Risk-Based Transportation Planning for Uncertainty

A Partnership between the Florida Department of Transportation and Three Florida Universities – Florida State University, University of Florida, and University of South Florida

Idaho APA Conference, October 2020

Presenters

Jennifer Z. Carver, AICP

Florida Department of Transportation

Dennis J. Smith, AICP

Florida State University

Tia Boyd

University of South Florida

Ruth L. Steiner, Ph.D.

University of Florida

Assessment of Planning Risks and Alternative Futures for the Florida Transportation Plan (FTP) Update

How should Florida's transportation system evolve to support mobility in the future?

How might the planning, policy setting process and implementation of the FTP change to accommodate risk and uncertainty?

How might the FTP goal areas and visions of alternate futures change in response to changes in risk and uncertainty?

How will the enhanced understanding of risk be incorporated into FDOT's business, from preliminary planning and design through project implementation?

Participants and Tasks

- Three Universities
  - University of South Florida, Florida State University, & University of Florida
  - Involvement of students
- A common scope and set of tasks
- Non-collaboration during the research phase was a requirement

Five Areas of Inquiry

Population

Florida's population will continue to grow

Florida will continue to have an aging population

Economics

Other sources for transportation funding will need to be explored

Public Private Partnerships

Environment

Climate change risks in Florida include sea level rise, extreme temperatures, and storm surge

Florida's population will become more sprawled

Technology

Autonomous vehicles will impact the built environment and how people travel

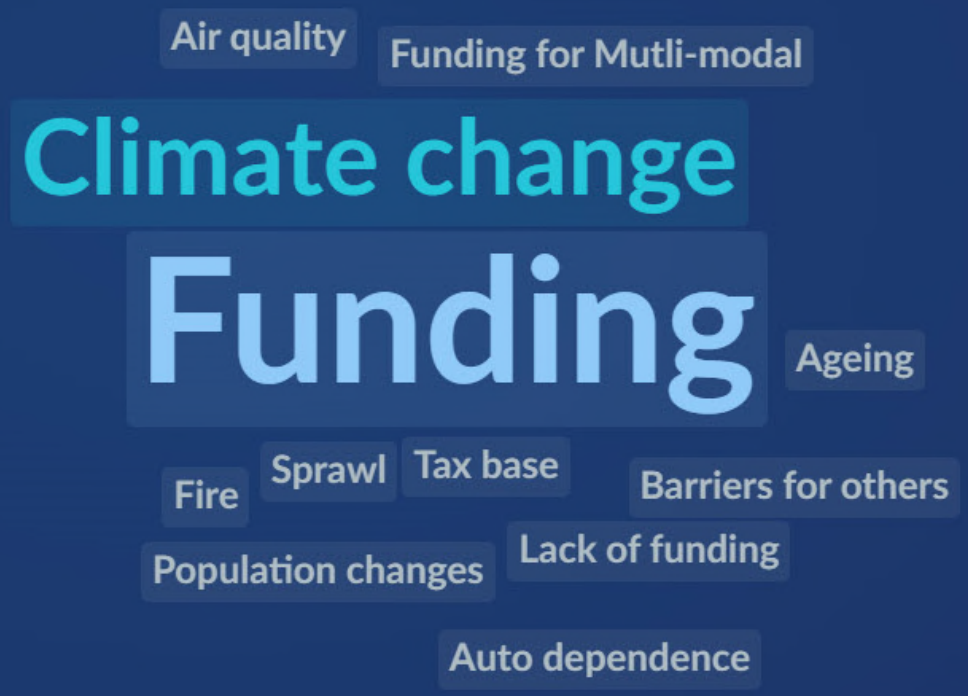
Cyber security and user privacy will need to be considered when implementing new technologies

Global Issues

Threats of terrorism and global conflict are possible factors that can impact the transportation network

Florida should plan for an increase in volume for global trade routes

Poll Results: What are the greatest hazards that the transportation system in your community will face over the next 25 years?



Literature Review

Population

- Rapid Population Growth
- Congestion from Suburbanization
- Population Decline
- Immigration
- Political Polarization
- Aging Population

Economic

- Another Recession
- Increasing Fuel Costs
- Growing Household Income Inequality
- Financing New Infrastructure
- Worsening Traffic Congestion
- Decreasing Transportation Frunding

Environment

- Storm Surge
- Sea Level Rise
- Extreme Weather
- Inland Flooding
- Open Space Reductions
- Extreme Temperatures
- Declining Water Quality
- Fire Hazards
- Water Scarcity

Technology

- Cyber Security
- Outdated Government Regulations
- User Privacy
- Lack of Funding for Smart Infrastrucutre
- Slow Adoption of New Technology

Global Issues

- Rising Energy Prices
- Global Recession
- Terrorism
- Climate Refugees
- Global Epidemics
- Global Conflict
- Food Crises

Plan Review

Reviewed State DOT's Long-Range Transportation Plans

Identified best practices in risk assessment:

- What risks are addressed?
- How are they being addressed?
- Where in the planning process?
- How is risk assessment integrated into the planning process?

	Plan Type							Modes Addressed													Investment		
State	Corridor-based	Financially-realistic	Needs-based	Performance-based	Policy-based	Project-based	Vision-based	All Roads	Aviation	Bicycle	Connected/ Autonomous Vehicles	Freight Modes	Highways	Intercity Passengers	Multimodal System	Pedestrian	Pipelines	Ports	Shared Mobility	Transit	Funding Strategies	Needs Estimates	Revenue Estimates
Florida				x	x		x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x
California				x		x		x	x	x	x	x	x	x	x	x	x	x		x			x
Georgia		x		x				x	x	x		x	x		x	x		x		x	x	x	x
Illinois					x		x	x	x	x		x	x	x	x	x	x	x		x	x		
Michigan	x		x					x				x	x	x	x					x			x
Minnesota				x	x			x	x	x		x	x	x	x	x		x	x	x	x	x	x
Missouri		x	x	x			x	x	x	x		x	x	x	x	x		x	x	x		x	x
New Mexico				x			x	x	x	x	x	x	x	x	x	x			x	x	x		x
New York	x				x			x	x	x		x	x	x	x	x	x	x	x	x	x		
North Carolina			x				x	x	x	x		x	x	x	x	x		x		x	x	x	x
Ohio					x		x	x	x	x		x	x	x	x	x		x		x	x	x	x
Texas			x	x				x	x	x		x	x	x	x	x	x	x		x	x	x	x
Utah					x	x		x	x	x	x	x	x		x	x	x		x	x	x	x	x

Risk to Assets

Promote an **agile, resilient, and quality infrastructure** (FDOT, 2015 FTP Policy Element),

Steps:

- Established a preliminary list of assets (2015 Florida Transportation Asset Management Plan)
- Reviewed assets included in various state LRTPs to expand categories (CA, GA, MN, MI, NY, UT)
- Accessed extensive asset databases maintained by state agencies (FDOT, DEP)
- Grouped asset vulnerability by type; transportation, environmental, economic
- Assigned of risk levels based on expert polling, validated by in-class review, and confirmed by final expert review.

Table 4.7: Cumulative Risk to Assets

Category	Cumulative Risk to Assets
Assets	
Transit	58
Airports	55
Seaports	54
Rail	45
US Highways	43
Interstates	42
Toll Roads	42
Bridges	41
State Roads	38
County Roads	38
Scenic Highways	38
Amtrak	37
Facilities	36
Trails	34
Bike Lanes	32
Spaceports	30
Traffic signals	24
State Parks	43
National Parks	41
Canals	30
Wetlands	29
Springs	27
Lakes	26
Rivers/streams	26
Protected Lands	26
Oil and gas wells	31
Mines	30

Tools to Evaluate Risk and Uncertainty

Risk Register

Flexible and customizable

Comprehensive tool

Useful at different stages of planning process

- Project evaluation
- Stakeholder engagement

Goal 4: More transportation choices for people and freight

Risk Event	Likelihood	Consequence	Vulnerability	Overall Risk	Timeframe	Risk Level	Consequence Management
Threats							
Lack of public acceptance of proposed projects	5	5	4	100	C	Critical	Mitigate
Inadequate funding and economic downturns restrict ability to expand travel options	5	4	4	80	E	Extreme Risk	Mitigate & Coordinate
Increased urban sprawl and auto-dependent development	5	5	3	75	C	Extreme Risk	Coordinate & Transfer
Limited system connectivity due to poorly coordinated agency deployment	4	4	4	64	N	High Risk	Coordinate
Increased travel demand due to population growth	5	3	3	45	C	Moderate Risk	Mitigate & Coordinate
Transit investment fails to increase or attract sufficient ridership	4	3	3	36	C	Moderate Risk	Mitigate
Inequity of AV applications for growing disadvantaged population	3	3	3	27	N	Moderate Risk	Coordinate & Transfer
Societal shifts in transportation preferences and needs in light of changing technology	4	2	3	24	E	Low Risk	Mitigate
Inadequate EV charging infrastructure	4	2	2	16	C	Low Risk	Coordinate & Transfer
Opportunities							
Improved first and last mile connectivity by ridesourcing and ridesharing							Share
Ease of integrated corridor management (ICM) and multimodal integration							Exploit & Share
More mobility options for aging population, teenagers, and users with limited mobility							Enhance & Share
Improved public information (or public awareness) across different modes of transportation							Enhance & Share
Ability to accommodate increase density and mix of uses							Exploit & Share
Improved public transportation services in rural areas and between rural and urban areas							Exploit & Share
Expanded interregional travel options for residents, visitors, and freight							Enhance
Reduced travel demand due to e-commerce, telecommunications and telecommuting							Exploit
UAVs reduce freight costs through the use of last-mile delivery services							Share

Risk Identification

Potential threat or opportunity for each agency goal

Risk Event	Likelihood	Consequence	Vulnerability	Overall Risk	Timeframe	Risk Level	Consequence Management
Threats							
Lack of public acceptance of proposed projects	5	5	4	100	C	Critical	Mitigate
Inadequate funding and economic downturns restrict ability to expand travel options	5	4	4	80	E	Extreme Risk	Mitigate & Coordinate
Increased urban sprawl and auto-dependent development	5	5	3	75	C	Extreme Risk	Coordinate & Transfer
Limited system connectivity due to poorly coordinated agency deployment	4	4	4	64	N	High Risk	Coordinate

and freight

Risk Evaluation

- 1 – 24 Low Risk
- 25 – 49 Moderate Risk
- 50 – 74 High Risk
- 75 – 99 Extreme Risk
- 100 – 125 Critical Risk

Risk Event	Likelihood	Consequence	Vulnerability	Overall Risk	Timeframe	Risk Level	Consequence Management
Threats							
Lack of public acceptance of proposed projects	5	5	4	100	C	Critical	Mitigate
Inadequate funding and economic downturns restrict ability to expand travel options	5	4	4	80	E	Extreme Risk	Mitigate & Coordinate
Increased urban sprawl and auto-dependent development	5	5	3	75	C	Extreme Risk	Coordinate & Transfer
Limited system connectivity due to poorly coordinated agency deployment	4	4	4	64	N	High Risk	Coordinate

and freight

Consequence Management

Threats	Opportunities
Avoid	Exploit
Mitigate	Share
Transfer	Enhance
Coordinate	

Risk Event	Likelihood	Consequence	Vulnerability	Overall Risk	Timeframe	Risk Level	Consequence Management
Threats							
Lack of public acceptance of proposed projects	5	5	4	100	C	Critical	Mitigate
Inadequate funding and economic downturns restrict ability to expand travel options	5	4	4	80	E	Extreme Risk	Mitigate & Coordinate
Increased urban sprawl and auto-dependent development	5	5	3	75	C	Extreme Risk	Coordinate & Transfer
Limited system connectivity due to poorly coordinated agency deployment	4	4	4	64	N	High Risk	Coordinate

and freight

Poll Results: Select the most disruptive or extreme event that may affect the future of transportation in Idaho

Case Study: Sea Level Rise In Florida

Sea Level Rise Scenarios

Sea Level Rise @ 2080

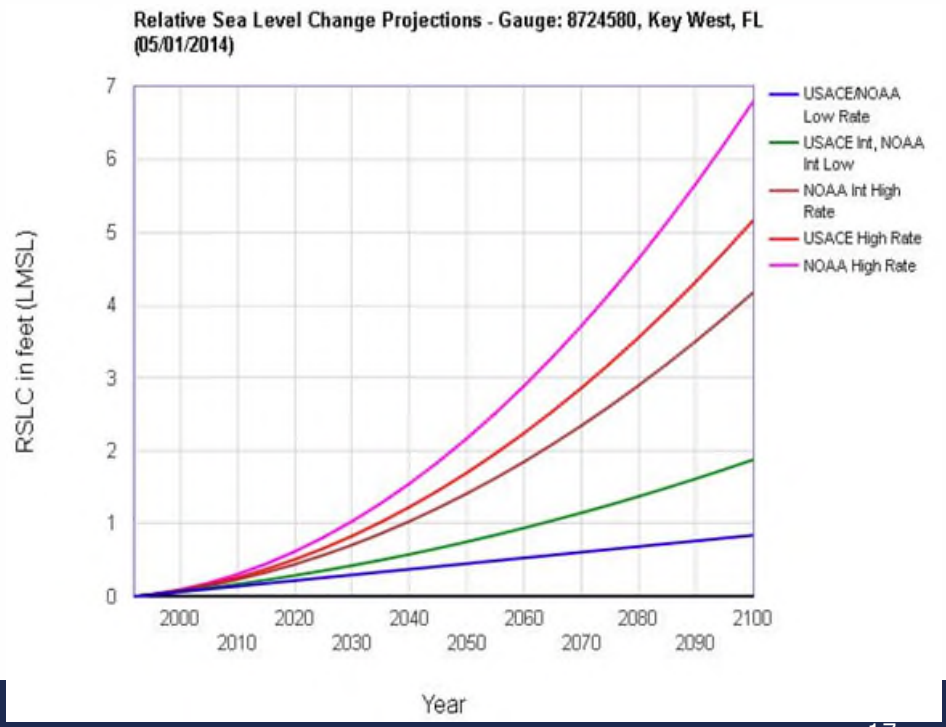
Curve 1 = USACE and NOAA Low

Curve 3 = NOAA Intermediate

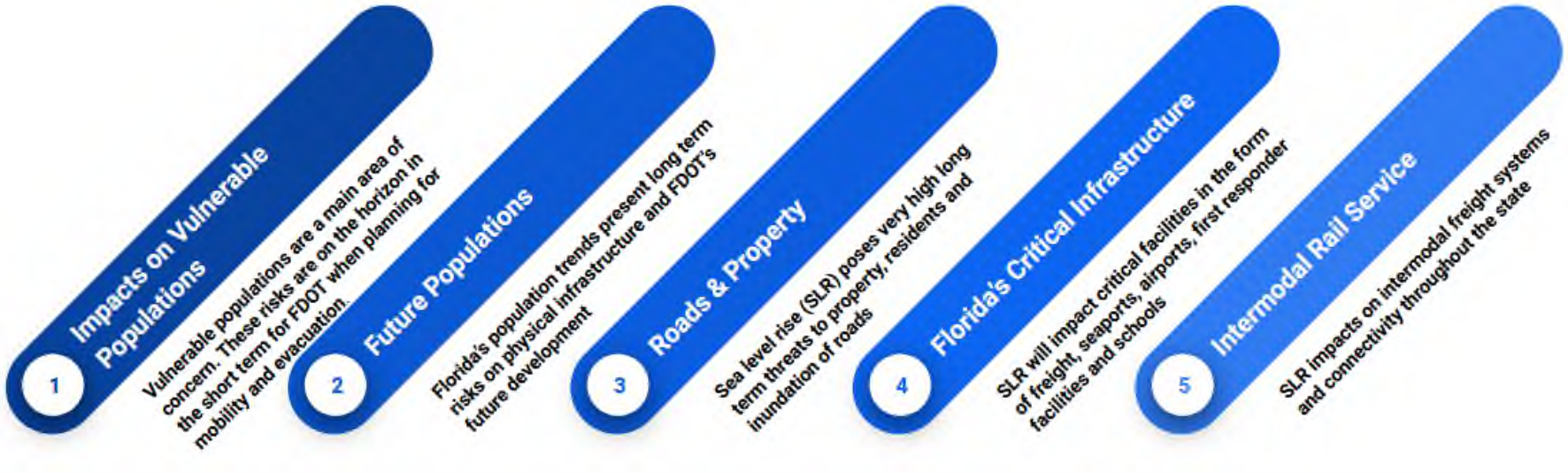
Curve 5 = NOAA High

UF | GEOPLAN CENTER

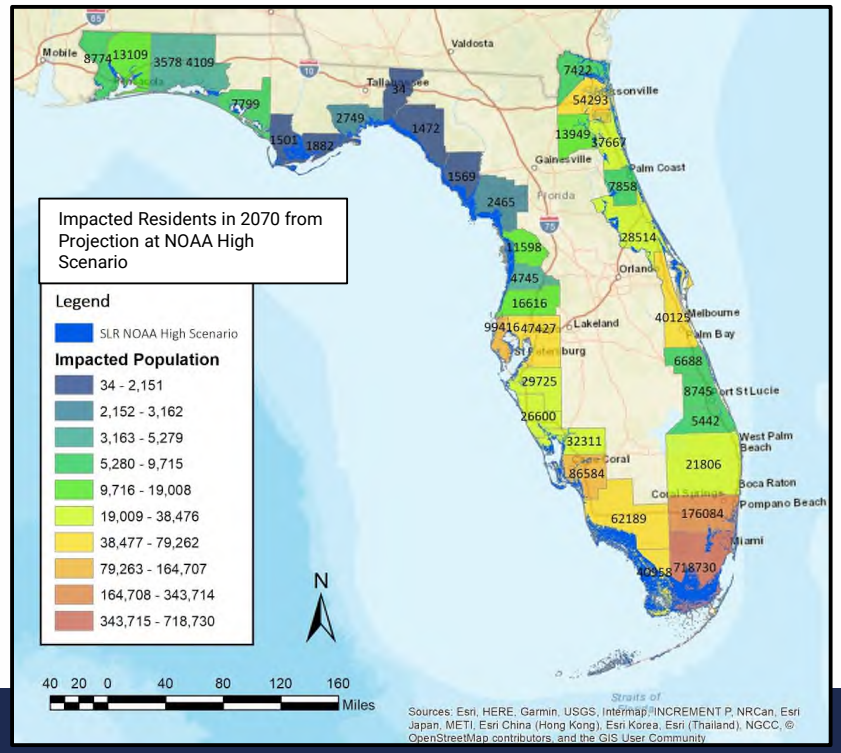
SEA LEVEL SCENARIO
SKETCH PLANNING TOOL

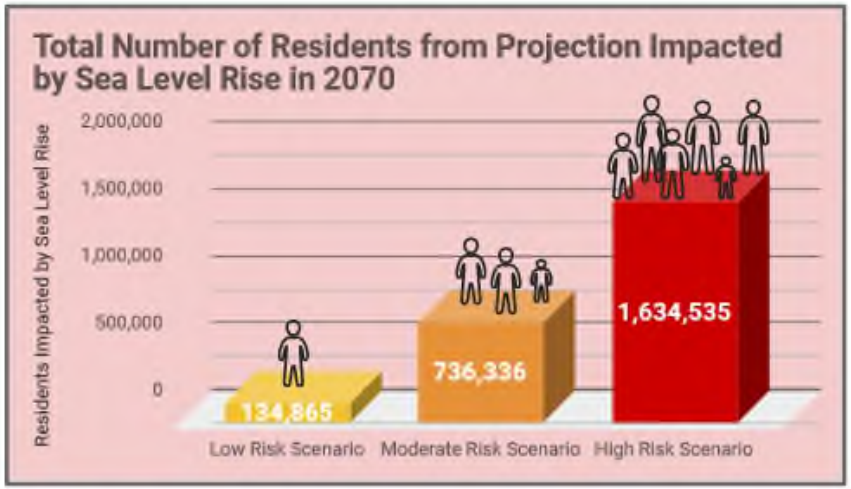


Fall 2018 Student Studio Work



Future Populations



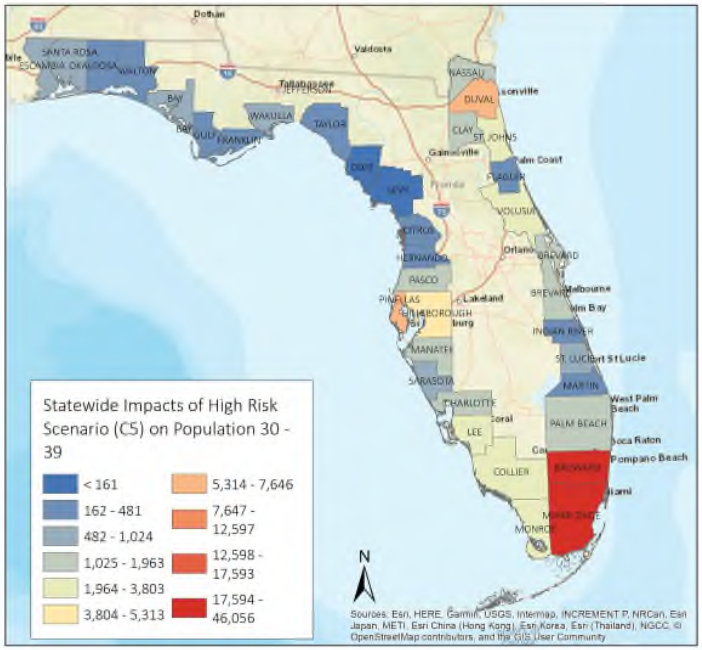


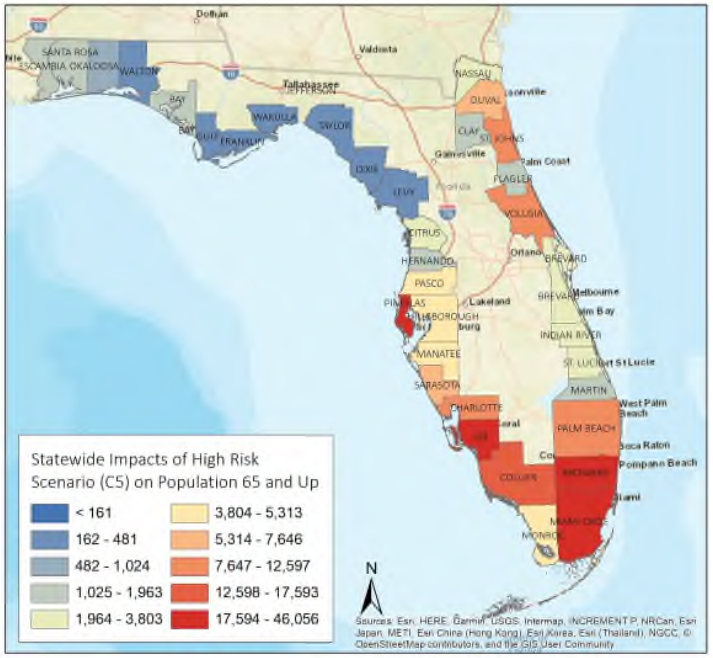
Why Focus on Future Populations?

- People moving inland
  - Increased inland road capacity
  - Physical deterioration of existing roads
  - Changes in land use and new roads
- Loss of future taxable land
- Changing travel patterns

Vulnerable Populations

Why Focus on Vulnerable Populations?
- Shift in travel patterns and mobility
- Barriers to certain forms of travel
- Vulnerable when thinking of extreme cases like evacuation routes



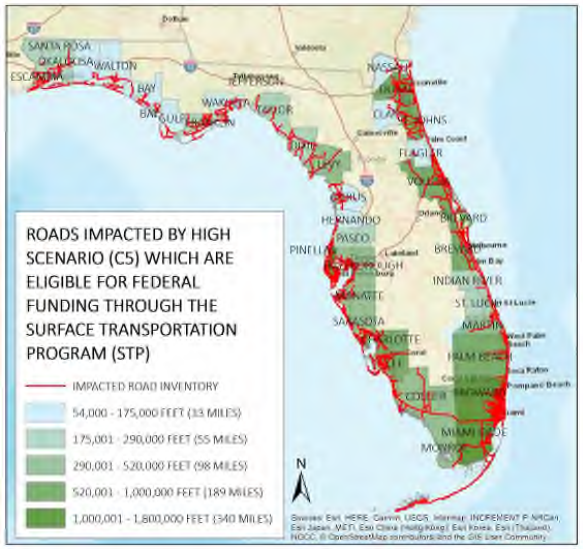


Highest Concentrations of 65 Up impacted by permanent flooding

Miami-Dade	**37,974**
Broward	**28,557**
Lee	**21,273**

This highlights where characteristics of current populations are

Roads and Property



***NEARLY $2OO BILLION IN TAXABLE PROPERTY IS IMPACTED IN THE CURVE 5 SCENARIO**

***NEARLY 40% OF ROAD LENGTH AFFECTED IN CURVE 5 ARE DESIGNATED EVACUATION ROUTES**

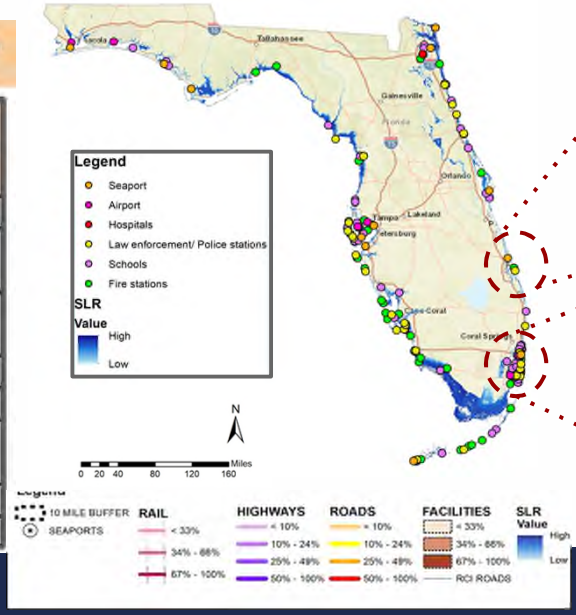
Summary of Road Inventory and Parcels	Length of Road Inventory Affected	Length of On-System FDOT Road Network Affected	Length of Designated Evacuation Routes Affected	Count of Property Parcels Affected	Area of Property Parcels Affected (Acres)	Sum of Taxable Property Value Affected
Low Risk Scenario (SLR C1)	4.5 miles	3 miles	3.5 miles	17,853	720,589	$2,840,396,372
Moderate Risk Scenario (SLR C3)	274 miles	53 miles	87 miles	149,125	1,786,740	$51,386,624,960
High Risk Scenario (SLR C5)	1,102 miles	260 miles	431 miles	493,486	2,878,609	$194,933,075,402

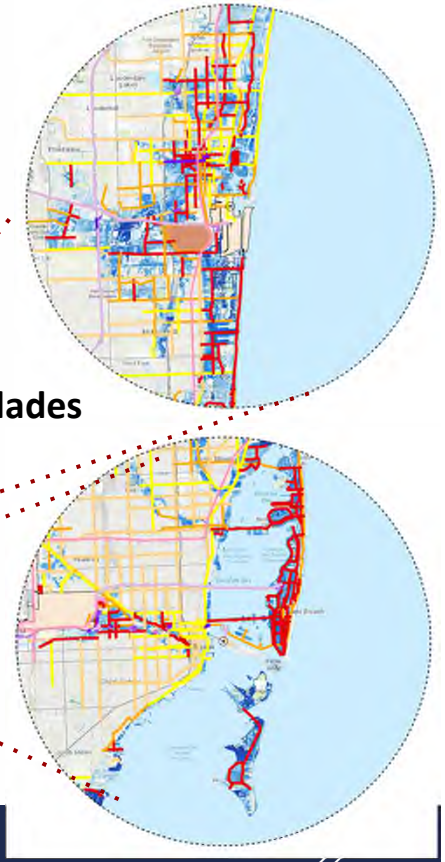
Critical Infrastructure

Damage to critical infrastructure at a regional level would have overall significant consequences on Florida's Economy.

Why Focus on Vulnerable Critical Infrastructure?

Facilities/Infrastructure	Total (Statewide)	2080 LOW	2080 MODERATE	2080 HIGH
Transportation Infrastructure/facilities				
Seaports	15	4 (26.66%)	9 (60%)	12 (80%)
Airports	18	1 (5.5%)	2 (11%)	6 (33%)
Emergency Response facilities				
Fire Stations	2125	0	13 (0.6%)	56 (2.6%)
Police Stations/Law enforcement	994	0	5 (0.5%)	35 (3.5%)
Hospitals	349	1 (0.28%)	2 (0.57%)	2 (0.57%)
Schools	8552	0	14 (0.16%)	127 (1.48%)





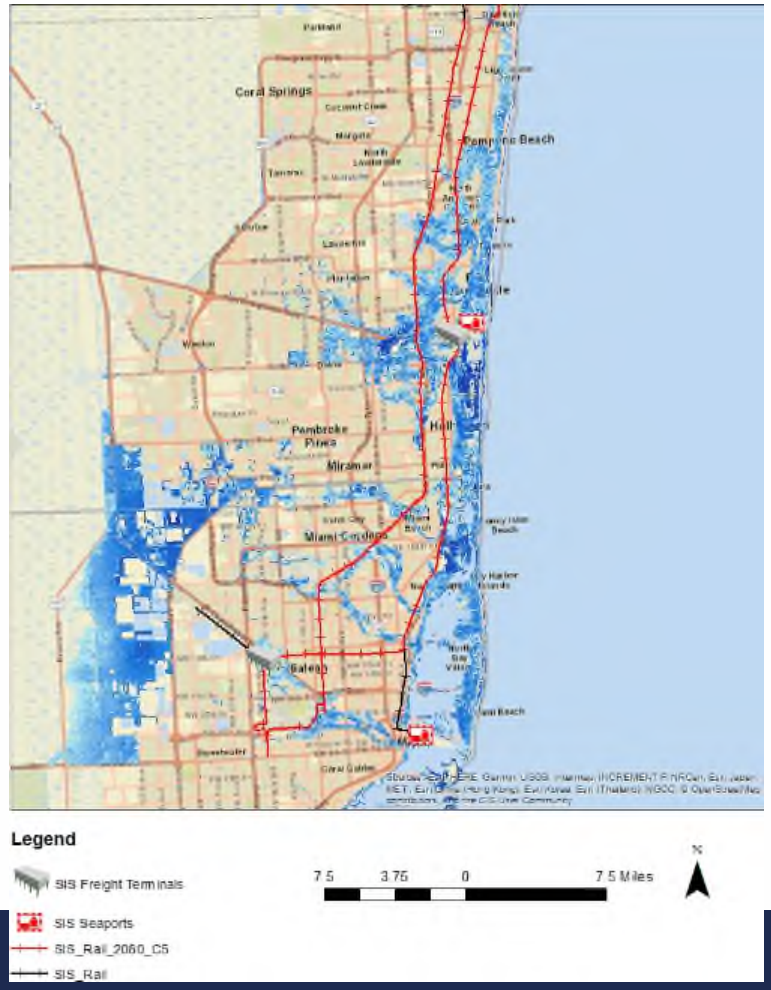
Everglades Port

Miami Port

Intermodal Rail Service

Table 13
Sea Level Rise Table FDOT District 5

Railroad	Name of Corridor	County Impacted	Miles of Track Impacted	Impacted by SLR C1	Impacted by SLR C3	Impacted by SLR C5
CSX	A-Line	Volusia	40 Miles	No	No	Yes
Florida East Coast	FEC Mainline	Brevard	70 Miles	No	Yes	Yes
		Volusia	44 Miles	Yes	Yes	Yes
(FDOT, 2017, 2018), (GeoPlan Center, 2014, 2017)						



Post Study and Collaboration

- Florida Transportation Plan Long Range Visioning
- Community of practice
- **Support** to Florida Transportation Plan subcommittees (Technology & Resilience)
- Framework for incorporating resilience into FDOT's work:
  - Identifying future research needs
  - Providing tools and resources

Contact Information

Jennifer Z. Carver, AICP
Florida Department of Transportation
Office of Policy Planning
850.414.4820
Jennifer.carver@dot.state.fl.us

Dennis J. Smith, AICP
Florida State University
Department of Urban & Regional Planning
850.645.7170
djsmith3@fsu.edu

Tia A. Boyd
University of South Florida
Center for Urban Transportation Research
813.974.5324
tiaboyd@usf.edu

Ruth L. Steiner, Ph.D.
University of Florida
Department of Urban and Regional Planning
352.294.1492
rsteiner@ufl.edu