

# Stakeholder Engagement Report: Transportation

## Climate Change Preparedness in New Jersey

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This report was prepared for the New Jersey Climate Adaptation Alliance which is facilitated by Rutgers University. The views and insights in this report do not reflect the position of Rutgers University nor the members of the Alliance Advisory Committee.

## Introduction

The New Jersey Climate Adaptation Alliance is developing a compendium of state and local public policy recommendations to enhance climate change preparedness in New Jersey. As part of that effort, the Alliance solicited insight and recommendations through various methods to better understand how specific sectors in New Jersey perceive climate change impacts and how these sectors are prepared for the potential effects. The findings through this process will help the Alliance to identify specific policy changes that are needed within the public health sector so the sector can better prepare and respond to the public health needs that may develop as a result of a changing climate.

## Background on the Transportation Sector in New Jersey

Transportation infrastructure in New Jersey is extensive and comprises a number of subsectors, including roads, bridges and tunnels; passenger and freight rail; passenger bus services; maritime transportation and aviation.

### *Roads, bridges and tunnels*

Road infrastructure includes highways, streets, bridges, tunnels, traffic control systems and intelligent transportation systems, as well as buses, bus terminals and maintenance and storage facilities. New Jersey has 38,000 miles of roadway and 6,447 bridges.<sup>1</sup> New Jersey Transit operates 3,602 buses, and private carriers offer additional bus service to New York, Philadelphia, and Atlantic City.<sup>2</sup> Trucks on highways are the dominant mode of movement for the freight system in the state, accounting for 75 percent of all goods moved by weight.<sup>3</sup>

### *Rail*

Rail infrastructure includes rail tracks, track beds, overhead catenary wires, signal systems, bridges, tunnels, stations, maintenance and storage facilities, and rail cars and locomotives. New Jersey has 1,001 miles of passenger rail lines, two Class I rail freight carriers, and 14 regional and shortline railroads.<sup>4</sup> Passenger services are operated by NJ Transit, the Port Authority of New York and New Jersey (PATH), and the Delaware River Port Authority (DRPA). Amtrak also operates interstate passenger rail service in New Jersey.

### *Maritime*

Maritime infrastructure includes navigable coastal and interior waterways, channels, piers, terminals, ports, and vessels. New Jersey is home to the largest port on the east coast (Port of Newark/Elizabeth), which processes 80 million metric tons of cargo annually, as well as

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<sup>1</sup> NJDOT (2008)

<sup>2</sup> NJDOT (2008)

<sup>3</sup> PBQD (2008)

<sup>4</sup> PBQD (2008)

the South Jersey port complex on the Delaware River and Bay. There are 225 miles of navigable marine channels in the state.<sup>5</sup>

### *Aviation*

Aviation infrastructure includes airports, heliports and landing strips, seaplane bases, and air traffic control systems. There are three commercial airports in the state, including Newark Liberty International Airport, as well as 46 general aviation airports.<sup>6</sup>

## **Approach**

The research methods used for this investigation included a review of available literature from various sources, reviews of agency websites, one-on-one interviews and small group meetings with representatives from various transportation agencies operating transportation infrastructure and or services in New Jersey. This report summarizes the results of our research and outreach, including the insights and information gathered from the interviews regarding perceptions of climate change and how prepared transportation operators in New Jersey are to address the potential impacts of climate change.

The following agencies were consulted as part of the outreach process:

- Delaware Valley Regional Planning Commission
- New Jersey Department of Transportation
- New York Waterways (Ferry)
- North Jersey Transportation Planning Authority
- Southeastern Pennsylvania Transportation Authority (SEPTA)
- South Jersey Transportation Authority
- South Jersey Transportation Planning Organization

The following agencies/companies were contacted but declined to participate in an interview:

- Conrail
- CSX
- Delaware River Bridge Authority
- Delaware River Joint Toll Bridge Commission
- Delaware River Port Authority
- NJ TRANSIT
- New Jersey Turnpike Authority
- Norfolk Southern

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<sup>5</sup> PBQD (2008)

<sup>6</sup> NJDOT (2008)

- PANYNJ
- SeaStreak America, Inc.(Ferry)
- U.S. Coast Guard

The observations and recommendations contained in this report represent a synthesis of the input received and do not represent the views of any one participating individual or agency.

## **Summary**

### ***Climate Change Impacts of Greatest Concern***

Across all transportation subsectors, stakeholders perceive the greatest risk to transportation infrastructure to be flooding from more intense precipitation events, storm surge, and sea level rise. Temporary and permanent inundation of airports, seaport facilities, ferry terminals, roads, bridges and tunnels, rail lines and stations, and storage and maintenance facilities are expected on a more frequent basis. Impacts are likely to include: overtopping and washout of roads, bridges, and rail lines; damage to drainage systems and low-lying electronic and mechanical equipment; damage to traffic and transit signaling systems; damage to vehicles and sedimentation in navigable channels.

In addition, stakeholders stressed power outages caused by flooded substations and subsurface transformers are likely to cause secondary infrastructure damage and disruption of transportation operations and services for potentially extended periods of time. All of these impacts are anticipated to result in more frequent, and perhaps prolonged, disruptions and delays in air, rail, maritime and road-based transportation and travel.

In addition to the flooding risks associated with extreme weather events, stakeholders identified severe wind and wave action associated with coastal storms as a significant threat. Risks include travel and speed restrictions on bridges and highways from high winds, damage to bridge piers and abutments caused by wave action, wind damage to overhead signs and traffic signal infrastructure, and damage to overhead catenary wires caused by falling limbs and downed trees. Stakeholders again recognized that storm related power outages caused by damage electrical transmission lines and substations are likely to cause secondary infrastructure damage and disruption of transportation operations and services.

Finally, transportation stakeholders perceive temperature extremes, especially an increase in high heat days, to be a significant climate change threat. This is especially true for the owners and operators of rail and road infrastructure. Extended periods of high heat days are anticipated to result in softening of pavement and increased rutting on heavily trafficked roads and highways, damage to roadway and bridge expansion joints, rail track damage and catenary wire sag and excess tire wear on buses and other motor vehicles. Extended

periods of high ambient and near-surface temperatures at airports could also impact aircraft lift dynamics, resulting in payload restrictions and the potential need for longer runways.

### ***Super Storm Sandy Experiences***

As a group, transportation stakeholders in New Jersey do not believe that Tropical Storm Irene and Hurricane Sandy were “game changing” events that altered their perceptions of climate change or how their agencies are addressing climate adaptation. However, they mostly agreed that these and other recent weather-related events have provided a stronger foundation for exploring potential climate threats and how these threats may impact transportation infrastructure and operations over the long term.

### ***Stakeholder Perceptions of Preparedness***

Climate adaptation planning and implementation in New Jersey’s transportation sector is relatively new. While some efforts date back to the Intergovernmental Panel on Climate Change’s publication of its Fourth Assessment report on climate change impacts, vulnerability and adaptation in 2007, most efforts have occurred in the past two to three years. Climate adaptation efforts to date in New Jersey’s transportation sector fall primarily into four categories:

- 1) policy and planning, which includes research and vulnerability assessment;
- 2) emergency preparedness and operations;
- 3) infrastructure maintenance and asset management; and
- 4) hazard mitigation and infrastructure adaptation.

Most statewide and regional transportation agencies and authorities in New Jersey acknowledge the importance of climate change adaptation in long-range and or strategic business planning processes. However, beyond mentioning the importance of the potential impacts of climate change, none have formal, enterprise-wide adaptation policies or strategies in place. In addition, the extent to which climate change is being addressed varies widely across sub-sectors. Several organizations have staff positions or a department dedicated to sustainability policy and planning. Others indicate little attention has been given to addressing climate impacts and adaptation within their organizations.

Most entities addressing climate impacts indicate they have undertaken climate change-related research and planning initiatives. Research and planning initiatives have included mitigation-focused studies such as carbon footprint analyses and greenhouse gas inventories, as well as studies designed to enhance understanding of climate and weather-related infrastructure vulnerabilities. However, there was general agreement among stakeholders that more research and planning is needed to support and advance adaptation implementation in the future.

As noted above, transportation stakeholders do not attribute “game changing” significance to recent weather events. However, these events have prompted a significant body of activity related to reviewing and updating emergency management plans and policies and procedures related to large-scale weather emergencies, especially coastal storms. Focus areas for improvement have included: emergency shutdown of transportation infrastructure such as bridges, tunnels, and transit services; securing fixed and movable transportation assets; inter- and intra-agency coordination and communication prior to, during and after emergency events; communicating with the public during emergencies and contingency planning for things like providing emergency transportation to support evacuations and the temporary replacement of infrastructure and services rendered inoperable by an incident or disaster.

Recent weather events have also prompted transportation agencies and operators to revisit infrastructure maintenance programs and asset management systems. In particular, organizations are implementing more regular and effective maintenance of drainage systems, including culverts, retention/detention basins, and storm water inlets; improving tree maintenance along transportation and utility rights of way and making provisions for back-up power supply for critical infrastructure elements. Several agencies and authorities have also begun to adapt asset management systems to include data collection and analysis that can help identify vulnerable infrastructure for possible adaptation improvements in the future. Finally, transportation agencies are increasingly enlisting front-line facility managers and operations staff in resiliency discussions in order to capture the vast knowledge these individuals possess regarding infrastructure performance.

In general, transportation agencies have not undertaken specific capital programs and projects that they identify as focused on climate adaptation. However, several have advanced or are advancing projects and programs designed to make transportation infrastructure more resilient to extreme weather events, especially coastal storms. The most evident of these projects and programs is the inclusion of resiliency elements in Sandy-related recovery and rebuilding projects. Examples include reconstructing roadbeds with deeper substrata and thicker pavement, installation of check valves on storm water outlets to prevent backflow flooding in tidal areas and elevation and flood proofing of low-lying electrical and mechanical equipment associated with critical infrastructure such as movable bridges and transit signal systems. Although adaptation improvements are not generally being advanced under the auspices of climate change adaptation, resiliency improvements are more frequently being incorporated in project designs to enhance the transportation infrastructure reliability and performance in the context of more intense and extreme weather events.

## **Challenges**

Transportation infrastructure and assets in New Jersey are extensive and diverse. There are many public jurisdictions, agencies, authorities, and private owners and operators responsible for planning, constructing, operating and maintaining the infrastructure and the range of transportation services available. This complexity, combined with the current policy environment in New Jersey, and divergent opinions of climate change and its potential impacts among political leaders, makes climate preparedness planning and adaptation in New Jersey a significant challenge.

Yet, opposing political views on climate change are not completely curtailing adaptation activity in the transportation sector. Recent weather events, including Tropical Storm Irene, Hurricane Sandy and others, have provided important opportunities for climate adaptation discussions under the auspices of extreme weather preparedness and hazard mitigation. Discussing climate adaptation solely within the context of preparedness and hazard mitigation may prove to be an important challenge to climate change mitigation efforts in the broader context of climate adaptation policymaking. However, stakeholders have made progress in a number of areas, and agree more should be done to advance climate preparedness and enhance infrastructure resiliency in New Jersey's transportation sector. Nevertheless, stakeholders face scrutiny from the public in justifying these investments through increases in fares, utility rates, and other cost increases.

Regardless of political context, comprehensive understanding of infrastructure vulnerabilities remains limited across sectors, especially among local government jurisdictions responsible for municipal and county roads, bridges and other transportation infrastructure. The degree to which adaptation activity has advanced varies widely across agencies and modes. This may be a result of available resources (or lack thereof) and/or a matter of internal agency prioritization. Fiscal constraints and austerity have favored a focus on short term needs over longer term resiliency. Activity also varies by geography, with more activity occurring among agencies and authorities in the northern New Jersey and among stakeholders responsible for infrastructure in coastal areas and along riverine corridors versus inland areas. This pattern is consistent with perceived vulnerabilities among stakeholders.

Vulnerability assessment methodologies vary in terms of basic assumptions (e.g., degree of sea-level rise over what time frame), analytical approaches and planning horizon (e.g., 30-50-80-100 years). Guidance and available standards regarding how to incorporate infrastructure adaptation in planning, project design and capital programming is insufficient. In addition, many transportation engineers and infrastructure managers lack expertise in climate science and risk assessment approaches.



## Insights from the Author

The research and interviews conducted for this paper, shed light on the current state of preparedness in New Jersey's transportation sector related to climate change adaptation. It is within this context that the following recommendations are made:

### *Policy and Planning*

- Advance Federal and/or State legislation or regulation that makes climate resilient infrastructure design mandatory and mainstream rather than optional and the exception to standard practice.
- Develop better methods and guidance for conducting transportation infrastructure risk and vulnerability assessments. The guidance should promote greater uniformity in climate risk assumptions (e.g., degree of sea level rise over a specified time horizon, anticipated frequency and severity of high-heat days and extreme precipitation events).
- Provide additional resources to increase the number of detailed infrastructure vulnerability assessments completed in all transportation subsectors.
- Identify what data is needed to adequately assess and monitor vulnerability across transportation subsectors and address gaps in available data. For example, detailed data on infrastructure elevation is currently lacking.
- Conduct research to investigate the range of infrastructure adaptation strategies feasible in New Jersey and implement demonstration projects to assess the effectiveness of various strategies.
- Improve project cost-benefit analysis techniques to incorporate the value of resiliency, including guidance on monetizing risk avoidance in the short, medium and longer term.
- Improve communication with transportation decision-makers regarding the important long-term bottom-line benefits of resiliency improvements even though they may add cost in the short term.

### *Infrastructure and Maintenance*

- Improve infrastructure maintenance processes and procedures to mitigate existing hazards and promote resiliency of existing infrastructure as currently designed. For example, regular maintenance of drainage systems, dredging of navigable channels, and tree/vegetation trimming.
- Improve asset management systems and practices (e.g. inspection and maintenance protocols) to incorporate long-term climate impacts and resiliency considerations that can identify potential adaptation needs.
- Expand the use of asset management approaches by infrastructure managers at the county and municipal level.
- Retrofit existing infrastructure that relies on electrical power (e.g. traffic signals) with battery back-up and/or quick connect auxiliary power supply.

### *Hazard Mitigation and Infrastructure Adaptation*

- Develop revised/enhanced infrastructure design standards that address likely climate risks and infrastructure vulnerabilities, including but not limited to: drainage and culvert design standards that incorporate extreme precipitation events; pavement, bridge deck, rail and overhead catenary wire standards that address thermal expansion and heat stress; building and overhead sign standards that incorporate resiliency to high winds, and road bed, rail bed and bridge design standards that address potential damage from washout, erosion, scour and wave action.
- Extend infrastructure design life requirements from the traditional 30 years to 50 or 100 years which more accurately reflects the true life-cycle of major infrastructure investments. This longer design life would provide an opportunity to more adequately and appropriately address longer term climate risks, including sea level rise. Include guidance on how much over-design is appropriate in the short term to address longer term risks over the extended design life of a project.
- Develop training programs for infrastructure engineers and operators that address the basics of risk analysis, climate science and how changing climate conditions may impact transportation infrastructure (i.e., wind and wave action, storm surge, changes to hydrology and soil dynamics from more frequent inundation and higher volume/rapid precipitation events).

## Appendices

### Climate Adaptation Current Practice Scan Transportation Sector Outreach

#### Interview List

Agency	Roads, Bridges & Tunnels	Passenger Rail/Light Rail	Bus / Paratransit	Maritime (Ports / Ferries)	Aviation	Freight Rail
Conrail						X
CSX						X
Delaware River Bridge Authority	X			X	X	
Delaware River Joint Toll Bridge Commission	X					
Delaware River Port Authority	X	X		X		
Delaware Valley Regional Planning Commission	X	X		X		X
NJDOT	X			X	X	X
NJ TRANSIT		X	X			
New Jersey Turnpike Authority	X					
Norfolk Southern						X
North Jersey Transportation Planning Authority	X	X	X	X	X	X
NY Waterways (Ferry)				X		
PANYNJ	X	X		X	X	X
SeaStreak America, Inc.(Ferry)				X		
South Jersey Transportation Authority	X				X	
South Jersey Transportation Planning Organization	X					
U.S. Coast Guard				X		

#### Interview Topic Guide

##### INTRODUCTION

Good Morning/Afternoon. Thank you for agreeing to participate in this interview. The interview is being conducted as part of a research study aimed at document the current state of practice in New Jersey regarding climate change adaptation planning and implementation. The study is funded with a grant from the Kresge Foundation and is sponsored by the NJ Climate Adaptation Alliance. The Alliance is a network of private sector practitioners, academics, non-governmental organizations and business leaders working to build climate change preparedness capacity in NJ. Rutgers University facilitates the Alliance. More information on the Alliance can be found at the following Website: <http://climatechange.rutgers.edu/njadapt.html>.

The Voorhees Transportation Center at Rutgers University is working with the Alliance to document the current state of climate change preparedness in the Transportation Sector. We have been asked

to conduct a series of interviews with agencies, organizations and companies representing the various subsectors of transportation to investigate what various entities are doing in the area of climate change adaptation and what policy initiatives might help the transportation sector prepare better for the potential impacts of climate change.

Our conversation today should take about 30 minutes. Your participation is completely voluntary and you may choose not to answer any questions you are not comfortable answering and; if at any time during our conversation you wish to stop participating, you are completely free to do so. This research is confidential. Confidential means that the research records will include some information about you, such as your name, the agency where you work and your contact information. The detailed record of this interview will be available only to the research team responsible for this study, except as may be required by law. If a report of this study is published, or the results are presented at a professional conference, only group results will be stated. If the research team wants to directly attribute a remark made during these interviews to an individual, we will contact that individual first to seek permission.

Do you have any questions about the study or the interview process as I have explained it? If not, then we can get started.

### **QUESTIONS/PROBES**

1. Do you perceive the potential effects of global climate change (i.e., high heat days, increased precipitation, more frequent and intense storms, storm surge, sea-level rise, etc.) are a threat to your subsector of transportation infrastructure and services?
  - a. What types of vulnerabilities or impacts are of concern to your subsector of transportation?
  - b. What do you perceive to be the greatest vulnerability or threat to your subsector?
  - c. Are there any “communities” within your subsector or that rely on your subsector (e.g., populations, industries, places, etc.) that are particularly vulnerable to these threats or impacts?
  - d. Have perceptions of climate change within your subsector changed since Hurricanes Irene and Sandy impacted the region?
  - e. On a scale of 1-10, how important do you believe it is for your subsector, agency/company/organization to consider climate change impacts in planning and operations?
  
2. What efforts are you aware of within your subsector to adapt to extreme weather and/or other climate change impacts? Please describe these efforts
  - a. What would you say are the leading practices within your subsector?
  
3. Is your agency/company/organization currently engaged in efforts to adapt to potential climate change impacts?
  - a. In what ways are climate change impacts and adaptation considered during:
    - i. Long-range and/or strategic planning
    - ii. Project planning
    - iii. Capital programming
    - iv. Operations

- v. Maintenance
  - vi. Other
- b. Does your agency have in place or are you working on an “official” adaptation policy, plan or strategy? If so, please describe the policy, plan or strategy and how it is being implemented.
    - i. Can you make a copy of the policy, plan or strategy available to the research team?
  - c. What timeframe does your agency/company/organization consider when planning for adaptation? (i.e., 10, 20, 50, 100 years)
  - d. How “prepared” would you say your subsector and/or your agency/company/organization is to address the potential impacts of climate change?
  - e. Is there sufficient capacity within your subsector and/or agency/company/organization (i.e., knowledge/expertise, staffing, funding, etc.) to plan for and implement adaptation strategies?
  - f. What specific resources are needed to support enhanced climate change preparedness within your subsector?
4. What short, medium and long-term steps need to be taken to better prepare your subsector for climate change impacts?
    - a. Short term (1-3 years)
    - b. Medium term (3-10 years)
    - c. Long term (10+ years)
    - d. Do these time horizons make sense?
  5. What are the 3-5 most important state and local policy initiatives that you think should be undertaken in the next 12 months that could significantly increase climate change preparedness within the sector?
    - a. Are there any other policy initiatives (perhaps with a longer time horizon) that you believe would significantly increase climate change preparedness within your subsector?

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