

# 1 Prevent Storm Damage to Homes

## I. Summary

### Issue:

Flooding, precipitation, high winds, storm surge, wave action, and wind-/water-borne debris can damage homes. Much of this damage can be prevented with targeted design and construction measures.

### Recommendation:

Require new and replacement windows to be wind-resistant. Recommend anchoring framing to foundations and strengthening foundations and basements in existing homes. Develop custom requirements for attached homes that present unique challenges.

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## II. Proposed Legislation, Rule or Study

*Amendments to the New York City Building Code:*

1. Add new sections to Chapter 16 as follows:
  - a. UV-resistant urethane caulking sealant shall be used for all exterior window and door assemblies (no silicone or latex caulking).
  - b. All new windows, including those in existing buildings, shall use a net design wind pressure and suction of 30 pounds per square foot.
  - c. Doorframe fasteners shall be of length sufficient to penetrate adjacent structural members by at least 1 1/2". Wood screws should be minimum #12. Nails should be minimum 12d. Tapcons should be at least 3/16" diameter. Spacing shall be such that the first fastener is located within 6" of the end of the jamb (one fastener at the top and bottom of each side) and then at no more than 16" spacing along vertical sides and top of frame.
  - d. Door hinge and strike plate fasteners shall be at least 3" in length or of sufficient length to penetrate adjacent structural members by at least 1-1/2".
  - e. Window frame fasteners shall be of length sufficient to penetrate adjacent structural members by at least 1 1/2". Wood screws should be minimum #12. Nails should be minimum 12d. Tapcons should be at least 3/16" diameter. Spacing shall be such that the first fastener is located within 6" of the end of the jamb (one fastener at the top and bottom of each side) and then at no more than 12" spacing around the perimeter.

### III. Supporting Information

#### Expanded Issue and Benefits:

##### Storm Surge Retrofits

Most of the structural damage to small homes during Sandy was caused by the storm surge. Requirements already exist to mitigate the effects of storm surge on new construction, substantially damaged homes, and those undergoing substantial alterations. Uses within flood zones that are not being raised and wet-floodproofed remain vulnerable to major structural damage and a risk of collapse in future storm surge events. Raising an existing house, rebuilding or reinforcing its existing foundation, and backfilling an existing basement or cellar will decrease these risks; however, these measures may be prohibitively expensive if no supplemental funding sources are available to homeowners.

For existing homes located in Coastal A and V Zone areas that are not required to implement storm surge retrofits, the following wet-floodproofing and structural improvement measures are recommended:

1. Elevate structure above Design Flood Elevation (“DFE”) (BC G304.1.1.1 for Zone A; BC G304.2.2 for Zone V)
2. Backfill basement to grade (BC G304.1.1.1 for Zone A; BC G304.2.2 for Zone V)
3. Rebuild or reinforce foundation to address flood loads, e.g. add interior piers (ASCE 24 Sections 1.5 and 1.6 for Zone A; BC G304.2.1 and ASCE 24 Sections 1.5 and 1.6 for Zone V)
4. Provide foundation flood openings in Zone A or open foundation in Zone V (ASCE 24 Section 2.6.1 for Zone A; BC G304.2.3 for Zone V)
5. Provide anchorage between superstructure and substructure (ASCE 24 Section 1.5 for Zone A; BC G304.2.1 and ASCE 24 Section 1.5 for Zone V)
6. Remove non-structural interior partitions below the DFE unless otherwise required by code

##### Windows and Doors

While the NYC Building Code specifies wind load design pressure requirements for windows and doors in new construction and substantial renovation, three areas related to building apertures remain to be addressed:

1. **Wind load:** NYC Building Code §1609.6.3.3 “Components and cladding” under the Simplified Design Procedure II currently references a net design wind pressure and suction of 30 pounds per square foot (psf). However, §1609.1.2 “Minimum Wind Loads” references 20 psf. The Task Force proposes requiring compliance with the more stringent 30 psf measure and further recommends that compliance be mandatory for all homes. Replacing windows to meet the current wind load performance standards will also bring windows into compliance with the current energy code.
2. **Installation:** When windows and doors are blown or forced in, precipitation and debris damage will increase and the positive pressure created by these openings might

contribute to roofs being forced upward. Research has shown that strengthening windows and doors can raise the wind speed required to lift the roof off of a house by one or two hurricane intensity categories. Thus, it would be prudent to require new door and window installation measures (such as longer screws and nails) to strengthen envelope assemblies. Using UV-resistant caulking increases durability and has considerable beneficial structural effect with regard to increases in wind load resistance.

3. **Protection:** For reasons noted above, window and door protection in the form of permanent or removable hurricane shutters can significantly improve a building's ability to withstand storm events. Shutters should be stored on the premises and installed upon notification from any New York City agency in the event of an approaching storm event.

### **Anchorage Measures**

A common mode of failure observed by NYC Department of Buildings inspectors following Sandy was the dislocation of some houses from their foundations. These were typically one or two story wood frame buildings that were not securely attached to their foundations and that were easily moved upward or laterally by the storm surge. Masonry walls adhere to the foundation due to mortar, but wood frame buildings rarely have any positive attachments. Anchoring wood frame buildings to their foundations as described in NYC Building Code Section 2308.6 in all instances where alterations expose sills over foundations in Coastal A and V Zones, even if the alterations do not trigger the requirements of NYC Building Code Appendix G, will improve resistance to storm surge, floods, and wind pressure. Such anchors will also improve the capacity of the masonry foundation or crawlspace masonry walls to resist water pressure by providing support at the top, with the floor structure acting as a diaphragm connecting the walls. Anchors or tie-ins installed without the benefit of direct design calculations do not provide full protection for flood or wind, but their marginal contribution to building survival is expected to be significant. The effectiveness of this measure depends upon properly reinforced foundations and proper connections between sill plates and floor joists or superstructure.

### **Attached Homes**

FEMA currently does not provide guidelines on addressing attached 1-2 family dwellings of the historic 'brownstone' or 'rowhouse' typology located in flood zones. These structures are often, though not always, constructed of masonry walls and have shared party walls. In most cases, they cannot simply be raised onto new foundations for compliance. An appropriate set of guidelines to bolster the resiliency of these homes should be determined by a Joint Task Force consisting of representatives from NYC and federal agencies, including FEMA.

Current federal regulations prohibit dry-floodproofing 'rowhouse' type structures because they are a residential use. However, it is likely that some elements of dry-floodproofing would be effective and appropriate for this housing type. In some cases, the only method of fully protecting these homes is to abandon use of the level below the DFE, which often eliminates a large percentage of the owner's living space, and significantly reduces the value of the home. In some cases, another story could be added to preserve value where portions of the building located below DFE must be abandoned and where the building structure can support such an addition, but this option will be limited by financial considerations, as well as zoning and/or landmark restrictions. FEMA currently will not provide the same funding to add a story that is provided to those who wish to elevate their homes (maximum of \$30,000).

## 1 PREVENT STORM DAMAGE TO HOMES

The Joint Task Force should submit its findings to the Department of City Planning and other relevant city agencies, and seek resolution of any conflicts between recommended building amendments and local zoning and landmark restrictions.

### Cost:

Cost estimates were provided by Gerard Romski, AVerne by the Sea:

1. Wind load (require new windows to withstand 30 psf) was not quantified.
2. Installation (Home Depot prices as of 3/15/13):
  - a. Sealant - No additional labor cost for installation of sealant, and less expensive materials than silicone are available. A 10oz tube of sealant will provide approximately 49 linear feet of caulking, enough for more than two 3'x7' doors. Example products include:
    - DAP Dynaflex Latex-\$4.33 per 10oz tube
    - Sonnenborn NP-1 Urethane-\$5.75 per 10oz tube
    - GE WD Supreme Silicon-\$7.97 per 10oz tube
  - b. Fasteners - Additional labor to install longer screw and nail fasteners is zero to negligible. Additional labor to install increased number of fasteners was not quantified. Additional labor required to install Tapcon fasteners into concrete or masonry was not quantified. Example products include:
    - Tapcon 3/16 in. x 2-3/4 in. Climaseal Steel Flat-Head Phillips Concrete Anchors (75-Pack) \$16.82 (\$0.22 each/15 required for 3'x7' door)
    - Wood Screws-Crown Bolt #10 x 3 in. Zinc-Plated Flat-Head Phillips Drive Wood Screw (50 pack) \$10.26 (\$0.21 each/15 required for 3'x7' door)
    - Nails-Grip-Rite #11 x 3 in. Bright Steel Smooth-Shank Finish Nails (1 lb. Pack/124 count) \$3.47 (\$.03 each/15 required for 3'x7'door)
3. Protection (hurricane shutters) was not quantified.

### Sources:

1. FEMA 2011 Coastal Construction Manual: Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas (4th ed.), <http://www.fema.gov/library/viewRecord.do?id=1671>
2. The American Society of Civil Engineers ASCE 24-05 Flood Resistant Design and Construction
3. FEMA 2009 Recommended Residential Construction for Coastal Areas P-259
4. FEMA 2012 Engineering Principles and Practices for Retrofitting Flood-Prone Residential Structures P-550
5. FEMA RA1, February 2013 Improving Connections in Elevated Coastal Residential Buildings