Storm Preparedness & Hazard Mitigation for Post-Sandy Red Hook, Brooklyn, NY
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Agenda

• Introduction to the Project
• Red Hook, Brooklyn
• Sandy’s Impact
• Hazard Risks
• Business Case Studies
• Mitigation Solutions
• Small Business Preparedness Plans
• Concluding Remarks & Lessons Learned
### Keys to Disaster Preparedness Planning

<table>
<thead>
<tr>
<th>KNOWLEDGE</th>
<th>Understand hazards and mitigation techniques</th>
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<tbody>
<tr>
<td>PREPARE</td>
<td>Design a readiness and response action plan using standardized templates</td>
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<tr>
<td>CONNECT</td>
<td>Network with other businesses to strengthen neighborhood disaster resiliency</td>
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Know Hazard Risks & Consequences

Flood

Wind
Hurricane Sandy Small Business Impacts

- Extended and widespread power outages
- Erratic response in some New York neighborhoods
- No central source for recovery information or assistance
Flood Risk is constantly changing

- Development
- Mitigation efforts

Methods to identify risk are improving

Manhattan at European Settlement

Manhattan today
NYC Evacuation Zones

NEW YORK CITY HURRICANE EVACUATION ZONES

KNOW YOUR ZONE*
1. Determine whether you live in an evacuation zone by using the hurricane evacuation zone locator at nyc.gov/hurrzone or reviewing this map. If your address is in one of the City’s hurricane evacuation zones, you may be ordered to evacuate if a hurricane threatens New York City.
2. Evacuees should prepare to stay with friends or family whenever outside evacuation zone boundaries.
3. If you can’t stay with friends or family, use the Find shelter tool on nyc.gov/hurrzone or call 311 to find a nearby shelter. Information on shelters also is provided by the Disaster Assistance Center, 718-972-0370.
4. Evacuation information is subject to change as the threat information and weather evolves. Check the City’s website for updated information or call 311. If you are uncertain or confused, stay put.

NEW YORK CITY HURRICANE EVACUATION ZONES**
When a coastal storm is approaching, the City may order the evacuation of low-lying areas in order to protect residents from storm surge and flooding. Please refer to the map below to determine whether you may be ordered to evacuate. Evacuation zones will be established based on the projected threat levels from a hurricane’s forecasted path, track, and storm surge.

■ Evacuation zones
* Information on evacuation zones is subject to change.
** Information on evacuation zones is subject to change.
Southwest Brooklyn
(Zone AE 12)

Zone AE = High Flood Risk
EL 12 = Base Flood Elevation of 12’ above sea level (not above the ground) during 1% annual chance event (100 year flood)
Wind Hazard
Mitigation Case Studies

- Case studies calibrated more general mitigation solutions:
  - Hazard environment
  - Range of businesses
  - Owned vs. leased space
  - Different building types
Mitigation Case Studies

Methodology:

- Red Hook Background
- Business operations
- Hurricane Sandy impacts
- Storm Preparedness Challenges
- Mitigation solutions
Small Business Case Studies

• Small Artisan Fabricator: Flickinger Glass Works
• Mid-size Manufacturer: Linda Tool
• Café Restaurant: Ft. Defiance
Hazard Risks and Consequences

- **Buildings**
  - Flooding
  - Power loss

- **Infrastructure (transportation)**
  - Staff access to business
  - Erratic response time for services recovery

- **Business Operations**
  - Document recovery
  - Lack of back-up of key records
  - IT and Telecommunications

Super storm Sandy flood water receding from MTA R line tunnel
Flickinger Glassworks

Business Operations:

- Small, artisan shop
- Custom repair and new glass fixture crafting using steel molds to specifications
- Staff of 8 to 16 based on business volume
Flickinger Glassworks

Hazard Risks:
• Located on Upper New York Bay
  • Near Buttermilk Channel
• Base Flood Elevation = +12 ft*
  • Existing ground elev. +7 ft.
• Front door and rear doors and windows are not water-tight
• Industrial hanging doors between spaces increase risk

* Base Flood Elevation based on FEMA post-Superstorm Sandy data

Connecting door between leased units allows water to enter Flickinger production area.
Hurricane Sandy Impacts

- Flood depth of about 3 ft.
- Business off-line for 4 – 6 weeks
- Operating equipment motors destroyed
- Business records destroyed
  - Off-site back-up storage also destroyed
- Brackish water contaminated kiln lining brick
Flickinger Glassworks

Storm Preparedness Challenges

• Prevent flooding of business space
  • Includes flooding from adjacent businesses
• Difficulty in obtaining replacement parts for operational equipment
• Lost customer design archives
• Lost business records
• Staff availability via public transportation

Five at-risk custom kilns; this one features newly elevated electrical engine to the left of the kiln.
Permanent Mitigation Solutions

- Elevate critical equipment such as kiln motors and polishing equipment
- Seal interior pass doors
- Scan and archive key customer designs using secure off-site provider
Temporary Mitigation Measures

- Evacuate critical office equipment, and small production equipment
- Install pre-fabricated $\frac{3}{4}$” plywood over door and window openings
  - seal edges with spray foam
- Use jacks and block stands to elevate equipment
- Institute emergency communications via e-blast
Window Shield Solution

Old Warehouse Doors & Windows Need Protection

Window Shield Design
Linda Tool

Business Operations:
- Mid-size manufacturer of machined metal parts
- Custom fabrication of finished metal parts/components
- Maintains International Standards Organizations (ISO) quality management certification
- Staff of 20 to 30 based on business volume
Linda Tool

Hazard Risks:

- Business is a few blocks inland from the Upper New York Bay and Erie Basin; Base Flood Elevation = 12 ft.*
  - Existing ground elevation = + 6 ft.
- Two pedestrian doors and one overhead door
- Plant floor is 3.5 ft. above street level
  - Office space located on mezzanine level

* Base Flood Elevation based on FEMA post-Superstorm Sandy data
Linda Tool

Hurricane Sandy Impacts

• Flood depth of 3 ft. in loading dock bay
• Sewer line back flow contaminated mechanical room and locker/restroom area
  o Eleven months later still working to fulfill backlog orders

High water mark in mechanical/electrical switchgear room
Linda Tool

Storm Preparedness Challenges

• Prevent flood water from reaching production equipment
• Potential flood water damage to small tools and delicate measuring equipment
• Potential health hazards from sewer backflow
• Temperature and humidity control
• Staff availability via public transportation
Linda Tool

Permanent Mitigation Solutions

• Install backflow preventer valve
• Install watertight pedestrian doors
• Reorganize plant floor storage to elevate sensitive items

Small tools and measuring equipment
Stored at floor level
Linda Tool

Temporary Mitigation Measures

• Install temporary flood barrier at loading bay door
• Install temporary flood barrier on plant floor around the loading bay
• Institute emergency communications programs

Approximate top of temporary Flood Barrier
Mechanical Room Drain
Flood Mitigation Applications

Backflow prevention

- Essential in areas with combined sewer system
- Maintenance is necessary
- NYC Code requires dual action backflow prevention
Fort Defiance Cafe

Business Operations:
• Locally owned and operated neighborhood café and bar
• Staff of about 20
• Open 7 days/week
  • 10:00 AM to Midnight except Tuesday
  • 10:00 AM to 3:00 PM Tuesdays
Fort Defiance Cafe

Hazard Risks:

• Basement flooding
  • Through sidewalk entry
  • Through basement wall masonry
• Water damage to ground floor
  • Water rising from basement
  • Seepage through door

Sidewalk hatch door to basement
Fort Defiance Cafe

Hurricane Sandy Impacts

- Basement flooding damaged critical equipment and inventory
- Ground floor flooding damaged equipment, furnishings and fixtures
- Lost food
- Electric meters for other tenants also located in basement
Fort Defiance Cafe

Storm Preparedness Challenges

• Prevent basement flooding
• Prevent ground floor flooding of food preparation and dining areas
• Moving large quantity of small items to higher ground; e.g.
  • Food stuffs
  • Wine bottles
• Dewatering flood water from basement

Stairway from sidewalk hatch to basement
Fort Defiance Cafe

Permanent Mitigation Solutions

• Clean and repoint basement walls
• Install flood door at front entry
Fort Defiance Cafe

Temporary Mitigation Measures

• Temporary flood barriers at openings
• Conduct plumbing survey and seal unused drains
• Disconnect and relocate critical equipment
• Evacuate critical supplies and inventory prior to severe storm event
Sidewalk Door Solution
Case Study Summary
Case Study Summary

Common challenges

• Flood damage to business assets
  • Operating equipment
  • Business records

• Staff availability/mobility
  • Mass transit-depandant

• Information on recovery assistance
  • Public sources
  • Private sources

Post Sandy flooding of MTA subway station
Know your Hazard Risks & Consequences

Step 1: What are my Hazards and Consequences?
Step 2: What is my Recovery Strategy?
Step 3: Develop My Plan
Step 4: Test My Plan

Revise in June/December and after Activation
Explore Mitigation Solutions

Storm Preparedness Plan Cycle
Case Study Conclusions
Lessons Learned

• Small businesses have unique building space and specific challenges

• They often rent space, so cannot mitigate easily

• Preparedness Planning is essential to protect business operations, leading to resiliency

• Small businesses are underserved by our community

• Old urban, northeast neighborhoods present unique challenges.
Let’s Keep Talking

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