

Optimum Protective Measures for the New York City Infrastructure Subjected to Future Hurricanes and Sea Level Rise, with George Deodatis
Thursday, March 8, 10:00am – 11:30am

Reading: NYSERDA ClimAID, Chapter 9: Transportation Case Study: Future Coastal Storm Impacts on Transportation in the New York Metropolitan Region (pp 323-344; 352-354)

<https://www.nyserda.ny.gov/climaid>

This case study focuses on the impacts and geographic reach of a 100-year Base Flood as a function of sea level rise on the transportation infrastructure of the New York Metropolitan Region. The analysis is based upon three ClimAid scenarios: (S1) comprising current sea level with a 100-year coastal flood along the coast and tide-controlled estuary; (S2) a 2-foot rise in sea level with a 100-year flood; and (S3) a 4-foot rise in sea level with a 100-year flood. Scenario S2 is expected to have significant impacts along the Brooklyn and Queens shorelines, around Jamaica Bay, and on the Rockaway Peninsula.

Due to the lack of centralized data on transportation infrastructure elevations for New York this study uses lowest critical elevations (LCE) to analyze the impacts. The combination of sea level rise and coastal storm surges is expected to limit the flow of vehicular and pedestrian traffic, parking patterns, and many of the MTA-NYCT bus routes. It can also slow access of first responders and emergency vehicles. In the case of tunnels and underground structures, risk to flooding is contingent on storm waters exceeding the lowest critical elevation of 8-9 ft., and whether adaptive or preventive structural measures have been taken. Many of the above-grade railroads, such as the NJ TRANSIT and PATH tracks in the Hudson, Hackensack, and Passaic River Basins are flood prone, and MTA Metro-North trains can encounter flood-prone segments. For transportation systems to operate properly, support systems are needed. The most prominent and potentially vulnerable are the electrical grid, pipelines and communication systems.

This case demonstrates the potential severity of climate change impacts of New York's transportation sector, and the need for adaptation measures for a resilient transport system. Without investment in protective measures costs associated with transportation risks will increase and may reach an annual average of \$1 million. Short-term measures (over the next 5-20 years) can be effective for a few decades and can be combined with medium-term (over the next 30 to 100 years) hard engineering measures to improve individual sites like stations and rail tracks and the system's operational resiliency. Long-term Sustainable Strategies (from now to beyond 100 years) can be combined with the short and medium-term strategies and require comprehensive plans with time-dependent decision paths and "exit strategies."

DISCUSSION NOTES

Following Hurricane Sandy, MTA decided to protect the subway system. There were \$1B in observed damages from Sandy. The MTA developed a major program to cover every opening in the system predicted to be flooded from the study (4,000 openings). This system is now almost complete.

However, this system doesn't work in isolation. There is need for redundant measures. The MTA's system needs to work perfectly in order to work at all. With lock quality resistant doors, if one fails the entire system fails. But there is potential to develop a more flexible adaptation strategy; need funding.

Once a decision was made to close the openings, that was how they were moving forward, no question. The MTA claims they can close all 4,000 openings in 8 hours (this is the time frame in which a train closes before arrival of an event/natural disaster). So far in every event, they have been successful in moving

trains to higher ground, but forecasts can change quickly. MTA is currently protecting areas that were hit hard during Sandy, but the next disaster may hit in very different areas.

There are numerous agencies in charge of different parts of infrastructure. MTA is in charge of some of the tunnels in NYC. But some authority lies with Amtrak, Port Authority, and both New York City and State. There are probably a dozen different agencies dealing with different parts of transportation infrastructure in NYC, but no coordinating agency. Overall, any subway discussion is very political. Whenever there is friction between state and city, things don't work with the subway.

The Netherlands had two major catastrophes in the 20th century (flood during WWI, flood in 1950s). There was nothing done before these two major floods. But the Netherlands decided they needed a comprehensive plan, and implemented one after each disaster. New York metropolitan area needs something similar that considers the entire geographic area, along with Long Island and New Jersey. This needs to happen at a federal level (or some other high level). Funds are often spent in sub-optimal ways. There still needs to be conversations between city and state.

In many areas, sooner or later people will have to move to higher ground. These may be places where there is continual damage on a yearly basis, even from nor'easters, in the same communities. Going back and repairing does not make sense from a cost-benefit analysis perspective. One approach could be telling these communities that they do not qualify for disaster response because of their vulnerable location (as an alternative to telling them that they need to move).

Major questions: Should adaptation decision-making be left to individual agencies, to communities, or someone else? At what level should planning occur? And how can we plan ahead vs. in an ad hoc manner? Is there another umbrella organization, non-federal, that could be responsible for this? Are there other models?

Idea for academic symposium: How can you get a cross-agency group together to plan this better than is currently being done? This could be an academic exercise that is very theoretical. It would need to involve these agencies, even though they might hear criticism, but we don't want to alienate them. There is precedent for cross-agency groups in areas of air pollution, especially in California.