Resilient Tampa Bay: Transportation Pilot Project

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Hillsborough MPO

October 9, 2018
FHWA 2018-2020 Pilot Program: Resilience & Durability to Extreme Weather

• 1 of 11 Pilot projects looking at integrating into agency practices, tools & resources, or deployment & monitoring.

- **Tampa Bay TMA**
  - Caltrans

- **Atlanta Regional Commission**
  - Corpus Christi MPO

- **Quad Cities - Iowa/Illinois MPO**
  - Houston-Gaveston Area Council

- **MassDOT**
  - Mid-America Regional Council (Kansas City, MO & Johnson Co, KS)

- **PennDOT**
  - UDOT

- **Navel Facilities Engineering Command (East and Gulf Coast)**
3 MPOs, Regional Planning Council, & FDOT D7
Resilient Tampa Bay – Transportation: Background

» Tampa Bay TMA
  • 2.8M Population
  • 2nd largest pop. in FL.
  • 1000+ miles of shoreline
  • 39% pop. in flood zones

» Regional vulnerability assessment of surface transportation assets
  • Incorporate into LRTPs, hazard mitigation, emergency mgt, and PDRP plans
Transportation Policy

- Federal Fixing America's Surface Transportation (FAST) Act addresses planning for and expenditures on surface transportation system
  - Added planning factor: Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation
- Florida Transportation Plan is statewide plan guiding Florida's transportation future
  - Agile, Resilient, and Quality Infrastructure Goal
- Florida Statutes - Long Range Transportation Plans
  - Metropolitan planning organizations are encouraged to consider strategies that integrate transportation and land use planning to provide for sustainable development and reduce GHG emissions

Slide courtesy of Lois Bush, Florida Department of Transportation
Work Plan

Climate & Weather
- Obtain Data
- Identify Vulnerable Areas
- Identify at risk Transportation

Critical Linkages
- Stakeholder Engagement
- Quantitative Analysis of Critical links

Fall 2018

Adaptation Strategies
- Econometric Analysis
- Adaptation/ Mitigation Strategies
- Include in Decision Making

Fall 2018 Winter 2019

Final Report
- Winter/Spring 2019
- Summer/Fall 2019
Incorporating stakeholder input into quantitative assessment

Weighting facilities/locations based on stakeholder input

Criticality Determination

Qualitative Assessment
- Stakeholder and practitioner input
- Persistent flooding locations
- Leveraging prior planning work (Current LRTP, hazard mitigation and local mitigation strategies)

Quantitative Assessment
- GIS-based Quantitative Analysis
- Context Sensitive Criticality Construct (Transportation disadvantaged population, social & economic importance)
- Sensitivity, exposure level and adaptive capacity

Supporting Image Sources: Sustainable Convos, Northern Arizona Healthcare
Data/Information Coordination

**One Bay**
- Hillsborough County Perils of Flood Act Matrix of Impacts Initiative

**Tampa Bay RPC**
- Pinellas County Restore Act Vulnerability Assessment

**Local Government Public Works**
- Tampa Sea Level Rise Vulnerability Assessment
- Local Mitigation Strategies
- Post Disaster Redevelopment Plans

**Resilient Tampa Bay Transportation**
- Resilient Tampa Bay Transportation: Vulnerability Assessment and Adaptation Pilot Project
- Tampa Bay RPC
- Transit Agency Asset and Operational Plans
- MPO Long Range Transportation Plans
2045 Transportation Plan

We Want to Hear from You!

Hillsborough MPO
Metropolitan Planning for Transportation

Forward Pinellas

Pasco County MPO
Florida

Beasley Media Group Inc.
What’s Important to You? Consider these priorities

- Storm Vulnerability
- Traffic Jams
- Open/Green Spaces
- Alternatives to Driving
- Equal Opportunity
- Shorter Commutes
- Public Service Costs
If you are completing the **online survey**, you should be on screen 2

If you are completing the **paper survey**, you should be at section 2

4,946 people picked this as a priority
Exaggerated Scenarios

Scenario A
Imagine a future where we primarily invest in NEW TECHNOLOGIES and a few roadway projects to manage traffic flow.

Scenario B
Imagine a future where we primarily invest in EXPRESSWAY LANES forming an outer loop so traffic can avoid the congested center of the region.

Scenario C
Imagine a future where we primarily invest in BUS AND RAIL SERVICES connecting, revitalizing and in-filling the communities that exist today.
Rate Scenario A
Technology Focus

By 2045, Worse than Today

By 2045, Better than Today

Rate this Scenario:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>Least Appealing</td>
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<td>Most Appealing</td>
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</tbody>
</table>

Results on priorities:

Storm Vulnerability
Traffic Jams
Open/Green Space
Alternatives to Driving
Equal Opportunity
Shorter Commutes
Public Service Costs

By 2045, Worse than Today

By 2045, Better than Today
Rate Scenario B
Expressway Focus

Rate this Scenario:

Results on priorities:

By 2045, Worse than Today

By 2045, Better than Today

Storm Vulnerability

Traffic Jams

Open/Green Space

Alternatives to Driving

Equal Opportunity

Shorter Commutes

Public Service Costs
Rate Scenario C
Transit Focus

RESULTS ON PRIORITIES:

By 2045, Worse than Today

Storm Vulnerability
Traffic Jams
Open/Green Space
Alternatives to Driving
Equal Opportunity
Shorter Commutes
Public Service Costs

By 2045, Better than Today

Rate this Scenario: 1 2 3 4 5
Least Appealing
Most Appealing
What’s in the current Hillsborough Imagine 2040 Plan?  (Adopted 11/12/14)

- Preserve System
- Reduce Crashes & Vulnerability
- Minimize Traffic for Drivers & Shippers
- Real Choices when not Driving
- Major Capacity Projects For Economic Growth
### 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><strong>$31 Million per year</strong></td>
</tr>
<tr>
<td><strong>Level 1</strong></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>
<tr>
<td><strong>Scenario 8b</strong></td>
<td><strong>$39 Million per year</strong></td>
</tr>
<tr>
<td><strong>Level 3</strong></td>
<td>Continue today's stormwater drainage, plus:</td>
</tr>
<tr>
<td></td>
<td>raise road profiles, enhance base, protect shorelines from wave damage</td>
</tr>
<tr>
<td></td>
<td>Category 3 storm impacts:</td>
</tr>
<tr>
<td></td>
<td>- 3 weeks major roads may be unusable</td>
</tr>
<tr>
<td></td>
<td>- $119 million economic loss (cut in half!)</td>
</tr>
</tbody>
</table>

Economic losses cut in half
Net Avoided Losses (Illustrative)
Category 3 Storm Surge

Tipping Point – 7 days

Function of the projected economic loss (GRP), strategy cost, and strategy effectiveness. NOT derived through Benefit-Cost Analysis.
Saffir-Simpson Hurricane Wind Scale
(1 = least extreme; 5 = most extreme)

Category 1
- Winds range from **74 to 95 mph**
- Minor damage to property (roof damage)
- Injuries to humans are isolated
- Short-term power outages

Category 2
- Winds range from **96 to 110 mph**
- Significant property damage, flooding
- Increased threat to humans due to falling debris
- Extensive, multi-day power outages

Category 3
- Winds range from **111 to 130 mph**
- Mobile and frame homes destroyed, extensive flooding
- Evacuation necessary for human safety
- Electricity, water unavailable for up to several weeks

Category 4
- Winds range from **131 to 155 mph**
- Houses, shopping centers irreparably damaged
- Humans at serious risk of death in certain areas
- Long-term power outages, water shortages

Category 5
- Winds of **155 mph+**
- Complete destruction of homes, shopping centers
- Trees uprooted, extreme flooding
- Power and water potentially out for months

Source: National Hurricane Center
What can we get if we invest in Reduced Vulnerability

Based on illustrative Cat 3 storm occurring in next 20 years

Investment Level 1 – $988 M (current spending trend x 20 years, in YOE $)
- Routine drainage improvements
- Up to 8 weeks of road network disruption with sample Cat 3 storm
- Economic loss to Hillsborough County: $266 M

Investment Level 2 - $1,025 M (in YOE $)
- Interstates only: drainage improvements, shoreline armoring & wave attenuation
- Up to 6 weeks of road network disruption with sample Cat 3 storm
- Economic loss to Hillsborough County: $153 M or 42% less
- $31 M investment results in $113 M benefit

Investment Level 3 – $1,159 M (in YOE $)
- Interstates & arterials: drainage improvements, shoreline armoring & wave attenuation
- 3 weeks of road network disruption with sample Cat 3 storm
- Economic loss to Hillsborough County: $119 M or 55% less
- $112 M investment results in $147 M benefit

Estimated avoided losses are based on making highway segments less vulnerable to storm & flood damage
## Typical Costs for Reduced Vulnerability

<table>
<thead>
<tr>
<th>Risk Mgmt. Strategy</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Base/Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raise profile/strengthen base*</td>
<td>Lane mile</td>
<td>$268,883</td>
<td>$268,883</td>
<td>$20,854,540</td>
<td>$68,807,075</td>
</tr>
<tr>
<td>Wave attenuation (WADs)</td>
<td>1 Unit</td>
<td>$750</td>
<td>$750</td>
<td>$3,887,400</td>
<td>$17,628,600</td>
</tr>
<tr>
<td>Shoreline protection (riprap)</td>
<td>Lin. ft.</td>
<td>$350</td>
<td>$350</td>
<td>$5,442,360</td>
<td>$24,680,040</td>
</tr>
<tr>
<td>Drainage improvements*</td>
<td>CL mile</td>
<td>$14,737</td>
<td>$14,737</td>
<td>$816,566</td>
<td>$816,566</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>$31,000,866</td>
<td>$111,932,281</td>
</tr>
<tr>
<td><strong>TOTAL plus contingency</strong></td>
<td>20%</td>
<td></td>
<td></td>
<td>$37,201,039</td>
<td>$134,318,738</td>
</tr>
</tbody>
</table>

* Counts marginal costs only. All costs are approximate
Gandy Boulevard critical segment in 2014 Vulnerability Assessment

» 1/3-mile segment connecting bridge to planned expressway

» $1.9M estimated for strategies
Inundation Profile – Gandy Blvd (segment)

The graph shows the elevation profile along Gandy Blvd, with categories for inundation levels. The profile includes data points for Roadway Elevation (DEM), 2040 SLR High MHHW, 2040 C1H, 2040 C3H, and Flooded (FEMA 1% Chance Flood). The categories are labeled as CATEGORY 1 and CATEGORY 3.

Note: Profile shown is that of the Florida Digital Elevation Model. Elevations of bridges and other manmade structures may not be accurately reflected.
Strategy Refinement for Implementation

- Refined strategies appropriate Selmon Elevated extension at Gandy Blvd.
- Developed conceptual designs & specific pre-engineering cost estimates
  - Within limit of $1.9M budget
  - Assume strategy mainstreaming as part of a project
- Offer low-risk, high benefit solutions to incorporate into elevated expressway extension PD&E proposal.

<table>
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<tr>
<th>Treatment</th>
<th>Cost Differential</th>
<th>Level of Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do nothing</td>
<td>None initially. Reconstruction cost is $3,312,000</td>
<td>Highest Risk. Required if roadway is destroyed.</td>
</tr>
<tr>
<td>Upgrade to full-depth concrete pavement</td>
<td>$876,000</td>
<td>Medium Risk. Road damage possible if inundation occurs.</td>
</tr>
<tr>
<td>Raise Profile</td>
<td>$1,119,000</td>
<td>Low Risk. Inundation from storm surge, rain or tide related flooding.</td>
</tr>
<tr>
<td>Erosion control via vegetation</td>
<td>$104,544</td>
<td>Low Risk. Embankment damage or washout if inundation occurs.</td>
</tr>
<tr>
<td>Pier protection via vegetation</td>
<td>$30 per pier (total depends on design)</td>
<td>Low Risk. Pier scour or damage possible if surge occurs.</td>
</tr>
</tbody>
</table>
Linkages to the Long Range Planning Process

- Needs Assessment: Vulnerability Reduction, State & Federal Mandates
- Vulnerability Screening and Project Prioritization Framework
- Leveraging Emergency Management, Local Hazard Management Plans
- Vulnerability Performance Metrics

Regional Vision and Goals
Alternate Improvement Strategies
Evaluation & Prioritization of Strategies
Development of Transportation Plan (LRP)
Project Development
Systems Operations (Implementation)
Monitor System Performance (Data)

Planning objectives inform Vulnerability and Risk Assessment scope setting
Assets profile and investment portfolio characterize exposure
System level Impact Assessment, MOEs
Develop customized suite of adaptation strategies
Emergency Management and Evacuation Planning
Regional Mobility and Economic Impacts
Planning for Transportation System and Transportation Project Development Phases

Increasing transportation resiliency is not linear. Need to address during all phases simultaneously.

Slide courtesy of Karen Kiselewski, Cambridge Systematics, Inc.
Tampa Bay Regional Resiliency Coalition

We face the same future and climate uncertainties. Our economies are tightly connected.

This Coalition will provide a formal platform for local governments to

- Work together to create guidelines for the development of resilient communities
- Learn “Best Practices” from each other and from other regions
- Leverage regional resilience efforts, to enhance funding and increase competitiveness for grant funds.
Contact Information

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Thank you!