

STRUCTURAL PROVISIONS

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STRUCTURAL DESIGN HIGHLIGHTS

2009 IBC Based Code

- References to both:
 - ASCE 7-2005
 - ASCE 7-2010
- Updated structural design referenced standards



CHAPTER 16 STRUCTURAL DESIGN

LOAD REQUIREMENTS

ASCE 7-2005

“ASCE 7”

Dead Loads

Live Loads

Snow Loads

Wind Loads

Soil Lateral Loads

Rain Loads

Flood Loads

ASCE 7-2010

“ASCE 7-10”

Earthquake Loads

NYC-Specific Load Requirements

Prior Code Buildings

Structural Integrity

CONSTRUCTION DOCUMENTS (BC 1603)

- Similar requirements in BC Chapter 1
 - BC 106.7 (2008 Codes) → BC 107.7 (2014 Codes)
- Earthwork plans
 - BC 106.8 (2008) → BC 107.8 (2014)
 - Requirements expanded and clarified
- Posting of live loads
 - BC 1603.3 (2008) → AC 28-108.21 (2014)

CONSTRUCTION DOCUMENTS (BC 1603)

- New drawing requirements (continued)
 - 1603.1.10 Superimposed dead loads
 - Indicated, where used
 - 1603.1.11 Other loads
 - Machinery or equipment loads greater than minimum specified
 - Identified by description and location

Structural Occupancy Category & Risk Category (BC 1604.5)

Definition of both (BC 1602):

“A category used to determine structural requirements based on occupancy”

- Structural Occupancy Category →
 - ASCE 7-2005 “Occupancy Category”
- Risk Category →
 - ASCE 7-2010 “Risk Category”



Structural Occupancy Category & Risk Category (BC 1604.5)

2014 PW1

13	Building Characteristics	<i>*Main use/dominant occupancy per AC §28-101.5. **Use 2014 Code equivalent</i>			
13A	Building was originally erected pursuant to which Building Code:	<input type="checkbox"/> 2014	<input type="checkbox"/> 2008		
	The earliest Code with which this building or any part of it is required to comply:	<input type="checkbox"/> 2014	<input type="checkbox"/> 2008		
13B	Primary structural system, choose one:	<input type="checkbox"/> Masonry	<input type="checkbox"/> Concrete (CIP)	<input type="checkbox"/> Concrete (Precast)	
		<input type="checkbox"/> Wood	<input type="checkbox"/> Steel (Structural)	<input type="checkbox"/> Steel (Cold-Formed)	
13C		Existing		Proposed	
	Structural Occupancy/Risk Category		2014 Code Designations?		2014 Code Designations?
	Seismic Design Category				
13D	Occupancy Classification*		<input type="checkbox"/> Yes <input type="checkbox"/> No		<input checked="" type="checkbox"/> Yes**
	Construction Classification		<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes <input type="checkbox"/> No
	Multiple Dwelling Classification				
					13E
					Building H
					Building S
					Dwelling

Structural Occupancy Category & Risk Category (BC 1604.5)

BC Table 1604.5

Structural Occupancy Category/ Risk Category	Description
I	Low hazard to human life in the event of failure
II	Ordinary Use Buildings not listed in Categories I, III & IV
III	Substantial hazard to human life in the event of failure
IV	Essential facilities

Structural Occupancy Category & Risk Category (BC 1604.5)

Load	Structural Occupancy Category (ASCE 7-05)	Risk Category (ASCE 7-10)
Snow Loads	√	
Wind Loads	√	
Flood Loads	√	
Earthquake Loads		√
Structural Integrity Loads	√	

Structural Occupancy Category & Risk Category (BC 1604.5)

- Category III includes any occupancy with an occupancy load greater than 5,000
- Examples per BC Table 1004.1.1:
 - Greater than 500,000 sf of business area > 5,000 occupants;
 - Greater than 1,000,000 sf of residential area > 5,000 occupants; or
 - Any occupancy, or combination of occupancies, that totals >5,000 occupants

Importance Factors (BC 1604.5.2)

BC Table 1604.5.2

Structural Occupancy/Risk Category	Snow Importance Factor, I	Wind Importance Factor, I	Seismic Importance Factor, I
I	0.80	0.87	1.00
II	1.00	1.00	1.00
III	1.10	1.15	1.25
IV	1.20	1.15	1.50

Load Combinations (BC 1605)

- Alternative ASD combinations no longer permitted
- Flood load combinations provided for:
 - A-Zone
 - Coastal A-Zone (NEW)
 - BC appendix G for applicability
 - V Zone

Live Loads (BC 1607)

- Sidewalk loads revised
 - Uniform live load reduced: 600 psf to 300 psf
 - Two concentrated load cases:
 - 8,000 lbs. on a 20 square inch area; and
 - 20,000 lbs. on an area of 20 inches by 10 inches
- Handrails and guards
 - Intermediate rail loads updated (Bulletin 2011-017)
 - Upward loads
 - Wind loads
- Special loads for fabric partitions provided

Wind Loads (BC 1609)

- Based on ASCE 7-2005
 - NYC local wind study
- Revised Exposure Categories
 - Exposure A no longer applies
 - Exposure D added
- Wind speed 98 mph (3-sec gust)
- Prohibition of gravel-ballasted roofs (1504.8)



Figure 1609.4.3 (4)
NEW YORK CITY WIND EXPOSURE: QUEENS SHORELINE

Notes:
••••• Exposure C: Buildings with a distance of 2,500 feet from shoreline.
••••• Exposure C: Buildings with a distance of 2,500 feet or 20 times building height from the shoreline, whichever is greater.
▨▨▨▨▨ Exposure D: Coastal zone, see Section 1609.4.
1. All islands located in the Jamaica Bay area are Exposure Category D.

Protection from Wind-Borne Debris (BC 1609.2)

- Buildings Resiliency Task Force recommendation
 - Local Law 101 of 2013
- Applicability:
 - Structural Occupancy Category III
 - Exposure D, where the glazing encloses:
 - Assembly spaces for 300 or more occupants; or
 - Areas of in-place shelter
 - Structural Occupancy Category IV
 - Exposures C & D

Protection from Wind-Borne Debris (BC 1609.2)

- Requirements:
 - Impact resistant glazing:
 - up to 60 ft above grade; and
 - up to 30 ft above adjacent aggregate-surfaced roofs within 1,500 ft of building
 - Impact resistant louvers (BC 1609.1.2.1):
 - Up to 30 ft above grade
 - Impact resistant garage doors (BC 1609.1.2.2)

Loads on Temporary Installations (BC 1618)

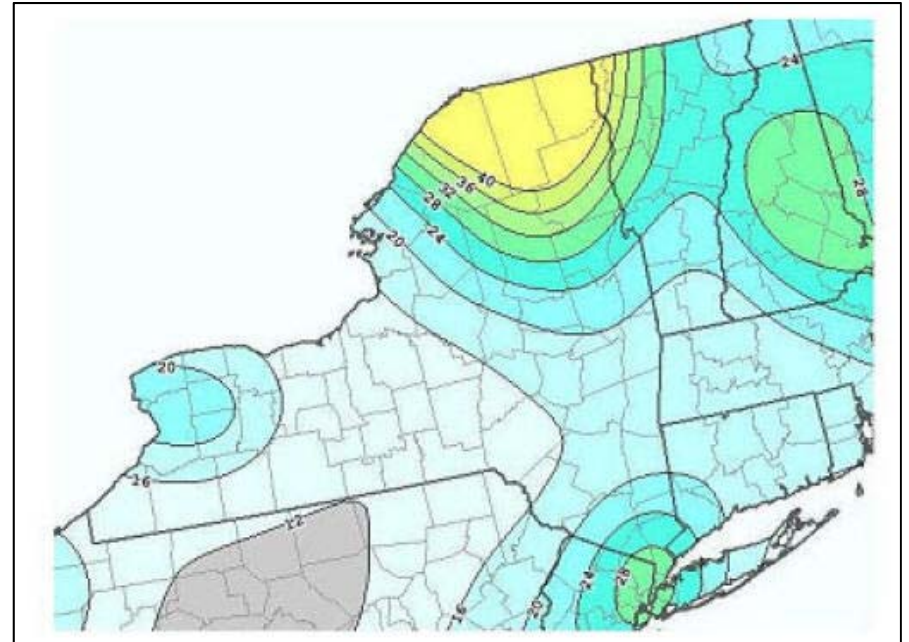
- Special provisions
 - Based on duration of installation
 - BC 3103 (temporary structures): 90 days
 - BC 33 temporary installations: 1 Year
 - Time extensions permitted
- Comply with new construction loads
 - Allowances for environmental load reduction
 - Wind – Based on BC 1609 with 0.8 factor applied
 - Seismic – 2% (D + L) permitted

Emergency Action Plans (BC 1618.3)

- Plans required for:
 - Environmental load reductions
 - Time extensions for installation
- Reliably implemented in 1 day or less
- Environmental load mitigation measures
 - Environmental load thresholds and monitoring
 - Prevention of wind-born debris

Earthquake Loads (BC 1613)

- Based on ASCE 7-2010 & IBC 2012
- Revised NYC acceleration parameters S_s & S_1
 - Differs from NYS
- Risk based design concept of ASCE 7-2010



2010 NYS BUILDING CODE
FIGURE 1613.5(1) MAXIMUM CONSIDERED EARTHQUAKE GROUND MOTION FOR NEW YORK STATE OF 0.2 SEC SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B

Determination of Seismic Design Category (BC 1613.5.6)

Site Class		Risk Category		
		I & II	III	IV
A	Hard Rock	A	A	A
B	Rock	B	B	C
C	Very dense soil/Soft rock	B	B	C
D	Stiff soil profile	B	B	C
E	Soft soil profile	C	C	D
F	Site-specific analysis required			

Structural Separations (BC 1613.7)

- Required 1 inch per 50 feet of height
 - Separation required at property line
 - Smaller separations permitted by analysis
 - Gaps between structures require covers

Structural Separations (BC 1613.7)

- Adjacent unreinforced masonry structures
 - Gaps require fill
 - Fill compressive strength 25 psi – 100 psi
 - Party walls must be made secure

Structural Integrity Provisions

- Key element expanded (BC 1614)
 - Tributary area > 3,000 square feet on single level
- Explosion prevention and deflagration venting references added (BC 1615.6.1)
 - Fuel Gas Code Appendices E & F
 - Fire Code

Structural Integrity – Key Element Analysis (BC 1616)

- Key element analysis triggers expanded
 - All Structural Occupancy Category IV buildings
 - Buildings with 3,000 or more occupants in one area (e.g. stadiums)
 - Clarification regarding walls greater than 10ft in length

Structural Peer Review (BC 1617)

- Peer review triggers expanded
 - Buildings with 3,000 or more occupants in one area (e.g. stadiums)
 - Clarification regarding walls greater than 10ft in length

	Yes	No	
9C			Structural peer review required per BC 16
			If yes, Structural Peer Reviewer License No.
			_____ P.E.

Concrete (BC Chapter 19)

- Based on ACI 318-2011
- NYC Code Committee Modifications
- Insulated Concrete Formwork (ICF) recognized (BC 1903.9)
 - ASTM E2634



Durability Requirements (BC 1904)

NYC Committee enhancements

- Specified strength (f'_c) increased for Group R Occupancies (BC 1904.3)
- Fly ash and other pozzolan limits increased for concrete exposed to deicing chemicals (BC 1904.4.2)



Mass Concrete (BC 1905.2.4)

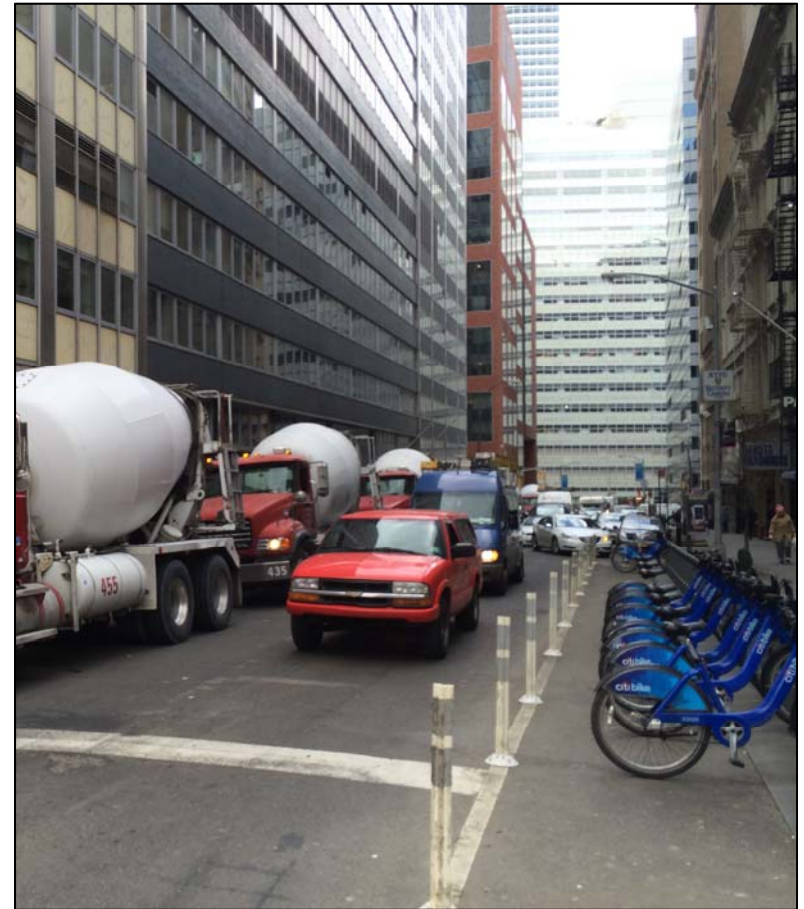
- Thermal control plan per ACI 301
 - Submitted by permit holder to PE/RA
 - $f'_c \geq 8,000$ psi and
 - Minimum dimension ≥ 36 inches
- Thermal monitoring required
 - Part of field testing
 - Monitor for seven days minimum

Concrete Mix Designs (BC 1905)

- Concrete Mix Designs: field test records and trial mixtures

(BC 1905.3.3)

- Up to 24 months old
- Measured from time of batching



Proportioning without field experience or trial mixtures (BC 1905.4)

Concrete proportioning determined in accordance with ACI 318, Section 5.4.

Not permitted for:

- Load-carrying structural concrete > 50 cubic yards
- Structural & non-structural concrete exposed to S1, P1, C2 or more severe exposures
- f'_c greater than 5,000 psi

Anchorage to Concrete – Strength Design (BC 1912)

Adhesive anchor installer certification (BC 1912.1, ACI 318 § D 9.2.2)

- NTSB Recommendation
- Applies to anchors installed horizontally or upwardly inclined position and supporting sustained tension loads
- Certification offered by ACI & CRSI
- Buildings Bulletin 2015-027
 - Alternative requirements to certified installers

Shotcrete (BC 1913)

- ACI Certification required for installers
- Mix designs verified by pre-construction test panels
 - Evaluation based on strength and visual grading of cores
 - Compressive strength must equal or exceed f'_c
- Production work evaluated by cores of in-place work
 - Test panels permitted when rebar spacing limits in-place cores

Formwork Design Drawings (BC 3305.3.2.1)

- Drawings must be site-specific and signed and sealed
- Required in more instances:
 - All major buildings
 - Slab thicknesses or beam heights greater than 10 inches
 - Imposed concentrated loads greater than 2,000 lbs
 - Loads imposed on existing buildings

Formwork Observation (BC 3305.3.3.2)

- Periodic observations of formwork installations
- Observations by
 - Formwork designer,
 - Qualified person under designer's supervision,
 - PE/RA retained by designer, or
 - Qualified person under supervision of PE/RA retained by designer



Masonry (BC Chapter 21)



- Updates to 2009 IBC
- Update to TMS 402/ACI 530/ASCE 5 National Standard
- Incorporates requirements for autoclaved aerated concrete (AAC) masonry

Construction Documents (BC 2101.3)

- Specified compressive strengths
- Anchorage details to structural members
- Testing and inspection program (Chapter 17)



Steel (BC Chapter 22)

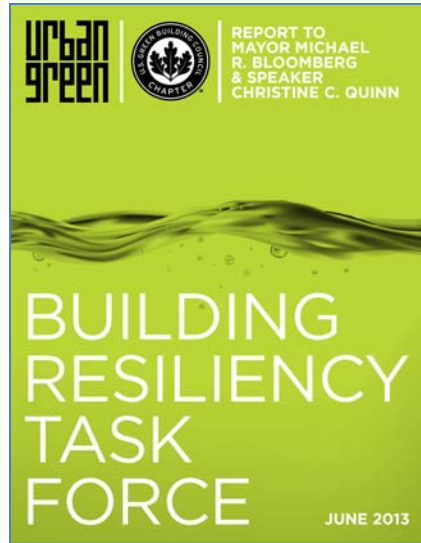
- Updated to 2009 IBC with NYC-specific modifications
- Updated structural steel standard AISC 360
 - Includes both ASD & LRFD design
- Updates to standards for cold-formed steel
 - AISI S100 & S200 for “light-frame” construction

Steel Joist Drawings (BC 2206.4)

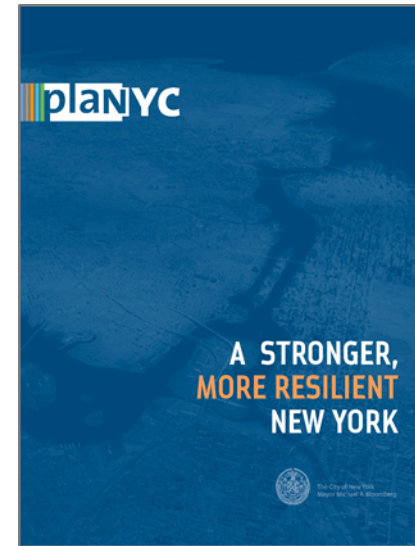
- Open-web joist placement plans required
 - Placement plans maintained on site
 - Certification of completion required from manufacturer
- Open-web joists prohibited in high rise buildings (BC 2206.6)

Wood (BC Chapter 23)

- Updated to 2009 IBC & AF&PA NDS -05
- Wood truss placement drawings (BC 2303.4)
 - Must be maintained on site
 - Provided by the truss manufacturer, including:
 - Truss placement diagram
 - Permanent restraint/bracing method and details
 - Temporary restraint/bracing method and details



BRTF
(Building Resiliency Task Force)



SIRR
(Special Initiative for Rebuilding and Resiliency)

27 Total resiliency-related City Council bills

17 Local Laws have passed

LL 109/13: Temporary Flood Shields

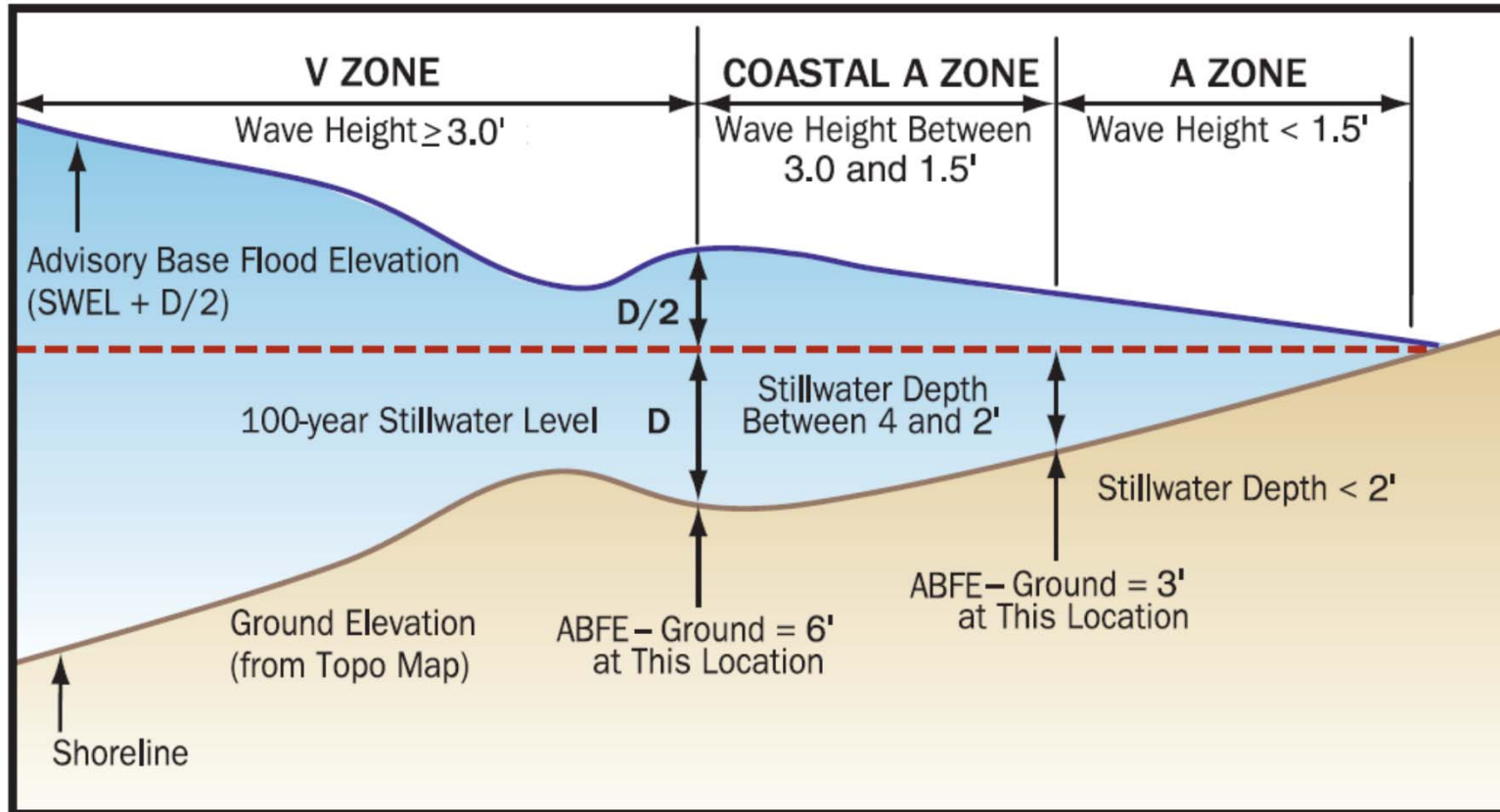
- Clarifies that blocked required means of egress must have nearby access point above the DFE. (G 308.6)
- Buildings in the 100-year floodplain and 500-year floodplain allowed to install footings and supports for temporary flood shields, stairs, and ramps a limited distance beyond the street line (BC 3202.1.1.1, BC 3202.2.2.3)
- Pre-FIRM buildings and buildings intended to be evacuated during floods, temporary stairs and ramps may be employed (G 308.7)



Coastal A-Zone

- Coastal A-Zone revisions:
 - Section G104.5.2: Coastal A-zone certifications
 - Section G201.2:
 - Revised definition of SFHA
 - Coastal A-zone definition and applicability
 - Section G 304.3: Coastal construction standards
 - Section G501: Amendments to ASCE 24 tables

Coastal A-Zone

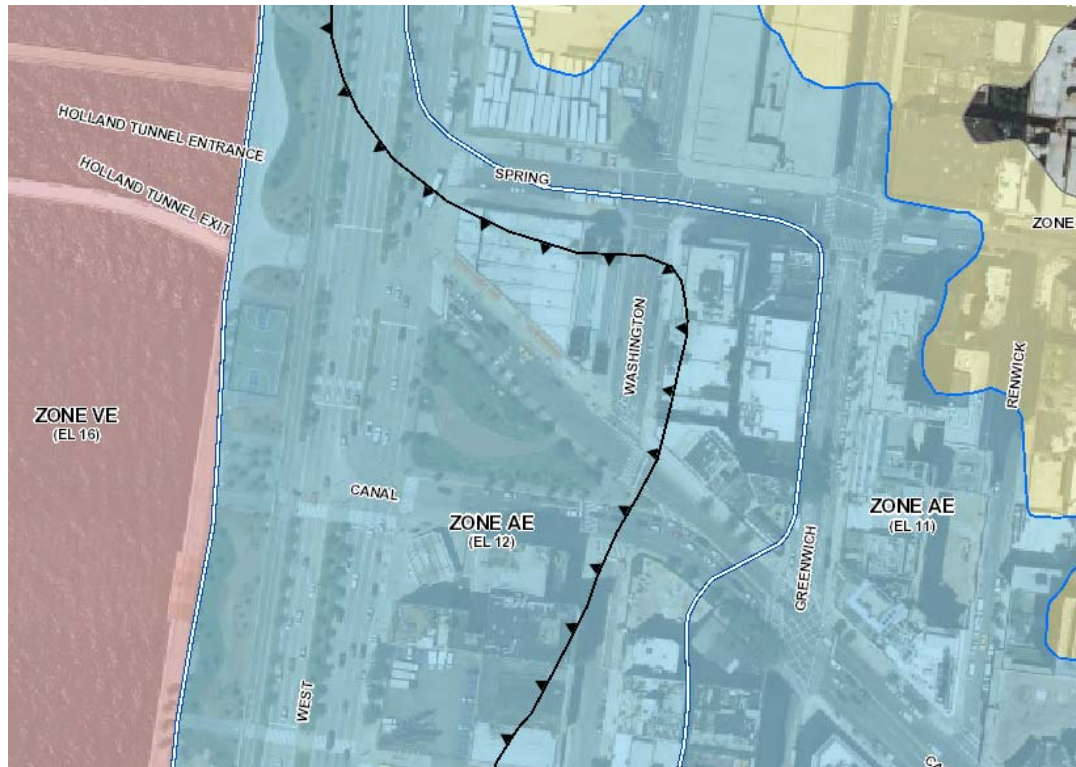


Design and Construction in Coastal A-Zones, Hurricane Ike Recovery Advisory, January, 2009

Coastal A-Zone Definition (BC G201.2)

COASTAL A-ZONE: An area within a special flood hazard area, shown on FEMA FIRMs 360497 as an area bounded by a “Limit of Moderate Wave Action,” landward of a V-Zone or landward of an open coast without mapped V-Zones. In a Coastal A-Zone, the principal source of flooding must be astronomical tides, storm surges, seiches, or tsunamis, and not riverine flooding. During the base flood conditions, the potential for breaking wave heights must be greater than or equal to 1 foot, 6 inches (457 mm). **In no case shall an area of special flood hazard be deemed a coastal A-Zone unless and until it has been identified as such on the adopted FEMA FIRMs 360497.**

Coastal A-Zones and PFIRM



FEMA New York City

Details Legend Layers

Preliminary_FIRM_NYC
Flood Hazard Boundaries

- 1 Pct Annual Chance Flood
- Floodway
- 0.2 Pct Annual Chance Flood
- Zone Break
- Limit of Floodway
- Limit of Study
- Limit of Moderate Wave Action
- Base Flood Elevations
- Coastal Transects
- Political Jurisdiction Boundaries

Coastal A-Zone Construction Standards (BC G 304.3)

New buildings and substantial improvements in a Coastal A-Zone shall comply with the V-Zone construction standards.

Exceptions:

- Wave-resisting stem wall foundation
- Wave-resisting dry floodproofing wall and foundation system

Coastal A-Zone Construction Standards (BC G 304.3)

Coastal A-Zone shall comply with the V-Zone construction standards.

Design and Construction
in Coastal A Zones



HURRICANE IKE RECOVERY ADVISORY



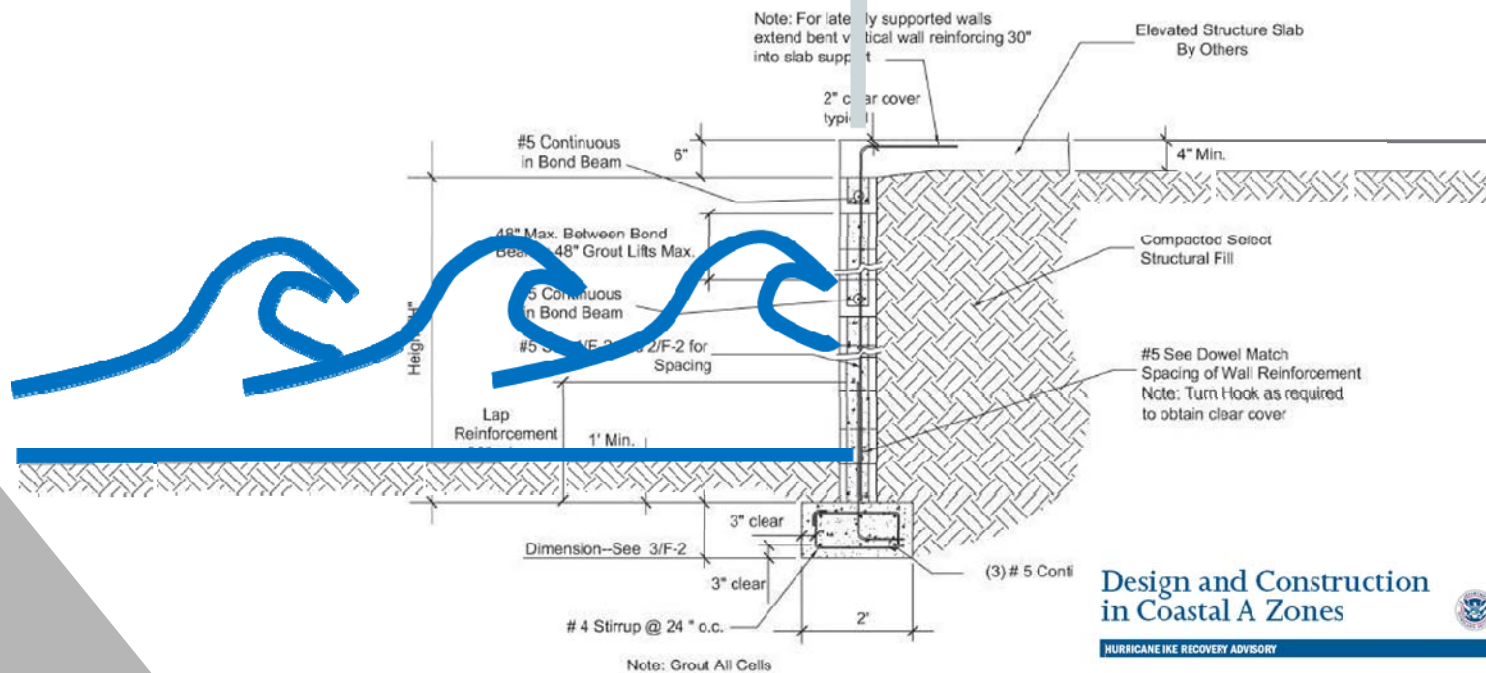
Coastal A-Zone Construction Standards (BC G 304.3)

Wave-resisting stem wall foundation:

- The underside of such floor system shall be located at or above the design flood elevation specified in ASCE 24, Table 4-1
- Stem walls enclosing areas below the design flood elevation prohibited
- Flood openings shall not be required in stem walls

Coastal A-Zone Construction Standards (BC G 304.3)

ASCE 24-13 (IBC 2015):
Wave-resisting stem wall foundation



Design and Construction
in Coastal A Zones



HURRICANE IKE RECOVERY ADVISORY

FEMA P 550

Coastal A-Zone Construction Standards (BC G 304.3)

Wave-resisting stem wall foundation design considerations:

- Wave action, debris impact, erosion, local scour
- Soil pressure behind walls
- Hydrostatic loads
- Live and dead surcharge loads from the slab above
- Sliding, uplift, or overturning

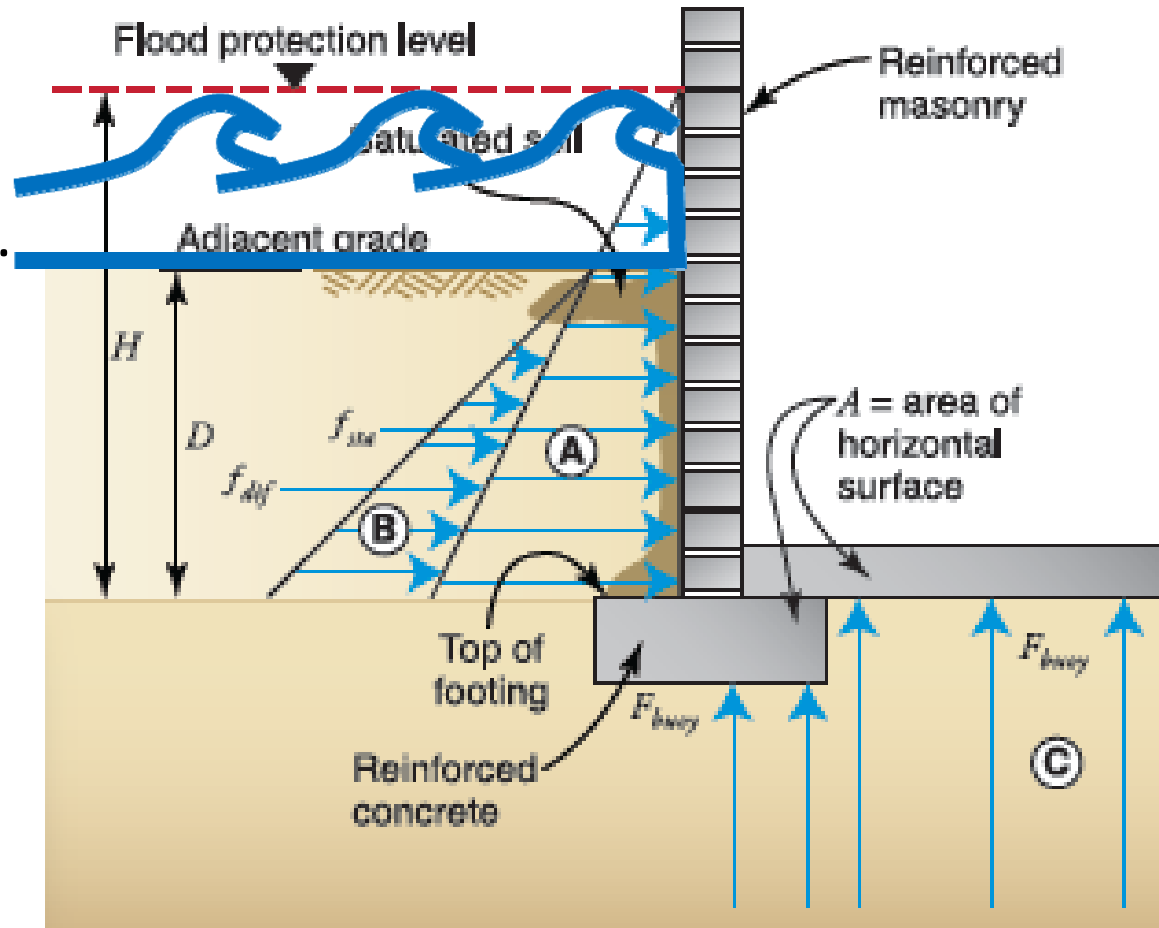
Coastal A-Zone Construction Standards (BC G 304.3)

Wave-resisting dry floodproofing wall and foundation system :

- Non-residential buildings dry floodproofed in accordance with Section G304.1.2:
 - Design flood elevation specified in ASCE 24, Table 6-1
 - Calculations demonstrating foundation, building and flood shields will resist wave action

Coastal A-Zone Construction Standards (BC G 304.3)

Wave-resisting dry floodproofing for commercial buildings.



FEMA P 936

Coastal A-Zone Construction Standards (BC G 304.3)

Wave-resisting dry floodproofing



Coastal A-Zones Certifications (BC G 104.5.2)

V-Zones and coastal A-Zones. Permit application shall include the following certifications, as applicable:

- Structural design certification
- Breakaway wall certification
- Utility certification