## **Fire-Resistance Detailing for Wood-Frame Exterior Walls**

Presented by: Chris Poles – Associate Principal, Cube 3

Don Havener, PE – Principal FPE, Cosentini Associates



ODE & FIRE ENGINEERING GROUP

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#### **Course Description**

On large, mid-rise wood-frame buildings, exterior walls are tasked with meeting a multitude of code and constructability requirements, not the least of which are fire-resistance continuity and detailing. Part 1 of a two-part workshop, this online session will provide practical information for designers seeking to better understand exterior wall fire design approaches and how to apply them to projects. First, we'll address common questions and areas of confusion, such as appropriate assembly options and whether exterior walls need to be rated from one side or both, impacts of claddings, furring, insulation and other enclosure components on fire performance, how to handle walls that jog in and out, and how to detail floor- to- exterior wall conditions in Type III and Type V structures. Second, a case study project will be examined in the context of both the code and detailing topics presented, with an emphasis on practical solutions to challenges encountered along the way.

#### Learning Objectives

- 1. Explain the code impacts of Type III and Type V construction on exterior wall requirements for allowable materials and fire-resistance ratings.
- 2. Review fire design requirements for exterior walls with an emphasis on common questions, including the use of asymmetric assemblies and bearing vs. non-bearing requirements.
- 3. Examine a variety of floor-to-exterior wall details for use in wood-frame, Type III construction and discuss code compliance paths and approval rationale for each.
- 4. Highlight the impact of claddings and insulation on the fire performance of exterior, wood-frame wall assemblies.

#### Outline

- Overview Case Study
- Exterior Wall Details and UL assemblies
- Truss Framing and Connections
- Exterior Wall Openings
- Building Stepbacks (Exterior Wall Vertical Offsets)
  - Continuous 2HR load Path
- Innovative Balcony Framing Approach
- Structural Steel in Exterior Walls



#### Case Study – New Rochelle, NY

#### Project Overview

Pro Forma Dictates relatively high density – Pushing the height to 8-stories.

335 Unit Mixed Use Residential Complex w. 5 Stories of Type IIIA Construction over 3 Stories of Type IA Construction.

Three levels of Structured Parking.

18,000 GSF of residential amenity spaces including leasing offices, café, fitness and outdoor terraces.



### Case Study – New Rochelle, NY

#### Code Compliance Approach

- 2015 IBC w/NY State Amendments
- Podium Building (IBC 510.2)
  - 5-stories of Type IIIA over 3-stories of Type IA construction (1/3 of podium bldg. is dwelling units.) Double-height space(s)
- Type IIIA portion subdivided by 2 Fire Walls
  - 4 Buildings in 1 Structure
- Lot line conditions
  - Limited setbacks = Limited openings



#### **Exterior Wall Details**





#### Exterior Wall Details - Code

- Fire Separation Distance < 25 feet requires exterior exposure protection. IBC 705.5
  - Many exterior walls are rated for "exposure from interior only" (asymmetrical rating)
  - Cladding can help UL U349.



#### Exterior Wall Details - Code

- Substituting materials? Is it on the Listed Design?
  - Coated OSB vs. FRT Plywood





Exterior Non-Load Bearing Wall

**Exterior Load Bearing Wall** 

Framing Direction Load Bearing Walls Floor Truss Approach







Interior Load Bearing Wall



Exterior Load Bearing Wall



Interior Load Bearing Wall



Exterior Non-Load Bearing Wall



Exterior Load Bearing Wall



Exterior Load Bearing Wall

#### **Truss Hangers + Fire Blocking**



Exterior Load Bearing Wall

Case for Fire Blocking @ Ceiling Plane

#### **Exterior Wall Openings**



P8 - Eighth Floor 165' - 8"							
	54 SF	36 SF	18 SE	36 SF	36 SF		P7 Total SF - 857 SF
P7 - Seventh Floor							esigned - 180 SF (21.0%)
100 - 2 014	54 SF	36 SE	18	36 SE	36 SE		P6 Total SF - 857 SF
P6 - Sixth Floor		ou or	SF				signed - 180 SF (21.0%)
144" - 9 1/2"			122				P5 Total SF - 941 SF
	54 SF	36 SF	SF	36 SF	SF	• 54 SF	Allowed - 235 SF (25%)
P5 - Fifth Floor 134' - 4 1/4"			-				signed - 210 or (23.0%)
	54 SF	36 SF	18	36 SF	18	- 54 SF	P4 Total SF - 941 SF
P4 - Fourth Floor			SF		SP		signed - 216 SF (23.0%)
123' - 11"			1000	(manufacture)			D2 Tatal SE 4 027 SE
	54 SF	36 SF	18 SF	36 SF	18 SF	- 54 SF	Allowed - 222 SF (25%)
P3 - Third Floor							signed - 216 SF (20.9%)
112 - 5	54 SF	36 SF	18	36 SF	18	54 SF	P2 Total SF - 890 SF
P2 - Residential			SF		SF		signed - 216 SF (24.3%)
102' - 7"			18	1223	18		P1 Total SF - 890 SF
	54 SF		SF		SF	► 54 SF	Allowed - 222 SF (25%) signed - 144 SF (16.2%)

#### **Exterior Walls Openings**







## Building Stepback – Code Approach

- 1. Building stepped back at 7<sup>th</sup> Floor (4<sup>th</sup> of wood).
- 2. Similar to Case 1 per Anthony's Presentation.
- 3. How do we achieve code compliance and minimize 2hr rated structure?
- 4. Does structure supporting the stepped-back wall require FRT lumber or noncombustible material?

## Building Stepback – Code Approach

How do we achieve code compliance and minimize 2-hr rated structure?

- 1. 2-hr rated Girder trusses support discontinuous exterior wall.
- 2. GT's supported by stacked 2-hr rated interior walls and integral posts.
- 3. Stacking of supporting structure minimizes 2-hr rating of horizontal assemblies.
- 4. GT's and low-roof trusses within 2-hr rated assembly.Provides lateral bracing for outboard exterior wall. (IBC 705.6)



## Building Stepback – Code Approach

Does structure supporting the stepped-back wall require FRT lumber or noncombustible material?

**EXTERIOR WALL.** A wall, bearing or nonbearing, that is used as an enclosing wall for a building, other than a *fire wall*, and that has a slope of 60 degrees (1.05 rad) or greater with the horizontal plane.

An exterior wall is defined as an exterior element that encloses a structure and that has a slope equal to or greater than 60 degrees (1.05 rad) from the horizontal plane. Exterior enclosing elements with slopes less than this are generally subjected to more severe weather exposure than vertical surfaces and thus may experience a greater amount of water intrusion. These sloped surfaces, which may include elements such as inset windowsills, sloped parapets and other architectural elements, should be designed to resist water penetration in a manner similar to a roof. **602.3 Type III.** Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. *Fire-retardant-treated wood* framing complying with Section 2303.2 shall be permitted within *exterior wall* assemblies of a 2-hour rating or less.

**705.6 Structural stability.** *Exterior walls* shall extend to the height required by Section 705.11. Interior structural elements that brace the exterior wall but that are not located within the plane of the exterior wall shall have the minimum *fire-resistance rating* required in Table 601 for that structural element. Structural elements that brace the exterior wall or within the plane of the exterior wall or within the plane of the exterior wall or within the plane of the exterior wall shall have the minimum *fire-resistance rating* required in Table 601 for that structural element. Structural elements that brace the exterior wall but are located outside of the exterior wall or within the plane of the exterior wall shall have the minimum *fire-resistance rating* required in Tables 601 and 602 for the exterior wall.







Girder Truss Framing @ Interior Load Bearing Wall



Girder Truss Framing @ Interior Load Bearing Wall



Girder Truss Framing @ Interior Load Bearing Wall



Girder Truss Framing @ Exterior Load Bearing Wall

## **Building Stepback – Conclusion**



Girder Truss Framing + 2-hr Load Path to Podium



#### **Balcony Details**





#### **Balcony Details**



#### **Balcony Details**







#### Structural Steel in Rated Exterior Walls

- Brick Relief in Wood Framing
- Signage
- Double Height Spaces
- Larger Spans



#### Structural Steel in Rated Exterior Walls

Rinn.





#### Structural Steel in Rated Exterior Walls





Condition 1: Exposed steel: Detail: N/A Refer to FRM manufacturer's instructions.

Where steel is exposed and can be accessed for the application of Fire Resistive Material (FRM) (intumescent paint), apply FRM to exposed face of steel column or beam. Follow FRM manufacturer's instructions as needed to provide 2-HR fire rating. Where *Non-Bearing* studs or bottom plates are installed next to a column or under a beam, the members shall be removed and FRM shall be applied to the exposed face of steel.

#### Structural Steel in Rated Exterior Walls - Code







**704.4.1 Light-frame construction.** Studs, columns and boundary elements that are integral elements in *walls* of light-frame construction and are located entirely between the top and bottom plates or tracks shall be permitted to have required *fire-resistance ratings* provided by the membrane protection provided for the *wall*.

Studs and columns in light-frame construction that are within the space defined by the top and bottom plate are considered as standard parts of the wall assembly rather than as individual members acting as a typical column. Other vertical elements would require individual encasement to achieve the required fire-resistance-rating.

#### 2015 IBC

2018 IBC

# > QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course

**Don Havener** 

**Cosentini Associates** 

dhavener@cosentini.com



**Chris Poles** 

CUBE 3

cpoles@cube3.com

CUBE<mark>3</mark>