relations issues when closures affect public access to and from business locations and homes. In contrast, just two fully equipped vehicles can usually close a freeway. The major issue there is speed, but once you get used to that, freeway traffic management is relatively straightforward."

Did You Know?

The cost/benefit for more than 100 call-outs of REACT was 6:1, according to a study by Battelle Memorial Institute completed in 2002.



REACT's service is provided by a team of 12 members who set up emergency lane/road closures, install and maintain signed detour routes, direct traffic, and participate in the Unified Command structure. "We require our team members to take the Traffic Control Technician and Traffic Control Supervisor courses developed by the American Traffic Safety Services Association, as well as the National Highway Institute Incident Management Course, an Incident Command course, and a Hazardous Materials course," Hauser said. "Our goal is to develop a mutual aid philosophy based on criteria already established by our local public safety agencies."

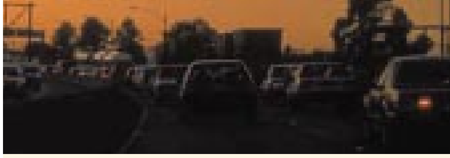
The Unified Command system allows several agencies to develop unified objectives and strategies for the incident. When an incident occurs, one "Incident Commander" from each agency reports to the command post. The combined command structure then implements the coordinated plan of action.

REACT works closely with the Maricopa County Sheriff's Office, the Arizona Department of Public Safety, Arizona Department of Transportation, and local police, fire, and transportation departments.

The goal is to provide the service throughout Maricopa County and to function through intergovernmental agreements among all the agencies and municipalities. A mutual aid/mutual response agreement is currently being developed through the AZTech partnership.

"Because the REACT team is handling traffic control, we're able to send our patrol officers back to the road after they complete the incident investigation," said Officer John Singleton of the Glendale Police Department. "I can't tell you how impressed we are."

AZTech, the regional partnership that supports the Phoenix region's ITS deployment, provides automated traffic surveillance that permits faster detection of incidents and real-time control of variable message signs (VMS) to alert motorists to incidents and detours.



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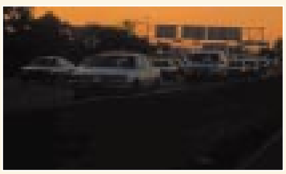

"The public works/transportation field must develop its emergency responders to be as proficient in traffic management as police and fire are in their given fields," Hauser said. "This will require in-depth training and mastery of skills on the job. Until we reach this level of job performance, we will not achieve the goal of efficient management of traffic during emergencies.

"Not all maintenance or operations field personnel are trained to handle the demands of this position," Hauser explained. "This role goes beyond basic traffic control. This is Emergency Traffic Management, which is the development and implementation of comprehensive program and demand strategies to maintain traffic flow through or around an incident."

LOS ANGELES, CALIFORNIA

SPECIAL EVENT TRAFFIC MANAGEMENT

With 2,000 Events a Year, Los Angeles has Special Event Management Down to a Science

About 2,000 times a year, the Los Angeles city council, public works commission, or police department notifies the city's transportation department that a special event has been authorized. The Oscars, ballgames, movie filmings, marathons, the Olympics, the Democratic National Convention—special event manager Ali Mahdavi has seen them all. In Los Angeles, it is not unusual for two (or more) major events to occur simultaneously. With a staff of only three engineers, Mahdavi's office has event management down to a science.

Special event management requires specialized skill sets. Developing and rewarding these skills is a key to Los Angeles' success in special event management.

"Successful special event operations require engineers, traffic officers, and field personnel to work together," Mahdavi said. The Special Event Division has 25 trained operations coordination specialists.

"Engineers close the streets and the traffic officers maintain the closure," he explained. "Traffic officers are stationed in our transportation command centers, and sometimes they serve as Event Commanders. Some of our engineers are trained in security, emergency evacuation, and contingency planning. We have a strong relationship with the traffic officers."

The city spends about $3.1 million a year for overtime pay for special events. Traffic officers receive 80-85 percent of that amount. City policy allows engineers who are required to attend special events during normal business hours to be reimbursed for the overtime effort necessary to catch up with their regular duties.

"An engineer's rank has no meaning at a special event," Mahdavi said. "We have a separate ranking system, based on their training, experi-

ence, and ability. For example, the engineer who supervises traffic management for Dodger games has relatively little seniority."

Engineers are evaluated after each event. Evaluation forms are handed in at the same time as the overtime pay time sheet. In addition, traffic officers and engineers who work at special events fill out extensive questionnaires that inventory their skills, including language skills.

"If someone said, 'Give me a signal engineer who knows Chinese,' we have the ability to do that," Mahdavi said. "We know who is good in what areas."

Public information is an important component of special event management in Los Angeles. "We put up signs with a hot line number well in advance of events that will disrupt regular traffic patterns," Mahdavi said. "We also use changeable message signs and the Internet to get the word out. We have a fax network of 105 agencies representing homeowners and businesses that we routinely notify of scheduled events, and we leverage their publicity networks to reach the public. When we believe a street closure will require the public to choose an alternate route, we identify hot points—churches, hospitals, schools, museums—and ask them to reschedule their operations if possible. If they are not able to do so, we try to accommodate them."

The city engineers prepare a traffic management plan for each event, identifying affected streets and traffic management strategies. Events are classified according to their effect on the transportation network, in terms of both extent and duration. The smallest events (Level 1) require no action from the transportation department, except possibly removal of parking restrictions. The next level up (Level 2) may require deployment of traffic officers. For 350-400 Level 3 events each year, the city engineers are deployed on site, and the traffic signal control center is asked to adjust signalization to accommodate event-generated traffic.

With 26 miles of road closure that must be maintained for 10 hours, the Los Angeles marathon is a Level 4 event. During the marathon the city deploys 80 engineers and 450 traffic officers, at a cost of $186,000 in overtime pay. At Level 4, the city's transportation operations center actively coordinates multi-modal traffic and travel management.

Level 5 events activate the citywide Emergency Operations Center (EOC), where officials from the city's public safety and transportation agencies coordinate operations from a single location. For example, when the Northridge earthquake struck on January 17, 1994 at 4:30 a.m., the EOC was activated by 4:31 a.m. By 6:00 a.m., 20 Los Angeles city traffic engineers were already detailed to conduct initial damage assessments. By 10:00 a.m., the department's emergency operations command centers were up and running.

"We were able to respond quickly because we had operational procedures in place, trained people, a chain of command, and a good radio communications network." Mahdavi said.

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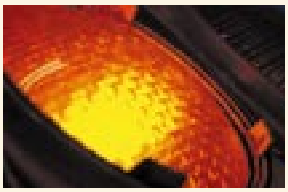

TRAFFIC SIGNAL CONTROL IMPROVEMENTS

San Diego Region Uses CMAQ Funds For Cross-Jurisdictional Signal Coordination

Interconnecting traffic signals and optimizing traffic signal timing can reduce travel time from 8 to 25 percent along a corridor or artery.[17] Cross-jurisdictional signal coordination not only alleviates traffic congestion; it improves air quality and safety as well.

Three municipalities in the greater San Diego region used federal CMAQ (Congestion Mitigation and Air Quality Program) funds to interconnect traffic signals along three major arterials. CMAQ funds may be used for projects or programs that contribute to attainment of clean air standards. Improved signal coordination enhances traffic flow and therefore reduces emissions from cars running idle at traffic stops.

The traffic signals along College Avenue, Federal Boulevard, and Broadway are interconnected by a fiber optic cable. A dedicated server computer in the Lemon Grove City Hall provides real-time monitoring and central control of the interconnected signals. All three municipalities, as well as the California Department of Transportation (Caltrans), have simultaneous access to the control system. The system is programmed so that each partner agency retains control over the timing of its own signals and other sensitive parameters.

A memorandum of understanding (MOU) among the three cities outlines the responsibilities of each of the parties. The City of Lemon Grove maintains the central control system, while each city maintains the fiber optic cable, traffic controller cabinets, and fiber optic modems located within its own city limits. (A copy of the MOU is included in Appendix A.)

[17] *Federal Highway Administration Brochure, "Cross-Jurisdiction Signal Coordination." (Publication No. FHWA-OP-02-034).*

TRAFFIC SIGNAL CONTROL IMPROVEMENTS

Adaptive Traffic Signal Control System Improves Post-Event Travel Time by 19 Percent

Getting home out of traffic faster after a concert or ball game—there's a real crowd-pleaser. Thanks to the adaptive traffic signal control system in downtown Minneapolis, post-event travel times have improved by 19 percent.

Adaptive traffic signal control systems automatically adjust traffic signal timing in response to actual traffic demands. Using real-time data on the volume and speed of traffic in each travel lane, the system continuously selects the most appropriate signal timing for existing conditions and implements it within one signal cycle. Adaptive traffic signal control systems are designed to provide fewer stops and less delay for motorists—a popular notion, indeed.

Minneapolis selected an adaptive control strategy to address challenges posed by significant variations in downtown traffic volumes and patterns that have evolved over the past few years. The termination of I-394, addition of the Target Center (a 20,000-seat arena), and increased development in the area have resulted in traffic patterns that vary significantly by time of day. Events, incidents, weather conditions, and construction activities add to traffic pattern variability.

The Adaptive Urban Signal Control and Integration (AUSCI) Intelligent Transportation System covers a portion of the Minneapolis central business district that includes 56 intersections. Traffic data is collected by 138 video detection cameras. AUSCI integrates an adaptive control system with the original signal control system (where signal timing was based on pre-programmed, time-of-day operation). The operator can easily select which of the two control strategies to implement. Therefore, a direct comparison of the effects of the two traffic control systems is possible.

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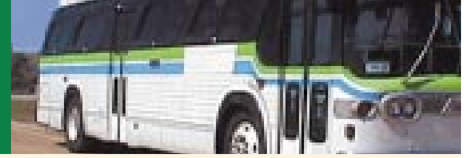
Although it reduces travel times after special events at the Target Center by an impressive 19 percent, the adaptive control system has had no overall measurable effect on traffic flow during routine rush hours. This suggests that the adaptive system is most effective at managing unpredictable traffic flows, rather than more routine rush hour traffic. However, eventually, the time-of-day timing plans installed in the conventional signal control system will become outdated, while the adaptive system will continually update itself. Thus, while there may be no differences now, the adaptive system may provide additional benefits later. Another factor affecting measurable improvement may be the fact that the system was deployed in a central business district. In Toronto, an adaptive signal control system is showing larger benefits along suburban arterials than in the central business district.

The AUSCI project was supported by the Federal Highway Administration (FHWA) as an Intelligent Transportation System (ITS) field operational test.



DEERFIELD, ILLINOIS

TRANSPORTATION DEMAND MANAGEMENT

Lake Cook "Shuttle Bug" Offers Commuters An Alternative to Traffic Back-Ups

Lake Cook Road, 25 miles north of Chicago in Deerfield, Ill., is a four-lane arterial roadway that carries more than 45,000 vehicles daily. Recurring congestion is a serious concern to the Lake Cook business community. For more than 10 years, major employers have supported the Lake Cook Transportation Management Association (TMA) in finding ways to better manage travel in the Lake Cook Corridor.

Back-ups at several intersections often extend up to a mile, with seven- to ten-minute delays. Every day, recurring congestion on Lake Cook Road is estimated to add more than 4,000 vehicle hours of delay to travel. More than 50,000 people work in companies located on or near this heavily congested road.

Because all the other major arterials in the larger 200-sq.-mi. corridor are also very congested for six to eight hours a day, commuters have few options to a long, frustrating drive to and from work. But since 1996, about 25,000 commuters have had another option—"Shuttle Bug," the TMA's shuttle service to and from commuter rail stations. The shuttle system covers 16 routes and services 35 business sites, providing service to about 600 commuters a day. Target riders are those who commute out of Chicago to jobs in the suburbs, but significant ridership also comes from suburban residents.

Pace Suburban Bus, the regional public suburban bus agency, and Metra, the Chicago region's commuter rail service, are key partners in the business transportation management program, which includes 18 other public agencies and 25 private sector partners, including Underwriters Laboratories, Walgreen's, and Morgan Stanley Dean Witter.

Sixty percent of program funding is provided through public funding sources and the remainder comes from the private sector. The program

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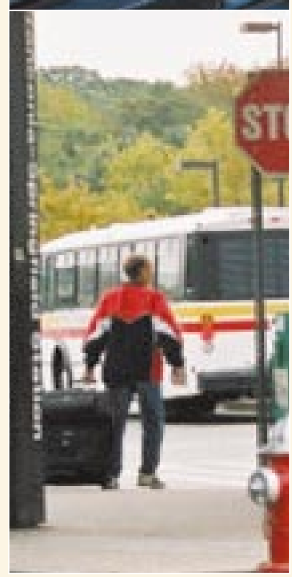


has used federal funds provided through the Job Access program, which supports transportation of inner-city workers to suburban locations (reverse commuters) as well as to start-up businesses. Congestion Mitigation and Air Quality (CMAQ) funds also are used. On routes where CMAQ funds are used, employers pay 20 percent of the cost of the shuttle bus. On other routes, the bus is provided free to participating employers.

"The program significantly reduces the cost to business of subsidizing public transportation for employees," said TMA Executive Director Bill Baltutis. "If the businesses had to start a bus service on their own, it would cost them $40,000 to $50,000 a year. We provide quite a savings."

For example, in the Lake Cook Service Area, the shuttle service costs $550,000 a year. Employers pay $216,000 of that cost. The employers' contributions are calculated based on the size of their employee population and pro-rated based on company ridership. Employee populations range from 100 to 2,500. Most companies pay an average of about $16.25 per employee annually, or just $40,625 for the largest employers.

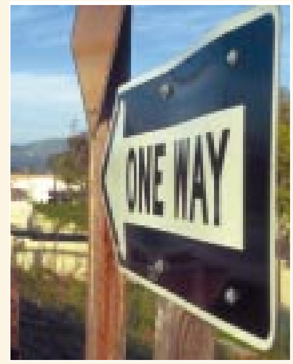
The shuttle bus offers premium service. "It is not a main line route," Baltutis said. "This is door-to-door, providing minimal waiting time, with timed departures. Each bus goes only to four or five companies."

The U.S. Environmental Protection Agency recognized the program in 1999 as a CMAQ "Success Story." The air quality benefits of the shuttle bus are boosted because many riders have commutes of more than 15 miles one way. Even more importantly, surveys show that 60 percent of those who take the shuttle previously drove to work alone.

Employers like the service because it helps attract employees, who, once employed, face a less stressful work trip. Another bonus--by adding fare-paying passengers on the return leg of train journeys to downtown, Metra is able to make its service more cost-effective.

ACCESS MANAGEMENT

Access Management: Finding the Benefits for Everyone



Access management coordinates access to land development with preservation of the safety, speed, and capacity of surrounding traffic flow. For example, limiting the numbers of driveways and median openings along arterials is an access management strategy.

Access management presents unique institutional and political challenges. Several states have instituted top-down, statewide access management initiatives with notable success. But in home rule states like New York, state initiatives are seen as an intrusion on local government control of land use. In those states, access management policies must be developed from the bottom up. Education, awareness, and diplomacy are the most important tools for winning local support for access management.

New York's 1,609 localities include 62 counties, 62 cities, 932 towns, and 553 villages. Each has unique developmental environments and transportation needs. When the New York State Department of Transportation (NYSDOT) partnered with the towns of Farmington and Canandaigua to develop an access management plan for a proposed capacity improvement project on Route 332, the key to success was defining project benefits that held value for all of the parties.

The original project scope developed by NYSDOT called for widening from two to four lanes, along with intersection and drainage improvements. The planning process established a project team that included representatives of the town governments, the NYSDOT's access management team, and NYSDOT regional staff. As a result of the interaction of this planning team, several access management elements were added to the plan: a restrictive median, pre-construction of future intersections, and the cooperative development of new access roads. Each of these

TABLE 1 VALUE OF ACCESS ELEMENTS Access Elements	Value to Towns	Value to State
Restrictive median	***Improved aesthetics and better control over the type and size of development***	***Safety—reduces and manages left turns***
Pre-construction of future intersections	***Reduced local costs for advance completion of local road network***	***Predictability in the development of local roads and better intersection spacing at full build-out***
Access roads	***Reduced local costs for advanced completion of local road network, improved opportunity to expand tax base away from Route 332***	***Safety, mobility, capacity—fewer turning movements and reduced local traffic on Route 332***

elements had value to both the towns and to NYSDOT, but, as Table 1 shows, those values differed.

"A classic win/win situation was defined, and resources were used in a way that allowed each party to contribute what it could best afford, thus broadening the project's overall benefits," said Ken Carlson of NYSDOT's Arterial Access Management Team. "In many projects each participant has distinct objectives and values, a distinct value system, and distinct responsibilities. It is not necessary to have the same goals to achieve symbiosis. All that is needed is to define actions from which all participants benefit in their own terms.

"In our experience, defining access management opportunities for any project from a technical perspective is relatively straightforward. That's not to say that it doesn't require substantial expertise, knowledge, or resources—but simply that technical options are definable and lead to generally predictable solutions," Carlson said. "It's the institutional, political and human elements that are less predictable, less tangible, call for

greater creativity and flexibility, and that ultimately determine whether an access management solution will be acceptable and implemented.

"That being the case, we focus the majority of our effort on addressing these human and institutional issues," Carlson said. Here are five tactics he recommends:

Be opportunistic Focus on areas with high potential benefits (such as high-traffic, rapidly developing corridors), but be flexible and respond to unanticipated events.

Use the right bait—self-interest Provide solutions that benefit all parties on their own terms.

Focus on broader objectives Recognize that the benefits of access management transcend traffic safety and efficiency.

Recognize and overcome barriers to cooperation Devise ways to work with decentralized multifaceted organizations and resolve turf issues.

Build teams and peer support using local leaders Achieve success by using local officials and regional staff as leaders, salespeople, and catalysts in their community and as peer support for officials in other localities.

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SEATTLE, WASHINGTON

Did You Know?

"Sidewalks and bicycle lanes, walkways and bike trails are part of the right-of-way and must be considered in traffic control plans when they are within the affected area."
City of Seattle Construction Staging Policy

CONSTRUCTION WORK ZONE TRAFFIC MANAGEMENT

In the Wake of a Quake, Seattle Manages Construction Work Zone Challenges

Seattle's historic district, which lies between downtown and the baseball field, was damaged in the February 2001 earthquake, requiring bridge closures and traffic detours. The construction of a new football stadium in the vicinity compounded traffic problems. The city's solid foundation of policies and procedures for traffic control in construction work zones helped city officials and contractors cope with these extraordinary challenges.

Contractors are required to file traffic control plans with the city, which are reviewed by a city traffic control engineer. To assist contractors in preparing their plans, the city provides CADD (computer-aided design and drawing) traffic channelization sketches for each of the city's signalized intersections. "This helps make the plans more accurate," said Marilyn G. Vancil, senior engineer in the Traffic Management Division of the Seattle Department of Transportation (SDOT).

Contractors are required to follow the City of Seattle's Traffic Control Manual for In-Street Work, which is based on the FHWA's Manual of Uniform Traffic Control Devices (MUTCD), but modified for urban conditions.

The city has published policies for construction staging and for parking restrictions for construction work (see Appendix A). "We strive to make curb space available for loading and unloading of passenger and commercial vehicles during construction," Vancil said. "The city follows a good neighbor policy of hooding meters where necessary in order to assure parking and loading-zone availability."

Seattle places priority on maintaining its public transportation and pedestrian and bicycle networks. "The Metro bus lines run on overhead electricity, so the construction contractors are not allowed to shut down

the trolley lines except on weekends, when Metro can use motorized coaches on the trolley routes," Vancil said.

"We also try to maintain pedestrian access on at least one side of a construction site, through covered walkways. Contractors are not charged for the walkway space," Vancil said.

CONTACT

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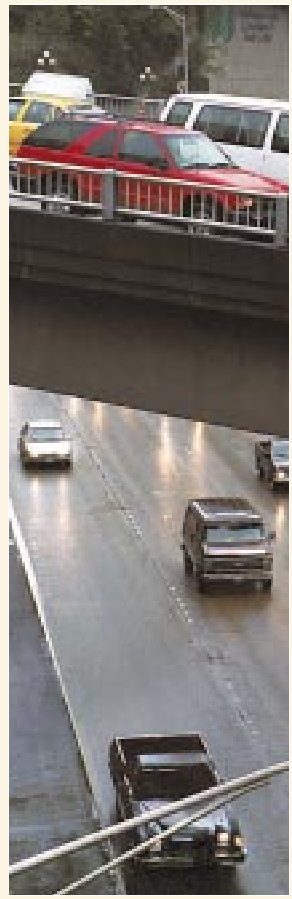

CASE STUDY

SAN ANTONIO, TEXAS

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ARTERIAL/FREEWAY COORDINATION

San Antonio Uses Technology To Alleviate Incident-Related Travel Delay

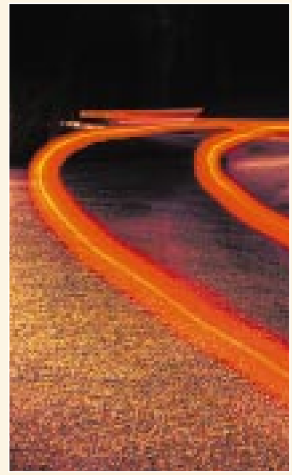
A growing proportion of the nation's freeways and arterials are equipped with real-time, automated traffic monitoring and control systems. Unfortunately, the systems often cannot use information about freeway incidents to direct traffic toward adjacent arterials or to adjust the arterial signal system for the increased traffic flow caused by the freeway incident. Typically, freeway systems are state-operated while arterial systems are locally operated. Integration between traffic monitoring and control systems on freeways and arterial systems is rare, occurring in only 6 of 78 cities studied in 1997 by the U.S. Department of Transportation.[18]

One of the exceptional six is San Antonio, Tex., where the city of San Antonio, the Texas Department of Transportation, and the region's emergency service providers joined to plan and operate an integrated arterial/freeway diversion and incident management corridor. Known as the Medical Center Corridor and located in the city's north end, it is 5.4 miles long and 1.2 miles wide. The Medical Center Corridor technologies are designed to seamlessly identify, respond to, and manage incidents.

The region's TransGuide freeway and incident management system has been expanded, easing freeway operations in the corridor. The more recently deployed arterial management system is centered on the corridor's primary parallel arterial diversion route, Fredericksburg Road. When incidents occur on the freeway, drivers using the arterial road are notified through a series of dynamic message signs on the major approaches from Fredericksburg Road to the freeway system. Drivers may then choose to remain on the arterial until they have reached an interchange downstream of the incident.

[18] *Tracking the Deployment of Integrated Metropolitan Intelligent Transportation Systems Infrastructure in the USA: FY 1997 Results*, Federal Highway Administration, Washington, D.C., September 1998.

The city of San Antonio's traffic management center, which is co-located in the TransGuide facility, also may choose to implement one of six predetermined incident-response signal plans. These special incident plans have been developed with the expectation that freeway incidents will cause travelers to place increased demands on Fredericksburg Road in the direction of the parallel Interstate and on adjacent coordinated systems in the Medical Center area. Consequently, these plans are designed to facilitate traffic movement in response to incident-induced traffic demands and to minimize related traffic delays.



The arterial management system costs $525,000 to launch and costs $47,000 a year to operate. Deployment expenditures included 10 loop stations, three camera systems, nine dynamic message signs, and a new arterial operations work station, as well as the development of the incident response signal plans. Ongoing arterial operations and maintenance costs are kept low by housing the operations center within the existing TransGuide operations center.

CASE STUDY

TUCSON, ARIZONA

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FOOTING THE TECHNOLOGY BILL

Selling a Traffic Jam, Paying for the Cameras
(PTI Transportation Innovation Award, 1999)

The federal government has provided money to encourage state and local governments to develop intelligent transportation systems (ITS). The catch is finding ways to pay for the maintenance and operation of these technology systems when taxpayers are loath to take on more burdens. Tucson was in that dilemma, having deployed ITS to monitor traffic without a clear way to pay for the system going forward.

The city solved the problem by "selling" the traffic flow video feed and information to a private business, METRO Networks-Tucson. The company takes the traffic information and resells the traffic update spots to radio, television, and other private concerns. In return, the city got a remodeled computer center, guaranteed aircraft time for city observation in an emergency, prime time commercial slots for transportation announcements, and full staffing of the computer center by private employees at no cost to the city. In addition, commuters benefit from quick and accurate traffic reports.

The contract is similar to other concession or franchise contracts typically awarded by government, in which a business pays government for the exclusive rights. The annual value of the contact to the city is approximately $114,4000. The city benefits, the taxpayers are relieved, and commuters get help avoiding a traffic snarl.

WASHINGTON, D.C.

REVERSIBLE LANES

Low-Cost and Flexible, Reversible Lane Systems Help Move Commuter Traffic and Ease Construction Zone Congestion

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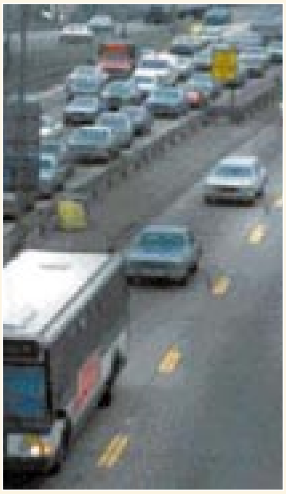
The Washington, D.C. Department of Transportation finds reversible lanes a low-cost, effective way to ease both the permanent condition of massive commuter traffic and the temporary challenges of urban construction. Here are two examples of the system's success.

Canal Road is a narrow and remarkably scenic major artery for commuters working in the nation's capital. A leafy, park-like drive, it follows the Chesapeake & Ohio Canal and towpath, often hugging the base of high rocky crags before ending at Georgetown University, just a mile or so from the White House. Although the federal government owns it, Canal Road is managed by the Washington, D.C. Department of Transportation (DC DOT), which has operated a reversible lane system there for decades.

Today, multiple fiber optic signs alert motorists that, on weekdays from 6:45 a.m. until 9:45 a.m., the three-lane stretch of Canal Road, from Arizona Avenue into the city eight miles, has two lanes inbound and one lane outbound. During afternoon rush hour, two lanes are outbound and one inbound. From Arizona Avenue, moving out towards Maryland, Canal Road narrows to two lanes. For six miles (to Foxhall Road), both lanes are inbound during morning rush hour, and both are outbound during afternoon rush hour. (Vehicles wanting to go in the opposite direction during those times are filtered off to a parallel road). During off-peak hours, the three-lane stretch has two outbound lanes, and the two-lane stretch is open to two-way traffic.

According to Wil DerMinassian, Associate Director of the D.C. DOT, Canal Road's reversible lane pattern has been very successful, and its flexibility easily adapts to new commuting patterns. Recently, he



explained, outbound traffic began to back up badly even before 4 p.m., which is the beginning of the afternoon rush hour. The overwhelming number of Maryland and Virginia tags on these cars indicated that federal government workers were changing their hours, probably using flextime, and were heading home earlier, DerMinassian said. So the department decided that Canal Road's afternoon rush hour would begin at 3 p.m. This low-cost solution simply meant altering the electronic signals and the back-up set of metal signs. Two other important D.C. arteries, Connecticut and Independence Avenues, use reversible lanes as well.

Reversible lane patterns are also easing congestion in construction areas. Sixteenth Street, another major commuter artery, is generally four lanes wide, with two lanes in each direction. But road reconstruction, being undertaken one lane at a time, threatened to cause massive congestion.

"Lane reversal has been very successful in the construction zone," DerMinassian said. "During the morning rush hour, overhead electric signs, together with variable message signs, direct two lanes of traffic inbound and one outbound. For the afternoon rush hour, the process is reversed." In addition, he reported the department has added seconds to the cycle length of traffic signals on Sixteenth Street, making side-road green lights less frequent. "As a result," DerMinassian said, "there has been no increase in congestion."

SECTION III

ACTION CHECKLIST



Five Actions for Government Leaders

As our communities face gridlock, citizens want a multimodal transportation system that operates smoothly, safely, and predictably, twenty-four hours a day, seven days a week. Here are some steps you can take to lead your community to excellence in arterial transportation operations management.

1. SET PERFORMANCE GOALS

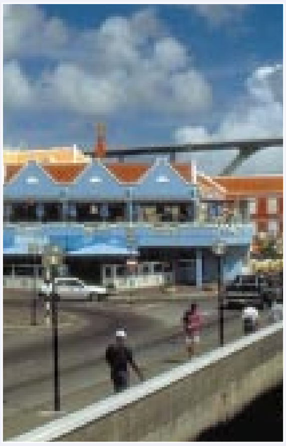
Don't just ask your transportation agencies to "manage congestion" on your community's arterial highways. Set measurable goals. Traffic congestion can be measured in terms of travel time and travel delay. Traffic safety can be measured in specific terms such as number of crashes or number of injuries. In your community, will your goal be to reduce traffic congestion over time? Or will your goal be to maintain current congestion levels as population and development flourish while your highway system capacity remains the same? If your community is growing—and most are—traffic congestion can only get worse unless you take action. Most communities cannot afford to build their way out of traffic congestion, and they face growing political opposition to road building projects.

Did You Know?

State and local transportation agencies can use the Roadway Operations Self Assessment Tool developed by the FHWA Office of Operations to assess their own roadway operations performance, and to find ideas about how to improve operations. The self-assessment covers a broad range of traffic operations areas, including traffic signal timing, incident management, work zones, and freeway service patrols. Organized in discrete modules, an agency may utilize only specific portions of the tool, or may choose to cover the complete set of topics. The questions are applicable to both local streets and to freeways. More than 40 state and local agencies were involved in the development if the assessment tool.

This tool is available on the Internet, free upon registration at http://www.ops.fhwa.dot.gov/Travel/Deployment_Task_Force/registration2.htm

2. DEVELOP A COMPREHENSIVE CONGESTION MANAGEMENT PROGRAM



Create a long-range vision for how you will achieve the target performance levels. Consider the strategies in this guidebook and others. Determine fitting solutions for your community, considering your transportation system, traffic and growth patterns, financial, technical, and personnel resources. The congestion management program you develop will be your answer to the question, "What are you doing about all this traffic?"

3. FOSTER INTERAGENCY AND CROSS-JURISDICTIONAL PARTNERSHIPS, PLANNING, AND PROCEDURES

No matter how good a job your jurisdiction does of managing congestion, traffic will continue to be affected by neighboring jurisdictions. Traffic operations are best coordinated at the regional level. Be a champion for regional transportation and public safety operations partnerships. Tackle turf issues and create working relationships. Bring together state, regional, and local jurisdictions to plan in advance how to handle joint operations for all types of incidents: traffic crashes, weather-related disasters, or terrorist incidents. Agree on joint operating procedures.

4. SEEK INNOVATIVE FUNDING ARRANGEMENTS TO LEVERAGE THE RESOURCES OF ALL PARTIES AND UPGRADE THE INFORMATION AND COMMUNICATIONS INFRASTRUCTURE THAT SUPPORTS TRANSPORTATION AND PUBLIC SAFETY OPERATIONS

Law enforcement, fire and rescue, and emergency medical services (EMS) agencies traditionally compete with transportation agencies for state and local funding. As crime, emergency services, or traffic emerge in the public perception as key problem areas, state legislatures and city councils allocate a greater piece of the funding pie to one or the other. Yet the events of September 11 point to the need to move beyond this narrow approach. Whether they are managing evacuation of a business district in the wake of a terrorist attack or responding to a crash on a

freeway, transportation and public safety officials must coordinate their operations in real-time, based on reliable information about the status of the transportation network. Traffic control, incident management, special event management, weather-related traffic management, and traveler information are all functions where the transportation and public safety communities share operational responsibility.

It is in everyone's interest to upgrade the quality and quantity of our information about what is happening on the roadways and on transit systems, to allow better, quicker operational decision-making. New technology investments can do this. The best systems will be regionally integrated and interoperable.

5. MEASURE PERFORMANCE

It is important to measure the results of a congestion management program—how else will you be able to tell whether it has been successful? Choose performance measures that are relevant to people's everyday lives so that you can use the results to tell the public what their local government has done to manage traffic congestion. Here are some performance measures that are important to system users:[19]

1. *System reliability—You could measure the change in average travel time between specific origin-destination pairs, or you could measure the change in average travel time during a standard time period. For example, one measurement could be a percentage showing how often the person's travel time is no more than 10 percent above the average time.*
2. *"Reasonable" travel time (or speed)—Use specific origin-destination pairs, possibly by route and by time of day; or other measures such as average minutes per mile and average minutes of delay.*
3. *Safety—Use the number of crash incidents or possibly economic costs of crashes.*
4. *Average delay at top "x" bottleneck points in the transportation system or average daily hours of travel.*

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[19] *Michael D. Meyer. "Measuring System Performance: The Key to Establishing Operations as a Core Agency Mission." Georgia Institute of Technology, August 2001.*

APPENDICES

Memorandum of Understanding Between the California Department of Transportation and the Cities of La Mesa, Lemon Grove and San Diego regarding a Traffic Signal Interconnect System for College Avenue, Federal Boulevard, and Broadway December 23, 1999

1. Parties

The parties of this Memorandum of Understanding ("MOU") are the California Department of Transportation ("Caltrans") and the Cities of La Mesa, Lemon Grove and San Diego (collectively, "the cities"). Each party is also referred to herein as an "agency".

2. Purpose

This MOU sets forth the understandings of the parties for installation and operation of an interjurisdictional traffic signal communication system, and states the respective responsibilities of each agency to maintain the system in proper working order.

3. The System

The system will interconnect traffic signals from each agency. Even though the central computer will be located at Lemon Grove City Hall, both Lemon Grove and San Diego will have simultaneous access to the system. In its discretion, Caltrans may have access to the central server computer either by using their existing QuicNet software and work station to access the second port of the field master, or by dialing into the Lemon Grove system using the same method that will be used by San Diego.

<u>1. Intersections</u>

The street intersections whose traffic signals are to be interconnected are:
–College Grove Drive and College Grove Way (San Diego)
–College Grove Drive and College Avenue (San Diego)
–College Avenue and Marketplace at the Grove Driveway (San Diego)
–College Avenue and Federal Boulevard (Lemon Grove)
–Broadway and Federal Boulevard (Caltrans)
–Broadway and Plaza Shopping Center, West Intersection (Lemon Grove)
–Broadway and Plaza Shopping Center, East Intersection (Lemon Grove)
–Broadway and Massachusetts Avenue (Lemon Grove)
–Massachusetts Avenue and SR 94, Eastbound Ramp (Caltrans)
–Massachusetts Avenue and SR 94, Westbound Ramp (Caltrans)
–Massachusetts Avenue and Waite Drive (La Mesa)

2. Condition Precedent — CMAQ Funding

Lemon Grove's participation in the project is to be funded by the federal CMAQ (Congestion Mitigation and Air Quality) Program, administered by Caltrans, as set forth in Exhibit B. Such funding is a condition precedent to the duties and responsibilities of all parties under this agreement, and if such funding is not approved and timely disbursed, then all duties and responsibilities of the parties under this MOU shall be released without any further legal or financial consequence.

3. Technical

The system will interconnect traffic signals from and between each agency via a fiber optic cable. The system will be under full time surveillance by a dedicated server computer to be located in Lemon Grove City Hall. Technical details about how the system will operate are given in Exhibit A, which is incorporated by this reference. Such technical details may be amended from time to time by mutual written agreement of the parties.

4. Responsibilities of the Parties

1. Security Devices

No agency will tamper with the security system, whose purpose is to prevent one agency's modification of another agency's signal timing or other sensitive parameters. Any action that may alter the functioning of the traffic signals of other jurisdictions shall only be upon written authorization of the parties to this agreement unless otherwise specified or provided herein.

2. Notification of Problems

If any party discovers a problem with the system, or receives a credible report of any operational problem with the system, it will promptly inform all affected agencies of such problem.

3. Correction and Communication

If a malfunction results in significant impairment or failure of system functionality, then the agency responsible for the malfunctioning part will promptly repair it. In the event that the source of system malfunction is unknown or unclear, then all parties will cooperate by exchange of information until a correct diagnosis of the problem is made.

2. City of Lemon Grove

The responsibilities of the City of Lemon Grove are:

1. Maintain traffic controller cabinets, fiber optic cable and fiber optic modems located within Lemon Grove city limits, as shown on Exhibit A and maintain fiber optic cable and fiber optic modems located within Caltrans right-of-way as shown on Exhibit A;

2. Acquire, install, maintain and operate central control system;

3. Inform all other parties of any planned down time, twenty four hours in advance;

4. In the event of system malfunction or failure, restore the system to full operation as soon as is reasonably feasible;

5. Pay the cost of such engineers and consultants whose work is necessary to get the system installed, tested, and functioning properly;

6. Provide operating system software and traffic operation software for all parties who wish to use it.

3. The City of San Diego

The responsibilities of the City of San Diego are:

1. Maintain traffic signal controller cabinets, fiber optic cable an fiber optic modems located within San Diego city limits.

2. Provide a computer at the City of San Diego capable of functioning with the central computer, at the Lemon Grove City Hall; such computer shall satisfy the technical requirements stated in Exhibit A, and be owned and operated by the City of San Diego; the contractor for the project shall be responsible for installing and testing the software for communication.

3. Pay for one telephone line at Lemon Grove City Hall for communication with the field equipment, as detailed in Exhibit A. The City of San Diego may use any existing phone line to connect to the central server computer and its operational software. This phone access shall be for the exclusive use of the City of San Diego.

4. Termination responsibilities of the City shall be as noted in Section 8.

4. The City of La Mesa

The responsibilities of the City of La Mesa are:

1. Maintain traffic signal controller cabinets and fiber optic modem located within the La Mesa city limits.

5. California Department of Transportation

The responsibilities of Caltrans are:

In its discretion, Caltrans may use their existing QuicNet software and work station to access the second port of the dual-port master until their software is upgraded to be compatible with the QuicNet 4/Windows NT telephone bridge system or pay for one telephone line at field master or Lemon Grove City Hall using the same method to access the system that will be used by San Diego; in either case, Caltrans will pay for the cost of its own connection to the central service computer.

6. Performance Deadlines Regarding System Installation

All parties which have performance responsibilities which are part of the installation, testing, and operation of the system described in Exhibit A shall take all reasonable steps necessary to make the system fully operational by 12/1/2000.

7. Amendment

This MOU may be amended from time to time by written agreement of all the parties. Such amendments shall automatically override and replace any contrary terms stated in this MOU, while leaving in full force and effect all other terms of this MOU.

8. Termination

This MOU, as amended from time to time, shall remain in effect until terminated by 60 day written notice given by any one party to all other parties. In addition, the City of San Diego may terminate this MOU by disconnecting the system telephone line, to be located at the Lemon Grove City Hall but paid for by the City of San Diego.

9. Authorization

The persons signing below warrant that they are fully authorized by their respective agencies to execute this MOU on behalf of their respective agencies.

The City of Lemon Grove: by: ______________________ Bob Richardson City Manager	The City of San Diego: by: ______________________ D. Cruz Gonzales Director of Transportation
Celtrans: by: ______________________ Stuart Harvey, District Division Chief Traffic Operations	The City of La Mesa: by: ______________________

City of Seattle

Paul Schell, Mayor
Seattle Transportation
Daryl R. Grigsby, Director

Parking Restrictions for Construction Work

February 24, 1999

Goal: Balance needs of construction work with needs of other users of streets.

General Rules:

Keep restrictions to the minimum needed for construction work.

When not needed, remove restrictions, especially in areas where parking areas are heavily used, whether commercial or residential, or on a street with heavy traffic.

This means, remove traffic restrictions

– If there is no work being done that day.

– If the work is at night.

– If no work will be done during the weekend.

In areas with parking meters:

– When work will be done between 7 a.m. and 6 p.m. weekdays and Saturdays, use yellow meter hoods.

– For 24-hour work, use red meter hoods.

– Don't use "no-park" signs for weekday or Saturday daytime work.

– When work will be done at night after 6:00 p.m. or all day Sunday, use T-39 barricade "no-parking" signs (write in the time restriction)

– Do not use traffic or parking lanes for material storage.

When exceptions to these general rules are needed, get permission from SEATRAN Traffic Control Programs in advance.

Seattle Municipal Building, 600 Fourth Avenue, Room 708, Seattle, WA 98104-1879
Tel: (206) 684-7623. TTY/TDD: (206) 684-4009, Fax: (206) 684-5180

Construction Staging Policy

December 10, 2001

1. Follow the City of Seattle Traffic Control Manual for In-Street Work
2. The primary objective of detour routing is to direct drivers away from residential streets. The secondary objective is to direct drivers to the arterial best suited, within reasonable proximity, to handle the detoured traffic.
3. Access to property shall be maintained whenever possible. Contractors need to inform adjacent property owners of work schedule a minimum of one week in advance. Contractors shall provide information signing for businesses affected by the construction at the discretion of the Traffic Engineer.
4. Metro cannot use motorized coaches on trolley tours except on weekends, and therefore they shall be accommodated.
5. When two contractors need to impact the Right of Way simultaneously, the first permit holder has the priority. The City prefers that both permit holders work out an agreement for shared usage within the constraints of an approved traffic control plan.
6. The contractor shall not impact Right of Way unless work is in progress.
7. Sidewalks and bicycle lanes, walkways and bike trails are part of the Right of Way and must be considered in traffic control plans when they are within the affected area.

The U.S. Department of Transportation has put its Transportation Acronym Guide online at http://www.bts.gov/btsprod/tag/index.html. You can type in the acronym and learn what it stands for, or you can access the entire listing, in alphabetical order. Here are just a few of the most common acronyms related to traffic management.

ARZ *Auto restricted zones*

AUSCI *Adaptive Urban Signal Control and Integration*

CBD *Central Business District*

EMS *Emergency Medical Services*

HOV *High Occupancy Vehicle*

HOV Lane *Carpool or Vanpool Lane*

ITS *Intelligent Transportation Systems*

LOS *Level of service*

LRT *Light rail transit*

MUTCD *Manual on Uniform Traffic Control Devices (DOT)*

MPH *Miles per hour*

P&P *Park-and-pool*

P&R *Park-and-ride*

ROW *Right-of-way (also R.O.W.)*

RRT *Rapid rail transit*

TDM *Transportation demand management*

TSM *Transportation systems management*

VPH *Vehicles per hour*

VPHPL *Vehicles per hour per lane*

3+ *Three or more persons per vehicle*

2+ *Two or more persons per vehicle*

REACT *Regional emergency action coordinating team*

CVO *Commercial Vehicle Operations*

Access Management: *Process for providing access to land development, while preserving the safety and capacity of the transportation system. For example, limiting the numbers of driveways and median openings along arterials is an access management strategy.*

Adaptive Signal Control Systems: *Systems that automatically adjust traffic signal timing in response to the actual traffic demands.*

Arterial: *A signalized street that primarily serves through traffic and secondarily (but still importantly) provides access to abutting properties, with signal spacings of 2.0 miles or less. Because they serve both of these functions, arterials are the class of roads most in need of management.*

Automated red light enforcement: *System that photographs cars entering the intersection during the red light signal phase.*

Automated Speed Enforcement: *Photo radar.*

Bus Rapid Transit (BRT): *A system that combines intelligent transportation systems technology, priority for transit, cleaner and quieter vehicles, rapid and convenient fare collection, and integration with land use policy.*

Busway: *A right of way restricted to buses by physical separation from other traffic lanes.*

Congestion Mitigation and Air Quality (CMAQ): *A program operated by the U.S. Environmental Protection Agency, which can be a funding source for congestion relief projects that have environmental benefits.*

Congestion Pricing: *Charging a premium, such as tolls, entrance feeds, and parking charges—to motorists who wish to drive during peak travel periods or on congested facilities.*

Dwell Time: *The time a transit unit (vehicle or train) spends at a station or a stop, measured from stopping to starting.*

Dynamic message sign (DMS): *Signs that use electronics or mechanics to vary the visual word, number, or symbolic display as traffic conditions warrant. The messages inform motorists about incidents or dangerous conditions and alternative routes, and they encourage safe driving. Also called changeable message signs or variable message signals (VMS).*

Event Management: *Managing traffic flow, public safety, and security at public events.*

Information Integration: *This occurs when agencies contribute data to a common database for use by multiple agencies and individuals. It is more complex than information sharing, which is simply a transfer of information from one individual or agency to anoth-*

er. The advent of computerization has sparked a revolution in information management, integration of data, and the potential to share this information more effectively across agency and jurisdictional borders.

Intelligent Transportation Systems (ITS): *The integrated application of a range of new technologies to enhance the safety and efficiency of vehicles and roadway systems. ITS encompasses advanced sensor, computer, electronics, and communications technologies, along with management strategies.*

Sensors: *These can measure pavement temperature, air temperature, precipitation, and other weather conditions, or the volume and weight of traffic, and relay the information to traffic management centers. The traffic engineers can use the real-time information on traffic and road conditions to adjust traffic signals and variable message signs or to deploy snowplows, traffic control, or roadside assistance. The information also may be provided to the public and the media.*

Traffic Management Centers (TMC) *monitor real-time information obtained from various components of an Intelligent Transportation System. Transportation and public safety agencies can share real-time information to improve incident response time and coordination, adjust traffic controls, and keep motorists informed of traffic and weather conditions.*

Traffic Management System (TMS): *Any of various measures to improve the operation of a facility without construction of additional roadway lanes, such as dynamic message signs (DMS), ramp metering and closed-circuit camera surveillance, and loop detection to detect and respond to emergencies.*

Transit Signal Priority (TSP) *or preemption systems. Systems read signals emitted from transponders in approaching emergency vehicles (preemption) or public transit vehicles (priority) to give them green-light priority through intersections.*

Transponder: *This piece of equipment emits a radio signal that allows a vehicle to be tracked by vehicle location systems, and allows emergency vehicles to be sensed by traffic signals and give priority to move through intersections.*

Transportation Demand Management (TDM): *Tackling congestion by motivating drivers to take transit, carpool, vanpool, walk, bicycle, or telecommute.*

Web Addresses

Federal Government

DOT *United States Department of Transportation www.dot.gov*

FHWA *Federal Highway Administration, www.fhwa.dot.gov*

The Federal Highway Administration website is a vast resource. The FHWA Office of Operations web site at http://ops.fhwa.dot.gov/ offers quick access to The Arterial Operations Toolbox {at http://www.ops.fhwa.dot.gov/Travel/art_mgmt_toolbx2.htm) as well as extensive information on emergency, incident, work zone, and other management topics. In addition, the FHWA has other websites, listed at http://www.fhwa.dot.gov/fhwaweb.htm, including an Expertise Locator. There you can find specific people to contact about a given topic, from creative contracting to intelligent transportation systems.

USDOT *Intelligent Transportation Systems Joint Program Office www.its.dot.gov*

FTA *Federal Transit Administration (formerly UMTA: Urban Mass Transportation Administration) http://www.fta.dot.gov*

FMCSA *Federal Motor Carrier Safety Administration, www.fmcsa.dot.gov*

NHI *National Highway Institute http://www.nhi.fhwa.dot.gov*

NHTSA *National Highway Traffic Safety Administration www.nhtsa.gov*

US EPA *United States Environmental Protection Agency www.epa.gov*

Professional Organizations

American Association of State Highway and Transportation Officials (AASHTO) *www.aashto.org. The major national organization for state transportation officials.*

Association of Public-Safety Communications Officials *www.apco911.org. Organization for 9-1-1 calltakers.*

American Planning Association *www.planning.org*

American Public Transportation Association (APTA) *www.apta.com*

American Public Works Association (APWA) *www.apwa.net*

American Traffic Safety Services Association (ATSSA) *www.atssa.com/*

Association for Commuter Transportation (ACT) *www.actweb.org*

Association of American Railroads (AAR) *www.aar.org*

Association of Metropolitan Planning Organizations (AMPO) *www.ampo.org*

Community Transportation Association of America (CTAA) *www.ctaa.org*

Institute of Transportation Engineers *http://www.ite.org/*

Traffic Incident Management Committee *www.trafficincident.org*

Intelligent Transportation Society of America (ITSA) *www.itsa.org*

International City/County Management Association (ICMA) *www.icma.org*

National Association of Counties (NACo) *http://www.naco.org*
National Association of County Engineers (NACE) *www.naco.org/affils/nace/index.htm*
National Association of Development Organizations (NADO) *www.nado.org*
National Fire Services Incident Management System Consortium *www.ims-consortium.com*
National Urban League *www.nul.org*
Public Technology, Inc. (PTI) *http://www.pti.org*

The non-profit technology organization for all cities and counties in the United States. Three primary local government associations—the National League of Cities, the National Association of Counties, and the International City/County Management Association—provide PTI with its policy direction, while a select group of city and county members conduct applied R&D and technology transfer functions.

Surface Transportation Policy Project (STPP) *http://www.transact.org*
Transportation Research Board (TRB) *www.nas.edu/trb*
U.S. Conference of Mayors *www.usmayors.org/uscm*

ITS Standards

IEEE *Incident Management Working Group http://grouper.ieee.org/groups/scc32/imwg/index.htm*
ITE *Traffic Management Data Dictionary www.ite.org/tmdd/index.html*

Publications/Resources--General

Roadway Operations Self Assessment Tool *Developed by the FHWA Office of Operations, this tool is available on the Internet, free upon registration at http://www.ops.fhwa.dot.gov/Travel/Deployment_Task_Force/registration2.htm*
State and local transportation agencies can use it to assess their own roadway operations performance, and to find ideas of how to achieve better operations. The self-assessment covers a broad range of traffic operations areas, including traffic signal timing, incident management, work zones, and freeway service patrols. Organized in discrete modules, an agency may utilize only specific portions of the tool, or may choose to cover the complete set of topics. The questions are applicable to both local streets and to freeways. More than 40 state and local agencies were involved in the development process.

Recent White Papers *on numerous transportation management topics are available on FHWA's National Dialogue site: http://ops.fhwa.dot.gov/nat_dialogue.htm*

Institute of Transportation Engineers. A Toolbox for Alleviating Traffic Congestion and Enhancing Mobility, *FHWA-SA-98-06A comprehensive summary of the tools available to solve the congestion problem. Among the many options discussed are Intelligent*

Transportation Systems (ITS) technologies, transit-oriented development and urban design, and congestion pricing.

U.S. Environmental Protection Agency, Creating Transportation Choices: Congestion Mitigation and Air Quality[CMAQ] Improvement Program Success Stories. *EPA 420-K-99-01Profiles of CMAQ-funded transportation projects that encouraged alternatives to people driving alone and that made auto travel cleaner. Available on EPA's website: http://www.epa.gov/otaq/transp/catc.htm*

Northwestern University Center for Public Safety, Enhancing Transportation Management Along Lake Cook Road and in the Lake Cook Corridor Planning for ITS Deployment*, June 2001*

Public Technology Inc., Frequency Report for PTI*, Washington, D.C., August 3, 2001*

Federal Highway Administration, Moving Ahead: The American Public Speaks on Roadways and Transportation in Communities*, Washington, D.C., February 2001, FHWA-OP-01-017*

Texas Transportation Institute, 2002 Urban Mobility Study*. The 2002 Urban Mobility Report http://mobility.tamu.edu/ums/provides data on the performance of some elements of the transportation system in 75 urban areas. The institute is located at Texas A&M University.*

Managing the Urban Transportation system: The Need for a New Operating Paradigm*, by Ann P. Canby, Federal Highway Administration, Aug. 2001 http://ops.fhwa.dot.gov/speech%20Files/urban_trans.doc.*

FHWA Video on Benefits of Traffic Signal Retiming "It's About Time, Traffic Signal Management: Cost-Effective Street Capacity and Safety," *For a copy, contact Pamela Crenshaw at the FHWA, pam.crenshaw@fhwa.dot.gov. It is also now available for download as streaming video (http://www.ops.fhwa.dot.gov/Travel/art_mgmt_toolbx2.htm)*

Bus Rapid Transit

Federal government sites: *http://www.fta.dot.gov/brt/; http://www.fta.dot.gov/brt/guide/index.html (includes case studies)*

Bus Rapid Transit Center *http://www.gobrt.org/ Operated by Breakthrough Technologies Institute, an independent, Washington, D.C. think-tank "dedicated to the development and deployment of clean and efficient energy and transportation technologies." Its website contains case studies of BRT systems.*

Bus Rapid Transit Institute *http://www.its.berkeley.edu/news/busrapidtransit.html A clearinghouse for BRT research and information. It will also provide training, technical assistance and support to local agencies considering bus rapid transit projects in their communities. The institute will also conduct research on advanced design, operation, and technological* *approaches for BRT. Funded by FTA, it was formed in January 2002 by UC Berkeley's Institute of Transportation Studies and the University of South Florida's Center for Urban Transportation.*

North American Bus Industries site*, http://www.metro-magazine.com/t_brt_home.cfm, has a BRT page that tracks BRT projects in the United States and abroad.*

Periodicals

"Bus Rapid Transit newsLane*," a monthly newsletter produced by WestStart-CALSTART with support from the Federal Transit Administration. Available free online to subscribers. Sign up at http://www.calstart.org/brt/brtform.htm*

Smart Urban Transport *(print edition) based in Australia. Subscription includes three magazines and a monthly e-newsletter. www.smarturbantransport.com*

Intelligent Transportation Systems

ITS Resource Guide 2001: Bringing ITS into Operation *FHWA-OP-01-025 (soft-cover, spiral-bound, well-organized) also available on the Internet: http://www.its.dot.gov/itsweb/guide.html*
Lists and describes the many government and association publications covering the various uses of ITS, including arterial operations and traffic control systems. For example, one publication is an excerpt from a comprehensive report on the first 10 years of the national ITS Program and is entitled, What have we learned about Intelligent Transportation Systems? Chapter 3: Arterial Management (2000). It examines such arterial management systems as adaptive traffic signal control, traveler information about conditions on arterial streets, automated red light running enforcement, and traffic signal preemption for emergency vehicles. Web access: http://www.itsdos.fhwa.dot.gov/jpodocs/repts_te/@9z01!.pdf Other listings cover standards, training, analysis tools, partnerships and other institutional issues, and more.

Intelligent Transportation Systems Benefits: 2001 Update, Federal Highway Administration. *FHWA-OP-01-024.*

U.S. Department of Transportation Intelligent Transportation Systems Joint Program Office *also publishes:*

Benefits brochures *that show how ITS technologies have benefited specific areas*
Cross cutting studies *presenting current data from related ITS applications*
Case studies *providing in-depth coverage of ITS applications in specific projects*
Technical reports *including results from various field operation tests*
Implementation guides *to assist project staff in the technical details of implementing ITS*
For a current listing of available documents, visit the web site at www.its.dot.gov

U.S. Department of Transportation Intelligent Transportation Systems Joint Program Office: Developing Intelligent Transportation Systems Using the National ITS Architecture: An Executive Edition for Senior Transportation Managers. *Washington, D.C. February 1998. Report No. FHWA-JPO-98-025. Practical guidance for deploying ITS.*

Public Technology, Inc.: Roads Less Traveled: Intelligent Transportation Systems for Sustainable Communities, *Washington, D.C., 1998. A 78-page guidebook produced with funding from the Transportation Partners Program of the U.S. Environmental Protection Agency.*

Public Technology, Inc.: Smart Moves: A Decision-Maker's Guide to the Intelligent Transportation Infrastructure, *Washington, D.C., 1996. A sixty-two page book on building a better community using intelligent transportation systems.*

Public Technology, Inc.: Traveling with Success, *Washington, D.C., 1995. A 55-page collection of case studies showing how local governments use ITS. Funded under a cooperative agreement with the Federal Highway Administration.*

Traffic Incident Management

U.S. Department of Transportation Joint Program Office. Organizing and Sustaining Regional Incident Management Programs: An Implementation Guide. *Prepared by Booz Allen & Hamilton, June 29, 1999.*

Federal government website
http://ops.fhwa.dot.gov/Travel/IncidentMgmt/IncidentMgmt.htm

Institute of Transportation Engineers – Traffic Incident Management Committee
www.trafficincident.org

IEEE Incident Management Working Group
http://grouper.ieee.org/groups/scc32/imwg/index.html

New York City - Integrated Incident Management System (IIMS)
http://www.dot.state.ny.us/reg/r11/iims/index.html

Response Guides and Manuals

Virginia DOT's Project Info-Share *http://www.virginiadot.org/infoservice/news/CO05032001-eoc.asp. This program reduces traffic delays due to accidents and incidents thanks to an information sharing program sponsored by the Virginia Department of Transportation for police, fire, and other incident response agencies in Virginia and adjacent states.*

Kansas City *http://kdot1.ksdot.org/public/kdot/kcmetro/kcindex.html The Incident Management Manual for the Kansas City Metropolitan Area provides information about incident management activities and serves as a reference to provide information about recommended procedures.*

Duluth - Superior (MN-WI) *(Adobe PDF file) http://www.dot.state.mn.us/guidestar/pdf/tocc/incident_manage_plan.pdf The Duluth-Superior Incident Management Plan describes interagency incident management procedures and strategies in the Duluth-Superior area.*

Hampton Roads, VA *(Adobe PDF file) Information on the Traffic Incident Management program in the Hampton Roads, Virginia area. http://www.hrpdc.org/publications/newsletters/spring2001.pdf*

Regional Transportation Operations

In a program jointly sponsored by the Federal Highway Administration, Federal Transit Administration, and Institute of Transportation Engineers, six case studies documented alternative approaches to developing and sustaining regional transportation operations. The studies cover institutional practices as well as lessons learned. Each case study is available as a separate publication. An executive guide offers an overview and comparison.

Organizing for Regional Transportation Operations:

Arizona AZTech *FHWA-OP-01-140*

Houston TranStar *FHWA-OP-01-139*

New York/New Jersey/Connecticut TRANSCOM *FHWA-OP-01-138*

San Francisco Bay Area *FHWA-OP-01-142*

Southern California ITS Priority Corridor *FHWA-OP-01-141*

Vancouver TransLink *FHWA-OP-01-143*

Executive Guide *FHWA-OP-01-137*

These publications are available in pdf format on the Internet at http://www.ite.org/library/reg_trans_ops.htm

Transit Signal Priority

Transportation Research Board Transit Signal Priority Workshops*, January 2002 Workshop presentations on programs in Seattle, Portland OR, State College, PA and other cities http://signalsystems.tamu.edu/archive.html*

The Traffic Signal Systems Committee *(A3A18), which hosted the workshop, is one of the committees of the Transportation Research Board (TRB,) a unit of the National Research Council (NRC.) A private, nonprofit institution, the NRC is the principal operating agency of the National Academy of Sciences and the National Academy of Engineering.*

"An Overview of Signal Transit Priority" *is a White Paper developed by the Intelligent Transportation Society of America (the draft was published in April 2002). It aims to describe TSP as well as the issues, pitfalls and solutions surrounding TSP implementation and operation.*

Or go to http://www.itsa.org/ then select "search" and type in "An Overview of Signal Transit Priority." The full Internet address is: http://www.itsa.org/committe.nsf/4c2db16e002c25928525620600031772/493aa4e21d7782 7585256b9d00463eec/$FILE/Signal_Priority_Paper_Open_Comments.doc

Construction Work Zone Traffic Management

The Work Zone Mobility and Safety Program website *designed by FHWA's Operations Group includes a best practices training module to download http://www.ops.fhwa.dot.gov/wz/workzone.htm*

City of Seattle Traffic Control Manual for In-Street Work, *August 1, 1994*

Access Management *A comprehensive introduction to access management, written by Elizabeth Humstone & Julie Campoli first appeared in Planning Commissioners Journal, Winter 1998 and is reprinted on the site: http://plannersweb.com/access/accintro.html. The article begins with an overview and continues with a three-part guide for roadway corridors, discussing land use strategies; curb cuts, driveways and parking; and site development strategies.*

Arterial/Access Management Slide Show *New York Department of Transportation Corridor Management Group http://www.dot.state.ny.us/progs/cmg/show.html*

The Transportation Research Board Committee on Access Management *hosts a website at http://www.accessmanagement.gov that includes links to numerous state access management projects.*

New Access Management Manual *The TRB Access Management Committee has also overseen a comprehensive new Access Management Manual for use by transportation professionals. It was developed by the Center for Urban Transportation Research, University of Florida..*

Brist, *Shawn and Ayman Smadi. An Evaluation of ITS for Incident management in Second Tier Cities: A Fargo, ND Case Study. Paper presented at the annual meeting of the Institute of Transportation Engineers, Nashville, TN, August 2000.*
Callas, S. Tri-Met's Transit Signal Priority System and Evaluation. Tri-Met. January 13, 2002. http://signalsystems.tamu.edu/archive.html

Canby, *Ann P. Managing the Urban Transportation system: The Need for a New Operating Paradigm, Federal Highway Administration, Aug. 2001. http://ops.fhwa.dot.gov/speech%20Files/urban_trans.doc.*

European Commission Report, *Telmatics Applications Programme—Transport Areas' Results (4th Funding Programme), July 2000. (http://www.trentel.org/transport/frame1.htm)*

Federal Highway Administration. *Intelligent Transportation Systems Benefits.2001 Update. (FHWA-OP-024) Washington, D.C. June 2001.*

Federal Highway Administration. *Moving Ahead: The American Public Speaks on Roadways and Transportation in Communities (FHWA-OP-01-017).Washington, D.C., February 2001.*

Federal Highway Administration. *Tracking the Deployment of Integrated Metropolitan Intelligent Transportation Systems Infrastructure in the USA: FY 1997 Results. Washington, D.C.. Federal Highway Administration, September 1998.*

Institute of Transportation Engineers: *A Toolbox for Alleviating Traffic Congestion and Enhancing Mobility, Washington, D.C. 1997.*

King County, Washington. *(website) Transit Signal Priority Successes. http://transit.metrokc.gov/programs_info/tsp/successes.html*

"LA Success Story: Go Metro Rapid!" *Bus Rapid Transit NewsLane newsletter produced by Westart-CALSTART, June 2002.*

Meyer, Michael D. *"Measuring System Performance: The Key to Establishing Operations as a Core Agency Mission." Georgia Institute of Technology, August 2001.*

"MTA Board Approves Wilshire Bus Rapid Transit, Exposition Light Rail Projects for Mid-City/Westside Corridor." *Los Angeles Metropolitan Transit Authority news release June 28, 2001 http://www.mta.net/press/2001/06_june/mta_094.htm*

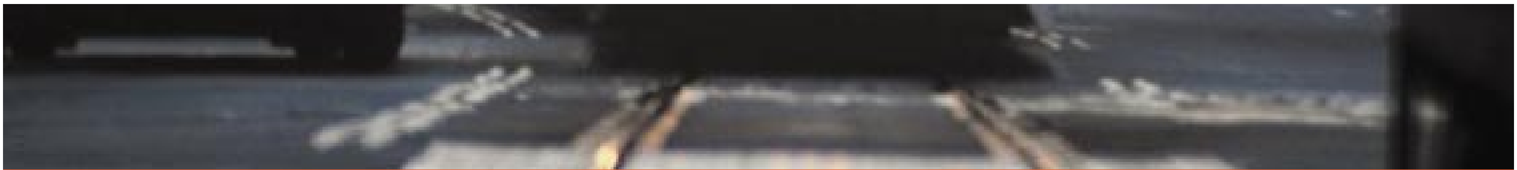
Public Technology Inc. *Frequency Report for PTI. Washington D.C., August 3, 2001*

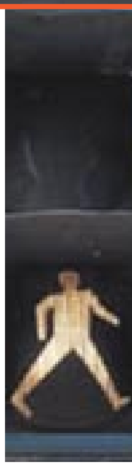
Shaver, Katherine. *Traffic Signal Re-Timing Approved to Help the Air. Washington Post. August 1, 2002: B1*

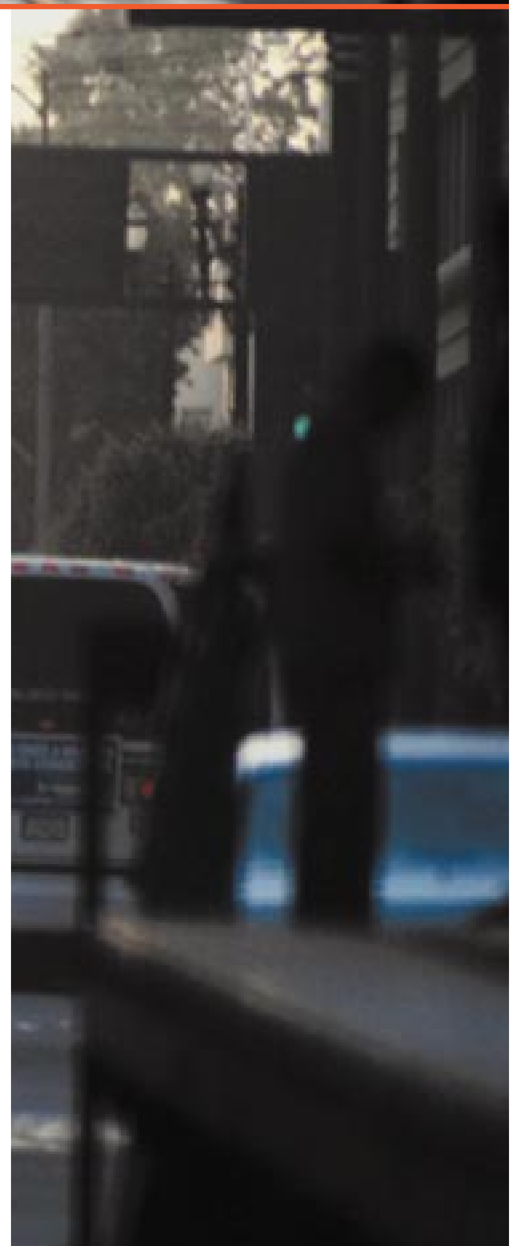
Texas Transportation Institute, *2002 Urban Mobility Study. http://mobility.tamu.edu/*

Texas Transportation Institute. *Return on Research: "PASSER© Maximizes Progression Along Roadways." Abstract: http://tti.tamu.edu/product/ror/passer.stm*

Unclogging Arterials: Prescriptions for Relieving Congestion and Improving Safety on Major Local Roadways *is available through Public Technology, Inc. Order this and other publications at the PTI Online Bookstore: http://onlinetransactions.pti.org/publications_store/*







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