Arterial Congestion Management Studies:
Metrics & Performance

October 20, 2015

Presented by:
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November 17, 2006

2

Agenda

Background
• Motivation
• Approach
• Goals

Data, Metrics, & Performance
• Data Types & Sources
• Desired Metrics
• Performance of Existing Programs

Ongoing & Future Programs
• SHRP2 & TSMO
• Reliability
• Advanced SHA Regional Demand Modeling Tool
Congestion is an existing problem on Maryland roadways, with expectations of increasing delays in future forecasts.

As part of SHA’s Business Plan, it is our goal to alleviate congestion throughout major corridors to stimulate mobility and growth in our region.

Quickly implementable solutions would go a long way to help relieve congestion until the long range plans can be implemented.
SHA has taken a more data driven and performance based approach to address traffic congestion needs:

- Where are roadway congestion trouble spots located, based on available data?
- How can SHA assess existing congestion issues?
- What are the most cost-effective solutions that can be implemented considering the fiscal constraints/realities experienced by the State of Maryland?
• SHA developed a **Reliability Roadmap** – a phased approach to develop a comprehensive program that improves reliability of our system

• SHA is developing Reliability Analysis and Modeling Tools
• The intent is to identify a set of cost effective solutions statewide for strategic implementation when funding sources become available (Fund 87, 77, CTP selection, external contributions)

• This approach conforms to federal law (i.e. MAP-21) and SHA’s Business Plan (i.e. supports Mobility Key Performance Area goal)

• Short term implementation periods for rapid congestion relief impacts
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• Desired Metrics & Tools of the Trade
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Ongoing & Future Programs
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Data Types & Sources: Vehicular Volumes

Type:
- Intersection Turning Movements (includes pedestrians and bicycles)
- Mainline Traffic Volumes
- Truck Percentages (Class Counts)

Source:
- Manual
- Pneumatic Tube counts
- Video-based counts (ex. Miovision)
- Radar-based counts (ex. Wavetronix)
- Infrared Sensors (ex. TRTL)

All counts are collected by and are available through the State Highway Administration’s Traffic Monitoring System (I-TMS)
# Data Types & Sources: Travel Times

**Type:**
- Vehicle Travel Times & Speeds by Segment

**Source:**
- Floating Car Travel Runs
- Bluetooth & WiFi for Origin-Destination
- Regional Integrated Transportation Information System (RITIS.org)

<table>
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<th>Type</th>
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<th>4:45 PM</th>
<th>5:00 PM</th>
<th>5:15 PM</th>
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<td>18.04</td>
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</table>
Data Types & Sources: Reliability

Police Reported Crash Intensity

Recurring Congestion Mobility

Source: Maryland State Highway Administration 2013 Mobility Report

Legend:
- Opposite Direction
- Rear End
- Side Swipe
- Left Turn
- Angle

Crash Severity (indicated by shape):
- Fatal
- Injury
- Property Damage

Types of Crashes (indicated by color):
- Pedestrian
- Bicycle
- Fixed Object
- Other
Desired Metrics

- Travel Time or Speed
- Delay (per vehicle)
- Vehicle and Person Throughput
- LOS by intersection and segment (to establish breakdown of the system)
- Network wide delays
- Latent Demand (vehicles unserved due to congestion)
- Future Crash Trends
- Low cost (less than $5Million) for quick implementation
- Return on investment of minimum 5 years

Final results to be used in the calculation of Benefit Cost Analyses for alternatives comparison.
Desired Metrics: Benefit Cost Analysis

- Benefit Cost Analyses (BCA) performed for Operations and Safety (separately and combined) to evaluate the project as a whole. Alternatives are compared and dropped based on the operations and safety savings.

- BCA tool was recommended to the Transportation Research Board for the 95th TRB Annual Meeting (2016).

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Operational Savings*</th>
<th>Safety Savings*</th>
<th>Net Cost*</th>
<th>Operational BCA</th>
<th>Safety BCA</th>
<th>Total BCA</th>
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* Costs per thousand
Tools of the Trade: Travel Demand to Traffic Operations

**LEVEL I (Planning)**
TRAVEL DEMAND MODELS
(MSTM, MPO Models)

**LEVEL II (Planning and Operations)**
MESOSCOPIC MODELS

**LEVEL III (Operations)**
TRAFFIC SIMULATION MODELS

- Corridor Studies
- Long Range Planning
- Freight Movement
- System Performance
- Scenario Analysis

- ICM / ATM / ATDM
- Cumulative Impact Assessment
- Incident Management
- Work Zone / Special Events
- Emergency Response

- Site Analysis
  - accessibility / traffic impacts
  - mitigation plans assessment
- Design/Operations Projects
- Intersection/Roadway Operations

Planning and Operations Data Hub
Tools of the Trade: Crash Prediction

A crash modification factor (CMF) is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site. The Crash Modification Factors Clearinghouse houses a Web-based database of CMFs along with supporting documentation to help transportation engineers identify the most appropriate countermeasure for their safety needs. Using this site, you can search to find CMFs or submit your own CMFs to be included in the clearinghouse.

Recently Added CMFs

| Implant automated speed enforcement cameras | CMF: 0.725 |
| CMF: 0.73 |
| 27 |
| Crash type: All |
| Crash severity: Minor injury |
| Widen paved shoulder from 3 ft to 6 ft | CMF: 0.93 |
| Crash type: Fixed object, Head on, Run off road, Sideswipe |
| Crash severity: Fatal

This site is funded by the U.S. Department of Transportation Federal Highway Administration and maintained by the University of North Carolina Highway Safety Research Center.
Performance of Existing Programs: FY 2015 Arterial CMS

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Corridor Limits</th>
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<tbody>
<tr>
<td>District 3 (Montgomery County)</td>
<td></td>
</tr>
<tr>
<td>1 MD 185</td>
<td>MD 410 to DC Line</td>
</tr>
<tr>
<td>2 MD 124</td>
<td>MD 119 to MD 355</td>
</tr>
<tr>
<td>District 3 (Prince George's County)</td>
<td></td>
</tr>
<tr>
<td>3 MD 450</td>
<td>Stonybrook Drive to MD 3</td>
</tr>
<tr>
<td>4 MD 414</td>
<td>Harborview Avenue to I-95</td>
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<td>District 4 (Baltimore and Harford County)</td>
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<tr>
<td>5 MD 26</td>
<td>Buckingham Road to Old Court Road</td>
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<tr>
<td>6 MD 43</td>
<td>Walther Blvd to Honeygo Blvd</td>
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<tr>
<td>District 5 (Anne Arundel, Charles, Calvert, and St. Mary's County)</td>
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<tr>
<td>7 MD 170</td>
<td>2nd Street to Wieker Road</td>
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<tr>
<td>8 MD 177</td>
<td>MD 2 to MD 607</td>
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<tr>
<td>9 MD 5 BUS</td>
<td>US 301 to MD 5</td>
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<td>10 MD 180</td>
<td>Ballenger Center Drive to Swallowtail Drive</td>
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<td>11 MD 97</td>
<td>MD 140 to MD 496</td>
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<tr>
<td>12 MD 32</td>
<td>Linden Church Road to MD 108</td>
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</table>
1: MD 185 CORRIDOR (MD 410 to DC Line)
Intersection Improvements at MD 410 and MD 191

<table>
<thead>
<tr>
<th>Safety Savings (millions)</th>
<th>Operational Savings (millions)</th>
<th>Benefit/Cost</th>
<th>Cost Estimate (millions)</th>
<th>ROW Impacts (acres)</th>
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<tr>
<td>$0.6</td>
<td>$96.1</td>
<td>&gt;50</td>
<td>$1.5*</td>
<td>0.04</td>
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</table>

*ROW costs not included

**PROJECT**
- Intersection improvements at MD 410 - provide southbound MD 185 right turn lane, extend MD 410 westbound left turn lane, and relocate bus stop
- Intersection improvements at MD 191 - add eastbound left turn lane, and change east-west phasing from split to concurrent at Raymond St/Rosemary St

**CORRIDOR**
- 1.4 miles, 3 signals
- Congestion in the southbound direction during the AM peak
- Queues form southbound upstream of MD 410 during the AM peak reaching the Capital Beltway (I-495)
- Congestion in the northbound direction during the PM peak
- Congestion on westbound MD 410 during the AM and PM peak
- Congestion at MD 191 intersection during the AM and PM peak

**BENEFITS**
- Network delay reduces by 45% during AM peak and 20% during PM peak
- At MD 410, intersection delay improves from 124 to 78 sec/veh during AM peak
- At MD 191, intersection delay improves from 124 to 41 sec/veh during PM peak and from 45 to 17 sec/veh during AM peak
- Travel time on southbound MD 185 reduces by 35% during AM peak and 42% during PM peak
- Queuing improves on westbound MD 410 and on eastbound MD 191 in both peaks
- Bus blockages are removed from MD 410 westbound
Examples of Proposed Mitigation (arterial and freeway):

- Hard Running Shoulders during Peak Hours
- Signal Optimization
- Adaptive Signal Control
- Transit Priority
- Queue Loop Detectors
Presented by Integrated Designs, Inc.

November 17, 2006

19

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SHA has been selected to receive FHWA SHRP2 and other FHWA funding assistance for a total of $2.2 Million.

- Organizing for Reliability (L06)
- Advanced Travel Analysis Tools (C10)
- Behavior Based Freight Models (C20)
- Reliability Data and Analysis Tools (L38)
- Work Zone Impact Estimation Tools (R11)
- FHWA Integrated Corridor Management (ICM) Pilot
Ongoing Efforts

- Integrated freeways and arterial systems M&O
- Freight consideration and multi-modal aspects
- Performance Metrics that considers ICM, ATM, ATDM
- Performance metrics that compares traditional projects with TSM&O projects
- Risk/ Uncertainty analysis tools

Pilot implementation: TSM&O strategies
Questions ?
Contact Information

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  Maryland State Highway Administration
  Office of Planning and Preliminary Engineering
  Data Services Engineering Division – Travel Forecasting and Analysis
  E-mail: cdelion@sha.state.md.us

• **DTALite, SHRP2 Ongoing Efforts:**
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  Maryland State Highway Administration
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  Data Services Engineering Division – Travel Forecasting and Analysis
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