Lessons Learned in Urban Flooding from Sandy

Sponsored by:
ASFPM Non-Structural Floodproofing Committee
William L. Coulbourne, P.E.
ATC
Manny Perotin, P.E.
CDMSmith
Acknowledgements

- ASCE/SEI
  - Supported by the Structural Engineering Institute
- FEMA Mitigation Assessment Teams
  - FEMA Building Science Branch
  - Supported by FEMA Region II
Outline

- Scale of the Sandy event
- Size of the urban problem
- Major flooding damage
- Reasonable mitigation measures
- Residual risk
Scale of Sandy Flood

- Storm surge of 8-14 ft in lower Manhattan
- Buildings flooded overland
- Basements filled with equipment flooded
- Building inter-connectivity allowed water to enter through utility tunnels and manholes
- Severe impact to services in some areas
Scale of Possible Urban Flood Problem
Urban Challenges

- High density – many high-rises, many all residential
- High value on floors above grade, forces utilities to floors below grade
- Important utilities service – can be down for days (electric, WWTP, phone, cable, internet)
- Building and utility inter-connectivity
Wall Street
Mitigation Strategies

- Dry floodproofing – shields, barriers
- Elevating utilities and critical functions
- Enclosures
- Temporary barriers/bladders
Lessons Learned – Urban Flooding from Sandy

- Tulane Medical Center, New Orleans
  - Core Area
    - Shields
    - Door
    - Reinforced walls
Reasonable Measures
Enclosures

Flood resistance in interior core areas

– “Floodproofed enclosure” for areas such as mechanical or electrical equipment, which can’t be relocated.
Residual Risk

- Level of risk not offset by hazard resistant design or insurance
- Example: A building elevated to the BFE is still vulnerable to damage when the 1-percent annual-chance flood is exceeded.

Consider the severity of the consequences of exceeding design conditions
Conclusions

- Residual risk
  - Human factors
  - Need for redundancies
  - Emergency plans and measures
  - O&M
- Million points of entry
- Salt water - corrosion
Questions?