



# INTEGRATING RESILIENCE INTO PROJECT PRIORITIZATION AND DECISION-MAKING

FHWA Resilience Peer Exchange

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## Background

## HRPDC Resiliency Studies and Planning Efforts

## HRTP Resiliency Studies and Planning Efforts

## Incorporating Resiliency in the LRTP Process

# HAMPTON ROADS



**Coastal Virginia  
Mouth of the Chesapeake  
Bay**



**1.7 Million  
People**



**Strategic Location  
Foreign Trade  
Tourism  
Military Facilities**



# SEA LEVEL RISE IN HAMPTON ROADS

- Hampton Roads is experiencing the highest rate of relative Sea Level Rise on the East Coast
- Sea Level Rise will result in significant impacts:
  - Permanent inundation of some areas
  - More frequent flooding of other areas
  - Some areas that have not seen flooding will start to experience it

**Vulnerability to Sea Level Rise (SLR)**



Source: National Climate Assessment via EPA, data from Hammar-Klose and Thieler 2001

# Flooding of the Midtown Tunnel

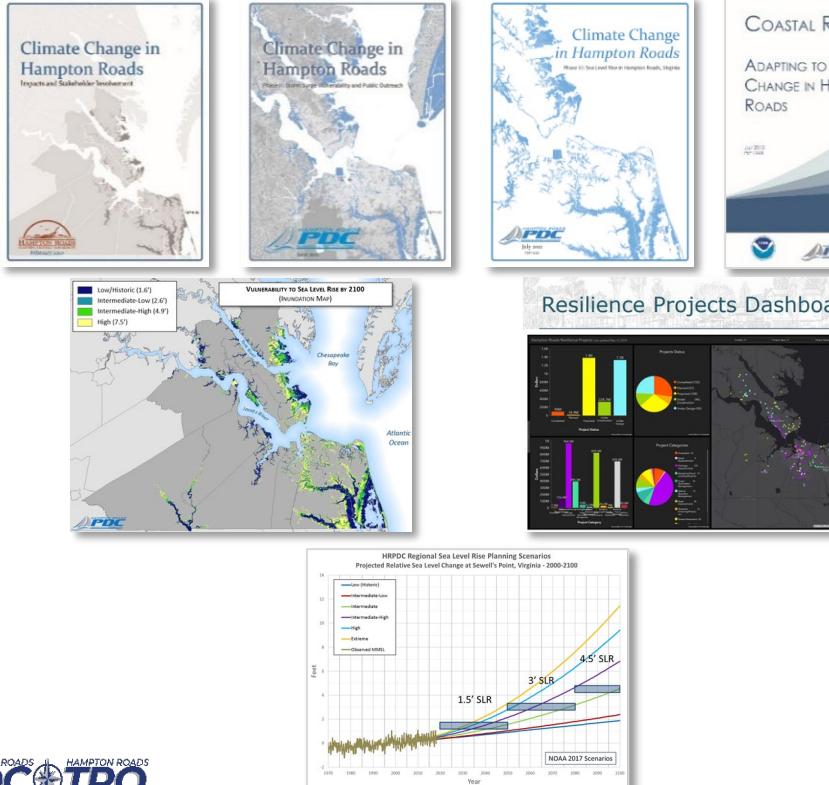


## RESILIENCY CONTEXT

- Several events have shut down critical infrastructure in the region



# RESILIENCY AND VULNERABILITY PLANNING EFFORTS



## Regional Sea Level Rise Policy

### Screening Values

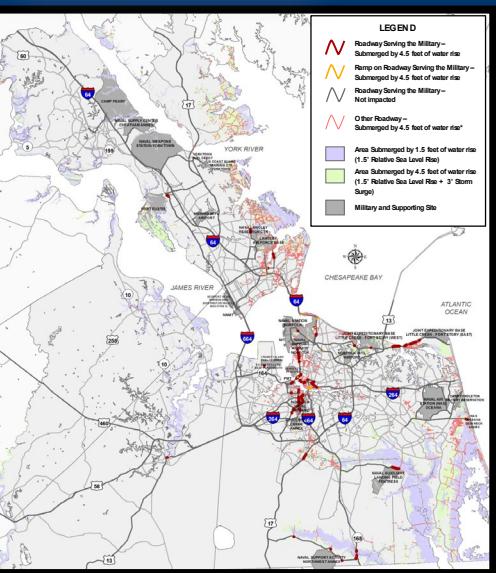
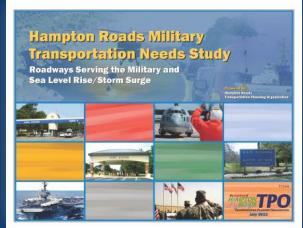
- 1.5 Feet for Near-Term Planning (2018-2050)
- 3 Feet for Medium-Term Planning (2050-2080)
- 4.5 Feet for Long-Term Planning (2080-2100)

### Risk-Based Engineering

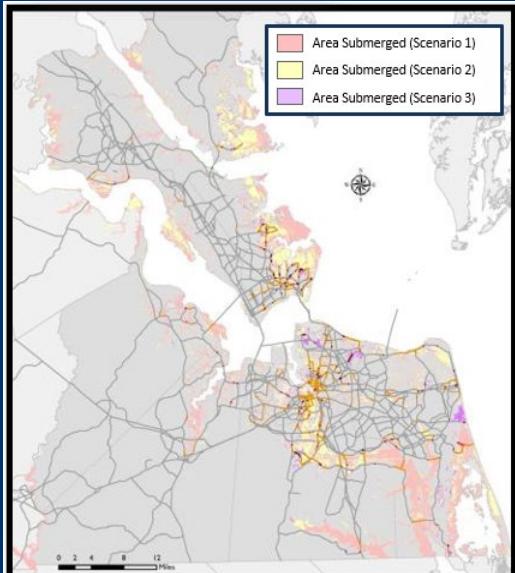
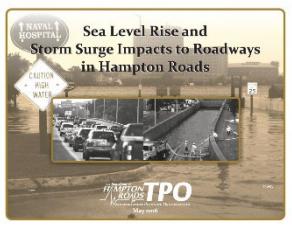
- Utilize best available seal level rise projections
- Explicitly account for construction timeline, project lifespan, criticality, and vulnerability to flooding
- Determine possible sea level rise impacts
- Perform benefit-cost analysis of adaptation options

# HRTPO STUDIES – VULNERABILITY ANALYSES

2013



2016



## Identify Vulnerabilities and Develop Adaptation Strategies

- Identify roadway segments vulnerable to flooding to develop adaptation strategies
- Raise awareness of potential flood locations to consider during design

## Project Evaluation and Prioritization

- Use study results to add a “flooding vulnerability” component within the Project Prioritization Tool

# INTEGRATING ADAPTION STRATEGIES

- Adaptation strategies reduce potential impacts to ensure transportation system reliability and resiliency



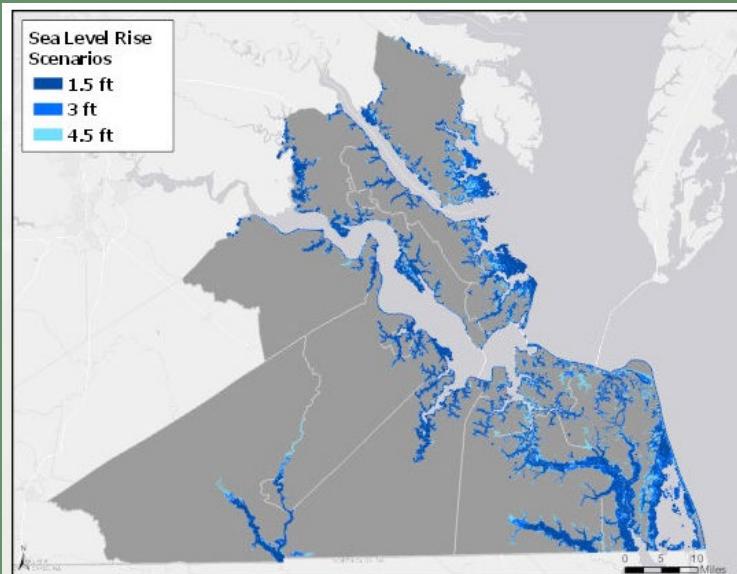
- Wythe Creek Road widening project**
  - Coordination between Poquoson, Hampton, and NASA
  - Used inundation mapping tool and modeling to make design modifications



- I-64 Southside High Rise Bridge project**
  - As a result of sea level rise planning efforts, VDOT increased bridge design height by 5-feet to account for future sea level rise

# ENHANCING RESILIENCY CONSIDERATIONS IN THE LRTP

## Sea Level Rise Scenarios



Scenario Planning



Project Prioritization  
Measures



Data-driven,  
Objective,  
Comprehensive Inputs



Resiliency Pilots with  
Volpe and Fernleaf

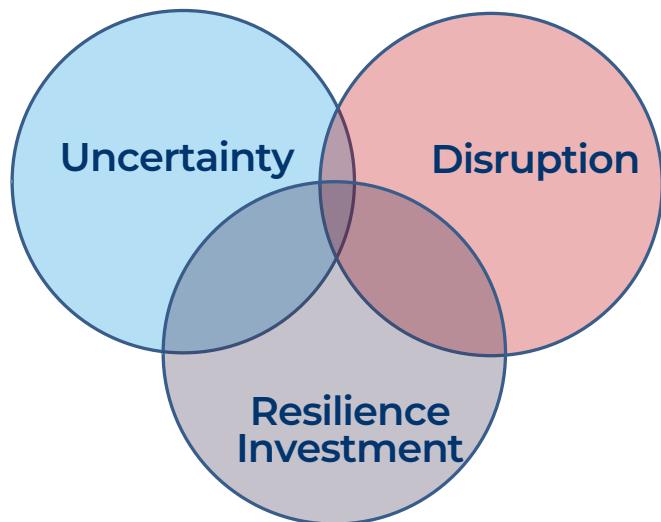
# RESILIENCY PILOT WITH VOLPE

## HRTPO Objectives with Volpe RDR Tool

- Model multiple flooding scenarios efficiently
- Support objective, data-driven resiliency measures for use in Project Prioritization Tool
  - Identify inundation and extent (low and high frequency events)
  - Quantify congestion as a result of flooding
  - Quantify congestion avoided from mitigating flooding
  - Cost-benefit ratio of resiliency improvements

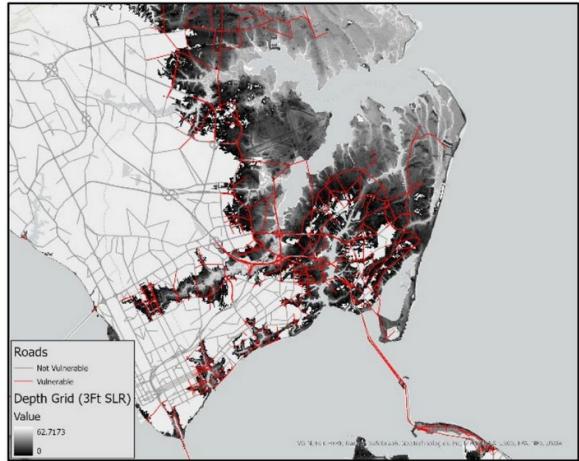
## Modeling Uncertain Disruption Scenarios

- RDR Tool to explore a large scenario space to assess Network-wide effects of losing some assets (highway links)



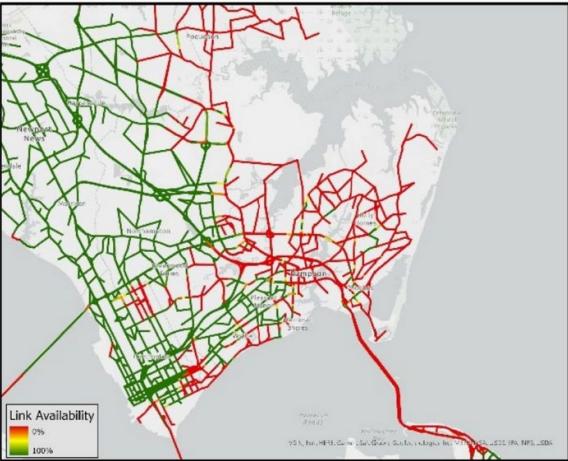
# VOLPE RDR TOOL OVERVIEW

## RDR EXPOSURE ANALYSIS TOOL



- Identify network assets vulnerable under given hazard condition

## RDR LINK CAPACITY LOSS CALCULATION



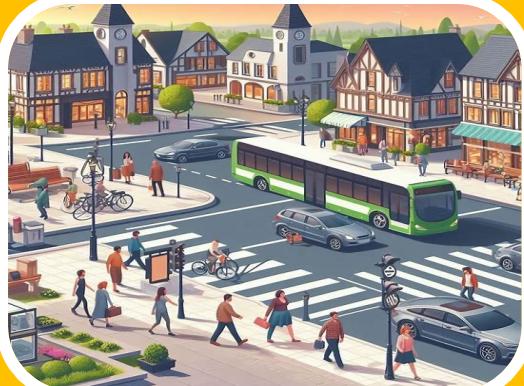
- Assess lost/reduced capacity under given hazard condition

## PROJECT RANKING BY ROI, PERFORMANCE UNDER UNCERTAINTY





## Greater Urban Growth



## Greater Suburban Growth



## Greater Inland/Westward Growth



### Sea Level Rise/Storm Surge Assumptions (based on Regional SLR Policy)

3-feet Sea Level Rise  
10-year Storm Surge

3-feet Sea Level Rise  
100-year Storm Surge

4.5-feet Sea Level Rise  
100-year Storm Surge

# VOLPE RDR TOOL: HRTPO PLANNING APPLICATIONS

## Scenario Planning

- Multiple flooding scenarios

## Candidate Project Identification

- Identification of high disruption assets for project consideration
- Project design/cost refinement incorporating resilience

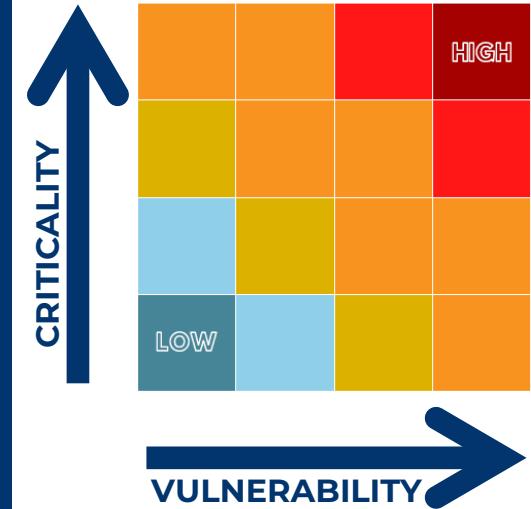
## Factors for Project Prioritization

- Vulnerability/exposure across scenarios (added equity and transit)
- Disruption severity/change in network performance
- Refinement of cost effectiveness measures

## Fiscal Constraint

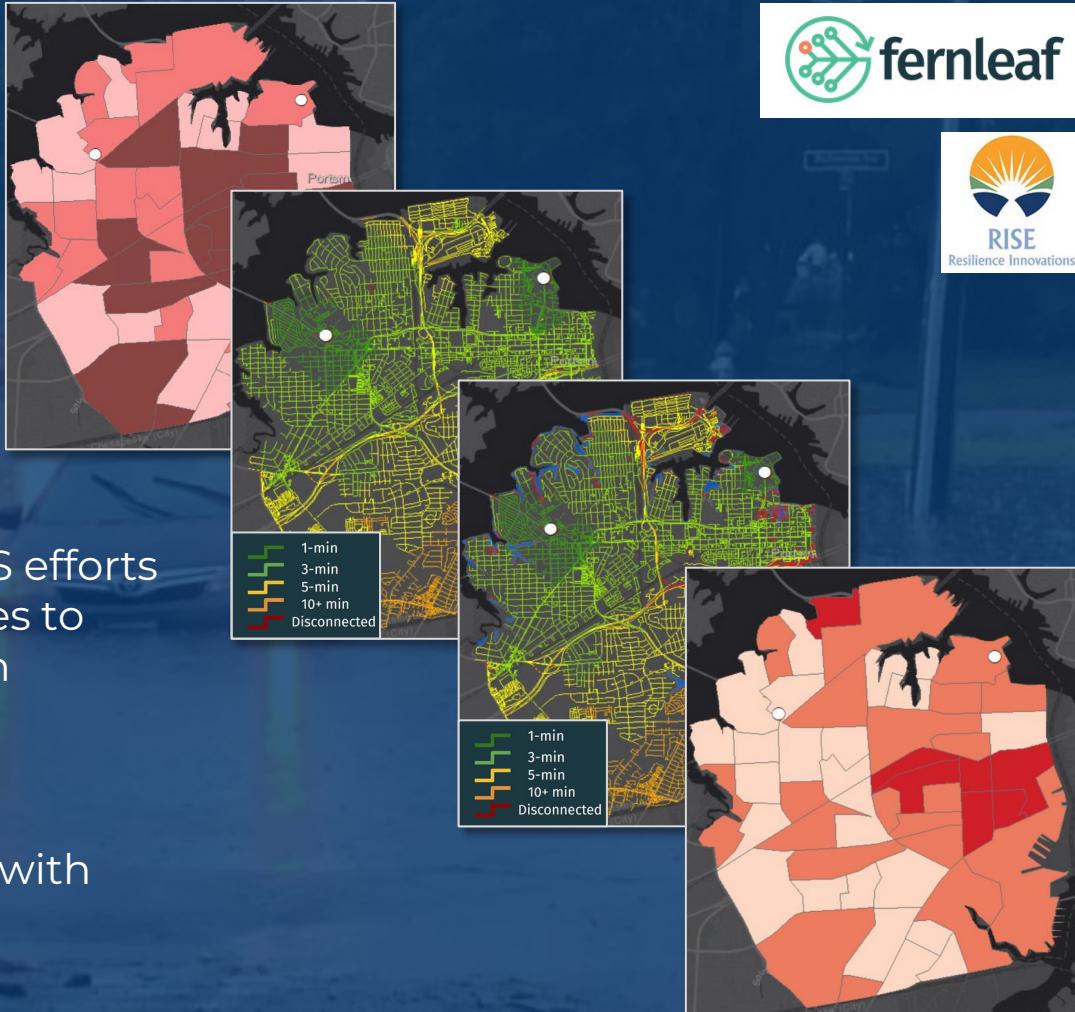
- Help identify critical projects to constrain in LRTP

## Measuring Criticality and Vulnerability



# RESILIENCE/ EQUITY PILOT WITH FERNLEAF

- Extreme weather/climate-induced events have had a disproportionate impact on socially vulnerable populations
- Build off Volpe RDR Tool and JLUS efforts
  - Data-driven objective measures to include in Project Prioritization
- Approach:
  - Screening Level Analysis
  - Combines Social Vulnerability with Roadway Network Analysis



# THANK YOU!

Hampton Roads Transportation Planning Organization  
Hampton Roads Planning District Commission

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