FHWA Pilot Project

South Florida Climate Change Vulnerability Assessment and Adaptation Pilot Project

Presented to: RCAP Implementation Workshop
April 30th, 2015
Agenda

- Discussion of transportation impacts in your community
- Project background and technical methodology
- Group Activity
- Project Findings
- How to Apply the Findings
- Q&A
Florida – The Sunshine State

- Caribbean Climate
- Plenty of Water Front Property
- Fascinating Limestone Geology
- Great for Morning Exercise
Discussion
Transportation Impacts in Your Community

- What are the issues you have seen in your community thus far?
- What do you see as the greatest threat to your community?
  - Long term SLR, Surge, Precipitation Induced Flooding
- How is your community planning for existing or future events?
- What factors guide future responses to vulnerabilities?
  - Level of Impact, usage, access to business centers, detours, etc.
Project Background
Project Intent

- Part of a broader national effort to define methods to determine vulnerability
- Led by Broward MPO for four county southeast Florida area
- Identify existing and future vulnerabilities of the transportation system
- Provide feedback to FHWA on approaches to refine methods
Project Scope

- Assess current and future impacts to regionally significant roads, railroads, and bridges

- Unit of analysis
  - **Roads:** Segmented at intersections of other regionally significant routes
  - **Railroads:** Segmented between stations

- Analysis involves measuring exposure to:
  - Current and future temporary flood inundation (storm surge & precip.)
  - Permanent sea level rise (SLR) inundation
Technical Methodology
Overall Vulnerability Approach

**Identify Assets of Interest**
- Regional road network
- Tri Rail network

**Calculate the Vulnerability Scores for Each Asset**

**Sensitivity**
- Bridge condition index
  - Scour rating (roads)
  - Substructure condition rating (roads)

**Exposure**
- % of segment permanently inundated by SLR (1, 2, & 3 Ft.)
- Current flood exposure index
- Future potential flood exposure index

**Adaptive Capacity**
- Average annual daily traffic (roads)
- Heavy commercial average daily traffic (roads)
- Tri-Rail ridership on segment (rail)
- Detour length (roads)

**Rank Flood Vulnerabilities**
Methodology – Spatial Refinement of Risk

Thank You FDOT GeoPlan and Other Local Partners!
1. Selecting/Developing Baseline Data

Developing the Baseline Data for Analysis

- Obtain LIDAR topographic mapping for region
- Obtain horizontally accurate roadway layer
- Determine bridge deck elevations from raw LIDAR files
- Identify network segments to apply in vulnerability analysis
2. Understand Current Flood Exposure

- Developing the Baseline Data for Current Vulnerability Analysis
  - Obtain FEMA mapping for each regional jurisdiction
  - Combine FEMA mapping into one regional geo-database
  - Rectify FEMA layer with more accurate LIDAR topographic data
  - Utilize cleaned FEMA layers
2. Understand Current Flood Exposure

Developing the Baseline Data for Current Vulnerability Analysis

- Obtain FEMA mapping for each regional jurisdiction
- Combine FEMA mapping into one regional geo-database
- Rectify FEMA layer with more accurate LIDAR topographic data
- Utilize cleaned FEMA layers
3. Understand Future Exposure – Permanent Inundation

Developing the Baseline Data for Sea Level Rise Vulnerability Analysis

- Obtain GeoPlan SLR mapping for 1, 2 and 3 foot increments for region
- Rectify SLR mapping with more accurate LIDAR topographic mapping
- Utilize cleaned SLR layers
4. Understand Future Exposure – Temporary Inundation
5. Summarize Exposure

- Calculate Current and Future Exposure Values for Each Network Segment
- Identify depth and percent inundated for each roadway segment for FEMA
- Identify percentage of segment inundated 1, 2, and 3 foot SLR values
- Calculate future exposure index based on elevation and distance values for each segment

Calculated Exposure Score for Each Network Segment
6. Understand Sensitivity & Adaptive Capacity

Assign Sensitivity and Adaptive Capacity Variable Values to the Network

- Match bridge point data to network segments
- Create relational database of bridge condition ratings for each network segment
- Transfer roadway segment traffic volumes from FDOT sources
- Transfer rail segment volumes from Tri Rail
- Determine detour length values for each roadway link

Calculated Sensitivity and Adaptive Capacity Scores for Each Network Segment
Group Activity
7. Calculate Vulnerability Scores

### Variable Weighting Schema - South Florida Climate Vulnerability Assessment

#### Roads

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Variable Weighting</th>
<th>Category Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>Bridge condition index (scour, substructure condition, # of bridges)</td>
<td>10.00</td>
<td>2.00</td>
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<tr>
<td>Exposure</td>
<td>% of segment permanently inundated by 1 ft. of SLR</td>
<td>2.50</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>% of segment permanently inundated by 2 ft. of SLR</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% of segment permanently inundated by 3 ft. of SLR</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Current flood exposure index (storm surge &amp; precipitation)</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>Adaptive Capacity</td>
<td>Average annual daily traffic (AADT)</td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Detour length</td>
<td>0.00</td>
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</table>

#### Rail

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Variable Weighting</th>
<th>Category Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>% of segment permanently inundated by 1 ft. of SLR</td>
<td>3.00</td>
<td>0.30</td>
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<tr>
<td>Exposure</td>
<td>% of segment permanently inundated by 2 ft. of SLR</td>
<td>2.00</td>
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</tr>
<tr>
<td></td>
<td>% of segment permanently inundated by 3 ft. of SLR</td>
<td>1.50</td>
<td></td>
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<tr>
<td></td>
<td>Current flood exposure index (storm surge &amp; precipitation)</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>Adaptive Capacity</td>
<td>Future potential flood exposure index (storm surge &amp; precipitation)</td>
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<tr>
<td></td>
<td>Road length</td>
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</tr>
</tbody>
</table>

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**Final Vulnerability Scores for Each Roadway Segment**

**Calculate Final Vulnerability Score for Each Segment**

*Database containing final segment values for current and future exposure, sensitivity and adaptive capacity values for each segment*

*Apply weighting schema to reflect current and future vulnerabilities*
Findings
Findings – Palm Beach County (North)
Findings – Palm Beach County (South & West)
Findings – Broward County (North & West)
Findings – Broward County (South)
Findings – Miami-Dade County (North)
Findings – Miami-Dade County (South & West)
How to Apply The Findings
Review Long Range Transportation Plans

Theoretical Example
Review Long Range Transportation Plan

Theoretical Example

Consider Longer Term Impacts of Current Capital Program Expenditures
Incorporate Into Project Decision-making
Assess Projects for Inclusion in Capital Program

Theoretical Example – Hollywood Boulevard

Consider Adding Projects to LRTP

Assess Long Term Costs and BCA of Response Options
Consider Transportation and Other Infrastructure Costs as Part of a Basis for a Broader Coastal Protection Strategy