Preparing for Climate Change

Maryland State Highway Administration
Maryland Climate Action Plan

- Required by Governor’s Executive Order (January 2007) - Released August 2008

- Requires SHA to develop a Climate Action Plan to address potential impacts to SHA assets

- Annual progress reports are presented to Governor O’Malley every November
MD SHA Activities

- Initiated a Climate Change Program in 2009
- Established a Climate Adaptation Team (CAT)
- Drafted a Broad Strategic Plan for Climate Change
- Developed a GIS tool to identify infrastructure vulnerable to varying intensities of sea-level rise
- Developing a Climate Action Plan, to include a vulnerable infrastructure assessment, for implementation by September 2011
Preparing for Climate Change

- Mitigation - measures to reduce greenhouse gas emissions
  - Highway System Efficiency
  - Reduced Fuel & Energy Use

- Adaptation - Natural or man-made adjustments or actions to accommodate or reduce the adverse consequences of climate change
  - Protect, Strengthen, Elevate or move critical infrastructure
  - Abandon & Disinvest
  - Enhance Redundancy
MITIGATION
Highway System Efficiency

What does this really mean?

- Better mobility equals better air quality
  - Focusing on keeping cars moving
  - ITS and managed lane strategies
  - Moving people
  - Mode shifts
  - Restructuring capacity (lane widths)
  - Recurring congestion vs. non-recurring
Highway System Efficiency

MD Statewide Transportation Model (MSTM)
### CHART Air Quality Data

#### Summary of CHART Benefits (2006-2009)

<table>
<thead>
<tr>
<th>Reduction due to CHART</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
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</thead>
<tbody>
<tr>
<td>Delay (Million Vehicle-hours)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truck</td>
<td>2.456</td>
<td>2.66</td>
<td>2.09</td>
<td>1.68</td>
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<tr>
<td>Car</td>
<td>35.09</td>
<td>33.32</td>
<td>29.57</td>
<td>30.75</td>
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<tr>
<td>Total Delay (Million Vehicle-hours)</td>
<td>37.54</td>
<td>35.98</td>
<td>31.66</td>
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<tr>
<td>Fuel Consumption (Million Gallons)</td>
<td>6.34</td>
<td>6.07</td>
<td>6.39</td>
<td>6.23</td>
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<tr>
<td>Emission (Tons)</td>
<td></td>
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<tr>
<td>HC</td>
<td>490.72</td>
<td>470.41</td>
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<td>CO</td>
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<td>5,283.47</td>
<td>4,648.42</td>
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<td>NO</td>
<td>235.02</td>
<td>225.29</td>
<td>198.21</td>
<td>203.07</td>
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<td>CO₂</td>
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<td>N/A</td>
<td>58,977.67</td>
<td>57,098.97</td>
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</table>
SHA Light-Duty Fuel Usage

MD State Highway Admin: Light-Duty Equipment Fuel Usage (Gas) - FY 2003 - FY 2010

- FY 2003: 1,029,189 gallons
- FY 2004: 977,164 gallons
- FY 2005: 931,177 gallons
- FY 2006: 889,445 gallons
- FY 2007: 857,174 gallons
- FY 2008: 838,241 gallons
- FY 2009: 816,163 gallons
- FY 2010: 751,204 gallons

Light-duty fuel consumption (gasoline usage)
Anticipated Changes

Highway Systems and Engineering must adapt for:

- Increased Temperature (+ 2 degrees F)
- Increased Precipitation in Spring Months
- More days over 100 degrees F in Summer Months
- Variety of forms of precipitation
- Increased Storm Frequency & Intensity
- Stronger Hurricanes
- Storm surge
- Increased 100-Year Event Frequency (every 20 years)
- Sea-level Rise (3-4 ft)
Climate Action Plan

SHA will continue to develop a Climate Action Plan and assess infrastructure vulnerable to sea-level rise

- Develop Inventory of Assets, Analyze, & Prioritize
- Gather Climate Information
- Assess the Risk to Assets using predicted impacts from Climate Change
- Develop Strategies to Address the Impacts
Consequences of Climate Change

Adapt planning and engineering specifics to:

- Pavement rutting & buckling
- Increased precipitation (spring rain storms & winter snow)
- More frequent and costly evacuations
- Scouring of bridge foundations & failure of bridge decks
- Flooding, Power Loss, Traffic Disruptions,
- Sea-level Rise Inundation of Coastal areas
Vulnerable Land
in Dorchester County Maryland
2 feet of Sea-Level Rise
Vulnerable Land in Dorchester County Maryland
5 ft. feet of Sea-Level Rise
Vulnerable Land in Dorchester County Maryland
10 ft. feet of Sea-Level Rise
Adaptation Planning Process

1. Identify current and future climate changes relevant to the system

2. Assess the vulnerabilities and risk to the system

3. Develop an adaptation strategy using risk-based

4. Identify opportunities for co-benefits and synergies across sectors

5. Implement adaptation options

6. Monitor and reevaluate implemented adaptation options

Highway System Vulnerability

- State Maintained Roads requiring further evaluation for impacts due to varying increases in sea-level
  - 2 ft. – 156 miles – 2%
  - 5 ft. – 371 miles – 4.5%
  - 10 ft. – 792 miles – 10%
- Prioritization of assets must consider emergency evacuation planning and system redundancy
SHA Structures Vulnerability

- Planning for Structures with more frequent & severe storms – must consider more than sea-level rise
  - FEMA 100-Year Floodplain indicates 28% of SHA Structures (bridges to culverts) need further impact evaluation

- State Maintained Structures requiring further evaluation for impacts due to varying increases in sea-level
  - 2 ft. – 93 structures – 3.5%
  - 5 ft. – 132 structures – 5%
  - 10 ft. – 196 structures – 7.5%

- Must research & consider new construction and design elements
Heather Lowe, SHA
410-545-8526
hlowe@sha.state.md.us