

Incorporating Resilience into Port Authority Infrastructure Design

FRA Rail Program Delivery Conference

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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)
 - Founded in 2008 and part of PlaNYC.
 - “Climate Change Adaptation in New York City: Building a Risk Management Response” published in 2010.
- NYC Climate Change Adaptation Task Force
 - PANYNJ participated in initial vulnerability assessment.

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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

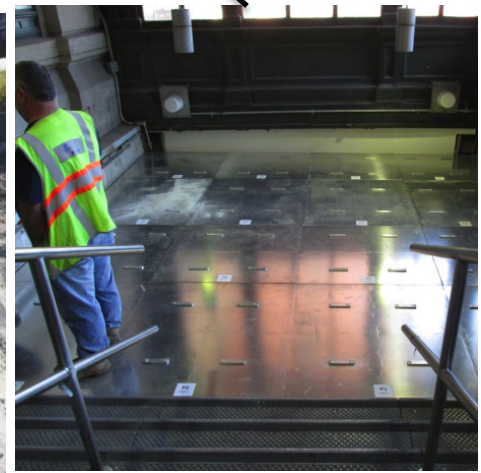
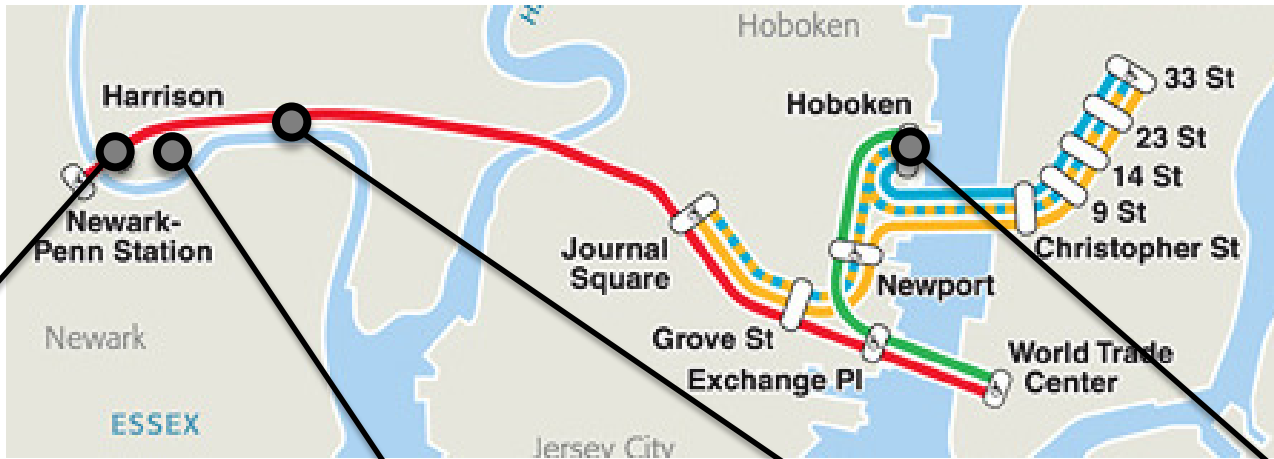


Salt Water Latent Damage Inspections



- 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

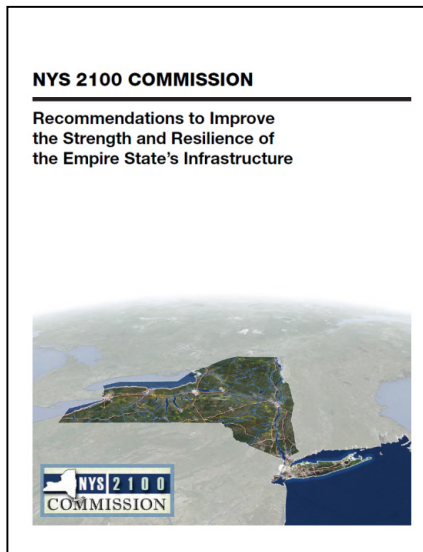
Presidential Policy Directive:

Critical Infrastructure Security and Resiliency (2/12/13)

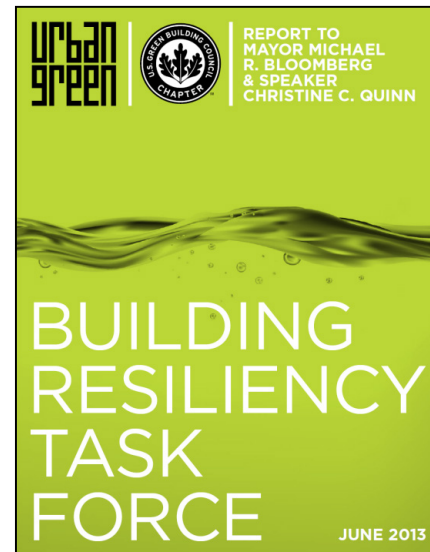
Federal Executive Order:

Council on Climate Preparedness and Resilience (11/1/13)

New York State 2100 Commission



New York City Building Resiliency Task Force



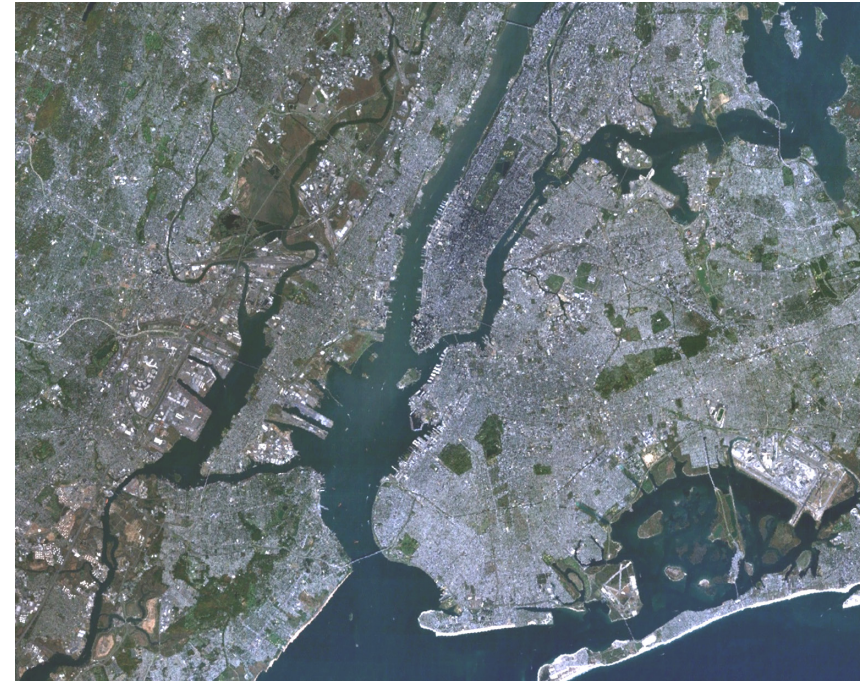
HUD Rebuild by Design Hoboken, NJ



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



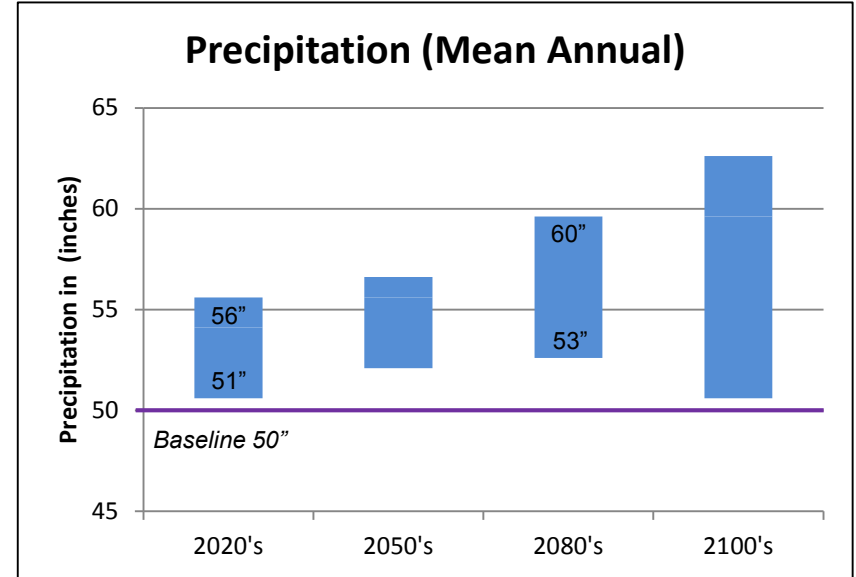
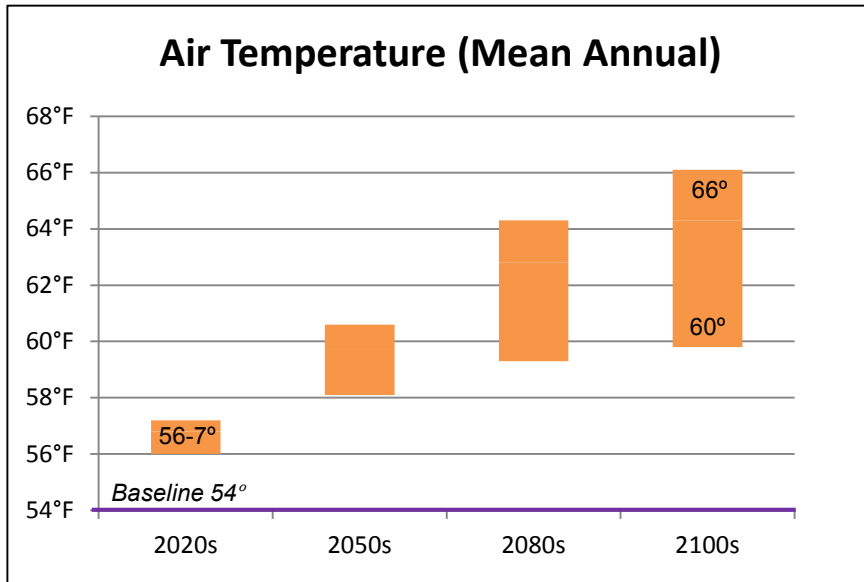
Infrastructure Resilience Design

- 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:

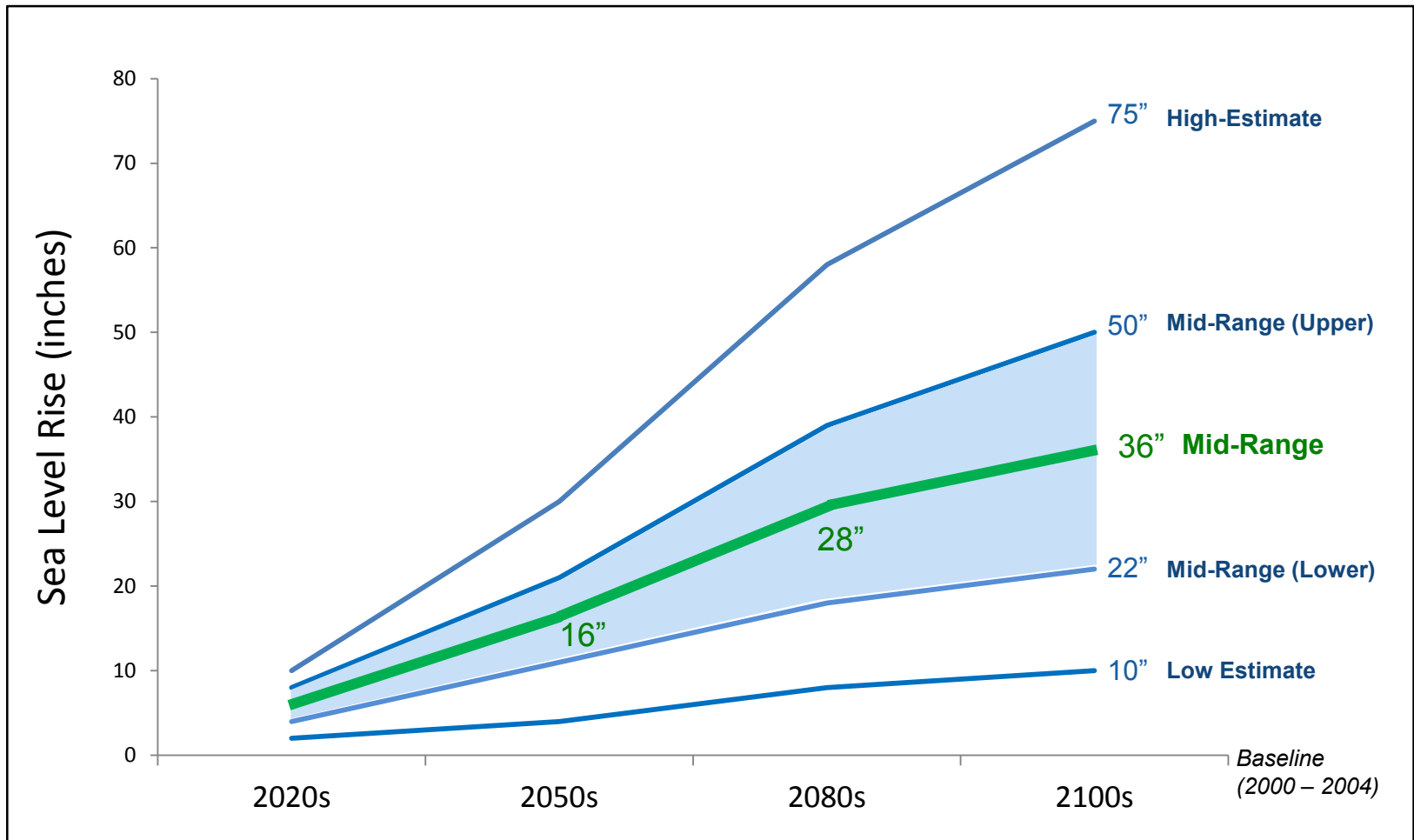
- **Sea level rise and severe storms**
- An increase in **average temperatures and extreme heat**
- An increase in **average precipitation and rainfall intensity**

Regional Mean Temperature and Precipitation Change



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:

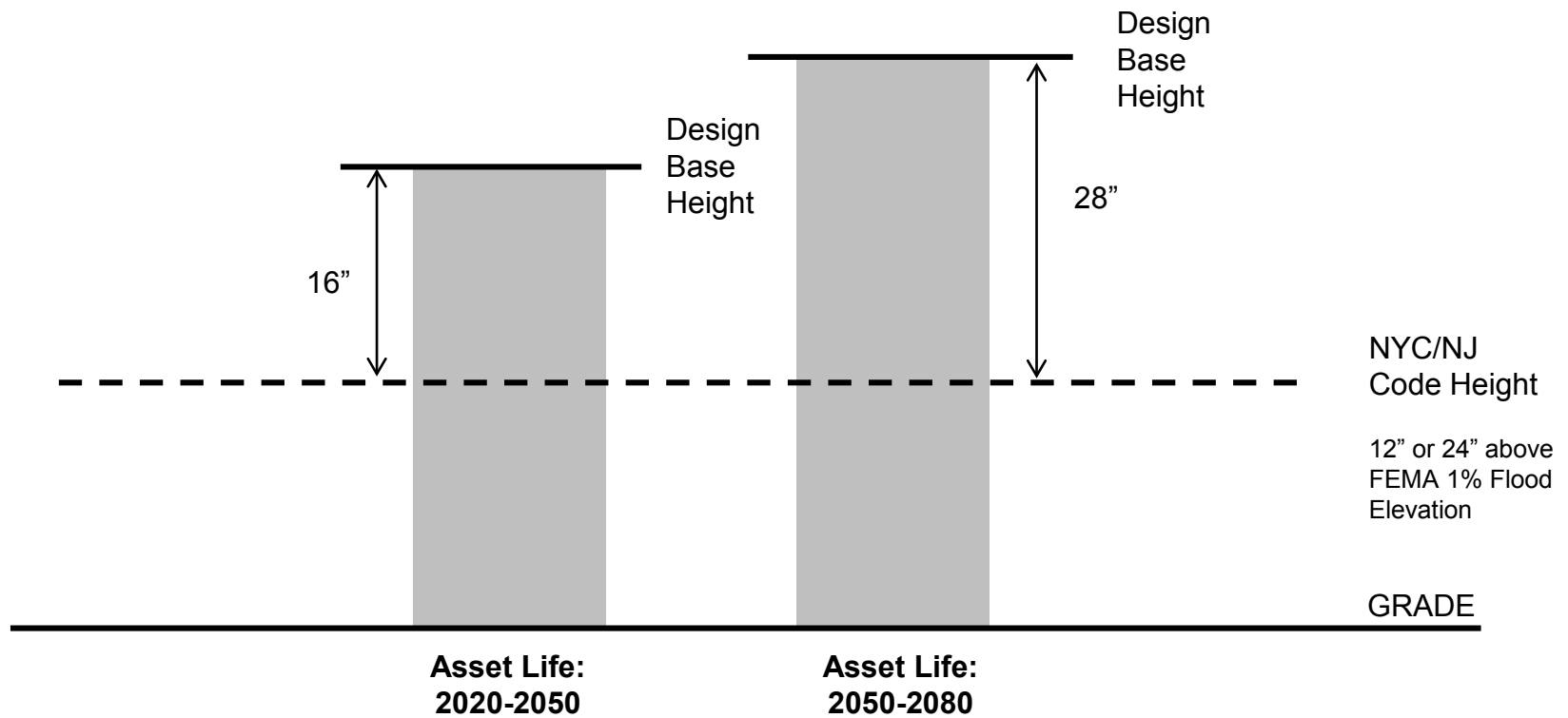
- Establish flood protection level above code based on:
 - Asset life and criticality
 - Sea level rise
- Recognize any system-wide flood protection already in place
- Coordinate with Agency Stakeholders through Flood Risk Assessment
- Perform Benefit Cost Analysis for projects > \$10M Total Project 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

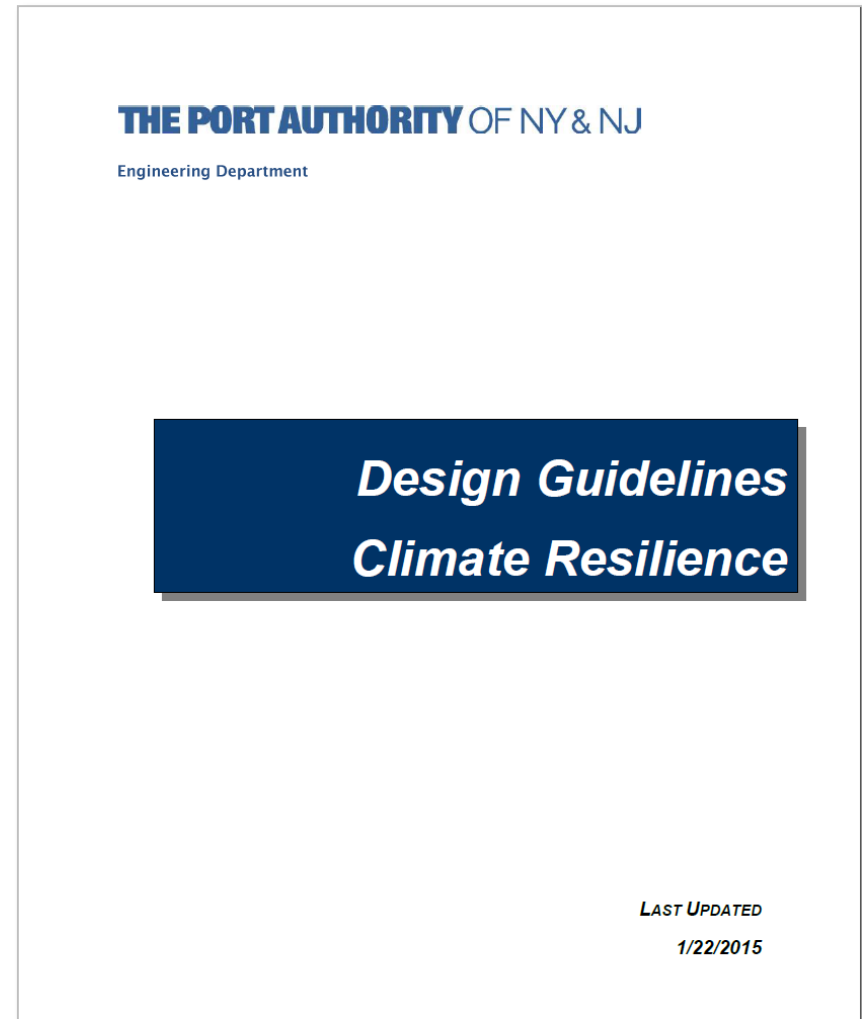


Sea Level Rise and Severe Storms: Flood Protection Elevation Criteria



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

<http://www.panynj.gov/business-opportunities/pdf/discipline-guidelines/climate-resilience.pdf>

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