Measuring the Impact of ITS on Mobility, Livability and Economic Vitality in Urban Areas – Florida’s Mobility Performance Measures Program

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Discussion Points

• Smart Cities and ITS
• Florida Performance Measures Program
• Strategic Highway Research Program
• Resources
Smart Cities
Smart Cities

• Smart cities can be identified (and ranked) along six main axes or dimensions:
  – a smart **economy**
  – smart **mobility**
  – a smart **environment**
  – smart **people**
  – smart **living**
  – smart **governance**
Planning for Operations

- Noncapacity congestion increasing – more from disruptions (crash, weather, construction, etc.)

Sources of Congestion Over 50% of congestion is directly attributable to large fluctuations in demand (such as special events), poor signal timing, traffic incidents, inclement weather, and work zones.
Operations Strategies

– Arterial Signal Coordination
– Arterial Transit Signal Priority
– Transit AVL
– Ramp Metering
– Traffic Incident Management (TIM)
– Pretrip and En Route Traveler Information
– Managed Lanes
– Speed Harmonization
– Hard Shoulder Running
– Work Zone Management
– Road Weather Management
Connection to ITS

• ITS
  – Plays a key role in improving mobility, livability and economic vitality of urban and rural areas
  – Combination of technology, communications and other operational strategies is essential to the smart city concept

• BUT how do we know that?
Building Blocks to Measuring Performance

- Data
- Measures
- Tools
- Policies
- Funding
- Evaluation
<table>
<thead>
<tr>
<th>LETTER</th>
<th>MAJOR TERM</th>
<th>MINOR TERMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Specific</td>
<td>Significant, stretching, simple</td>
</tr>
<tr>
<td>M</td>
<td>Measurable</td>
<td>Motivational, manageable, meaningful</td>
</tr>
<tr>
<td>A</td>
<td>Attainable</td>
<td>Appropriate, achievable, agreed, assignable, actionable, adjustable, ambitious, aligned, aspirational, acceptable, action-focused</td>
</tr>
<tr>
<td>R</td>
<td>Relevant</td>
<td>Result-based, results-oriented, resourced, resonant, realistic</td>
</tr>
<tr>
<td>T</td>
<td>Time-bound</td>
<td>Time-oriented, time framed, timed, time-based, \textit{timeboxed}, time-specific, timetabled, time limited, trackable, tangible</td>
</tr>
</tbody>
</table>
NCHRP 08-36, Task 102

Assessing Alternative Methods for Measuring Regional Mobility in Metropolitan Regions
February 2012

- Used FDOT concepts as a starting point
- Identified specific performance measures
- Emphasized need for tying outcomes to agency activities
NCHRP 8-36: Mobility Performance Measure Structure

- Categories
  - Quantity of travel (e.g., vehicle-miles traveled)
  - Quality of travel (e.g., delay, reliability indices)
  - Accessibility (travel time to opportunities)
  - Capacity Utilization (e.g., how long does congestion last, how many miles does congestion cover?)
NCHRP 8-36: Mobility Performance Measure Structure

- **Measurement Scale**
  - Facility-based measurements (e.g., detectors)
  - Trip-based (e.g., vehicle probes, personal device tracking)

- **Geographic Scale**
  - Facility
  - Corridor
  - Areawide
Importance of Mobility

“Providing mobility for people and goods is transportation’s most essential function.”

Mobility performance measures

MAKE SENSE
Dimensions of Mobility

To adequately address mobility, **all four dimensions** should be emphasized and multiple performance measures used.
Quantity

How much
Quality

How good

How bad

SOFT SHOULDER
BLIND CURVES
STEEP GRADE
BIG TRUCKS
GOOD LUCK!
Accessibility
Capacity Utilization
Applicability to All Modes
Mobility Performance Measures

Program Goals

I. Develop and improve measures and reporting techniques

II. Report on mobility measures for MAP 21 and statewide reporting purposes

III. Provide guidance on mobility performance measures (MPMs) to State and MPO stakeholders
# FDOT’s Draft Statewide Mobility Performance Measures

<table>
<thead>
<tr>
<th>MODE</th>
<th>QUANTITY</th>
<th>QUALITY</th>
<th>ACCESSIBILITY</th>
<th>UTILIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>People</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway</td>
<td>Vehicle miles traveled</td>
<td>% travel meeting generally acceptable operating conditions</td>
<td>% population within 30 min of jobs</td>
<td>% miles severely congested</td>
</tr>
<tr>
<td></td>
<td>Person miles traveled</td>
<td>% miles meeting generally acceptable operating conditions</td>
<td></td>
<td>% travel severely congested</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Travel time reliability</td>
<td></td>
<td>Hours severely congested</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Travel time variability</td>
<td></td>
<td>Vehicles per lane mile</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delay</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average travel speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aviation</td>
<td>Passengers</td>
<td>Departure reliability</td>
<td>Highway adequacy (LOS)</td>
<td>Demand to capacity ratios</td>
</tr>
<tr>
<td>Rail</td>
<td>Passengers</td>
<td></td>
<td>% population within 30 min drive time</td>
<td></td>
</tr>
<tr>
<td>Seaport</td>
<td>Passengers</td>
<td></td>
<td>% population &lt; X time or distance</td>
<td></td>
</tr>
<tr>
<td>Transit</td>
<td>Ridership</td>
<td>Average headway</td>
<td>Highway adequacy (LOS)</td>
<td></td>
</tr>
<tr>
<td>Pedestrian</td>
<td>Level of Service (LOS)</td>
<td></td>
<td>Sidewalk coverage</td>
<td></td>
</tr>
<tr>
<td>Bicycle</td>
<td>Level of Service (LOS)</td>
<td></td>
<td>Bike lane/shoulder coverage</td>
<td></td>
</tr>
<tr>
<td><strong>Freight</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway</td>
<td>Combination truck miles traveled</td>
<td>Travel time reliability</td>
<td>Highway adequacy (LOS)</td>
<td>% miles severely congested</td>
</tr>
<tr>
<td></td>
<td>Combination truck tonnage</td>
<td>Travel time variability</td>
<td></td>
<td>% travel severely congested</td>
</tr>
<tr>
<td></td>
<td>Combination truck ton miles</td>
<td>Combination truck delay</td>
<td></td>
<td>Hours severely congested</td>
</tr>
<tr>
<td></td>
<td>traveled</td>
<td>average travel speed</td>
<td></td>
<td>Vehicles per lane mile</td>
</tr>
<tr>
<td></td>
<td>Truck miles traveled</td>
<td>Truck LOS</td>
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<td></td>
</tr>
<tr>
<td>Aviation</td>
<td>Tonnage</td>
<td></td>
<td>Highway adequacy (LOS)</td>
<td></td>
</tr>
<tr>
<td>Rail</td>
<td>Tonnage</td>
<td></td>
<td>Highway adequacy (LOS)</td>
<td></td>
</tr>
<tr>
<td>Seaport</td>
<td>Tonnage</td>
<td></td>
<td>Quality rail access</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Truck equivalent units</td>
<td></td>
<td>Highway adequacy (LOS)</td>
<td></td>
</tr>
</tbody>
</table>
MAP-21 Requirements

Moving Ahead for Progress in the 21st Century

USDOT wants States and MPOs to do performance based planning
USDOT will establish measures for States to use to assess:

- Condition of Pavements
- Condition of Bridges
- Performance of (mobility)
  - Interstate System
  - National Highway System
MAP-21 National Goal Areas for the Federal Aid Highway Program

- Safety
- Infrastructure Condition
- Congestion Reduction
- System Reliability
- Freight Movement and Economic Vitality
- Environmental Sustainability
- Reduced Project Delivery Delays
Performance Measures Map-21 Provisions

• FHWA Establishes Performance Measures for:
  – Pavement condition on the Interstate and NHS
  – Bridge conditions
  – Injuries and fatalities
  – Traffic congestion
  – On-road mobile source emissions
  – Freight movement on the Interstate
Performance Measures Map-21
Provisions

• States (and MPOs, where applicable) will set performance targets in support of those measures, and State and metropolitan plans will describe how program and project selection will help achieve targets
FDOT Draft MAP-21 Recommendations

- Vehicle miles traveled
- % travel meeting generally acceptable operating conditions
- Travel time reliability
- Delay
- % miles severely congested
FDOT Draft MAP-21 Freight Recommendations

- Combination truck miles traveled
- Travel time reliability
- Combination Truck Delay
- % miles severely congested
Travel Time Reliability
Importance of Travel Time Reliability as a Performance Measure

• As the predominant (service) mobility measure
  – Freeway facilities in large urbanized areas
  – Freight

• As an important mobility measure in other situations

• Probably the measure most closely tied to Traffic Operations and ITS
  – Cost effectiveness of traffic operations improvements

• Almost certainly will be a MAP-21 required measure
Importance of Travel Time Reliability as a Performance Measure

- As the predominant (service) mobility measure:
  - Freeway facilities in large urbanized areas
  - Freight

- Measure most closely tied to Traffic Operations and ITS:
  - Cost effectiveness of traffic operations improvements

Reporting as a mobility performance measure:
- ITS Office to the Florida Transportation Commission
- TranStat as a statewide mobility performance measure
- Almost certainly will be a MAP-21 required measure
There are two general types of travel time reliability performance measures:

- Percent of trips that “succeed”
- Comparison of variability in travel times

<table>
<thead>
<tr>
<th>Success Measure</th>
<th># Trips</th>
<th>Travel Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free flow time</td>
<td>80th percentile</td>
<td>95th percentile</td>
</tr>
<tr>
<td>80th percentile</td>
<td>95th percentile</td>
<td>Free flow time</td>
</tr>
</tbody>
</table>

Travel Time Reliability
Travel Time Index = \frac{\text{Percentile travel time}}{\text{Free flow travel time}}
## Travel Time Reliability Issues

<table>
<thead>
<tr>
<th>Category</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>When</strong></td>
<td>• Peak Hour, Peak Period, Daily?</td>
</tr>
<tr>
<td><strong>Distance/Segmentation</strong></td>
<td>• How far from A to B?</td>
</tr>
<tr>
<td><strong>Facility/Trip</strong></td>
<td>• By Roadway, not Origin/Destination</td>
</tr>
<tr>
<td><strong>Network/Facility Type</strong></td>
<td>• Freeway/Arterial</td>
</tr>
<tr>
<td><strong>Real Time vs Reporting</strong></td>
<td>• Traffic Ops/Planning</td>
</tr>
<tr>
<td><strong>Data vs Calibrated Model</strong></td>
<td>• Actual Data/Predictive Analysis</td>
</tr>
</tbody>
</table>
Operations Strategies Most Impacting Travel Time Reliability

• Incident Management
• Work Zone Management
• Pre-Trip Traveler Information
• Ramp metering
• Active Transportation and Demand Management
• Speed Harmonization
• HOT lanes
Major Task Topics

1. Support/Develop Mobility Performance Measures Program
2. Report and Analyze Measures
3. Bicycle and Pedestrian Mobility
4. Research and Reliability
5. Other/Future
Other/Future Topics

- Asset Management Plan
- Bottlenecks
- Managed Lanes
- Predictive Model versus Real Data
- Accessibility Measure
- Economic/Benefit Cost of Reliability
- Freight Reliability
SHRP L38 and Florida
SHRP2

Second Strategic Highway Research Program (SHRP 2) established by Congress

more than 100 research projects
What is SHRP2?

**Tools to save lives, save money, save time.**

- Products developed from objective, credible research
- Solutions that respond to challenges of the transportation community – safety, aging infrastructure, congestion
- Collaborative effort of AASHTO, FHWA, and TRB
- Tested products, refined in the field

**SHRP2 Solutions offer new technologies and processes to enhance the efficiency of transportation agencies**
Focus Areas

**Safety**: fostering safer driving through analysis of driver, roadway and vehicle factors in crashes, near crashes, and ordinary driving

**Renewal**: rapid maintenance and repair of the deteriorating infrastructure using already-available resources, innovations and technologies

**Reliability**: managing non-recurring events to create more predictable travel times

**Capacity**: planning and designing a highway system that offers minimum disruption and meets the environmental, and economic needs of the community.
SHRP2 Reliability Program Products

L02: Travel Time Reliability Monitoring System (TTRMS) for incorporating reliability into the transportation planning and programming process.

L05: Focuses on geometric design treatments.

L07: Demonstrates how to apply travel time reliability to determine level of service.

L08: Provides tools for assessing economic benefits of improving travel time reliability.

C11: SHRP2 L38 project will test tools developed by SHRP 2.
SHRP2 Pilot Test Sites

- Washington State DOT
- Caltrans/Southern California Association of Governments
- Minnesota DOT
- Florida International University
  AECOM, HNTB and FDOT District 6
Reference Guide for Incorporating Reliability into Planning & Programming

• The Reference Guide
  – Practical. Address reliability in real world planning
  – Accessible. Find specific information to help make a specific decision
  – Broad. Cover both technical and communication issues
  – Primary audience is managers

• The Technical Reference
  – Detailed. Tools and data needed to calculate performance measures
  – Easy to use. Technical ‘recipes’ to evaluate reliability
  – Primary audience is analysts
Five Key Steps for Incorporating Reliability

• Addressing reliability in policy statements
• Developing and tracking reliability measures
• Evaluating reliability needs and/or deficiencies
• Sizing funding for an operations program using reliability (and in consideration of program trade-offs)
• Prioritizing projects (operations, capacity, etc.) using reliability