Incorporating Resilience into Port Authority Infrastructure Design

First International Conference on Surface Transportation System Resilience to Climate Change and Extreme Weather Events
September 16, 2015

Peter Adams
Climate Resilience Specialist
Engineering Department
Port Authority of NY and NJ
Port Authority District Map

Aviation
- John F. Kennedy International Airport
- LaGuardia Airport
- Newark Liberty International Airport
- Stewart International Airport
- Teterboro Airport
- Atlantic City International Airport

Bridges
- Bayonne Bridge
- George Washington Bridge
- Goethals Bridge
- Outerbridge Crossing

Bus Terminals
- Port Authority Bus Terminal
- George Washington Bridge Bus Terminal
- Journal Square Transportation Center

Port Commerce
- Port Jersey-Port Authority Marine Terminal
- Brooklyn-Port Authority Marine Terminal
- Elizabeth-Port Authority Marine Terminal
- Howland Hook Marine Terminal
- Port Newark

Tunnels
- Holland Tunnel
- Lincoln Tunnel

Rail
- Journal Square Transportation Center
- PATH Rail Transit System

World Trade Center
PATH
Pre-Sandy Work on Adaptation

• New York Panel on Climate Change (NPCC)
  o Founded in 2008 and part of PlaNYC.

• NYC Climate Change Adaptation Task Force
  o PANYNJ participated in initial vulnerability assessment.
PATH Tunnels and Stations – Sandy Impacts

• Extensive flooding of PATH tunnels, stations and substations
• Significant damage to power traction systems, signals, elevators, escalators, and other electrical devices
Salt Water Damage Inspections

• Significant salt intrusion residue found at flooded facilities
• Corrosion found in electrical systems
PATH – Examples of Measures in Place
Federal, State and Local Resiliency Efforts

Presidential Policy Directive:
**Critical Infrastructure Security and Resiliency (2/12/13)**

Federal Executive Order:
**Council on Climate Preparedness and Resilience (11/1/13)**

**New York State 2100 Commission**

**New York City Building Resiliency Task Force**

**HUD Rebuild by Design Hoboken, NJ**

Photo credit: http://www.rebuildbydesign.org/events/presentation-to-the-public/
Regional Collaboration

• Regional transportation collaboration – working with the MTA, NJ Transit, and Amtrak

• Active participant in the Sandy Regional Infrastructure Resilience Coordination Group (organized by federal Sandy Recovery Office at FEMA)

• Membership in NYC Climate Change Adaptation Task Force
Infrastructure Resilience Design

- Ability to **reduce magnitude and/or duration** of “disruptive events”

- Effectiveness depends upon asset’s ability to anticipate, absorb, adapt to, and/or **rapidly recover**

Climate and weather related “disruptive events” include:

- **Sea level rise and severe storms**
- An increase in **average temperatures and extreme heat**
- An increase in **average precipitation and rainfall intensity**
Regional Mean Temperature and Precipitation Change

**Air Temperature (Mean Annual)**

- 54°F Baseline
- 56°F – 57°F Projected
- 58°F – 60°F Projected
- 62°F Projected
- 64°F Projected
- 66°F Projected

**Precipitation (Mean Annual)**

- 51” Baseline
- 56” Projected
- 60” Projected
- 53” Projected
- 60” Projected

Source: NASA Goddard Institute, Columbia University (2013)

Applicable to Port District and Recommended for Port Authority adoption by OEEP
Regional Mean Sea Level Rise

Source: NASA Goddard Institute, Columbia University (2013)

Applicable to Port District and Recommended for Port Authority adoption by Office of Environmental and Energy Programs
Increased Temperature, Precipitation and Mean Sea Level: Guideline Modifications

- **Bridges:** Change joint seal design criteria (higher temperatures)
- **Rail:** Modify rail for expansion and contraction (higher temperatures)
- **Modify Landscape Design:** Provide drought resistant plantings (higher temperatures)
- **Modify Mechanical Systems:** Provide submersible pumps (increased precipitation)
- **Drainage/Utility Design:**
  - Adjust pipe sizes to reflect (increased precipitation)
  - Stormwater outfall water level evaluation (mean sea level rise)
  - Adjust groundwater table (mean sea level rise)
Sea Level Rise and Severe Storms: 
Updated Flood Protection Design Criteria

Updated process to establish flood protection criteria:

• Establish flood protection level above code based on:
  • Asset life and criticality
  • Sea level rise

• Recognize any system-wide flood protection already in place

• Coordinate with Agency Stakeholders through Flood Risk Assessment

• Perform Benefit Cost Analysis for projects > $10M Total Project Cost

• Establish Basis of Design
Sea Level Rise and Severe Storms: Asset Criticality

- NYC/NJ flood hazard code defines critical/non-critical buildings
  - Code flood protection levels higher for critical

- Infrastructure flood protection is not covered by the building code

- Infrastructure categories:
  - Train Tunnels
  - Vehicular Tunnels
  - Electrical substations/switch houses and emergency generators
  - Fire Protection Systems
  - Aircraft Fueling Systems
  - Pumping Systems and Dikes
Sea Level Rise and Severe Storms:
Flood Protection Elevation Criteria

Asset Life: 2020-2050
Design Base Height: 16"

Asset Life: 2050-2080
Design Base Height: 28"

NYC/NJ Code Height: 12” or 24” above FEMA 1% Flood Elevation

GRADE
Design Guidelines Climate Resilience

• Used for all capital projects
• Addresses hazards:
  • Increased heat
  • Increased precipitation
  • Sea level rise
• Step-wise process for building flood resilience
Thank you

Design Guidelines Climate Resilience

Peter Adams
phadams@panynj.gov