Better information — and the means to deliver it — underpin USDOT’s efforts to ease congestion through operational and technological improvements.

Approximately half of all congestion can be traced to recurring causes such as physical bottlenecks. The other half stems from nonrecurring causes, such as crashes, work zones, and weather. In May 2006, the U.S. Department of Transportation’s (USDOT) National Strategy to Reduce Congestion on America’s Transportation Network (also known as the Congestion Initiative) noted that “we have a significant short-term ability to mitigate the impacts of congestion and provide critical additional capacity during peak traffic periods by more effectively addressing these factors.”

If transportation managers can manage these recurring and nonrecurring conditions successfully, in a practical sense, capacity will be optimized, thereby creating a more efficient system. This optimization of existing capacity is becoming increasingly important as financial and other limitations constrain the addition of new physical capacity.

Reducing delays due to incidents, work zones, and poorly timed traffic signals is possible through an array of strategies and tools currently available. One of the primary focus areas of the Congestion Initiative is promoting operational and technological solutions, such as 511 traveler information, traffic incident management, work zone mobility, and traffic signal timing. USDOT identified these practice areas as offering the highest probability for generating significant benefits quickly and targeted them for greater attention and accelerated deployment in the action plan for rolling out the Congestion Initiative. Collectively, these practices provide operators, planners, decisionmakers, and travelers with information that allows for more informed decisions, better coordination, and quicker actions that can help avoid and reduce traffic congestion.

With the goal of deploying these technologies and practices broadly across the country, the
Federal Highway Administration (FHWA) and State and local transportation officials are building on early successes and demonstrating the potential for significant benefits to national mobility.

Real-Time Traveler Information

At the heart of these technological solutions and operational strategies, approaches, and policies is real-time traveler information, which is essential to addressing both recurring and nonrecurring congestion. Real-time traveler information is information that enables travelers to decide how they will use (or not use) the transportation system. Agencies use the information to better manage and improve the system.

Operational and Technological Solutions: Four Areas of Emphasis

- Real-Time Traveler Information
- Traffic Incident Management
- Work Zone Mobility
- Traffic Signal Timing

Real-time information enables motorists to manage the uncertainty of travel during congested conditions by leaving earlier or later, taking an alternative route, or even postponing discretionary trips. In fact, according to Transportation Analysis Fellow Karl Wunderlich at Noblis, coauthor of the FHWA report On-Time Reliability Impacts of Advanced Traveler Information Services (ATIS), Volume III: Implications for ATIS Investment Strategies, "Users of traveler information services who can vary their departure times by as little as 5 minutes on either side of their normal departure times can reduce late arrivals by up to one-third or more."

Another key benefit is more predictable travel, knowing what to expect before travel begins. Timely and accurate information about traffic incidents, weather, construction, transit, and special events helps improve the predictability of travel times and ultimately may help reduce the time spent driving in congestion. In a Washington, DC, case study in the aforementioned report, users reduced "late shock" (expecting ontime arrival prior to travel but arriving late) by more than 80 percent. By adapting trip decisions to the latest conditions, users of traveler information can cut significantly the amount of time they need to add into their trips due to the possibility of encountering backups from rush hour traffic, a crash, or some other tieup.

FHWA is pursuing three key activities under the umbrella of real-time traveler information:

- Facilitating deployment of 511 traveler services
- Encouraging the display of travel times on dynamic message signs (DMSs)
- Establishing and supporting a real-time system management information program, as called for in section 1201 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)

Although each of these areas provides benefits individually, the real contribution will come from the synergy of all three. For example, addressing the section 1201 requirements can provide the data necessary to support new or enhanced 511 services and provision of travel times on DMSs, and the capabilities of the private sector could support section 1201 requirements and 511 travel times.

511 Traveler Information Services

The Federal Communications Commission designated the three-digit telephone number 511 for traveler information services provided by public transportation agencies throughout the United States. Now, 6 years into the program, almost 40 percent of the U.S. population is covered by 511 services. FHWA is striving for implementation of 511 services in all 50 States by 2010, a goal set by the U.S. Congress in SAFETEA-LU.

USDOT has been a primary facilitator in deployment of 511 services and posting of travel times on DMSs. The decision to deploy 511 is itself a catalyst that can help States align resources behind the scenes, set up operational arrangements between jurisdictions and agencies, and establish basic condition-reporting systems that provide a common highway operating picture on a statewide and even regional basis.

As traveler awareness and use of 511 grows, expectations of the information quality and ease of use
When posted on highway signs, the 511 logo, shown here, alerts motorists to the availability of traveler information. Source: 511 Deployment Coalition.

When posted on highway signs, the 511 logo, shown here, alerts motorists to the availability of traveler information. Source: 511 Deployment Coalition.

likely will rise, spurring departments of transportation (DOTs) to improve services to the public and provide transportation alternatives. The San Francisco Bay area, for example, continues to improve its 511 services to meet customer demands. "The bay area’s 511 service has continued to grow in popularity among users as new features and enhancements are implemented," says Carol Kuester, project manager of the Metropolitan Transportation Commission’s 511 program. "Additions in past years have included travel times on major routes provided via toll tag readers and loop detectors along the roadways, as well as the Predict-A-TripSM service that provides users with typical travel time and speed information for user-selected routes based on historical information."

USDOT continues to play a key role in creating a critical mass of awareness for the 511 system, particularly now as the initiative reaches the halfway mark in terms of market penetration.

In response to motorists' requests, Houston TranStar now posts estimated travel times on its DMSs, as shown here. Photo: Carlton Allen, TxDOT.

Travel Times on DMSs

Another means of using technology to reduce congestion is by displaying travel time information on DMSs. Nationwide, more than 4,500 DMSs are installed and operated by nearly 100 agencies. Usually a State or metropolitan area will use these signs to provide information on upstream congestion, significant delays due to traffic incidents, or spot-specific problems (such as dangerous weather or road conditions), and general traveler information. However, sometimes the information is vague or signs are left blank even though traffic conditions may be deteriorating. The result is a transportation resource that is underutilized and a traveling public who questions the value of the investment.

A 2004 FHWA memorandum to field offices encouraged States to post travel times on DMSs in congested corridors and urban areas. The memo stated that FHWA's goal should be "to have travel time information as the default information available to motorists throughout the day.... Furthermore, no new [DMSs] should be installed in a major metropolitan area or along a heavily traveled route unless the operating agency and the jurisdiction have the capability to display travel time messages." Over the next several years, FHWA's objective is to ensure that travel time messages are displayed on DMSs in all of the top 40 most populous urban areas. Currently, 25 of the top 40 areas display this information.

In 2005, the Washington State Department of Transportation (WSDOT) began posting travel time messages on five DMSs on I-5, I-405, and I-90 in the Seattle area. The public's response was overwhelmingly positive, with more than 90 percent approving of the messages. Time-based messages enable motorists to make more informed choices and exert more control over their travel. Although no quantitative studies have been conducted, informal Web surveys and comments received by agencies show that travel time messages help travelers decide when to take an alternate route and provide travelers with a sense of comfort knowing how long it will take them to reach certain milestones along their trip.

Travel Time in Demand in Houston and Chicago
Posted travel times proved important to drivers in the Houston, TX, metropolitan area, who e-mailed Houston TranStar — the partnership responsible for coordinating the planning, design, and operation of Houston’s roadways, emergency management functions, and intelligent transportation systems (ITS) — requesting that more useful information be posted on blank DMSs.

Since the mid-1990s, Texas Department of Transportation (TxDOT) staff at Houston TranStar had been posting travel times during peak periods on DMSs; however, many of the agency’s signs remained blank during offpeak times. In an effort to use the signs more efficiently, TranStar initiated a campaign to post on the signs a safety message of the week. But through e-mails to the Houston TranStar Web site (www.houstontranstar.org), the agency learned that motorists felt that the weekly safety messages were not the best use of the signs.

TxDOT and the Texas Transportation Institute then conducted a Web survey asking what types of messages motorists desired. The survey indicated that drivers were primarily interested in seeing incident information (93 percent) and travel times (82 percent). Many respondents indicated that although incident information is important, they also need travel time information to better determine how incidents affect their travel.

Responding to motorist feedback, TranStar created an automated system that posts travel times on up to 100 DMSs at 10-minute intervals across more than 553 kilometers (344 centerline miles) of Houston-area freeways. Travel times are based on data collected from nearly 2 million EZ TAG toll transponders currently circulating in the Houston metropolitan area. (Motorists’ identities remain anonymous.) Data from these vehicle probes are collected at 232 locations and transmitted to TranStar for analysis. Reader stations are, on average, 3-5 kilometers (2-3 miles) apart, but not more than 8 kilometers (5 miles) apart.

A toll authority in northern Illinois also heeded customer input in its decision to post travel times. The Illinois State Toll Highway Authority (ISTHA), which oversees one of the most congested areas in the Nation, provides average travel times from one toll plaza to another based on data captured by its electronic toll collection system. More than 1.5 million motorists now use the automated IPASS toll transponder, offering ISTHA high-quality, time-stamped location information in near real time. ISTHA uses data from three sources to calculate travel times: IPASS transponders, radar sensor stations, and loop detectors maintained by the Illinois Department of Transportation. ISTHA currently posts travel times on 33 DMSs located on tolled and nearby nontolled roads.

Although ISTHA has not conducted a formal study, e-mails and calls to the customer input line indicate that drivers greatly approve of travel time information and will complain when a nonincident-related message is posted when travel time information normally is available.

SAFETEA-LU Section 1201

SAFETEA-LU’s section 1201 states, “The Secretary shall establish a real-time system management information program to provide, in all States, the capability to monitor, in real time, the traffic and travel conditions of the major highways of the United States and to share that information to improve the security of the surface transportation system, to address congestion problems, to support improved response to weather events and surface transportation incidents, and to facilitate national and regional highway traveler information.”

Through section 1201, agencies will be able to anticipate changes and events and take remedial actions, and provide road users with information to make better travel-related decisions. The specific goal of the program is to have all States possess the capability of sharing data on system performance nationwide. Significant opportunities exist for private sector involvement or partnering in implementing this program, including information gathering, data processing, and information dissemination.

In May 2006, FHWA issued a notice in the Federal Register requesting comments on the proposed program goals, definitions for various parameters, the current status of related activities in the States, and implementation issues to guide development of the Real-Time System Management Information Program. Based on comments received from State DOTs and other representatives of the private sector and national associations, FHWA now is in the process of developing a rule to implement the Real-Time System Management Information Program. FHWA expects to publish a notice of proposed rulemaking in the Federal Register in the fall of 2007.
Traffic Incident Management

FHWA also is focusing on managing traffic incidents as a means to reduce congestion. Traffic incidents cause approximately 25 percent of all congestion, and each minute of lane blockage creates 4 minutes of congestion after the incident is cleared. Specifically, FHWA identified several main themes: getting drivers safely out of harm’s way and removing vehicles from traffic lanes, developing policies to improve incident management, establishing institutional arrangements, and facilitating data sharing.

NUG for Traffic Incident Management

In 2004, FHWA, the American Association of State Highway and Transportation Officials, and other partners officially launched the National Traffic Incident Management Coalition (NTIMC) to promote safe and efficient management of traffic incidents. NTIMC includes 20 national transportation, public safety, and private sector associations working together to improve traffic incident management in the United States. At a national meeting in 2006, NTIMC met to discuss adoption of a National Unified Goal (NUG) for traffic incident management to reduce incident-related congestion and improve responder and motorist safety. The NUG addresses three themes: safe, quick clearance; safe responders; and prompt, reliable incident communications.

NTIMC developed the NUG through a process that included outreach and listening sessions with each member association and interactive discussion of a preliminary goal by invited delegates at the 2006 conference. After the final NUG was approved by NTIMC following the conference, each member began a formal process of adopting the goal. The process will culminate in a national ratification summit in 2007.
Promoting more aggressive and widespread traffic incident management is an important strategy to lessen the effects of nonrecurring congestion as well as provide a safer driving environment. Traffic incident management is a planned and coordinated process to detect, respond to, and remove traffic incidents and restore capacity as safely and quickly as possible. Effectively managing traffic incidents requires cooperation between organizations that often have conflicting onscene priorities and operating cultures. For example, transportation agencies must interact with a variety of public and private sector partners, including law enforcement, fire and rescue, emergency medical services, public safety communications, emergency management, towing and recovery, hazardous materials contractors, and traffic information media.

Recently the National Traffic Incident Management Coalition (NTIMC) ratified a National Unified Goal (NUG) for incident management, which aims to improve safety for incident response personnel and facilitate clearing incidents as quickly as possible. USDOT is advancing several key components of the NUG: driver removal (or "Move It") laws, full-function service patrols, high-level State policy agreements for safe and quick incident clearance, and integrated interagency communications.

Driver removal laws are considered key strategies for speeding clearance of noninjury crashes, which accounted for about two-thirds of all crashes on U.S. roadways in 2002. These laws encourage or require drivers involved in noninjury crashes to move crashed vehicles out of roadways if they can do so safely. Move It laws also may empower responders to move vehicles and debris. By moving vehicles quickly out of travel lanes, drivers reopen blocked lanes, reduce congestion, reduce the likelihood of secondary incidents, and place themselves and responders in safer locations. Nearly half of all States have enacted Move It laws, though the laws vary widely in their wording and requirements. The Congestion Initiative seeks to encourage enactment of Move It laws in all States and to improve consistency in wording.

Full-function service patrols provide important onscene services to clear minor incidents and disabled vehicles and, when properly equipped, can provide a broad range of services by working with other responders to clear major incidents more quickly. Most important, however, a service patrol can assist with traffic control at the incident, protecting responders and warning and guiding approaching motorists safely and efficiently past the incident.

FHWA developed a policy memorandum in 2006, titled "Use of Service Patrols for Safe and Quick Clearance of Traffic Incidents: Recommended Practice and Guidance." The goal for the memo is implementation of "24/7" full-service patrol coverage on all urban freeways.

"We believe the time has come to view 24/7 full-service patrols on urban freeways as a fundamental component of metropolitan area transportation," says FHWA Associate Administrator of Operations Jeffrey Paniati. "With the volume of traffic on these facilities, service patrols can no longer be viewed as a luxury; they are a necessity to provide safe, reliable transportation service."

Policies on safe, quick clearance set the direction — at a policy level of partner agencies — that guides programmatic actions and results in quicker clearance and safer responders. Particularly in congested areas, public perception of transportation and response agencies hinges on the efficiency of traffic incident clearance. Clearance policies should contain performance goals to be most effective. The Washington State Joint Operations Policy
Statement (JOPS) is an agreement between WSDOT and the Washington State Patrol (WSP) pledging cooperation on a number of issues, including a goal of clearing all incidents within 90 minutes.

"WSP and WSDOT report progress in meeting the 90-minute goal to the Governor at her quarterly Government Management, Account-ability, and Performance sessions with her cabinet," says John F. Conrad, WSDOT's assistant secretary for engineering and regional operations. "Through JOPS and coordination with the Washington State Association of Fire Chiefs, we have established traffic incident management training to bring WSDOT, WSP, and fire responders together to talk about safety and efficient scene clearance. We are also working together to develop and adopt a Washington State version of the NUG to improve incident management."

Similarly, Florida's Open Roads Policy commits the Florida Department of Transportation and the Florida Highway Patrol to clear all incidents within 90 minutes of the arrival of the first responding officer.

Integrated interagency communications facilitates the sharing of accurate and unambiguous information about an incident among responding partners, resulting in quicker and safer incident clearance and more reliable information conveyed to travelers to minimize unexpected delays. Integration of public safety computer-aided dispatch (CAD) systems and ITS technologies facilitates more effective use of resources on the scene within the incident command system. Further, collaboration enables fusing of data from transportation and public safety systems for more complete and accurate performance measurement of traffic incident management programs. FHWA sponsored successful field tests of integrated CAD-ITS systems in Salt Lake City, UT, and Washington State in 2003. More recently, the Oregon Department of Transportation integrated its systems with the Oregon State Police and the city of Portland's 911 system.

Multiagency regional and statewide traffic incident management, containing the themes and goals of the NUG, can lead to significant congestion relief. For example, the Maryland Department of Transportation's Coordinated Highways Action Response Team (CHART), a robust traffic incident management program that includes service and incident response patrols, reduced average incident duration by 23 percent in 2005. CHART assisted in 20,515 lane blockage incidents where average incident duration in 2005 was approximately 22 minutes, compared to 29 minutes for similar incidents responded to by other Maryland agencies. Using a traffic simulation program, analysts determined that CHART reduced travel delay on major Maryland corridors by 37 million vehicle-hours in 2005 — equivalent to 6.5 hours of savings per year per Maryland resident.
A well-timed traffic signal can reduce the delay drivers experience on arterial streets. Shown here is a congested arterial in downtown Portland, OR. Photo: Portland State University.

Work Zone Mobility

Work zones are a necessary part of maintaining and upgrading the Nation's aging highway system, but they account for nearly 10 percent of all congestion. Anticipating and mitigating the effects of work zones is another method of relieving congestion. Real solutions come from fundamental changes in the way projects are planned, estimated, designed, bid, and finally, constructed.

FHWA updated the Work Zone Safety and Mobility Rule in September 2004 to broaden the former rule to better address today's mobility issues. The new rule advocates stronger consideration and management of work zone mobility impacts throughout the project delivery process. Compliance with the updated rule is required by October 12, 2007.

The rule features three primary components: (1) implementation of an overall, agency-level policy on work zone safety and mobility to institutionalize the consideration and management of work zone impacts; (2) creation of agency-level processes to support policy implementation, including procedures for assessing the impacts of work zones, analyzing data, conducting training, and reviewing agency processes; and (3) development of project-level procedures to assess and manage impacts of individual projects, including creation of transportation management plans. For more information on the Work Zone Safety and Mobility Rule, please visit http://ops.fhwa.dot.gov/wz/resources/final_rule.htm.

Ohio's Work Zone Policy

The Ohio Department of Transportation (ODOT) developed a policy that limits the number of lanes that may be closed for construction and maintenance on interstate highways and other freeways. The policy requires sufficient mainline capacity during construction and maintenance and mandates allowable queue thresholds that must be met.

ODOT provides training for implementing its work zone policy. The training addresses traffic modeling software, work zone traffic control, and inspection requirements, among other topics. The class is one of several required for approximately 2,500 ODOT highway workers, project inspectors, and others. As part of their prequalifications, consultants also are required to attend a class on work zone design. Testing and certification are required for both ODOT and consultant staff.

For Dave Holstein, administrator of ODOT's Office of Traffic Engineering, the overarching principle of work zone safety and mobility is early planning. "It is absolutely critical to identify potential work zone impacts early enough in the project development process to be able to include an engineering solution in the subsequent plan development," he says. "You don't want to get too far into a project and then realize you needed wider bridges, more right-of-way, or a different environmental footprint to mitigate a work zone impact. When an impact cannot be completely designed out of the project, innovative contracting or innovative construction techniques can be used to minimize the time an impact is present."

Traffic Signal Timing
Another source of congestion is outdated or poor signal timing at intersections. When signal timing is not updated to accommodate changes in traffic patterns, drivers may be subjected to unnecessary stops and delays. Outdated signal timing accounts for an estimated 10 percent of the total delay on major roadways and a far greater percentage on local roadways. The problems associated with signal timing are an indicator of inadequate resources being dedicated to the workforce, infrastructure, and technology used to manage traffic signal systems. USDOT is committed to helping State and local agencies improve their traffic signal management programs.

One effort is the traffic signal operation self-assessment, which encourages agencies to take a serious look at how traffic signal systems are being managed within their jurisdictions. The self-assessment provides the input to develop the National Traffic Signal Report Card, part of a national effort to bring more attention to the need for additional investment in traffic signal operations.

"In an era of tight budgets, many jurisdictions find that funding for ongoing improvements to traffic signal systems has been one of the first areas to be reduced," says Douglas E. Noble, senior director of operations and management at the Institute of Transportation Engineers. "However, investment in traffic signal operations is the most cost-efficient means to improve overall effectiveness of the transportation system and to help reduce congestion."

The first National Traffic Signal Report Card was released in 2005 and received extensive media attention. The national score was D-, and media coverage focused on the need for additional resources to support traffic signal operation. Then-Washington, DC, Mayor Anthony A. Williams commented that "this report card on traffic signal timing should be a wake-up call for all mayors. In DC, we are updating our signals and timing to improve traffic flow and to lessen congestion."

The emphasis of the report card is on communicating the importance of high-quality operations, improved training, and management programs that produce traffic signal timing that corresponds to current traffic patterns, thus facilitating traffic flow and lessening the opportunity for congestion. Development of the 2nd National Traffic Signal Report Card is underway for release in late summer 2007.

A tool to help improve signal timing is ACS [Adaptive Control Software] Lite, a product developed through a public-private partnership of FHWA, private sector researchers, and traffic signal controller manufacturers. ACS Lite is designed to monitor and evaluate traffic conditions and refine signal timing consistent with current traffic conditions in real time. ACS Lite is intended to be a low-cost solution for improving signal timing in small- to medium-size communities. The software is designed specifically for closed-loop traffic signal systems, which represent an estimated 90 percent or more of U.S. traffic signal systems.

ACS Lite Testing

As part of ACS Lite testing, researchers conducted a before-and-after traffic study on State Route 70 in Manatee County, FL, to assess the benefits of the software. Specifically, the study focused on collecting data on traffic volumes at eight intersections between Caruso Road to the east and U.S. 301 to the west, performing "floating car" travel time and delay studies, and conducting statistical analysis on traffic volume, speed and travel time, and delay data. The floating car methodology involves performing travel time runs using a test vehicle driven at an average speed through the arterial, allowing vehicular speed to be dictated by the platoon speed, not the posted speed limit. Travel time measurements begin when the test vehicle passes the stop line at the first intersection and end when the vehicle passes the stop line at the last intersection in the section of arterial being evaluated.

The results indicated that the total travel time, stopped delay, number of stops, and fuel consumption decreased during the "after" study period when the ACS Lite software was in effect. In addition to a 9 percent reduction in network traffic volumes between the "before" and "after" study periods, the researchers also reported a 12 percent reduction in travel time, 28 percent reduction in number of stops, and 28 percent reduction in travel time delay, attributing a significant portion of the gains to the ACS Lite software.

Bottom Line

The problems caused by congested roadways call for a more thoughtful and hands-on approach to operating the transportation system to get the most out of existing investments — the United States cannot underutilize the capacity already in place. The challenge to reduce congestion and increase mobility requires public agencies to think and act differently, incorporating proven operational strategies and technologies to provide congestion relief. FHWA is working with its State and local partners to help them adopt the most beneficial approaches, which should add up to significantly reduced congestion on the Nation's roadways.
Rich Taylor is a transportation specialist with FHWA's Office of Operations. He manages the Operations Performance Measurement program and coordinates congestion mitigation activities for FHWA. He previously served as director of information programs for the Intelligent Transportation Society of America, as an ITS designer with Wilbur Smith Associates, and as a research scientist with the Virginia Department of Transportation. Taylor holds bachelor's and master's degrees in urban planning and a master's degree in civil engineering from the University of Virginia.

For more information, contact Rich Taylor at 202-366-1327 or rich.taylor@dot.gov.

Other Articles in this issue:
The Congestion Problem
Targeted Investment
Partners In Time
The Role of PPPs In Addressing Congestion
Solutions To the Traffic Snarl
Perspective on Freight Congestion
The Dream of an Automated Highway