Climate Change Activities

Maryland State Highway Administration

August 10, 2011
Maryland Climate Action Plan

- Maryland Climate Action Plan
  - Required by Governor’s Executive Order (January 2007) - Released August 2008

- Eight Strategies related to Transportation & Land Use assigned to MDOT as lead agency, evaluated in multi-modal working groups

- Annual progress reports are presented to Governor O’Malley every November
US 40 Carbon Neutral Corridor Study

2035 Strategies for Smart Corridor – CNC

- Real-time traffic management & Transportation Demand Management
- Refocus growth in corridor Town Centers
- Improve energy efficiency & expanded renewable energy sources
- Generate renewable energy through partnerships with Industrial, Wastewater, and Landfill activities
- Improve MARC and introduce Bus Rapid Transit
- Protect non-growth areas for conservation and maximum carbon sequestration
- Implement a premium bicycle & pedestrian network

Scenario 5 Component | 2035 Reduction Compared to 2035 Baseline (tons GHG/day) | % Reduction in Corridor Emissions from 2006
--- | --- | ---
US 40 Corridor Town Centers and Supportive Transportation Strategies | 1,050 | 39%
Corridor Energy Consumption | 3,247 | 34%
Industrial, Wastewater, and Landfill Strategies | 789 | 34%
Corridor Energy Supply | 1,563 |
Corridor Conservation, Restoration, and Carbon Sequestration | 702 | 63%

**TOTAL** | **7,351** | **43%**
Maryland Climate Change Commission

- Adaptation and Response Working Group
  - Department of Natural Resources
  - Department of Planning

- Greenhouse Gas & Carbon Mitigation Working Group
  - Department of the Environment
  - Department of Energy

- Scientific and Technical Working Group
  - Department of the Environment
  - Department of Natural Resources
The Climate Adaptation Team (CAT) goals are to:

- Develop a Climate Adaptation Risk Policy using an Asset Management Approach
- Provide Implementation guidance of the Risk Policy in a SHA-wide Climate Action Plan
- Utilize mitigation strategies in development of the CTP
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
  - Disinvest or Relocate
  - Enhance Redundancy
MITIGATION
SHA GHG Reduction

- On-Road Strategies
  - Highway System Efficiency

- Off-Road Strategies
  - Way We Do Business
Highway System Efficiency

What does this really mean?
Better mobility equals better air quality

- Focusing on keeping cars moving (TSM/TDM)
- 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)
# Highway System Efficiency

## 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>
</tr>
</thead>
<tbody>
<tr>
<td>Truck Delay (Million Vehicle-hours)</td>
<td>2.456</td>
<td>2.66</td>
<td>2.09</td>
<td>1.68</td>
</tr>
<tr>
<td>Car</td>
<td>35.09</td>
<td>33.32</td>
<td>29.57</td>
<td>30.75</td>
</tr>
<tr>
<td>Total Delay (Million Vehicle-hours)</td>
<td>37.54</td>
<td>35.98</td>
<td>31.66</td>
<td>32.43</td>
</tr>
<tr>
<td>Fuel Consumption (Million Gallons)</td>
<td>6.34</td>
<td>6.07</td>
<td>6.39</td>
<td>6.23</td>
</tr>
<tr>
<td>Emission (Tons)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HC</td>
<td>490.72</td>
<td>470.41</td>
<td>413.87</td>
<td>424.00</td>
</tr>
<tr>
<td>CO</td>
<td>5,511.54</td>
<td>5,283.47</td>
<td>4,648.42</td>
<td>4,762.25</td>
</tr>
<tr>
<td>NO</td>
<td>235.02</td>
<td>225.29</td>
<td>198.21</td>
<td>203.07</td>
</tr>
<tr>
<td>CO₂</td>
<td>N/A</td>
<td>N/A</td>
<td>58,977.67</td>
<td>57,098.97</td>
</tr>
</tbody>
</table>
SHA Light-Duty Fuel Usage

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

(Thousands of gallons)

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

Continue to:

- Increase use of alternative fuels
- Improve alternative fuel distribution systems
- Make scheduled fleet replacements with higher efficiency vehicles
- Track carbon footprint data for fleet fuel use

Develop calculation methods and implement tracking of carbon footprint data for heavy equipment
Improved Construction Performance

- May 4, 2010 - SHA adopted Truck Staging and Idling Requirements
- Incorporate SHA idling policy into contract specifications
- Provide contractor incentives to increase use of alternative fuels
- Improve quality or type of turf installed to sequester maximum nitrogen and carbon
## Predicted Climate Changes

<table>
<thead>
<tr>
<th>Change</th>
<th>Near Term (20 Years)</th>
<th>Mid-Century (40 Years)</th>
<th>End-of Century (90 Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ Annual Mean Temperature °F</td>
<td>2.5°F</td>
<td>3.8 - 4.8°F</td>
<td>5.4 - 9.0°F</td>
</tr>
<tr>
<td>Δ Number of Days with temperature = or &gt; 100°F</td>
<td>1-4 days</td>
<td>4-9 days</td>
<td>9-14 days (under high emissions)</td>
</tr>
<tr>
<td>Δ Annual Total Precipitation</td>
<td>6.00%</td>
<td>8.0 -11.0%</td>
<td>11 -17%</td>
</tr>
<tr>
<td>Annual Amount of Precipitation (currently @ 41.84 inches)</td>
<td>45 inches</td>
<td>48.6 inches</td>
<td>50.85 inches</td>
</tr>
<tr>
<td>Δ Storm Intensity Increase in Average amount of rainfall per rainy day event</td>
<td>-</td>
<td>8-9%</td>
<td>12-15%</td>
</tr>
<tr>
<td>Δ Annual Frequency of 2 Year Rainfall Event 3.5 inches/24 hours*</td>
<td>50%</td>
<td>54%</td>
<td>57%</td>
</tr>
<tr>
<td>Δ Annual Frequency of 10 Year Rainfall Event 4.5 - 5.5 inches/24 hours*</td>
<td>10%</td>
<td>11%</td>
<td>12%</td>
</tr>
<tr>
<td>Δ Frequency of 100 Year Coastal Flood Event</td>
<td>1 in 100</td>
<td>1 in 80 to 1 in 40</td>
<td>1 in 20 to 1 in 2</td>
</tr>
<tr>
<td>Δ Sea Level Increase**</td>
<td>2 - 5 inches</td>
<td>1 - 2 feet</td>
<td>3 - 6.5 feet</td>
</tr>
<tr>
<td>Likely Regionally Influenced Increases</td>
<td>-</td>
<td>2.3 inches</td>
<td>+5.9 - 8.3 inches</td>
</tr>
<tr>
<td>Δ Storm Surge Depth</td>
<td>-</td>
<td>+/- 20 inches</td>
<td>+/- 40 inches</td>
</tr>
</tbody>
</table>

*Calculated using Δ Storm Intensity predictions for North Eastern United States.

**Does not include Regional Influences
Anticipated Changes

Highway Systems & Engineering must Adapt Assets to account for:

- Increased Temperature
- 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
- Sea-level Rise
Consequences of Climate Change

Highway Systems & Engineering must Adapt Assets for:

- Pavement rutting & buckling
- Increased precipitation (spring rain & winter snow)
- More frequent and costly evacuations
- Scouring of bridge foundations & failure of bridge decks
- Flooding, Increased 100-Year storm frequency (every 20 years), Power Loss, Traffic Disruptions
- Sea-level Rise Inundation of Coastal areas
SHA Risk Policy

- Adaptation – Build into Project Development Process
  - Policy to cover not what to adapt to but when to adapt
  - Assess risk and prioritize activities by anticipated impact and whether near- or long-term consequences
  - Focus on near-term impacts with low variability of occurrence
Vulnerable Land
Dorchester County Maryland
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

Focus Areas in new Business Plan Development that need to have shared vision on direction strategies, and objectives

Mobility and Economic Development KPA

Freight

Congestion

Environmental Compliance and Stewardship KPA

Air Quality

MITIGATION
Focus Areas in new Business Plan Development that need to have shared vision on direction, strategies, and objectives

Asset Management and Maintenance KPA

Facilities  Asset Mgmt

Environmental Compliance and Stewardship KPA

Climate Change

ADAPTATION
Asset Management

- Incorporate Climate Change data collection in Transportation Asset Management Program (TAMP) to better analyze priority assets
  - Age
  - Elevation
  - Materials Used
  - Design Lifetime and stage of life
  - FEMA maps
  - Current & historical performance and conditions

- Vegetation Survey
- Soil type
- ADT
- Bridge SR
- Scour criticality
- Length/width of Bridge
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 Roads 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
QUESTIONS

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