

THE OPERATIONS STORY

21ST CENTURY OPERATIONS USING 21ST CENTURY TECHNOLOGIES





The ability to move about our neighborhood, our city, and between cities has been taken for granted for years. Transportation mobility affects our ability to do our jobs, our quality of life, and the economic productivity of our country. In today's environment, mobility is also important to safety and security. Increasingly, mobility is jeopardized by congestion and unexpected delays. The Texas Transportation Institute estimates that in 2001, 75 of the largest metropolitan areas experienced 3.5 billion vehicle-hours of delay, resulting in 5.7 billion gallons in wasted fuel and \$69.5 billion in lost productivity.

The effects of congestion are growing. "Rush hour" is no longer an hour in many places. In 1982, "rush hour" in larger urban areas averaged two to three hours; in 1999, "rush hour" in these same areas had increased to five to six hours. Congestion is not restricted to large metropolitan areas. While the growth of congestion is most severe in the largest urban areas, congested travel in mid-sized cities tripled between 1982 and 2001. Congestion is steadily increasing in rural areas as well, particularly along major freight corridors and near recreation sites. Delays at international borders, intermodal facilities such as ports, and along heavily traveled freight corridors degrade productivity and reduce global competitiveness.

It has been estimated that approximately half of the congestion experienced by Americans happens virtu-

ally in the same location and at the same time every day—it is "recurring." Traffic demand exceeds the available capacity of the system and there are simply more vehicles than available space on the road. However, the other half of the delay results from unexpected events such as crashes, fog, snow, and work zones. The three main causes of non-recurring congestion are: traffic incidents ranging from flat tires to overturned trucks with hazardous materials (25 percent of congestion), work zones (10 percent of congestion), and adverse weather (15 percent of congestion).

When these temporary disruptions occur during already congested conditions they dramatically reduce the available roadway capacity, increase crashes, and make a bad situation much worse. When disruptions occur during non-peak periods or on normally uncongested roads they create a "surprise" for travelers. A mid-afternoon trip that is planned for 20 minutes suddenly turns into a frustrating 40-minute crawl. Travelers and freight shippers are especially sensitive to unanticipated disruptions to tightly scheduled personal activities and manufacturing distribution activities.

Congestion and unexpected delays affect everything we do—going to work, picking up the kids at school, shopping for groceries, pursuing recreational activities, or delivering products to stores for our consumption. For a majority of Americans, congestion and delays have become a part of daily life.





What Can be Done?

Some will argue that congestion and delays are just signs of a healthy economy or of a growing metropolis, and to a certain extent this is correct. Some congestion is inevitable. In areas of high growth, the pace at which new capacity can be added to the transportation system is often exceeded by the growth of travel. In more developed areas, space limitations or environmental issues often limit the ability to add additional lanes.

However, there are things that can be done to keep congestion from severely degrading the quality of life in our cities, undermining the competitiveness of our industries, and reducing the safety and reliability of our national transportation system. Successfully reducing the effects of congestion and unexpected delays requires three coordinated approaches—construction, preservation, and operation.

Construction projects that add capacity, alleviate highway bottlenecks, and provide operational improvements are one key approach. These projects can include new highway capacity in high growth areas or along major corridors, and spot improvements, such as the elimination of lane drops, addition of turning lanes at intersections, and creation of passing lanes on two-lane roadways. Capacity improvements are particularly important for highway freight movement to and from ports and rail terminals. We are becoming more dependent on imports and exports to support consumer and manufacturing demands and to develop new markets for products and services. Virtually all of this trade uses highway connections to intermodal yards and ports. Identifying and relieving bottlenecks can increase the throughput on highways and enable us to make better use of air, rail, and maritime services to meet growing freight demands.

Secondly, we must continue to maintain the existing system. Many of our roadways and bridges are growing old. As our highways approach middle age, rehabilitation and maintenance are a necessary part of sustaining mobility. However, we must maintain the system in a way that minimizes the disruption to travel during construction, and reduces the need for future maintenance.

Finally, we must operate the system smarter and more aggressively than we have in the past. We no longer have the luxury of a “build and forget” mentality when it comes to the management and operation of the surface transportation system. We must operate the system in a way that maximizes the “available” roadway capacity and minimizes the impacts of “unexpected” events.

Operations: A Common Sense Approach

Better operation of the transportation system holds the potential for substantially improving the way agencies address recurring and non-recurring congestion in all parts of the country and on all parts of the highway system. The growing congestion problem in urban areas and increasing delays throughout the system—and the implications for productivity and security—spurs the consideration of better approaches to transportation operations. An operations approach to the transportation network is a viable and effective strategy to improve traffic flow and meet growing travel demands. In some locations, it may be the only viable alternative. In all locations, it just makes good common sense to want to get as much out of existing investments as possible. With technology innovations (intelligent transportation systems) new tools are now available to make the most of the available roads and capacity.



The history of highway transportation, until most recently, was focused on building and maintaining the road network. Transportation agencies “grew up” around the need to build roads, beginning with the farm to market roads of the 1930s and into the Interstate System construction era of the 1950s, 60s, and 70s. As better operations becomes a strategy more fully applied to transportation, it will require rethinking how services are delivered to those who depend on the transportation system. Operating the system to maximum efficiency will hinge on the ability to reshape traditional transportation organizations into “21st century operations agencies using 21st century technologies.”

What Is a 21st Century Operations Agency?

To understand what is meant by a 21st century operations agency, it is helpful to compare historical transportation agencies and emerging operations agencies. To use popular jargon, some things are “out” and others are “in.”

Out	In
Project focused	Customer focused
Output-oriented	Performance-based
Jurisdictions	Systems
Historical information	Real-time information
8/5	24/7
Reactive	Proactive

To elaborate, 21st century operations agencies have the following six characteristics:

Customer focused

A transportation agency that exhibits 21st century operations focuses on and understands the needs of its customers—residents, tourists, workers, business-

es, and freight shippers and carriers. These agencies recognize that travelers care about the quality and reliability of their trip from end-to-end, regardless of who “owns” the roadway. Agencies obtain feedback from their customers and are responsive to their travel needs. They make sure that information about the performance of the transportation system is readily available, timely, and targeted to customers’ needs.

Performance driven

Performance of the transportation system will become a key metric. Today, we largely measure performance in terms of the condition of the physical system. Increasingly, performance measures such as reliability and delay will be important determinants of how well the system is meeting customers’ needs. These measures are in the early stages of development, and we have much to learn about the measures and their uses.

Systems approach

Operations requires a regional and integrated approach to managing the performance of the transportation system. This means having a regional view that transcends city/county/State boundaries and system ownership. The result is a higher-level concern for the operation of the entire transportation system regardless of agency ownership. A systems approach also refers to the integration of technology such as intelligent transportation systems within and across agencies. The performance of the transportation system is largely determined by the ability of agencies to work cooperatively by sharing data and coordinating responsibility.

Real-time management

Key to virtually every operations strategy is real-time, or near real-time, information about what is happening on the roadway system, including information on weather, incidents, speed, volume, or sudden changes in construction plans. This information can be shared with the public to help them become part of the solution, and the information can be shared with multiple agencies for faster coordination and more precise responses. Improved information is also an



asset to the freight community. Information on the location of freight shipments helps carriers manage their fleets, helps manufacturers control their inventory systems, and provides advance information to Federal agencies concerned with trade facilitation and national security.

24/7

Historically, highway agencies develop and administer projects. This work is largely accomplished during “typical” work hours—8 hours a day, 5 days a week. However, the transportation system functions 24 hours a day, 7 days a week. Delay can happen any time, any place, and for many reasons. To be responsive to their customers, operations agencies develop the capability to conduct some functions on a 24/7 basis. This requires different staff approaches and a change in philosophy.

Proactive

Highway agencies focused on better operations are proactive in anticipating and managing transportation events. They routinely plan for special events, providing signal-timing changes, signs, and traveler information. These agencies monitor weather forecasts and anticipate their impact on transportation. They also plan for traffic impacts from work zones and design projects to minimize disruptions to travelers and businesses. Operations agencies fully plan for the disruptions to traffic in advance of the event.

What Are 21st Century Technologies?

21st century technologies, referred to as intelligent transportation system (ITS) technologies, have been researched, deployed, and tested to some degree for more than 10 years. These technologies provide information about the transportation system and support development of tools that traffic professionals and travelers never had before. The technologies can be generally grouped into six types:



Information gathering

Today, technologies collect information more thoroughly or more frequently than transportation professionals were able to do in the past. Cameras, traffic sensors, vehicle probes, and weather sensors are some examples.

Information sharing

As technology matures, an ever-increasing array of devices is available to share traveler information. Dynamic message signs, highway advisory radio, 5-1-1 telephone services, Internet Web sites, and specialized warning systems (like fog warnings) are examples of technologies used routinely to share information with travelers.

Control

There are also advanced technologies and software that provide improved methods for controlling and managing traffic. Advanced traffic signal control provides ways to remotely adjust systems of signals to respond in real time to changing traffic demands. Lane control signals, ramp meters, transit signal priority, and variable speed limit signs are other technologies that can control traffic in real time.



Vehicle-based

From complex crash avoidance technologies to in-vehicle guidance systems currently on the market, vehicle-based technologies hold promise to dramatically improve safety and give travelers (including commercial drivers) meaningful information about travel conditions to help them avoid bottlenecks and other potentially disruptive congestion situations. This is an area of growing technology innovation.

Vehicle to roadside to home base

Sometimes referred to as tracing and tracking technology, this allows fleet operators—trucking companies, transit agencies, snowplow operators—to maintain contact with their fleets and the cargo they are moving via satellite systems as well as terrestrial-based systems. This allows assets to be managed more efficiently and improves on-time performance. These systems are expanding in use, experiencing lower per unit costs, and have the extra advantage of addressing security needs as well as productivity and safety needs.

Payment

Electronic toll tags and “smart” cards for transit and parking are technologies being rapidly deployed. These technologies add efficiency to payment operations and expedite traffic flow.

Taken together, these technologies enable new ways of managing the transportation system to improve its operation. The technologies themselves are not the answer, but the improved ability to operate the system, enabled by the technologies, is key to addressing congestion and delays.

The opportunity for better managing and operating the transportation system to address congestion comes from combining new technologies with a new focus on operations within transportation agencies. Agencies that have embraced 21st century operations will take advantage of new technologies and apply them to achieve better system performance. Applications like freeway management, arterial management, incident and special event management, work zone

mobility and safety management, and road weather management marry technology innovations with a desire to better serve customers through improved mobility. These same technologies, supplemented by pre-arrival and clearance information for freight at borders and intermodal terminals, can improve freight flows as well.

What Is FHWA Doing to Support 21st Century Operations Using 21st Century Technologies?

The Federal Highway Administration (FHWA) identified congestion as one of its “vital few” priority areas. As discussed above, “operations” is one of three strategies for addressing congestion. FHWA has a number of programs designed to accelerate the evolution of transportation agencies into 21st century operations agencies using 21st century technologies. FHWA’s programs are organized to support:

- National recognition of the importance of operations
- Institutional and regional change to enhance operations
- Advancements in 21st century operations

National recognition of the importance of operations

FHWA leads the effort to increase the emphasis on and visibility of transportation operations. This includes analysis of system performance and identification of operational problems and solutions, development of policy and legislation (particularly in preparation for reauthorization of TEA-21), and creation of a National Transportation Operations Coalition (NTOC). Through the NTOC, the FHWA is working with the leadership of 13 transportation associations, including the Institute for Transportation Engineers (ITE), the American Association of State Highway and Transportation Officials (AASHTO), the Intelligent Transportation Society of America (ITS America), the American



Public Transportation Association (APTA), to increase national attention to the importance of more effectively managing and operating the surface transportation system.

Institutional and regional programs

Building regional partnerships is fundamental to supporting 21st century operations. These partnerships focus on attracting a wide variety of stakeholders including many, like law enforcement, who are not typically involved. The partnerships have several functions, such as creating regional performance measures that quantify goals for transportation system operations. These partnerships are also key to the deployment of ITS regional architectures, use of ITS standards, and deployment of integrated ITS solutions. FHWA is working aggressively to support the development of regional partnerships through guidance, training and technical assistance, to develop performance measures that capture the day-to-day operation of the system, and to assist State and local governments in the development and implementation of intelligent transportation system solutions.



Advancements in 21st century operations

Implementing 21st century operations requires advancements in nearly all facets of transportation operations and management. These include:

- **Improving day-to-day operations.** Agencies adopting 21st century operations concern themselves with how well the transportation system performs on a daily basis. Consequently, they support activities to improve day-to-day operations through demand management, access management, asset management, application of traffic control devices and traveler information, and they use traffic analysis tools to better understand problems and possible solutions.
- **Reducing recurring congestion.** Reducing recurring congestion requires the development and implementation of new technologies and new approaches for freeway, arterial, and corridor management and control.
- **Mitigating non-recurring congestion.** Aggressive management of temporary disruptions, such as incidents, work zones, weather, and special events, can reduce the impacts of these disruptions and return the system to “full capacity.”
- **Streamlining freight operations.** Movement of freight is critical to economic productivity. Agencies adopting 21st century operations work to streamline freight operations through freight analysis, professional development, freight size and weight policies, and freight technology.
- **Responding to emergencies.** Throughout daily activities, transportation agencies must consider public safety and security by preparing for emergency response and recovery, and military coordination.

FHWA's Office of Operations has extensive programs to address each of these areas. Programs include research and testing of advancements in the state-of-the-art technologies, development of guidance documents, training, documenting best practices, and providing technical assistance to advance the state-of-the-practice.

ADDITIONAL INFORMATION ON THESE PROGRAMS IS
AVAILABLE FROM THE FHWA OFFICE OF
OPERATIONS OR VISIT OUR WEB SITE AT
www.fhwa.dot.gov/operations

Through its institutional and technical leadership, FHWA continues to advance better transportation system operations as an important approach to addressing congestion, reducing unexpected delays, and making the most out of our existing investment. Operating the system at its peak efficiency and maximizing the available capacity hinges on reshaping transportation agencies to be customer focused and performance driven while using systems approaches and real-time management on a 24/7 basis. When transportation agencies embrace this vision and invest in the institutional change and technology required to make it happen, the transportation system will be operating in a truly 21st century fashion.

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