Applying the Sea-Level Scenario Sketch Planning Tool to Enhance the Resilience of Long-Range Transportation Plans: Lessons Learned from Two Florida MPOs

Josh DeFlorio, Cambridge Systematics
Allison Yeh, Hillsborough County MPO
James Cromar, Broward MPO

With contributions from Crystal Goodison, UFL GeoPlan Center & Maria Cahill, Florida DOT
Introduction

» Florida is on the front lines of sea level rise and coastal inundation exposure
  • Nation’s second-most extensive coastline
  • Many highly developed coastal areas
  • Low-lying—already subject to recurring tidal flooding

» UFL GeoPlan Center developed the Sea Level Scenario Sketch Planning Tool

» Hillsborough County MPO and Broward MPO both applied the tool in conducting FHWA Climate Resilience Pilots
Sea Level Scenario Sketch Planning Tool

Planning level geographic information systems (GIS) tool to assess Florida transportation infrastructure potentially at-risk to projected sea level rise.

- Developed by the University of Florida GeoPlan Center for the Florida Department of Transportation
- Follows U.S. Army Corps of Engineers (USACE) SLR methods
- Uses NOAA tide gauge data (sea level trends and tidal datums)
- Maps SLR inundation regionally and statewide in Florida from 2040 – 2100; at USACE High, Intermediate, and Low projections; using multiple tidal datums; accounts for hydrologic connectivity.
Sea Level Scenario Sketch Planning Tool: Components

Map Viewer
- Visualize areas of inundation and affected infrastructure
- Low technical expertise needed, no GIS software needed

GIS Data Layers
- SLR Inundation Surfaces & Affected Infrastructure layers
- GIS Software and intermediate GIS expertise needed

SLR Inundation Surface Calculator
- Create custom inundation layers
- Intermediate/Advanced technical/GIS expertise needed

All components available on project website:
http://sls.geoplan.ufl.edu
Hillsborough County MPO:
Vulnerability Assessment & Adaptation Pilot Project

Allison G. Yeh, AICP, LEED GA
Hillsborough County MPO
Hillsborough County, Florida

- 158 miles of coastline
- 3rd Largest Population in 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
Economic Analysis

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

Analysis
- Mapping (ArcGIS)
- Modeling (TBRPM)

Data Collection
- SLR – Sea Level Scenario Sketch Planning Tool
- Storm Surge - Slosh
- Flooding (FEMA)

Evaluation Process
Risk Scenario

» Simulated Category 3 storm surge
  • Same category, trajectory as 1921 Tarpon Springs
  • High tide
  • Addition of sea level rise from Sketch Planning Tool (2040)
Assess Potential Network 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
## Vulnerability Reduction Investment Assumed in 2040 Plan

<table>
<thead>
<tr>
<th>Investment Level</th>
<th>Benefits and Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scenario 1</strong></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>$31 Million per year</td>
</tr>
<tr>
<td></td>
<td>Continue today's stormwater drainage improvement programs</td>
</tr>
<tr>
<td></td>
<td>Category 3 storm impacts:</td>
</tr>
<tr>
<td></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**
- Adopted
- $39 Million per year
- 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**

---

**Legend**
- Disrupted Network (Group 2)
- Disrupted Network (Group 1)
- Disrupted Network (Full impact)
- ZMG Roadway Network
- Surge
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
Climate Adaptation Stakeholder Meeting

January 29, 2015
Rising sea levels require unified effort

For a state surrounded by water, Florida should be leading the national push to adapt to climate change. Yet with Gov. Rick Scott's self-proclaimed disdain for climate change, the state is falling behind to direction from Washington. The Tampa Tribune editorial board calls on local governments to act now, before rising sea levels rent apart communities and infrastructure. 

Published: March 26, 2015

Hillsborough governments building sea-level rise into development plans

BY CHRISTOPHER O'DONNELL

Tribune staff

For the first time, the Hillsborough County Planning Commission might ask local governments to consider the effects of climate change when规划ing for future growth and development.

The shift in approach would not be drastic. It's just one proposed line in a massive comprehensive land use plan for Hillsborough, Pasco and Pinellas counties.

Published: March 26, 2015

'Climate adaptation' on planners' radar

BY STEVE CONTARNO

For the first time, the Hillsborough County Planning Commission might ask local governments to consider the effects of climate change when planning for future growth and development.

The shift in approach would not be drastic. It's just one proposed line in a massive comprehensive land use plan for Hillsborough, Pasco and Pinellas counties.

Published: March 26, 2015
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
South Florida Climate Change Vulnerability Assessment and Adaptation Pilot Project

Presented to: First International Conference on Surface Transportation System Resilience to Climate Change and Extreme Weather Events
         September 18, 2015

Presented by: James Cromar
Director of Planning
Broward Metropolitan Planning Organization
Regional Transportation Network

- Palm Beach County
- Broward County
- Miami-Dade County
- Monroe County
## Data Collection

<table>
<thead>
<tr>
<th>Name/Type</th>
<th>Data Collected</th>
<th>Accuracy</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>LiDAR Derived Elevation Contours and DEM</td>
<td>DEM-FLiDAR Mosaic</td>
<td>5-meter mosaic for the entire Florida state</td>
<td>FGDL</td>
</tr>
<tr>
<td>FDOT-UFL-GeoPlan Tool</td>
<td>Inundation Surfaces</td>
<td></td>
<td>UFL-GeoPlan Website</td>
</tr>
<tr>
<td></td>
<td>Affected Infrastructure</td>
<td></td>
<td>UFL-GeoPlan Website</td>
</tr>
<tr>
<td>Transportation Network</td>
<td>Transportation Data</td>
<td></td>
<td>FDOT-GIS</td>
</tr>
<tr>
<td>SLR Scenarios based on NOAA Tidal Surface information</td>
<td>1ft, 2ft, 3ft SLR for Miami Dade, Broward, Monroe County’s</td>
<td></td>
<td>Broward County GIS</td>
</tr>
</tbody>
</table>
Network Irregularities

Inset

Network Roadway Comparisons
- NAVTEQ-based Network
- MPO-based Network

Topography (10ft DEM)
- High (186.1')
- Low (-12.9')

www.browardMPO.org
FEMA Data Example

False inundation examples
(road on embankment)
After Elevation Clean-Up Tool Run and Bridge Elevation Adjustments
Climate Stressors

- Sea level rise (SLR)
- Storm surge and related inundation
- Heavy precipitation and related flooding (including impacts from SLR – groundwater interactions)
Integrating Data into Decision Making

- Transportation Planning and Prioritization
- Rehabilitation or Reconstruction of Existing Facility in High Risk Areas
- New Facility on New ROW in High Risk Areas
- Operations
- Maintenance

http://www.browardmpo.org/planning/adapting-to-climate-change
Lessons Learned / Conclusions

- Don’t delay decisions by trying to develop “perfect data”
- Data needs to be “good enough” to inform decisions

Taking action in Broward
- Determine potential roadway impacts in vulnerable areas
- Propose actions to reduce vulnerability
- Prioritize the funding
- Implement projects
Thank You!

Josh DeFlorio  
Cambridge Systematics  
jdeflorio@camsys.com

Crystal Goodison  
GeoPlan Center, UFL  
goody@geoplan.ufl.edu

Allison Yeh  
Hillsborough County MPO  
yeha@plancom.org

Maria Cahill  
Florida DOT  
Maria.Cahill@dot.state.fl.us

James Cromar  
Broward MPO  
cromarj@browardMPO.org
Links

Sea Level Scenario Sketch Planning Tool
http://sls.geoplan.ufl.edu

Hillsborough County MPO Pilot
www.planhillsborough.org/hillsborough-transportation-vulnerability-assessment-pilot-project

Broward MPO Pilot
www.browardmpo.org/planning/adapting-to-climate-change