"Hurricane Sandy Coastal Projects Performance Evaluation Study"

U.S. Army Corps of Engineers, Assistant Secretary of the Army for Civil Works, Report to Congress, Disaster Relief Appropriations Act, 2013

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Background: In January 2013, Congress enacted *Public Law 113-2, Disaster Relief Appropriations Act 2013* to fund recovery, evaluation, and planning efforts in the US Army Corps of Engineers (USACE) districts affected by Hurricane Sandy which made landfall in October 2012. The "*Hurricane Sandy Coastal Projects Performance Evaluation Study"* (USACE Performance Evaluation Study) investigated the performance (engineering, ability to provide safety, and economic benefit) of 115 federal projects in the areas impacted by the storm; of which 75 were located within the North Atlantic Division and were the focus of this review.

An ASBPA Science and Technology (S&T) Committee workgroup reviewed the USACE Performance Evaluation Study to identify how the report supports ASBPA on the following topics:

1. Reducing coastal risk is in the national interest.
2. Storm damage reduction projects provide national economic benefits.
3. Additional research needed.

Reducing Coastal Risk is in the National Interest: The USACE Performance Evaluation Study does not explicitly address reducing coastal risk. Section 3.0 provides a review of the performance of projects based on their exposure to varying levels of Hurricane Sandy's forces: from extreme tides and waves (>200-year return event – 6 projects) to those projects that experienced lesser tidal and wave elevations (<30-year return event- 69 projects). Most of the projects evaluated in the study were located along an open coast and included rock revetments, beach fills, groins, levees, and/or bulkheads. Six projects were exposed to extreme water levels (Table 8), where the storm's tides and waves exceeded design. At two project locations, significant wave damages to shoreline structures and to the first or second row buildings occurred but were not widespread (e.g Rockaway Beach NY). Damages were a magnitude lower than would have occurred without the projects (though the study does not provide quantification). An example of exemplary performance was Coney Island NY.

In addition, many areas along the bay sides of the coastal barriers and mainland experienced widespread flooding from the storm while adjacent oceanfront areas protected by federal projects, often at higher elevations, were spared (e.g. Westhampton Beach NY). Most USACE coastal storm damage reduction projects are not designed or are limited in scope to address back-bay or mainland wave inundation and flooding, and the USACE does not quantify the impacts to these areas, thus future mitigation efforts may not be the most comprehensive solution for these areas.

It will take a multitude of federal, state, and local agencies to plan and enforce coastal risk reduction measures. From the perspective of the USACE, comprehensive protection is limited by several barriers such as: authority for addressing back-bay flooding, lack of coastal sand dunes, limited pre-storm data, real estate easements, funding for maintenance of the nourished shoreline, permitting constraints and environmental windows, authorization for future coastal and storm damage reduction projects, cost sharing requirements, floodplain management, and opposition from shoreline users.

Storm Damage Reduction Projects Provide National Economic Benefits:
The economic benefits of the projects evaluated in the study were not quantified. Section 3.1.3 presents qualitative discussions for individual projects on whether the project provided a reduction to storm damages, protected critical infrastructure, or reduced the post-storm recovery efforts. No national benefit was calculated nor presented in the study.

With respect to storm damage reduction, the study noted that only projects exposed to conditions worse than the design event suffered significant property damages. However projects provided significant benefits such as those that incorporated a protective dune or storm berm, generally held damages to a minimum. Furthermore, rubble mound structures, such as groins and revetments, generally seemed to withstand the storm conditions, although the discussion of structures was limited to post-storm visual observations at Coney Island, Sea Bright, and Westhampton (Sections 3.1.2 and 3.2.2).

Patterns of damages were estimated for some of the affected communities along the rivers and tidal inlets in sections of Monmouth County NJ using the FEMA Modeling Task Force-Hurricane Sandy Impact Analysis. This tool enabled the agency to categorize the damages to homes and businesses as *affected*, *minor*, *major*, *destroyed* and provided some value estimate for the number of damaged structures (see Table 9), though no links are provided between the presence or performance of federal projects and those damaged structures.

Concerns:
Other concerns of the workgroup that should receive further investigation:

- The study provides limited discussion regarding the storm damage reduction benefits or impacts of singular coastal structures such as seawalls, groins, geotubes, and breakwaters. These types of projects may become a more viable alternative to erosion control if sand sources are not available, yet there are many obstacles in permitting such features;
- There is a higher cost of project execution due to limited windows, dredge availability, and multiple mobilizations;
- For some coastal areas, some of the local sponsors are experiencing difficulties in real estate acquisition, timely funding match, and opposition to dunes.

Additional Research Needed:
Based upon the information provided in the study, the workgroup recommends the following:

- Storm damage reduction studies/projects that address back-bay flooding;
- Pre-storm monitoring/surveys (needed for better quantification);
- Studies or agency evaluations of existing restrictive construction windows;
- Quantification of local and regional shoreline changes from existing coastal structures;
- Update terminology and make use of modern design technology *(Section 1.3.2 mentions structures in the context that "many of the projects were authorized and completed over a broad range of time when different terminologies were used…" With regard to hard structures, current terminology uses "Shore Protection Structures" to identify seawalls and other forms of shoreline armoring which may be detrimental to beaches, and "Erosion Control Structures" to identify detached breakwaters and other hard structures that stabilize beaches by reducing erosion through reduction of wave energy. Regulation and policy that treat all "Hard Structures" in the same manner should be updated so that projects can make use of modern design technology in the most effective manner. The approaches of using either Pilot Projects, or Phasing Projects, used effectively by the Corps successfully in the past, should again be reconsidered as effective approaches to designing projects in the highly variable coastal environment.)*;
- Evaluations of redundancy measures such as incorporating structures (buried seawalls) in shore protection designs for an extreme event;
- Quantification of the value of reduced damages and examples of areas impacted with and without federal projects;
- Quantification of volumetric sand losses, overwash volumes, etc. (i.e. a sand budget referenced to standardized design, pre and post-storm cross shore and longshore project limits);
- Quantification of profile changes to better illustrate the response of beaches to the storm (i.e. what were the post-storm beach slopes? – data are needed for future designs, particularly to illustrate limiting cases and help calibrate cross-shore models); and
- Studies of project sediment quality and how it impacts project performance.

As we have seen from the billions of federal dollars expended during the response and recovery phases of Hurricane Sandy and with the threat of sea level rise and increased storms, it is clear that reducing coastal risk is in the national interest. The USACE Performance Evaluation Study listed projects that provided measureable protection under varied coastal conditions and recommends planning, design, and construction activities that could withstand future extreme events. The ASBPA S&T Committee supports continued efforts in determining the needed scientific data, engineered projects, and planning efforts that will reduce future expenditures in coastal risk areas.