Hillsborough County MPO
Vulnerability Assessment & Adaptation Pilot Project

Coastal Adaptation & Resilience in Tampa Bay Workshop
September 23, 2015

Bayshore Boulevard - Tropical Strom Debby 2012

Allison Yeh, AICP, LEED GA
Executive Planner, Hillsborough County MPO
2014 US DOT Climate Adaptation Plan*

“Transportation infrastructure is inherently long-lived. Bridges, tunnels, ports and runways may remain in service for decades…In addition to normal deterioration, transportation infrastructure is subject to a range of environmental risk over long time spans, including wildfire, flood, landslide, geologic subsidence… storms, hurricanes and tornados. “

Considerations:
✓ Magnitude of environmental stress a project can withstand
✓ Adapt planning, design, and operation of transportation infrastructure
✓ Mainstream climate into planning, construction & operations

*Following the President’s National Climate Action Plan – June 2013

FHWA Order 5520: Transportation System Preparedness & Resilience to Climate Change & Extreme Weather Events

Signed December 15, 2014

Integrate considerations of climate and extreme weather risks into FHWA’s planning operations, polices and programs.
Vulnerability Assessment Framework

2010-2011 Pilots
San Francisco Bay-MTC
New Jersey DOT/TPA
Virginia DOT
Washington State DOT
Oahu MPO

2013-2015 Pilots
19 Pilots around the country including:
Hillsborough County MPO
Broward County MPO

http://www.fhwa.dot.gov/environment/climate_change/adaptation/adaptation_framework/
Project background

- **FHWA Pilot**: Climate change vulnerability assessment and adaptation analysis, focused on the transportation sector.

- **LRTP update**: Reduce Crashes & Vulnerability investment program

- Both led by HC MPO/Planning Commission, with partners

- **Final Report – October 2014**

Hillsborough County, Florida

- 158 miles of coastline
- 4th most populous Florida (1.2 Million)
- 22% of the population lives in a flood prone area
- Economic Hub of Tampa Bay Metropolitan Region
- Largest seaport in Florida
- Home to US Central Command & Special Operations Command Center
- Tampa General – Regional Burn Center
Surface Transportation Assets

- 800 Freeways & Toll Road Lane Miles
- 3,300 Arterial & Collector Lane Miles
- 3 Major Bridges Across Tampa Bay
- Tampa International Airport
- Container, Bulk Cargo & Cruise Ship Terminals
- 9 Transit Centers & 243 Vehicle Fleet
- Heritage Streetcar System
- Class I Rail Lines & Intermodal Yard
Evaluation Process

Economic Analysis
- Econometric Modeling (REMI)

Seek feedback
- LMS Group
- Emergency Mgt.
- FDOT
- Port Tampa Bay
- Aviation Authority

Analysis
- Mapping (ArcGIS)
- Modeling (TBRPM)

Data Collection
- SLR - USGS
- Storm Surge - Slosh
- Flooding (FEMA)

Seek feedback
Local Mitigation Strategy Working Group - Selection of Assets
Risk Scenario

» **Simulated Category 3 storm surge**
  - Same category, trajectory as 1921 Tarpon Springs
  - High tide
  - Addition of sea level rise (2040)
Assess Potential Disruption Impacts

» Simulation of phased recovery (post-storm surge)

» Simulate travel disruption using TBRPM
  • One “typical day”

» Derive daily change in
  • Hours of delay
  • Miles travelled
  • Trips (lost)

» Estimate range of potential disruption for each scenario
<table>
<thead>
<tr>
<th>Location</th>
<th>Annual Average</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hillsborough County</td>
<td>$10.2 M</td>
<td>($3.6 from SW fees)</td>
</tr>
<tr>
<td>City of Tampa</td>
<td>$13.5 M</td>
<td>($6.1 from SW fees)</td>
</tr>
<tr>
<td>Temple Terrace</td>
<td>$0.8 M</td>
<td></td>
</tr>
<tr>
<td>Plant City</td>
<td>$6.9 M</td>
<td></td>
</tr>
<tr>
<td>FDOT District 7</td>
<td>$9.8 M</td>
<td></td>
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</tbody>
</table>

**Net Cost to Budgets**  
*Not including stormwater fees*
Potential Cost-Feasible With New Funding

- Harden 78 lane miles of Interstates $37 M
- Harden 178 lane miles of other arterials $97 M

“Harden” means improve stormwater drainage systems, strengthen road base, raise road profile, and protect shorelines from waves using vegetation or structures.

Annualized over 20 years = $8 M per year +/-
Sample Strategy
Wave Attenuating Devices (WADs)
Vulnerability Reduction Investment Assumed in 2040 Plan

<table>
<thead>
<tr>
<th>Investment Level</th>
<th>Benefits and Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td>$31 Million per year</td>
</tr>
<tr>
<td>Current</td>
<td>Continue today's stormwater drainage improvement programs</td>
</tr>
<tr>
<td>Category 3 storm impacts:</td>
<td>8 weeks major roads may be unusable</td>
</tr>
<tr>
<td></td>
<td>$266 million economic loss</td>
</tr>
</tbody>
</table>

| Scenario 8b      | $39 Million per year                                   |
| Adopted          | Continue today's stormwater drainage, plus:           |
|                  | raise road profiles, enhance base, protect shorelines from wave damage |
| Category 3 storm impacts: | 3 weeks major roads may be unusable |
|                  | $119 million economic loss (cut in half!)             |

Economic losses cut in half
2040 Plan
Capacity Projects & simulated CAT 3 storm surge

- Memorial Hwy
- Gandy Connector
- US 41 Overpass/Interchange at CSX/Causeway
- Streetcar Modernization & Extension
Memorial Highway Project

- Cost Feasibility based on FDOT Strategic Intermodal System (SIS) 2040 Plan:
  - Part of SR 60/I-275 interchange reconstruction
  - $193 M cost (in YOE)
- Vulnerable area: 0.6 – 1.1 mi. based on Cat 1-Cat 3 storm surge
- Replacement cost: $100 M +
- Protection cost: $ 4.2 M
- Potential to incorporate into SIS project

Memorial Highway – 158,000 ADT
Engaging County Government

- Environmental Protection Commission of Hillsborough County raised issue of Climate Adaptation for the first time in August 2014

- EPC presented to the Board along with local NOAA scientist, Dr. Charles Paxton

- EPC was given direction
  - to move forward on coordinating local efforts
  - to look at climate adaptation
Local Comprehensive Plans

Proposed New Policy

“Develop strategies to identify and address issues related to climate adaptation in cooperation with the EPC, the Planning Commission and other agencies”
Rising sea levels require unified effort

For a state surrounded by water, Florida should be leading the nation in preparing to adapt to climate change. Yet with Gov. Ron Scott's self-proclaimed skepticism of man-made warming, the state is often left out of discussions on how to combat rising sea levels and the impact already being felt from increased flooding. The state's coastal communities need to start preparing for the worst-case scenario, as rising sea levels will threaten their infrastructure and people's livelihoods.

The Times editorial board is calling for a state-wide plan to address the issue of sea-level rise. The plan should include efforts to reduce greenhouse gas emissions, increase resilience to sea-level rise, and provide financial support for affected communities. The state should also invest in research to better understand the impact of climate change on Florida's coastline.

"The state of Florida is taking a risk by not addressing climate change," wrote the editorial. "Our coastlines are vulnerable to rising sea levels, and the state cannot afford to ignore this problem any longer. We must act now to protect our communities and the environment that we all depend on."
Addressing Climate Issues Regionally

Tampa Bay Climate Science Advisory Panel (CSAP)
Unified Projection of Sea-Level Rise in Tampa Bay Region

TBRPC ONE BAY Resilient Communities

- Pinellas County Climate Team
- Hillsborough County EPC Workgroup
- Manatee County Green Team
- Pasco County
- City of Clearwater DOE Pilot Project
First International Conference on Surface Transportation System Resilience to Climate Change and Extreme Weather Events

NAS Building
2101 Constitution Ave., NW
Washington, DC
September 16-18, 2015
Contact Information

Allison Yeh, AICP, LEED GA
Hillsborough County MPO/Planning Commission
tel: 813.273.3774 x351
yeha@plancom.org

Rich Clarendon, AICP
Hillsborough County MPO
tel: 813.273.3774 x368
Clarendonr@plancom.org

Margaret Rush, MPH
Environmental Protection Commission
tel: 813.627.2600 x1289
Rush@epchc.org

www.planhillsborough.org
## Sample Menu of Risk Management Strategies

<table>
<thead>
<tr>
<th>Storm Surge Vulnerability</th>
<th>INVESTMENT LEVEL</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exposure: Reduce exposure to storm surge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevate</td>
<td>-</td>
<td>RAISE PROFILE (low lying interstates)</td>
<td>➔ Increase deployment</td>
<td></td>
</tr>
<tr>
<td>Protect</td>
<td>-</td>
<td>SEA WALLS/BULKHEADS (low lying interstates)</td>
<td>➔ Increase deployment</td>
<td></td>
</tr>
<tr>
<td>Shield</td>
<td>-</td>
<td>-</td>
<td>➔ Same as MEDIUM</td>
<td></td>
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<tr>
<td><strong>Sensitivity: Reduce the impacts of storm surge</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Maintain</td>
<td>DRAINAGE (culverts, grates, catch basins)</td>
<td>➔ Increase deployment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ROADWAY (base, shoulder, pavements)</td>
<td>➔ Increase deployment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strengthen</td>
<td>ROADWAY BASE (upon reconstruction)</td>
<td>BRIDGE APPROACHES/RAMPS (approach plates)</td>
<td>SECURE BRIDGE DECKS (anti-buoyancy measures)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>SCOUR COUNTERMEASURES</td>
<td>➔ Increase deployment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>RENO MATS</td>
<td>➔ Increase deployment</td>
<td></td>
</tr>
<tr>
<td>Attenuate</td>
<td>FENCING (low lying interstates/major arterials)</td>
<td>BARRIERS/WAVE ATTENUATORS</td>
<td>➔ Increase deployment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RIP RAP</td>
<td>DUNES (selective deployment)</td>
<td>➔ Increase deployment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SALT RESISTANT VEGETATION</td>
<td>CONSTRUCTED WETLANDS (selective deployment)</td>
<td>➔ Increase deployment</td>
<td></td>
</tr>
<tr>
<td><strong>Adaptive Capacity: Increase the capacity of the network to recover functionality</strong></td>
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<td></td>
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</tr>
<tr>
<td>Recover</td>
<td>PLAN (increase post disaster response planning/response budgets)</td>
<td>DRAINAGE (upsize during replacement cycle to</td>
<td>➔ Increase deployment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>STAGING (establish new recovery/supply areas/lifelines)</td>
<td>➔ Increase deployment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PERMIT (blanket debris permits)</td>
<td>SUPPLIES/MATERIALS (stockpile)</td>
<td>➔ Increase deployment</td>
<td></td>
</tr>
<tr>
<td>Reroute</td>
<td>ESTABLISH EMERGENCY DETOURS</td>
<td>DYNAMIC REROUTING (ITS)</td>
<td>➔ Increase deployment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>BUILD REDUNDANT CRITICAL CONNECTORS</td>
<td>➔ Increase deployment</td>
<td></td>
</tr>
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