Overview of Operations

Regional Operations Forum
Session Outcomes

• Define Management & Operations and ITS
• Understand the relationship between transportation systems management & operations (TSM&O) and the overall transportation system
• Understand TSM&O terminology
• Define mobility as it relates to both the agency and the user
• List TSM&O strategies that have an impact on mobility
• Identify the steps needed to encourage support of TSM&O
• Understand the benefits of TSM&O
• List the SHRP2 technical tools that can be used to support TSM&O
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• Define Management & Operations and ITS
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Definition of Transportation Systems Management and Operations

“An integrated program to optimize the performance of existing multimodal infrastructure through implementation of systems, services, and projects to preserve capacity and improve the security, safety, and reliability of our transportation system.”

Source: Transportation System Management and Operations Mega Issue White Paper, Institute of Transportation Engineers, Washington, DC
http://www.ite.org/mega/M&Ofinal.pdf
TSM&O Can be a Complex Discipline

- Congestion and safety are not independent
- Recurrent and non-recurrent congestion are not necessarily independent
- Multiple strategies can be either synergistic or counter-productive
- Strategies that improve traffic flow on one facility may have a negative impact on another facility
Putting TSM&O Into Perspective

• DOTs have many responsibilities:
  – Planning
  – Design
  – Construction
  – Maintenance
  – Traffic and Safety
  – Management and Operations
  – Research
  – Administration (HR, information technology, finance, etc.)

• TSM&O must compete with these other activities and responsibilities for attention and resources
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Relationship Between TSM&O and the Overall Transportation System

Performance Management

Network Infrastructure

Data Collection & Management

Plans Processes and Policies

Management & Operations

Organizational Capacity
TSM&O and Organizational Capacity

• Structure – What is the relationship between TSM&O and the overall DOT organization?
• Internal Partnerships – Is TSM&O integrated into the activities of appropriate DOT units?
• Resources – How do TSM&O resources compare with those of other activities?
• Workforce Development – Are appropriate policies in effect to attract and retain adequate qualified staff?
Structural Alternative #1
TSM&O Status Equivalent to Other Activities

Indicates lead role for TSM&O. Other units retain some M&O responsibilities
Structural Alternative #2
TSM&O at a Lower Level and Split

CAO

Chief Engineer
Plan. & Design

Planning

Design

Chief Engineer
Maint. & Ops.

Freeway Ops

Traffic Eng. & Safety

Maintenance

Administration

Districts

Indicates lead role for TSM&O. Other units retain some TSM&O responsibilities
Structural Alternative #3
TSM&O at a Lower Level and Split

CAO

Chief Engineer
Plan. & Design

Planning

Design

Chief Engineer
Maint. & Ops.

ITS

Traffic Eng. & Safety

Maintenance

Administration

Districts

TMC(s)

Indicates lead role for TSM&O. Other units retain some TSM&O responsibilities
The Structure Influences TSM&O’s Priority Within the Department

• Is there a unit within the department responsible for its TSM&O activities, or are TSM&O responsibilities spread across multiple units?
• How many levels of reporting exist between the TSM&O unit(s) and the top of the organization?
• Do the TSM&O unit(s) have their own multi-year budgets?
• Are the department’s TSM&O activities described in its annual reports and plans?
Internal Partnerships Between TSM&O and Other Activities

• Some of the activities within a DOT include:
  – Planning
  – Design
  – Construction
  – Maintenance
  – Traffic and Safety
  – Management and Operations
  – Research
  – Administration (HR, information technology, finance, etc.)

• TSM&O must both compete and cooperate with other activities
  – Competition for funding, staffing, and other resources
  – Cooperation includes integration of TSM&O into processes of other activities
TSM&O and Transportation Agency Processes

- Planning
- Design
- Construction
- Operations
- Maintenance

TSM&O and Transportation Agency Processes

Cross Cutting Activities
- Performance Management
- Asset Management
- Risk Management
- Workforce Development
- Customer Service
Internal Partnerships with Traditional DOT Activities

Planning
- Planning for non-recurrent congestion

Design & Construction
- Mitigating construction impacts

Maintenance
- Improving safety, reliability and throughput

Management and Operations
The Many Levels of TSM&O Involvement

- Planning
- Design and Construction
- Maintenance

Management and Operations

- Roadway Segment or Intersection
- Corridor or Network
- Regional and Multimodal
TSM&O Resources – Dividing up the Highway Funding Pie
## Workforce Development; Differences in TSM&O Staffing Needs

<table>
<thead>
<tr>
<th>Typical Characteristics</th>
<th>Traditional Staff</th>
<th>TSM&amp;O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Societies</td>
<td>ASCE, APWA, APA</td>
<td>IEEE, ITS America, ITE</td>
</tr>
<tr>
<td>Typical initial job assignments</td>
<td>Training program (rotation). Construction inspection</td>
<td>TMC operation, traffic signal timing, traffic data collection</td>
</tr>
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TSM&O is an Alphabet Soup

• As with many broad-based applications, a sometimes confusing terminology has evolved
• TSM&O terminology includes:
  – Description of the specialty itself
  – References to participating organizations
  – Identification of supporting tools, resources and technologies
• It is important to understand the language of TSM&O
The Many Names of TSM&O

- Management and Operations (M&O) is by far the most common designation and should be used whenever possible.
- Operations and Management (O&M) used by some, should be avoided because of the potential confusion with Operations and Maintenance which goes by the same abbreviation.
- Transportation Systems Management and Operations (TSMO) was popular with FHWA and is still in use.
- Regional TSMO (RTSMO) is a reference to the focus of TSMO within a limited geographical area. It is often used by the planning community.
Some Participating Organizations – Associations and Professional Societies

- American Association of State Highway and Transportation Officials (AASHTO)
- American Public Transportation Association (APTA)
- Association of Metropolitan Planning Organizations (AMPO)
- Institute of Transportation Engineers (ITE)
- International Bridge, Tunnel and Turnpike Association (IBTTA)
- ITS America
- National Transportation Operations Coalition (NTOC)
AASHTO’s is Defined by its Committee Structure

- AASHTO Board of Directors and Executive Committee

- Standing Committees
  - Aviation
  - Environment
  - Finance and Admin.
  - Highway Traffic Safety
  - Highways
  - Performance Management
  - Planning
  - Public Transportation
  - Rail Transportation
  - Research
  - Water Transportation

- Subcommittees in Standing Committee on Highways
  - Bridges and Structures
  - Construction
  - Design
  - Highway Transport
  - Maintenance Materials
  - Right-of-Way & Utilities
  - Systems Operation and Management (SSOM)
  - Traffic Engineering
Two Key National Players

• US Department of Transportation (USDOT) – Broad responsibility for policy, research, education, coordination and funding related to all transportation modes

• Transportation Research Board (TRB) – Lead role in transportation research related to all modes.
The USDOT Organization

Secretary
Deputy Sec.

FHWA
Federal Highway Administration

NHTSA
National Highway Traffic Safety Administration

FTA
Federal Transit Administration

RITA
Research and Innovative Technology Administration

FMCSA
Federal Motor Carrier Safety Administration

Office of Operations

ITS/JPO
ITS/Joint Program Office

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES
The TRB Organization

TRB
Transportation Research Board

NCHRP
National Cooperative Highway Research Program

TCRP
Transit Cooperative Research Program

NCFRP
National Cooperative Freight Research Program

SHRP2
Strategic Highway Research Program 2

Safety
Renewal
Reliability
Capacity
Terminology – Analysis

• Benefit-Cost (B-C) Analysis (BCA) – a process for comparison of the benefits and costs of a project, decision or policy

• Highway Capacity Manual (HCM) – a TRB publication that contains concepts, guidelines, and procedures for calculating capacity and quality of service of roadway facilities.

• Level of Service (LOS) – a measure used to describe the quality of flow on a given roadway facility. LOS is usually expressed using a series of letter grades (A through F) that describe the type of flow, speeds and delays encountered by traffic on the facility.
Terminology – Statistics

• Probability Density Function (PDF) – describes the likelihood that a variable will assume a given value.

• Cumulative Distribution function (CDF) – the probability that a variable with a given distribution will assume a value less than or equal to a given value. This function is used in SHRP 2
PDF CDF Examples

**Probability Density Function (PDF):** Plots of several hypothetical normal distributions with various means (μ) and variance (σ²). For transportation applications, horizontal axis could represent various travel times while vertical axis could represent the probability of their occurrence.

**Cumulative Distribution Function (CDF):** The CDF is a plot of the same data as the PDF. Curves with the same colors represent the corresponding PDF plot. These curves indicate the probability that the travel time will be less than or equal to the value on the X axis.
Relationship to SHRP2 Project L02

- Project Title - Establishing Monitoring Programs for Travel Time Reliability
- Project outputs:
  - Guidelines for programs to monitor travel-time reliability
  - Guidebook for designing, building, operating, and maintaining reliability monitoring systems.
- Applicable to freeways, toll roads, and urban arterials
- Offers a variety of techniques for processing and analyzing and presenting travel time data including the CDF

Reference:
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What is Mobility?

• Mobility is the relative ease with which people and goods can move from an origin to a destination
• Accessibility refers to the ability to reach desired goods, services, activities and destinations within a reasonable amount of time
• While mobility refers to the performance of the transportation system itself, access is the ultimate goal
What is Congestion?

• Traffic congestion is a condition on road networks that occurs as demand approaches capacity. It is characterized by slower speeds, longer trip times, and increased queuing.

• Congestion is the inverse of mobility. As congestion increases, mobility decreases.

• Many different definitions of congestion, some of which are based on level of service.
Two Types of Congestion

• Recurrent (recurring) congestion – Congestion that occurs repeatedly and predictably on a given roadway or roadway system

• Non-recurrent (non-recurring) congestion – Congestion that has not been predicted and which may occur unexpectedly
Many Differences Between the Two Types of Congestion

• Different causes:
  – Recurrent congestion; commuters, major traffic generators, inadequate capacity
  – Non-recurrent congestion; incidents, construction, weather, special events

• Different strategies:
  – Recurrent congestion; time-of-day controls (signals, ramp metering, reversible lanes)
  – Non-recurrent congestion; adaptive controls, incident response

• Different performance measures:
  – Impacts of recurrent congestion; travel time and delay
  – Impacts of non-recurrent congestion; travel time reliability and incident duration
Causes of Delay

Majority of delays caused by non-recurrent events

- Bottlenecks 40%
- Traffic Incidents 25%
- Bad Weather 15%
- Work Zones 10%
- Poor Signal Timing 5%
- Special Events 5%
Why Such a Big Deal About Congestion?

- Engineers and elected officials have used it to define the state of the system
- Reported by States to the Highway Performance Monitoring System (HPMS)
- Implicitly represents the balance of supply and demand
- But congestion is not a good measure of non-recurrent performance
The Mobility Problem

![Graph showing the increase in VMT and Lane Mile Index from 1980 to 2005. The VMT Index is shown with diamonds and the Lane Mile Index with squares. The graph is labeled with '1980 = 100%' and shows a steady increase over time.](image-url)
Level of Service (LOS)

• Previously described as the use of letter grades (A through F) to describe traffic flow on a given roadway facility or at an intersection
• A qualitative approach for describing roadway performance and implicitly mobility and congestion
• Popular for communicating with non-technical groups
• LOS approach that is the basis of the HCM is only applicable to recurrent congestion
Levels of Service

- A – Free flowing; complete mobility
- B – Slightly more traffic, but still free flowing
- C – Traffic moves at speed limits, occasionally limited passing opportunities
- D – Equivalent to heavy off-peak traffic. Operational goal for many urban areas
- E – Some congestion, irregular flow, roadway operating at or near capacity
- F – Irregular flow, roadway operating under congested conditions
Levels of Service for 70 mph
Free Flow Speed

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Max. Density</th>
<th>Min. Speed</th>
<th>Max. V/C Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Max. Density</td>
<td>11</td>
<td>18</td>
<td>26</td>
</tr>
<tr>
<td>Min. Speed</td>
<td>70.0</td>
<td>70.0</td>
<td>68.2</td>
</tr>
<tr>
<td>Max. V/C Ratio</td>
<td>0.32</td>
<td>0.53</td>
<td>0.74</td>
</tr>
</tbody>
</table>
# How LOS Works in Practice

<table>
<thead>
<tr>
<th>Peak Period</th>
<th>Free-Flow Speed</th>
<th>Speed</th>
<th>V/C Ratio</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>70.5</td>
<td>58.2</td>
<td>0.84</td>
<td>D-E (speed) or C-D (V/C ratio)</td>
</tr>
<tr>
<td>PM</td>
<td>71.8</td>
<td>62.3</td>
<td>0.89</td>
<td>C-D (speed &amp; V/C ratio)</td>
</tr>
</tbody>
</table>
Non-Recurrent Performance is Added to the HCM by SHRP2 Project L08

- **Project Name:** Incorporation of Non-Recurrent Congestion Factors into the Highway Capacity Manual Methods
- Adds non-recurrent congestion to the HCM
- Uses Excel-based software to model freeway and arterial flows in the presence of various causes of unreliability
- Probability of the occurrence of the cause of non-recurrent congestion is based on national/regional data or may be entered by the user
- Outputs include the full range of HCM performance measures including LOS
Evolution of Mobility Measures

- Congestion
- Travel Time
- Reliability
- Hours of Delay
A Few Good Performance Measures

Mobility Measures for Standardization

1. Customer Satisfaction
2. Extent of Congestion – Temporal
3. Extent of Congestion - Spatial
4. Delay – Non-Recurrent
5. Delay - Recurrent
6. Incident Duration
7. Speed
8. Throughput – Person
9. Throughput – Vehicle
10. Travel Time – Link
11. Travel Time – Reliability
12. Travel Time - Trip
Customer Satisfaction

This measure remains undefined. Customer satisfaction is typically measured through agency-sponsored surveys. TSM&O is usually a subset of these surveys which emphasize areas of particular concern to the agency conducting the survey.
Extent of Congestion - Spatial

Miles of roadway within a predefined area and time period for which average travel times are 30% less than unconstrained travel times.
Extent of Congestion - Temporal

Length of time that a predefined set of roadways is congested

Congested is defined as speeds less than either the unconstrained speed or free-flow speed
Incident Duration

The time elapsed from the notification of an incident until all response vehicles have left the scene.
Non-Reccurrent Delay

Vehicle delays in excess of recurrent delay for the current time-of-day, day-of-week, and day-type.
Recurrent Delay

Vehicle delays that are repeatable for the current time-of-day, day-of-week, and day-type
Speed

The average speed of vehicles measured in a single lane, for a single direction of flow, at a specific location on a roadway.
Throughput - Person

Number of persons including vehicle occupants, pedestrians and bicyclists traversing a roadway section in one direction per unit time. May also be the number of persons traversing a screen line in one direction per unit time.
Throughput - Vehicle

Number of vehicles traversing a roadway section in one direction per unit time. May also be the number of vehicles traversing a screen line in one direction per unit time.
Travel Time – Link

The average time required to traverse a section of roadway in a single direction.
The buffer index is the additional time that must be added to the trip travel time, to ensure that travelers using the route will arrive at their destination at or before, the intended time, 95% of the time.
Travel Time – Trip

The average time required to travel from an origin to a destination on a trip that might include multiple modes of travel.
What gets measured gets done!
Relationship to SHRP2 Project L02

- Project Title: Guide to Establishing Monitoring Programs for Travel Time Reliability
- The guidebook produced by this project describes how to develop and use a Travel Time Reliability Monitoring System (TTRMS)
- Travel time reliability is the key performance measure for monitoring system effectiveness under non-recurrent conditions

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TSM&O Strategies

• Broad range of available strategies
  – Technical systems and tools (ITS)
  – Procedures (incident management)
  – Policies (memoranda of understanding, planning and budgeting)

• Strategies should be implemented with a clear understanding of objectives
  – Recognizing that a suite of strategies may be required to accomplish a given objective
  – Identifying appropriate performance measures to ensure objectives are achieved
The Applicability of Strategies Being Implemented Should be Considered

• Intended Impact: Supply, demand
• Conditions addressed: Recurrent, non-recurrent
• Roadway type: freeways, arterials, networks
• Objective: congestion, travel time, safety
## Not All Strategies are Created Equal

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Recurring</th>
<th>Non-Recurring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causes</td>
<td>VMT</td>
<td>Crashes\nSpecial Events\nWeather</td>
</tr>
<tr>
<td>Mobility Performance Measures</td>
<td>Travel Time Delay</td>
<td>Incident duration\nTravel Time Reliability</td>
</tr>
<tr>
<td>Strategies</td>
<td>HOV lanes\nRamp metering\nSignal timing</td>
<td>Incident clearance\nIncident Management\nTraveler Information\nResponsive signal operation</td>
</tr>
</tbody>
</table>
Traffic Signals

- Includes three variations
  - Better timing of time-of-day systems
  - Traffic-responsive systems
  - Adaptive systems

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<thead>
<tr>
<th>Characteristics</th>
<th>Applicability</th>
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<tr>
<td></td>
<td>Always</td>
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<tr>
<td>Supply vs. Demand</td>
<td>Supply</td>
</tr>
<tr>
<td>Conditions Addressed</td>
<td>Recurrent</td>
</tr>
<tr>
<td>Roadway Type(s)</td>
<td>Arterials &amp; Networks</td>
</tr>
<tr>
<td></td>
<td>Freeways</td>
</tr>
<tr>
<td></td>
<td>Occasional</td>
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<td>Demand</td>
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<td>NR.</td>
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<tr>
<td></td>
<td>Never</td>
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</tbody>
</table>
Ramp Metering

• Includes the following
  – Time-of-day systems
  – Traffic-responsive systems
  – Adaptive systems
  – Priority lanes

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<tr>
<td>Roadway Type(s)</td>
<td>Freeways</td>
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## Incident Management

- Includes the following
  - Incident clearance
  - Traveler information
  - Traffic management

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<tr>
<td>Roadway Type(s)</td>
<td>Freeways</td>
</tr>
<tr>
<td>Objective</td>
<td>All</td>
</tr>
</tbody>
</table>
Traveler Information

- Includes the following
  - Pre-trip planning
  - En-route information
  - In-vehicle information

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Lane and Speed Control

• Includes the following
  – Photo enforcement
  – Traffic calming
  – Variable speed systems
  – Variable lane usage

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<tr>
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<td>All</td>
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Electronic Payment Systems

- Includes the following
  - Tolling
  - Transit fare payment
  - Parking payment
  - Mileage based insurance

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<td>All</td>
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</table>
Commercial Vehicle Operations

• Includes the following
  – Weigh stations
  – Safety inspection
  – Border crossings

• Applicability
Commercial vehicle operations are used to facilitate freight movement. While weigh stations and safety inspections primarily occur on freeway facilities, they may also be found in specialized locations such as border crossing and surface streets with heavy commercial traffic.
Transit Operations

- Includes the following
  - Bus preemption
  - Arrival information
  - Improved scheduling

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<td>Roadway Type(s)</td>
<td>Arterials &amp; Networks</td>
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Integrated TSM&O

- Includes the following
  - Integrated Corridor Management
  - Active Traffic Management
  - Integrated Payment Systems

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</table>
We’ve just scratched the surface

• Many other strategies exist that have not been covered here due to the breadth of the TSM&O field
• Some of the strategies that have not been covered include:
  – Parking advisory systems
  – Travel time and performance monitoring systems
  – Traveler information systems
  – Communications systems
Evolution of TSM&O Strategies

The Present
Conventional Systems

Traffic Signals
Ramp Metering
Incident Clearance

Smart Systems
Adaptive Signals
Adaptive Metering
Incident Management
Social Media

Integrated Systems
ICM
ATM
EPS

The Future
Crowd Sourcing
Cloud Computing
Connected Vehicle

SHRP2
STRATEGIC HIGHWAY RESEARCH PROGRAM

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES
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Where was TSM&O in the 1970s?

Our tools Included:

• Ramp metering
• Traffic signal timing
• Lane management
• Incident management
• Variable message signs (VMS)
• Traffic management centers
• Detectors and CCTV
Where are we in the 21st century

Our tools Include:

- Ramp metering
- Traffic signal timing
- Lane management
- Incident management
- Variable message signs (VMS)
- Traffic management centers
- Detectors and CCTV
In 40 years we haven’t experienced a revolution, but we’ve seen some evolution
The Evolution of the 21st Century has included…

The introduction of:
- Improved technology (smaller, faster, cheaper)
- Expansion of electronic payment systems
- 511
- Travel times on VMS
- Photo enforcement

As well as:
- Increased travel demand (more congestion), and
- Less money
The ingredients of a revolution

• Improved Performance
• Performance Measurement (discussed in the previous section)
• Outreach (marketing)
• Customer Service
• Organizational changes to accommodate unique needs of operations
Improved Performance

- Better signal timing
  - Retiming as needed
  - Use of responsive and adaptive systems
- Incident management beyond response
  - Improved traveler information
  - Use of diversion and load balancing
  - Retiming signals on alternate routes
- Equal attention to arterials and freeways
- Ubiquitous use of TSM&O applications
Outreach (marketing)

- Develop a message using performance measurement results
- Market internally - at budget meetings, organizational studies, planning activities, etc.
- Market externally – senior management, elected officials, general public
- Publicize M&O at every opportunity
  - Associations (ITE, ITS/A, AASHTO)
  - Publications
  - I-95 Coalition
  - NTOC
Customer Service - One popular definition

“Excellent customer service (is) the ability of an organization to constantly and consistently exceed the customer's expectations.”

We’ve made a start, but more can be done…

Some agencies have a right to brag about:

• Customer surveys
• Freeway service patrols
• Traveler information
• Websites
• Publications
• Call centers
Transportation Customers

- Many different categories of customers
- Different customers have different concerns and can be reached in different ways
- Transportation customers include:
  - Commuters
  - Local travelers
  - Vacation travelers
  - Truckers and shippers
  - Elected officials
  - Property owners
  - Providers (insurance industry, OEMs, aftermarket suppliers)
## Customers’ Concerns

<table>
<thead>
<tr>
<th>Customer Type</th>
<th>Primary Concern(s)</th>
<th>Secondary Concern(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commuters</td>
<td>Reliability</td>
<td>Travel time, tolls</td>
</tr>
<tr>
<td>Local Travelers</td>
<td>Reliability or travel time</td>
<td>Reliability or travel time</td>
</tr>
<tr>
<td>Vacation Travelers</td>
<td>Travel time</td>
<td>Reliability</td>
</tr>
<tr>
<td>Truckers &amp; Shippers</td>
<td>Reliability</td>
<td>Travel time, tolls</td>
</tr>
<tr>
<td>Elected Officials</td>
<td>Customer service</td>
<td>Congestion</td>
</tr>
<tr>
<td>Property Owners</td>
<td>Noise, access</td>
<td>Mobility</td>
</tr>
<tr>
<td>Providers</td>
<td>Safety</td>
<td>Vehicle performance</td>
</tr>
</tbody>
</table>
## Tailoring the Outreach to the Customer

<table>
<thead>
<tr>
<th>Customer Type</th>
<th>Survey Results</th>
<th>Service Patrols</th>
<th>Traveler Info.</th>
<th>Websites</th>
<th>Pubs.</th>
<th>Call Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commuter</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Local Traveler</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Vacation Traveler</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truckers &amp; Shippers</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Elected Officials</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Property Owners</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Providers</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Customer Service Responsibilities

• Customer service is not the responsibility of the public information officer (PIO)
• Customer service is an organization-wide attitude and includes:
  – Operations including first responders
  – Engineering
  – Construction
  – Maintenance
  – Planning
SHRP2 Project L01

• Project Name: Integrating Business Processes to Improve Reliability
• Project concluded that the TSM&O can’t be advanced without a supporting organizational framework
• Project developed a methodology that permits agencies to assess the quality of this framework

Project Reference:
Key Finding: The Common characteristic of the more effective states

The “Program”

Processes that support Program

Supporting Institutional Framework

Effective SO&M performance based on continuing capability improvement

Effective & sustainable programs require specific business/technical processes

Supportive processes depend on organization, staff capabilities & relationships
Relationship to SHRP2 Project L05

• Project Name: Incorporating Reliability Performance Measures into the Transportation Planning and Programming Process
• Product is a guidebook that describes the way in which reliability can be included in the planning process
• The guidebook also describes the way in which the results of project evaluations can be communicated to the general public

Project Reference:
Session Outcomes

• Define Management & Operations and ITS
• Understand the relationship between TSM&O and the overall transportation system
• Understand TSM&O terminology
• Define mobility as it relates to both the agency and the user
• List TSM&O strategies that have an impact on mobility
• Identify the steps needed to encourage support of TSM&O

• Understand the benefits of TSM&O
• List the SHRP2 technical tools that can be used to support TSM&O
TSM&O Strategies Have Many Positive Attributes

• Improve recurrent and non-recurrent congestion
• Address issues of supply and demand
• Employed on arterials and freeways
• Little impact on travel behavior
• Rapid implementation
• Relatively low cost
### Benefits of Some TSM&O Strategies

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Signal Retiming</td>
<td>Delay reduced 8% to 25%</td>
</tr>
<tr>
<td>Ramp Metering</td>
<td>Speeds increased 24%</td>
</tr>
<tr>
<td>Freeway Incident Management</td>
<td>Incident duration reduced 39% to 51%</td>
</tr>
<tr>
<td>Traveler Information</td>
<td>On time reliability improved 5% to 16%</td>
</tr>
</tbody>
</table>
# TSM&O vs. Construction

<table>
<thead>
<tr>
<th>Operations</th>
<th>The Winner</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/C ratios 10 to 60</td>
<td>←</td>
<td>B/C ratios typically 1 to 5</td>
</tr>
<tr>
<td>Impacts widespread (corridor/region)</td>
<td>←</td>
<td>Impacts localized (section/intersection)</td>
</tr>
<tr>
<td>Implementation 1 to 2 yrs</td>
<td>←</td>
<td>Implementation 5 to 12 yrs</td>
</tr>
<tr>
<td>Rarely affects travel behavior</td>
<td>←</td>
<td>Affects travel patterns &amp; land use</td>
</tr>
<tr>
<td>Low visibility to traveler</td>
<td>←</td>
<td>Highly visible where implemented</td>
</tr>
<tr>
<td>Often a political non-starter</td>
<td>←</td>
<td>Politically attractive</td>
</tr>
</tbody>
</table>
Choosing Between TSM&O and Adding New Capacity

• Certain problems can be resolved by adding new capacity:
  – Major capacity deficiencies for either intersections or roadways
  – Safety problems due to inadequate geometrics, site distance, etc.

• Certain problems can be addressed by TSM&O
  – Non-recurrent congestion due to incidents, weather, etc.
  – Recurrent congestion due to poor signal timing, inefficient lane utilization, short term peaks in demand

• TSM&O and new capacity are not mutually exclusive.
  – TSM&O can be used to supplement new capacity
  – TSM&O can offer interim solutions while new capacity is developed
  – TSM&O can reduce the impacts of construction and maintenance
New Capacity vs. TSM&O Decision Tree

Define the Problem

- Recurrent
  - Signalization
    - Grade Separation
    - Add a lane
    - Signal timing
- Areawide
  - Transit
- Non-Recurrent
  - Traveler Information

Indicates TSM&O strategy. All others construction or transit related
Define the Problem

- Recurrent
- Localized
- Non-Recurrent
- Areawide

Geometric safety improvements
Access to special events venues
Traveler information
Adaptive controls
Enhanced incident response
Traveler information

Indicates TSM&O strategy. All others construction related
The Message

• TSM&O is not a panacea
• It should be considered as either an alternative or a supplement to the addition of new capacity
• It is an important tool for addressing non-recurrent congestion
• The ability to implement TSM&O solutions more rapidly and at lower cost than new construction makes them a candidate for interim solutions
Relationship to SHRP2 Project L07

- Project name: Evaluating Cost-Effectiveness of Highway Design Features
- This project includes a design guide that is a compendium of design treatments likely to affect non-recurrent congestion
- Also includes an Excel-based tool that designers can use to evaluate the effects of such treatments on delay, safety, travel time reliability, and lifecycle benefits and costs.

With its obvious benefits, Why doesn’t TSM&O get more attention?

• Construction culture
• Greater visibility and localized impact of construction
• Highway industry lobbying
• Deteriorating physical condition of infrastructure
• Existing construction and maintenance-oriented agency staff
Session Outcomes

- Define Management & Operations and ITS
- Understand the relationship between TSM&O and the overall transportation system
- Understand TSM&O terminology
- Define mobility as it relates to both the agency and the user
- List TSM&O strategies that have an impact on mobility
- Identify the steps needed to encourage support of TSM&O
- Understand the benefits of TSM&O
- List the SHRP2 technical tools that can be used to support TSM&O
Status of SHRP2 Technical Tools

- Development of tools is complete
- All tools have had some pilot testing done
- All the tools are available for national use – visit SHRP2 Solutions website under Reliability Solutions

https://www.fhwa.dot.gov/goshrp2/Solutions/Reliability/List
# Summary of Technical Tools

<table>
<thead>
<tr>
<th>Number</th>
<th>Project Name</th>
<th>Product(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L02</td>
<td>Establishing Monitoring Programs for Travel Time Reliability</td>
<td>Guidebook for existing TMS</td>
</tr>
<tr>
<td>L04</td>
<td>Incorporating Reliability Performance Measures in Planning and Operations Modeling</td>
<td>Includes a software to adopt simulations to evaluation of travel time reliability</td>
</tr>
<tr>
<td>L05</td>
<td>Incorporating Reliability Performance Measures into the Transportation Planning and Programming Process</td>
<td>The techniques for the use of reliability data to support decision-making and communicate the results</td>
</tr>
<tr>
<td>L07</td>
<td>Evaluation of Costs and Effectiveness of Highway Design Features to Improve Travel Time Reliability</td>
<td>Tool to evaluate the impact of geometric design treatments on reliability and evaluate their costs and effectiveness.</td>
</tr>
</tbody>
</table>
# Reliability Project Applications

<table>
<thead>
<tr>
<th>Number</th>
<th>Facility Type</th>
<th>Applicability</th>
<th>Potential User(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freeway</td>
<td>Arterial</td>
<td>Corridor</td>
</tr>
<tr>
<td>L02</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>L04</td>
<td>X</td>
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<tr>
<td>L05</td>
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<td>X</td>
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</tr>
<tr>
<td>L07</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L08</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Pilot testing of Technical Tools

- A subset of these tools includes L02, L05, L07, L08, and C11
- Combinations of these tools were pilot tested under SHRP2 program designated L38
- L04 simulation-based tool is being pilot tested now.
- SHRP2 grants are being offered in assistance Round 7 to deploy the L38 group and pilot test the L04 product
A Call to Arms

• Let’s encourage and support performance measurement for all endeavors
• Use performance measures for self improvement and TSM&O outreach
• Encourage innovation – don’t get hung up on safe solutions
• Get involved – participate in the education of senior management, elected officials and the general public regarding the availability and role of TSM&O