Chapter 12 | Transportation

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Key Message #1

Transportation at Risk

A reliable, safe, and efficient U.S. transportation system is at risk from increases in heavy precipitation, coastal flooding, heat, wildfires, and other extreme events, as well as changes to average temperature. Throughout this century, climate change will continue to pose a risk to U.S. transportation infrastructure, with regional differences.
Extreme events that increasingly impact the transportation network are inducing societal and economic consequences, some of which disproportionately affect vulnerable populations. In the absence of intervention, future changes in climate will lead to increasing transportation challenges, particularly because of system complexity, aging infrastructure, and dependency across sectors.
Engineers, planners, and researchers in the transportation field are showing increasing interest and sophistication in understanding the risks that climate hazards pose to transportation assets and services. Transportation practitioner efforts demonstrate the connection between advanced assessment and the implementation of adaptive measures, though many communities still face challenges and barriers to action.
Fig. 12.1: U.S. Transportation Assets and Goals at Risk

Heavy precipitation, coastal flooding, heat, and changes in average precipitation and temperature affect assets (such as roads and bridges) across all modes of transportation. The figure shows major climate-related hazards and the transportation assets impacted. Photos illustrate national performance goals (listed in 23 U.S.C. § 1508) that are at risk due to climate-related hazards. Source: USGCRP. Photo credits from left to right: JAXPORT, Meredith Fordham Hughes [CC BY-NC 2.0]; Oregon Department of Transportation [CC BY 2.0]; NPS—Mississippi National River and Recreation Area; Flickr user Tom Driggers [CC BY 2.0]; Flickr user Mike Mozart [CC BY 2.0]; Flickr user Jeff Turner [CC BY 2.0]; Flickr user William Garrett [CC BY 2.0].
Annual Vehicle-Hours of Delay Due to High Tide Flooding

The figure shows annual vehicle-hours of delay for major roads (principal arterials, minor arterials, and major collectors) due to high tide flooding by state, year, and sea level rise scenario (from Sweet et al. 2017). Years are shown using decadal average (10-year) values (that is, 2020 is 2016–2025), except 2100, which is a 5-year average (2096–2100). One vehicle-hour of delay is equivalent to one vehicle delayed for one hour. Source: Jacobs et al. 2018, Figure 3, reproduced with permission of the Transportation Research Board.
Fig. 12.3: Transportation Vulnerability and Risk Assessments

This figure shows transportation vulnerability and/or risk assessments from 2012 to 2016 by location. Cumulatively, these vulnerability assessments elucidate national-scale vulnerabilities and progress. Data for the U.S. Caribbean region were not available. See the online version of this map at http://nca2018.globalchange.gov/chapter/12#fig-12-3 to access the complete set of vulnerability and risk assessments. Sources: ICF and U.S. Department of Transportation.
Fig. 12.4: Flood Impacts on Colorado Highway

Flooding events can result in serious damage to road infrastructure. Here, debris flow covers US Highway 14 (Poudre Canyon) after the High Park Fire in 2012. Photo credit: Justin Pipe, Colorado Department of Transportation.
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NYC’s Strategic Plan to Protect Residents Against Natural Disasters
Hurricane Sandy
The City’s action on climate change took on new urgency after Hurricane Sandy struck the region in October 2012.

- 44 lives lost
- $19 billion in damages and lost economic activity
- Thousands of New Yorkers were displaced from homes
- 51 square miles (17% of NYC land mass) flooded
- 88,700 buildings were inundated, including 23,400 businesses
- 2,000,000 people lost power, many for weeks and longer
Climate Change and NYC

The OneNYC plan is organized across four strategic visions for growth, equity, sustainability, and resiliency.
Climate Change and NYC
OneNYC, the Mayor’s long-term strategic plan to address our most pressing challenges, strengthens and expands the City’s commitment to a multilayered approach to resiliency.

- **Neighborhoods**: Every city neighborhood will be safer by strengthening community, social, and economic resiliency.
- **Buildings**: The city’s buildings will be upgraded against changing climate impacts.
- **Infrastructure**: Infrastructure systems across the region will adapt to enable continue services.
- **Waterfronts**: New York City’s coastal defenses will be strengthened against flooding and sea level rise.

Our Resilient City
Climate Change Adaptation Task Force

- Identify climate change-related risks to critical infrastructure and system interdependencies across various climate hazards
- Over 50 stakeholders (city, state, private sector):
  - Transportation
  - Waste, Sewer and Water
  - Energy
  - Telecom
  - Social Infrastructure (Parks; Hospitals)
- Assess climate change vulnerabilities and adaptation strategies - sector and neighborhood level

Projected floodplains for the 2020s, 2050s, 2080s, 2100

Source: FEMA; CUNY Institute for Sustainable Cities

- FEMA 2013 Preliminary FIRMs 100-year Floodplain
- Projected 2020s 100-year Floodplain
- Projected 2050s 100-year Floodplain
- Projected 2100 100-year Floodplain
Hardening Transportation Infrastructure

• $10.5b MTA Fix and Fortify initiatives for transit:
  ➢ Dry flood proofing tunnels, such as tunnel plugs, covers, and stop logs
  ➢ Wet floodproofing design, including submarine doors
  ➢ Deployable flood protection systems
  ➢ Elevate critical equipment
• Resiliency work ongoing on DOT traffic & ferry infrastructure
• Resiliency investments at NYC airports by PANYNJ and others

Source: MTA via Untapped Cities
Hardening Water and Wastewater Infrastructure

- $1.9b committed to build out sewers, alleviate flooding in SE Queens
- $1.5b green infrastructure program will alleviate urban flooding and improve water quality
- $161m committed on wastewater resiliency investments
- Dam upgrade program to protect water supply
Hardening Energy Infrastructure

- Con Edison Storm Hardening Collaborative
  - $1B storm hardening investments
  - Climate Change Study
- Storm hardening measures in rate cases with LIPA/PSEG, National Grid
- Repowering older in-city generation facilities to improve reliability
- Developing framework for resilient district energy and battery storage
- Developed 2 regional resiliency assessments with DHS on liquid fuels and commodities
NYC has begun using climate change projections in capital project design

**Goal of Design Guidelines:** establish consistent approach for using climate change data across the City capital plan

- Addresses 1) extreme heat, 2) extreme rainfall, 3) tidal inundation with sea level rise, and 4) coastal storms
- For the City of New York capital projects
- For new capital construction and major rehabilitations
- Buildings, infrastructure, and landscapes
NYC has begun using climate change projections in capital project design
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<th>End of Useful Life</th>
<th>Base Flood Elevation (BFE) in NAVD 88</th>
<th>+ Freeboard</th>
<th>+ Sea Level Rise Adjustment</th>
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Questions?

Latest version of Guidelines are at nyc.gov/resiliency