

CM Lessons Learned:

Government Program to repair/ elevate damaged properties:

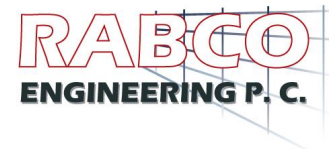
HURRICANE SANDY



Presentation by Robert Bennett, PE

RABCO ENGINEERING PC

Freeport, New York



Superstorm Sandy

- **Superstorm Sandy**
- On the night of October 29, 2012, New York and the tri-state region, which includes New Jersey and Connecticut, were devastated by Superstorm Sandy, the most destructive storm of the 2012 Atlantic Ocean hurricane season. At the time of landfall, Superstorm Sandy was classified as post-tropical, however, several characteristics led to the especially high level and breadth of flooding, including:
 - Daily high tide cycles;
 - A full moon, which added to the high tides;
 - Strong winds; and,
 - Moderate amounts of rainfall in upstream areas, which drained through the Community and converged with the incoming storm surge along drainage corridors.
- In addition to Superstorm Sandy's impacts, long- term sea level rise has added roughly one foot to local water levels since 1900.⁷

Hurricane Sandy from space



The beginning of Hurricane Sandy

Projected path of Hurricane Sandy, 26 October 2012



Sandy north of Cuba and predicted path on October 25, 2012



Hurricane Sandy 1,850 km wide



Map of Mid- Atlantic States



Map of Long Island and NYC



Aerial view of NYC looking south



Aerial view of south Manhattan looking north



The Brooklyn–Battery Tunnel remained flooded after the storm



Submerged NYC taxi cabs



Beachfront homes destroyed



Floating cars from underground parking garage



Destroyed amusement park ride at Coney Island Brooklyn, NY



Incoming high tide on New Jersey shoreline



Post fire damage at Breezy Point, Queens, NY



Post fire damage at Breezy Point, Queens, NY



Post fire damage at Breezy Point, Queens, NY



sub-basement; 1 State Street, NYC



Downtown Manhattan cleanup



Downtown Manhattan



Downtown Manhattan



Downtown Manhattan



NY State Governor Cuomo



- On November 26, 2012, Governor Cuomo called Sandy "more impactful" than Hurricane Katrina, and estimated costs to New York at \$42 billion.
- The storm severely damaged or destroyed around 100,000 homes on Long Island with more than 2,000 homes deemed uninhabitable there.
- There were 71 Hurricane Sandy-related deaths in the state of New York.

NY State/ FEMA program for storm recovery



GOSR

Governor's Office of Storm Recovery

- Established in June 2013, GOSR coordinates statewide recovery efforts for Superstorm Sandy, Hurricane Irene and Tropical Storm Lee. Through its NYRCR Program– as well as its NY Rising Housing Recovery, Small Business and Infrastructure programs– GOSR invests \$4.4 billion made available through HUD's CDBG-DR Program to better prepare New York for future extreme weather events.

Types of Projects

- Critical Facility/ Infrastructure Hardening
- Hardening of Shelters, fire departments, water, wastewater plants, and other similar facilities. These projects represent an array of facilities and infrastructure that are retrofitted to continue operating during severe storm events and other emergencies

Types of Projects

- Drainage Improvements and Green Infrastructure
 - Grey and green projects that expand the capacity of drainage infrastructure to handle heavy rainfall events
- Economic Development
 - Workforce development, small business grants, and economic corridor revitalization

Types of Projects

- Emergency preparedness & Recovery Operations
- Non-Infrastructure projects that are broadly dedicated to the development or expansion of programs and services that communities rely on to prepare for and respond to emergency events
- Economic Development
- Workforce development, small business grants, and economic corridor revitalization
- Emergency preparedness & Recovery Operations
- Non-Infrastructure projects that are broadly dedicated to the development or expansion of programs and services that communities rely on to prepare for and respond to emergency events

Types of Projects

- Housing Resiliency/ Property Elevations
- Residential resiliency technical assistance, housing elevation, affordable housing development
- Shoreline Protection (Ocean and Riverine)
- Projects that preserve property and/or prevent erosion, such as living shorelines and rock revetments, bulkheads

Types of Projects

- **Transportation Infrastructure**
- Streetlights, road elevation, and other projects that directly repair or enhance structures which are integral to the integrity of transportation routes and devices that are critical to a community during a severe storm event



Residence Home elevation programs

- NYC- “Build it Back”
- Long Island, NY- “NY Rising”
- Programs were developed under GOSR
(Governor’s Office of Storm Recovery)

Housing Resiliency/ Property Elevations Protection Features

- -Elevate properties above the base flood elevation
- -provide new hardened foundation system (on piles)
- -elevate utilities/ equipment
- -reinforce structures for improved resistance to wind loading
- -Flood vents or open pier system

Elevated wood frame residence



Elevated wood frame residence



Elevated wood frame residence



Elevated wood frame residence



100 year old residence at grade



Elevated wood frame residence



Completed home elevation



Existing damaged home on grade



Elevated home on open pier system





Elevated home on open pier system



Elevated home on open pier system



Major Program Pitfalls

- -out of town Program managers unfamiliar with local conditions/ requirements
- -loosely defined design parameters

Collapsed home during construction



Collapsed home during construction



Collapsed home during construction



Major Program Pitfalls

Major Program Pitfalls

- -unbalanced funding
- -requirement for property owners to coordinate directly with contractors

Unbalanced funding



Unbalanced funding

Unbalanced/ inappropriated funding



Unbalanced funding



Unbalanced funding



Major Program Pitfalls

- -requirement for property owners to coordinate directly with contractors
- -program still not completed almost 7 years after storm occurrence

Incomplete construction



Incomplete construction



Major Program Pitfalls

- -Lack of communication/ coordination between project participants (eg. CM's, local Building Departments, Engineers/ Architects, insurance companies, utility companies, banks, property owners, contractors)

Flood gates; New Bedford, MA



Flood gates; New Bedford, MA



Long Island, New York



1920 home at grade level



1920 home under construction



1920 home under construction



1920 home under construction



1920 home elevation complete



1920 home elevation complete



Lessons Learned

- -PLANNING/ PLANNING/ PLANNING
- -COORDINATION/ COORDINATION/
COORDINATION

고맙습니다

Thank you

Danke schön

merci beaucoup

muchas gracias

Большое спасибо

ขอบคุณมากครับ



RABCO
ENGINEERING P. C.