Acknowledgments

High Street Consulting

+ Mark Egge
  Data Scientist

+ Erin Dean
  Senior Planner

UMD

+ MAP-21 Tool Team

MPO Partners

BMC, MWCOG, WILMAPCO
# PM3 BASELINE SCORES

<table>
<thead>
<tr>
<th>Interstate Reliability</th>
<th>Non-Interstate NHS Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Metric:</strong> Level of Travel Time Reliability</td>
<td><strong>Metric:</strong> Level of Travel Time Reliability</td>
</tr>
</tbody>
</table>
| \[
\frac{80\text{th Percentile } TT}{50\text{th Percentile } TT} < 1.5 = \text{Reliable}
\] | \[
\frac{80\text{th Percentile } TT}{50\text{th Percentile } TT} < 1.5 = \text{Reliable}
\] |
| **Measure:** Traveler-weighted Portion of Interstate NHS Segments that are Reliable | **Measure:** Traveler-weighted Portion of Non-Interstate NHS Segments that are Reliable |

### Freight Movement

**Metric:** Truck Travel Time Reliability

\[
\frac{95\text{th Percentile } TT}{50\text{th Percentile } TT}
\]

**Measure:** Distanced-weighted Average of All Interstate Segments
FORECASTING FUTURE RELIABILITY PERFORMANCE

Segment Scores

Statistical Model

Volume
Capacity
Roadway Characteristics

Segment Attributes

NPMRDS

HPMS + NPMRDS
FORECASTING METHODOLOGY

1. SETUP
Calculate current volume and capacity (based on best available data)

2. MODEL FITTING
Fit statistical model, associating LOTTR / TTTR with volume, capacity, and roadway attributes

3. UPDATES
- Forecast future volume based on growth rates
- Update future capacity based on planned projects

4. FORECASTING
Forecast future LOTTR / TTTR using updated volume and capacity
DATA TRANSFORMATION AND MODELING

• LOTTR / TTTR Data is left-bounded at 1 and right-skewed
  • Subtract 1 from LOTTR / TTTR and Log Transform

• Models have limited overall explanatory power (~25% of total variation in segment level scores), but highly significant coefficient estimates (used for forecasting)

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Estimate</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-0.623</td>
<td>0.022</td>
</tr>
<tr>
<td>cars (thousands)</td>
<td>0.028</td>
<td>0.000</td>
</tr>
<tr>
<td>capacity (thousands)</td>
<td>-0.017</td>
<td>0.000</td>
</tr>
</tbody>
</table>

LOTTR Model (Log LOTTR)

All estimates statistically significant at p < 0.001, R² 0.23

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Estimate</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-2.02</td>
<td>0.089</td>
</tr>
<tr>
<td>Volume / Capacity Ratio</td>
<td>2.82</td>
<td>0.221</td>
</tr>
<tr>
<td>Location: Urban</td>
<td>0.67</td>
<td>0.093</td>
</tr>
</tbody>
</table>

TTTR Model (Log TTTR)

All estimates statistically significant at p < 0.001, R² 0.26
UPDATE FUTURE VOLUME

• Grow Traffic Volume by Geometric Growth Rates

<table>
<thead>
<tr>
<th>Growth Rate</th>
<th>Directional Miles (Statewide)</th>
<th>Percent of System (Statewide)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 1%</td>
<td>1927</td>
<td>37%</td>
</tr>
<tr>
<td>1 – 2%</td>
<td>1377</td>
<td>28%</td>
</tr>
<tr>
<td>2 – 3%</td>
<td>909</td>
<td>18%</td>
</tr>
<tr>
<td>3 – 4%</td>
<td>918</td>
<td>18%</td>
</tr>
</tbody>
</table>
UPDATE FUTURE CAPACITY

1) Identify Capacity Enhancing Projects
2) Conflate project boundaries to TMC segments
3) Add+1 Lane within Project Boundaries After Project Completion Date

• Capacity Projects (Statewide): 48
  • Lane-Miles (2017): 10,966
  • Lane-Miles (2021): 11,127

• Signal Upgrade Locations: 14
  • ITS Affected Directional Miles: 61.5 (LOTTR reduction of 0.15)
APPLY STATISTICAL MODEL

Using our previously fit LOTTR and TTTR models:

1. Predict Current Performance
2. Predict Future Performance Based On Future Volume, Future Capacity
3. Update Current Observed Metric Value by Predicted Difference
4. Aggregate to Performance Measure Score
INTERSTATE RELIABILITY

Higher ➔ More Reliable

Maryland Statewide Interstate Reliability

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No Build High Growth</td>
<td>71.5</td>
<td>71.5</td>
<td>70.9</td>
<td>70.4</td>
<td>69.4</td>
</tr>
<tr>
<td>Build High Growth</td>
<td>71.5</td>
<td>71.5</td>
<td>71.5</td>
<td>71.0</td>
<td>70.0</td>
</tr>
<tr>
<td>No Build</td>
<td>71.5</td>
<td>71.5</td>
<td>71.5</td>
<td>71.5</td>
<td>71.5</td>
</tr>
<tr>
<td>Build</td>
<td>71.5</td>
<td>71.5</td>
<td>72.1</td>
<td>72.1</td>
<td>72.1</td>
</tr>
</tbody>
</table>
### Maryland Statewide Non-Interstate Reliability


<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No Build High Growth</td>
<td>82.0</td>
<td>81.9</td>
<td>81.6</td>
<td>81.2</td>
<td>80.6</td>
</tr>
<tr>
<td>Build High Growth</td>
<td>82.0</td>
<td>81.9</td>
<td>81.6</td>
<td>81.4</td>
<td>80.8</td>
</tr>
<tr>
<td>No Build</td>
<td>82.0</td>
<td>82.0</td>
<td>81.9</td>
<td>81.7</td>
<td>81.4</td>
</tr>
<tr>
<td>Build</td>
<td>82.0</td>
<td>82.0</td>
<td>81.9</td>
<td>81.9</td>
<td>81.7</td>
</tr>
</tbody>
</table>

**Higher ➔ More Reliable**

**Graph:**
- X-axis: Years 2017 to 2021
- Y-axis: Reliability (84.0 to 78.0)
- Lines represent:
  - No Build High Growth
  - No Build
  - Build
  - Build High Growth

**Table Summary:**
- 2017: Baseline (82.0)
- 2018: No Build High Growth (81.9), Build High Growth (81.9)
- 2019: No Build High Growth (81.6), Build High Growth (81.6)
- 2020: No Build High Growth (81.2), Build High Growth (81.4)
- 2021: No Build High Growth (80.6), Build High Growth (80.8)
TRUCK TRAVEL TIME RELIABILITY

Higher ➔ Less Reliable

Maryland Statewide Truck Travel Time Reliability Index

<table>
<thead>
<tr>
<th>No Build High Growth</th>
<th>Build High Growth</th>
<th>No Build</th>
<th>Build</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (2017)</td>
<td>1.87</td>
<td>1.87</td>
<td>1.87</td>
</tr>
<tr>
<td>2018</td>
<td>1.88</td>
<td>1.88</td>
<td>1.87</td>
</tr>
<tr>
<td>Two Year Performance (2019)</td>
<td>1.89</td>
<td>1.88</td>
<td>1.87</td>
</tr>
<tr>
<td>2020</td>
<td>1.89</td>
<td>1.89</td>
<td>1.87</td>
</tr>
<tr>
<td>Four Year Performance (2021)</td>
<td>1.90</td>
<td>1.89</td>
<td>1.89</td>
</tr>
</tbody>
</table>
RELATED ONGOING/ UPCOMING EFFORTS AT MDOT SHA

MDOT TRAFFIC RELIEF PLAN (TRP) INITIATIVES

- I-695 TSMO PROJECT
- SMART SIGNAL CORRIDORS
- TSM&O EFFORTS
MDOT SHA TSM&O Strategic Plan

Integrated approach for planning, operations, and maintenance to improve the security, safety, and reliability of our transportation system.
Summarizes a business case for TSM&O

Establishes mission, vision, goals, objectives and performance measures for TSM&O within MDOT/SHA

Identifies strategies and projects required to implement TSM&O

Recommends resource needs to carry out plan
Ongoing TSM&O Initiatives

2016 Annual User Savings
$1.6+ Billion

CHART/ TSM&O
$1500 Million

Capital Projects
$29 Million

Signals & Multimodal Strategies
$84 Million
TSM&O Master Plan

- Incidents
- Closures
- Crashes
- AADT
- PTI/TTI
- Bottlenecks
- Existing Project Lists
- Funded – CTP/ TIP
- Unfunded – CLRP/ HNI

Identify Needs
- Safety/ Mobility
- Asset Conditions

Screening
- Concepts, Traffic Analysis/ BCA

Design/ Implementation
- OHD/ CHART/ OOTS/ OPPE/ Districts
TSM&O Project Planning

- Logical Segments
- Existing Conditions
- Purpose & Needs
- Feasible Concepts
- Traffic Analysis/ Benefits
- Planning level Costs

- Benefit/ Cost & LCAA
- Recommended Concept(s)
- Project Delivery Options
- Funding/ Phasing
- Design
- Implementation
Integrated Corridor Management/Active Traffic Management Projects

- Emphasis on Innovations & Technology Solutions
- Performance based Practical Transportation
- Innovative Procurement Strategies – Progressive Design Build
- Connected Automated Transportation
UPCOMING PM3 EFFORTS

• Refine the Reliability Models
• Identify UNRELIABLE SEGMENTS and Causes of Unreliability
• Identify Mitigation Strategies
  • TSM&O Improvements
  • Capital Improvements
• Coordinate efforts with MPO, agencies and local partners
• Communication of Results/ Outreach
CONTACT INFORMATION

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