Scan Team Report
NCHRP Project 20-68A, Scan 08-02

Best Practices In Maximizing Traffic Flow On Existing Highway Facilities

Supported by the
National Cooperative Highway Research Program

August 2011

Executive Summary

Domestic Scan 08-02 is being conducted as a part of NCHRP Project 20-68A, the U.S. Domestic Scan program. The program was requested by the American Association of State Highway and Transportation Officials (AASHTO), with funding provided through the National Cooperative Highway Research Program (NCHRP). The purpose of this scan was to survey strategies used in the United States to maximize traffic flow without expanding capacity on existing facilities. The scanning tour took place from November 9 through 20, 2009. The scan team visited Virginia; Maryland; New Jersey; Minneapolis, Minnesota; California; and Washington State. The team also held a Web conference with the District of Columbia Department of Transportation (DDOT). This report presents a summary of the scan team's approach, goals, objectives, findings, and recommendations.

Introduction

Near-gridlock traffic congestion has been front-page news in large metropolitan areas of the United States for at least two decades, and for much longer in major urban areas, like Los Angeles. The long rush-hour delays and increasing vehicle miles of travel are no longer confined to large metropolitan areas and have become economic and quality-of-life issues in medium-sized cities experiencing growth.

The negative impacts of growing congestion are significant. Long and regularly occurring delays for freight and people reduce productivity, making some areas less competitive for new businesses and resulting in local economic impacts. Congestion is high on the list of civic concerns in metropolitan areas where long commutes and roadways queued with slow or stopped vehicles worsen with every passing year. Environmental research also indicates that congestion's negative effects on the built and natural environments are increasing. As more data on climate change and energy consumption becomes available, more emphasis is being placed on reducing congestion. At the same time, stricter regulations to protect the built and natural environments have increased costs and constraints for expanding highways. Recently, congestion levels have dropped slightly because of the sluggish economy and high unemployment rate. However, as the economy recovers and grows, it is expected that congestion will rise once again, consistent with historic trends.

As shown in Figure ES.1, The Federal Highway Administration (FHWA) studies of historical data consistently indicate that less than half of all congestion is attributable to recurring bottlenecks. Adding roadway capacity (e.g., widening freeways) may not resolve nonrecurring congestion related to construction, special events, weather, and incidents such as crashes. These nonrecurring causes of congestion account for approximately 55% of all congestion. Poorly timed traffic signals also contribute to recurring daily congestion in the broad arterial highway networks.

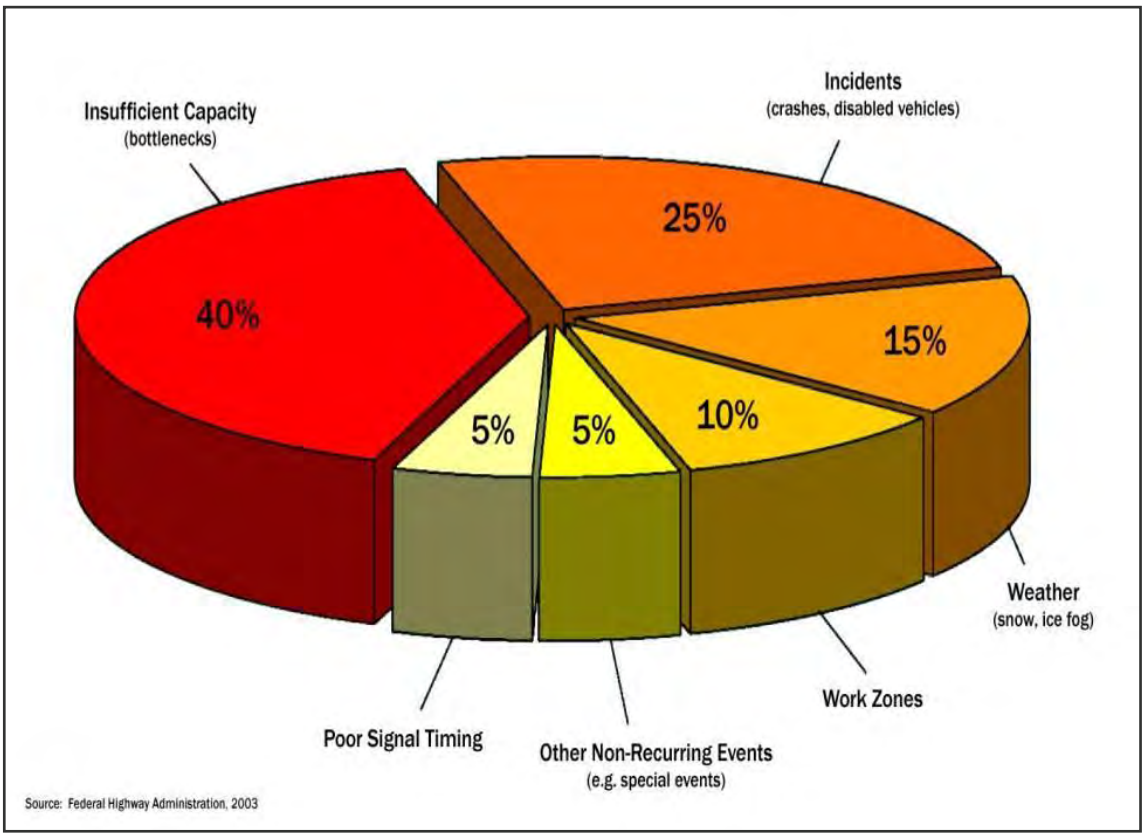

Figure ES.1 ***Causes of traffic congestion***

The rising cost of infrastructure, combined with the growing complexity and controversy of expanding vehicle capacity in urban environments, have increased the value of looking first at maximizing vehicle flow on existing facilities without physically expanding roadway capacity. Advancements in transportation technology have created new options for optimizing traffic flow without building new facilities.

Scan Purpose and Scope

The strong economies of the 1980s and 1990s spurred both job and population growth, which led to the current increased demand for personal mobility and growing vehicle congestion in many metropolitan areas. This inexorable pressure is forcing transportation agencies to consider expanding vehicle capacity on major highways.

As part of environmental clearances such as the National Environmental Policy Act (NEPA)[1] and other project planning processes, transportation agencies are required to consider demand management and system management solutions that might accommodate growing mobility demands without major highway expansion.

These solutions typically are addressed at the regional level and are often considered systematically and linked to air quality conformity. At the project level, these solutions

[1] National Environmental Policy Act, http://en.wikipedia.org/wiki/National_Environmental_Policy_Act

may be given limited consideration. Specifically, system management solutions may be quickly discarded from alternative consideration in favor of expanding capacity. Agencies may not have tools, policies, or processes that allow full and thorough consideration of system management solutions.

This scan reviewed each of the following strategies to maximize traffic flow:

- Use of shoulders as lanes
- Congestion pricing/high-occupancy toll (HOT) lanes
- Traffic smoothing
- Real-time travel management/information
- Coordination of construction activities
- Traffic signal enhancements
- Strategic use of narrow lanes
- Contraflow
- Reversible lanes
- Incident response
- Planning for operations projects
- Performance measures

Details of each strategy are provided is this report.

The scan team was charged with identifying transportation agencies that have successfully implemented several of these types of solutions and documenting their experiences for others to consider when addressing the congestion issues of their own facilities.

Summary of Findings and Recommendations

Current State of the Practice

As a result of discussions that occurred during the scan, the team organized its findings into three classifications of current practices:

- **Common Practices**
  Common practices (i.e., methods, strategies, and technologies) are well tested, have good available guidance, and are used by many urban and urbanizing areas. Many of the agencies visited on the scan tour use many similar methods and practices for improving traffic flow and relieving congestion.

- **Best Practices**
  Best practices are those that are believed to be most effective at addressing congestion (i.e., maximizing flow). The best practices to mitigate traffic flow are carefully planned and implemented with a vision of the future and do not solely focus on current issues.

- **Emerging Practices**
  Emerging practices are new and are being tested in urban and urbanizing areas. Guidance is being developed and performance data is being collected for these practices; follow-up is recommended. As transportation technology matures, it can be applied in new and different ways to maximize traffic flow.

The team found that all of the agencies visited had professionals who are well versed with the strategies listed above. Depending on the specific issue, agency policy, environmental considerations, local constraints, and other governing factors, these agencies have applied many of these strategies to the situations they faced with their own facilities. There was consistency in some of the solutions that were used; some required modification to support the situation in which they were used. In several instances, developing technologies were being deployed. For example:

- **Common practices** include maintaining and supporting intelligent transportation system (ITS) hardware and software systems, including loops and other detection methods, dynamic message signs (DMS), and closed circuit television (CCTV) that allow agencies to broadcast Web- or phone based traveler information (511 systems) and respond to traffic incidents. Many agencies are managing and coordinating work zones on freeways and reporting information through Web-based management systems.

- Considered **best practices**, congestion pricing and managed lane systems have become more prevalent, as they offer reliable travel times in otherwise congested corridors. HOT lanes are the most widely used strategy, as they maintain the incentive for carpooling and transit that were introduced in high-occupancy vehicle (HOV) lanes.

- The advances in traveler information are considered an **emerging practice**. More-detailed real-time traffic information, including transit arrival and various parking management systems, is becoming more easily accessible via a multitude of media. This information is influencing travel choices, including routes and modes. Traveler information is being expanded in places like the San Francisco Bay area to provide the best travel routes customized to meet customer needs. Documenting the benefits or results of traveler information can eventually help agencies better predict and even influence demand because of recurring and nonrecurring events. Another example of an **emerging practice** are Smart Work Zones that incorporate portable traffic management systems and use supporting devices like automated

speed enforcement are providing for work zones that are less congested and safer.

The scan team evaluated the current practices it observed in the agencies it visited, organized them into the three classifications discussed above, and developed recommendations for maximizing traffic flow and congestion relief.

Recommendations

After-it had visited the host agencies, the team evaluated owner practices and developed findings for how the agencies used different strategies for maximizing traffic flow. The team's findings-based recommendations are as follows:

- Understand and apply ramp metering **under the proper** circumstances to increase mainline traffic flow and improve safety. Newer systems deploy advanced corridor-based algorithms using real-time data. They also incorporate features such as HOV bypass lanes and freeway-to-freeway metering.
- Use adaptive traffic signal control, which has proven to be effective in maximizing flow on congested arterials. Developing cooperative operations agreements or protocols between multiple jurisdictions for operating traffic signals along arterial corridors has yielded great benefits to regions for the costs involved.
- Use improved traffic incident management systems that integrate transportation agencies and law enforcement for improved response times.
- Use service patrols for incident response to also help reduce recurring congestion.
- Share information between agencies, including prototypical agreements for traffic management concepts and standards, IT communications, publicly developed traffic operations center software, and operational protocols for incident response and ramp metering.
- Spread the cost of development and reduce redundant expenditures by sharing best practices among the traffic operations and management community. Ramp meter software would be a good example.
- Create iconic messages (brands) for agency goals to clarify the relationship and role of efficient operations in managing demand and expanding capacity.
- Improve the understanding of benefits by further developing performance measurement through partnerships among operations/maintenance agencies, planning (metropolitan planning organization [MPO]) and research organizations.
- Emphasize the customers' importance in providing advanced traveler information systems (e.g., 511 systems).
- Foster and develop relationships with private news media. While technology has advanced and Web-based technologies can be used to push travel information, open

and trusting relationships with private news media are also essential to ensure that the broadest audience is reached.

- Deploy a core list of field equipment to serve as the backbone of traffic management systems that manage flow and provide traveler information.
- Ensure that technology maintenance is budgeted and planned into management systems to allow technology to evolve and expand over time.
- Pursue collaboration and coordination among transportation providers (e.g., highway, transit, enforcement, and planning). These partnerships are essential for increasing public trust, improving decision making, and, ultimately, increasing efficiency.

Implementation

The scan team identified several potential dissemination avenues for the results of this scan:

- Publishing articles in magazines and professional journals, including *TR News*[2] and *Research Results Digest*[3]
- Providing AASHTO Web site content
- Making presentations at appropriate AASHTO committee meetings
- Making presentations at regional meeting for state DOTs
- Using the FHWA Web site and other information exchange opportunities
- Conducting webinars
- Making presentations to the Transportation Research Board (TRB) Committee and at appropriate association meetings
- Sharing results using contemporary social media
- Incorporating best practice information into reauthorization initiatives
- Providing a knowledge transfer session (i.e., a webinar) to the host scan agencies
- Sharing best practices with appropriate Strategic Highway Research Program (SHRP 2)[4] researchers and Local Technical Assistance Programs[5]
- Sharing innovations through AASHTO's Technology Implementation Group[6]

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[2] *TR News*, http://www.trb.org/Publications/PubsTRNewsMagazine.aspx

[3] Transit Cooperative Research Program Research Results Digests, http://www.trb.org/Publications/PubsTCRPResearchResultsDigests.aspx

[4] Strategic Highway Research Program (SHRP 2), http://trb.org/StrategicHighwayResearchProgram2SHRP2/Blank2.aspx

[5] National Local Technical Assistance Program and Tribal Technical Assistance Program (LTAP/TTAP), http://www.ltap.org/

[6] AASHTO Technology Implementation Group, http://tig.transportation.org/Pages/default.aspx

- Creating and distributing a CD of the best practice findings
- Establishing a peer-to-peer network

A more detailed discussion of these strategies can be found in Implementation Plan.