



## Lessons Learned from Super Storm Sandy

Following Super Storm Sandy's assault on the New York metropolitan area in 2012, researchers from the University Transportation Research Center (UTRC) at the City University of New York conducted surveys to determine lessons learned from local responders to the devastation in the seaport. The surveys were conducted by UTRC consortium member Stevens Institute of Technology, Hoboken, New Jersey, and are included in the study *Lessons from Hurricane Sandy for Port Resilience*.

Survey findings<sup>1</sup> identified several general principles for urban coastal responders :

1. safety of life is the primary consideration,
2. make plans before hand to provide leadership across organizations with strong and redundant communication systems between the leadership team and their staff,
3. current design and building codes must be re-evaluated given the frequency of storms,
4. protect property and operational continuity by raising buildings and moving electrical systems up out of the flood zone, and
5. conduct drills and tabletop exercises to build responder capabilities and experience.

Before making landfall on the October 29, 2012, Hurricane Sandy weakened to a post-tropical cyclone (Super Storm Sandy). However during its northward move, Sandy increased significantly in size, driving a catastrophic storm surge and waves into the Northeast coast of the United States (figure 1).

New York Harbor was directly in the path of the most damaging part of the storm. There was significant impact on many of the terminal facilities of the Port of New York and New Jersey. The U.S. Coast Guard closed the entire Port to all traffic before the storm hit on October 28<sup>th</sup>, and it was not fully reopened to vessel traffic until November 4<sup>th</sup>. After the storm, the U.S. Coast Guard, U.S. Army Corps of Engineers, Sandy Hook Pilots, and others quickly surveyed the damage to prepare to reopen the Port. Activities included conducting

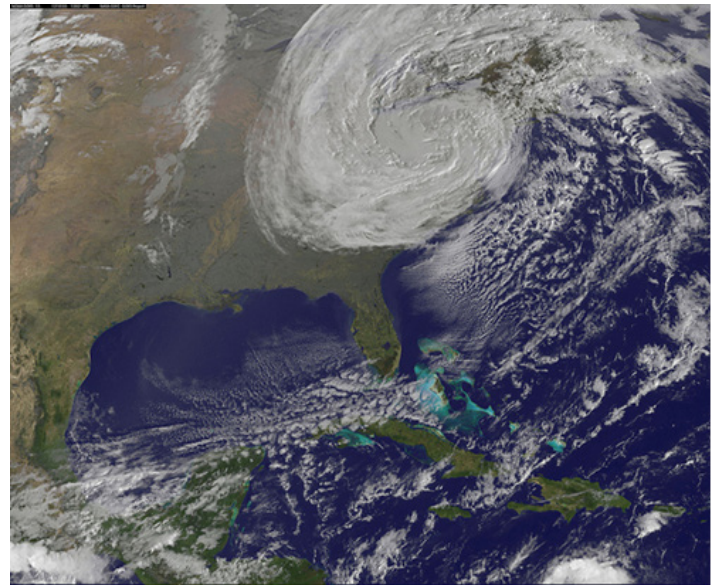


Figure 1: Superstorm Sandy at 6:02 a.m. EDT, Oct. 30, 2012.

waterway surveys to ensure navigational aids were on station, locating and removing marine debris, locating floating shipping containers, and making sure that the channels were cleared for navigation. However, even though the waterways were reopened within days, numerous port facilities were unable to resume operations for weeks due to extensive damage. In particular, no activities could occur at marine terminals until electricity was restored, and industry needs were a lower priority than service recovery at hospitals and residences. Recovery of the Port's supply chain functions did not occur for several weeks— or months in some cases.

A series of interviews were conducted to identify lessons learned by port stakeholders that could assist in returning the Port to full service more rapidly in the future. The specific objective of the research was to develop guidance that could enhance port resilience. The study used surveys of key port stakeholders to identify and elaborate on the steps that were taken to coordinate recovery activities. The project also reviewed the existing design codes for port facilities and infrastructure and attempted to identify how these design codes could be improved. The researchers utilized numerous stakeholder interviews to gather information, to understand events, and to identify the circumstances that led to the Port's storm-related impacts.

<sup>1</sup> T.H. Wakeman and J.K. Miller, *Lessons from Hurricane Sandy for Port Resilience*, Final Report, University Transportation Research Center, Region 2, UTRC-RF Project No. 49997-56-24, December 2013, Available at: <http://www.utrc2.org/publications/hurricane-sandy-port-resilience>.

Capt. Andrew McGovern

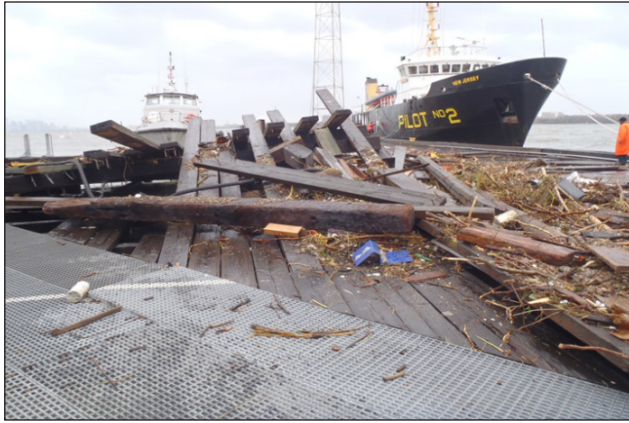


Figure 2: Port Damage

From a structural standpoint, Sandy had a relatively minor impact on the Port's waterside structures. Piers and wharves in large ports such as the Port of New York and New Jersey are typically designed to withstand horizontal impact loads from fully loaded ships and extreme vertical loads associated with containers and cargo handling equipment. While most of the waterside structures made it through the storm unscathed, there were many instances of wave and surge related damage to ancillary structures, equipment, and cargo throughout the port (figure 2).

Most major port damage was due to the 6-8 foot storm surge plus a spring high tide that led to water levels in excess of 12 feet above normal. While storms such as Sandy are relatively rare, global sea level rise increases the likelihood that storms capable of similar impacts will occur in the future. For this reason, consideration should be given to making potential upgrades to the existing guidelines for coastal infrastructure design that include consideration of future sea level rise. Based on a review of the existing local building codes and the lessons learned from the interviews, the following recommendations were made:

1. A uniform building code should be created and applied for the entire harbor region, including port facilities. Currently, these facilities fall under exemptions to local building codes, which include the state codes of New York and New Jersey and the New York City building code.
2. The responsible state and municipal agencies should adopt ASCE 24 for siting of critical utility and mechanical equipment and should directly reference ASCE 24 for flood resistant design for all port facilities. (ASCE 24 is

published by the American Society of Civil Engineers and presents the minimum requirements and performance expectations for the siting, design, and construction of buildings and structures in areas subject to flood hazard.)

3. The facility owners should adopt one of the available design documents (or create their own) as the primary source for all storm-related design—such as ASCE 24. Current practice is to rely on a series of documents that consistently cross-reference one another.
4. The Port Authority should add a section to their lease agreements devoted to Port specific structural considerations.
5. The Port of New York and New Jersey should adopt a reasonable and consistent methodology for incorporating sea level rise in their planned engineering upgrades.

Merging resiliency principles from reviewed literature and the descriptions by stakeholders, a simple stepwise process was formulated for enhancing port resiliency. There are activities that can take place prior to a disruption (i.e., pre-event) or they can take place following the occurrence of an incident (post-event). The two timeframes may be further divided into two categories: 1) issues primarily defined by infrastructure and organizational mandates, and 2) those issues that are characterized by human behavior. It was evident from the interviews that many stakeholders felt that one of the keys to their success in reopening the Port quickly was their ability to improvise and establish *ad hoc* processes that drew on their prior relationships, their shared experiences, and their trust in one another's professional expertise.

## About This Project

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