The Evolution of Mid-Rise Design: Code Changes = New Opportunities

Archie Landreman
WoodWorks – Wood Products Council
Evolution of Mid-Rise
Evolution of Mid-Rise

Type V Construction
4 Stories
108k SF Total Building
Type V Buildings

Multi-family

Restaurants

Retail

Office
Evolution of Mid-Rise

Type V Construction
4 Stories
108k SF Total Building

Type III Construction
5 Stories
216k SF Total Building
Type III Buildings

Multi-family

K-12/Higher Ed

Hospitality

Office
Evolution of Mid-Rise

Type V Construction
4 Stories
108k SF Total Building

Type III Construction
5 Stories
216k SF Total Building

Add a mezzanine – not counted as a floor if conditions are met
Marseille Condos, Seattle, WA

5 stories for Residential + Mezzanine + Multi-Story Podium
Evolution of Mid-Rise

**Type V Construction**
- 4 Stories
- 108k SF Total Building

**Type III Construction**
- 5 Stories
- 216k SF Total Building

Add a mezzanine – not counted as a floor if conditions are met

5 story residential on top of multi-story podium
IBC Podium Provisions

Special Provisions for Podiums in IBC 2012 510.2
Increases allowable stories... not allowable building height
IBC Provisions for Mixed-Use podium have been evolving.

**2015 IBC allows multiple podium stories above grade.**
Basements

IBC 506.4 & 506.5: A single basement is not included in the total allowable building area if it doesn’t exceed the area permitted for a building with no more than one story above grade plane.

Basement is defined as that where the finished surface of the floor next above is:
• Less than 6 feet above grade plane or
• Less than 12 feet above the finished ground level at any point
MIXED OCCUPANCIES
Many buildings utilize a higher construction type than necessary due to traditional practice. This can have an impact on fire ratings, materials and ultimately cost.
MIXED OCCUPANCY BUILDINGS

START WITH UNSEPARATED OCCUPANCIES, USING SPECIAL PROVISIONS AND/OR OTHER SPECIAL DESIGN ALLOWANCES AS NEEDED. WORK UP FROM THERE.
Mixed-use occupancies on 1st floor of residential buildings often require longer spans for open areas (parking, retail, assembly). Some designers choose steel or concrete for these longer spans. This doesn’t mean that it has to be a Type IA podium, can use these materials in any construction type (IBC 602.1.1)
**SPECIAL PROVISIONS**

**IBC 510.2**

**5 STORY MIXED-USE POSSIBILITIES**

**4 STORIES OF TYPE V**
**OVER 1 STORY PODIUM**

**5 STORIES OF TYPE III**

*Photo credit: GABLES RESIDENTIAL*
6 & 7 STORY MIXED-USE POSSIBILITIES

5 STORIES OF TYPE III
OVER 1 STORY PODIUM

5 STORIES OF TYPE III
OVER 2 STORY PODIUM

PHOTO CREDIT: MATT TODD & PB ARCHITECTS

SPECIAL PROVISIONS
IBC 510.2
7 STORY MIXED-USE POSSIBILITIES

6 STORIES OF TYPE IIIA OR IV

OVER 1 STORY PODIUM

SPECIAL PROVISIONS

IBC 510.2

Image Credit: Michael Green Architects/Hines Group
Small Assembly Spaces:
• A building or tenant space used for assembly purposes with an occupant load of less than 50 persons shall be classified as a Group B occupancy. Example: small cafe

Small Assembly Spaces Accessory to Other Occupancies:
• Occupant load less than 50 persons or less than 750 sf in area - can be classified as a Group B occupancy or as part of main occupancy
Examples:
• Conference room in office building
• Fitness center in hotel
Many mixed use buildings, especially apartment buildings, are implementing occupiable roof top decks, either for individual use or as a gathering space.

No current code sections clearly discuss this except for basic exit provisions but several design routes have been used.

Typically these spaces do not have a roof and therefore aren’t classified as stories per the definition of a story (IBC 202).
**Occupied Roofs Code Development**

**2012 IBC** section 1021 contains exit provisions for occupied roofs

**2015 IBC** clarified egress requirements for occupied roofs (IBC 1006.3)

**2018 IBC** further recognizes occupied roofs. 2018 IBC provisions:

- **302.1**: Occupied roof classified as occupancy it most closely resembles
- **503.1.4**: Permitted to be used as an occupied roof if the occupancy of the roof is an occupancy that is permitted by code for the story immediately below the roof. Area of the occupied roofs is not required to be included in the building area. Further exceptions for sprinklered buildings exist
Does an occupied rooftop/roof deck need to be included in allowable building size (height and area) calculations?

Occupied rooftops are becoming common in multi-family and commercial buildings as building designers and owners seek to increase marketability by offering amenities such as roof decks. In most cases, these roof decks are open and uncovered with half height walls/parapets around their perimeter. However, some or all of the roof deck space may also be enclosed by full height walls and a roof covering. In both scenarios, questions that often arise include whether the roof deck needs to be considered as a separate story and how the occupancy and area contribute when evaluating height and area requirements based on a specific construction type.

Code language regarding this topic continues to evolve. Under the 2012 and 2015 IBC, some feel that the relevant code provisions leave room for interpretation. As such, a design team may choose to consult with the Authority Having Jurisdiction (AHJ) regarding what he or she deems acceptable. Code changes set for inclusion in the 2018 IBC further clarify provisions on this topic (see below).

In the meantime, following is a summary of how designers in the U.S. have successfully implemented occupied roof decks in their projects without including them in the total Roof Decks without Roof Coverings

IBC 2012 Table 506 and IBC 2015 Table 504.4 provide limitations on allowable number of stories in a given building. However, parapets are not required. The 2012 IBC Table 506.7.1 allows a roof deck with a parapet to include the area and height limitations for a roof deck and a separate story. The 2015 IBC Table 504.4 adds additional guidance to the 2012 IBC Table 506.7.1 by stating that the Allowable Roof Area (ARA) shall be determined for each story and within the story limit of the building. The ARA shall include all areas within the roof deck, including any roof cover, except for roof coverings that are required to prevent fire propagation and roofing that is required for a roof deck or a roof covering. The ARA shall be determined for each story and within the story limit of the building. The ARA shall include all areas within the roof deck, including any roof cover, except for roof coverings that are required to prevent fire propagation and roofing that is required for a roof deck or a roof covering.
WoodWorks/AWC H&A Calculator

https://www.awc.org/codes-standards/calculators-software/heights-areas
Savings Can be Found in the Details
Shafts, Stairs, Partitions & More
Stair, Elevator & MEP Shafts

If the building can be framed with wood, the shafts can be framed with wood
Shaft Wall Savings – Case Study

Switch to Wood Framed Shaft Walls Saves Project $176,000

- Gala at Oakcrest, Euless, TX
- 4 Story, 135,000 sf multi-family building
- 2 Elevator Shafts, 3 Stair Shafts, all originally designed in masonry – project was otherwise all wood framed
- Initial estimates were total of $266,000 for all 5 shafts
- Team switched to wood shafts, cut $176,000 from cost and at least 3 weeks from schedule

Source: Gardner Capital Construction, project General Contractor & Developer
Mass Timber Shaft Walls

Photo: Alex Schreyer

Photo: Lendlease
Shaft Wall Resource

Code provisions, detailing options, project examples and more for light-frame wood and mass timber shaft walls

Free resource at woodworks.org
Wood Within Podium Level(s)

FRTW is permitted in non-bearing, non-rated exterior walls in types I & II (IBC 603.1)

Thermal/building envelope benefits, as well as consistent exterior wall detailing

Credit: WoodWorks

Source: Mahlum Architects
Wood Within Podium Level(s)

2021 IBC allows stairs below the podium to be framed with wood if building above podium is type III, IV or V

Credit: WoodWorks
What Will The Future Bring?
Tall Wood in the US
IBC 2021
3 YEAR CODE CYCLE
In December 2015, the ICC Board established the ICC Ad Hoc Committee on Tall Wood Buildings. Objectives:
1. Explore the building science of tall wood buildings
2. Investigate the feasibility, and
3. Take action on developing code changes for tall wood buildings.
TALL WOOD APPROVED!

Unofficial results posted Dec 19, 2018
Final votes ratified Jan 31, 2019

AWC: Tall Mass Timber code changes get final approval
Dec 19, 2018

LEESBURG, VA. – The International Code Council (ICC) has released the unofficial voting results on code change proposals considered in 2018, including passage of the entire package of 14 tall mass timber code change proposals. The proposals create three new types of construction (Types IV-A, IV-B and IV-C), which set fire safety requirements, and allowable heights, areas and number of stories for tall mass timber buildings. Official results are expected to be announced during the first quarter of 2019. The new provisions will be included in the 2021 International Building Code (IBC).

"Mass timber has been capturing the imagination of architects and developers, and the ICC result means they can now turn sketches into reality. ICC’s rigorous study, testing and voting process now gives tall mass timber buildings the safety and performance criteria that have been unavailable to architects and developers," said Sarah Jones, AWC director of code change.
2021 IBC Introduces 3 new tall wood construction types: IV-A, IV-B, IV-C
Previous type IV renamed type IV-HT
Type IV-C Protection vs. Exposed

All Mass Timber surfaces may be exposed

Exceptions: Shafts, concealed spaces, outside face of exterior walls

Credit: Susan Jones, atelierjones
# Type IV-C Height and Area Limits

<table>
<thead>
<tr>
<th>Occupancy</th>
<th># of Stories</th>
<th>Height</th>
<th>Area per Story</th>
<th>Building Area</th>
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<tbody>
<tr>
<td>A-2</td>
<td>6</td>
<td>85 ft</td>
<td>56,250 SF</td>
<td>168,750 SF</td>
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<tr>
<td>B</td>
<td>9</td>
<td>85 ft</td>
<td>135,000 SF</td>
<td>405,000 SF</td>
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<tr>
<td>M</td>
<td>6</td>
<td>85 ft</td>
<td>76,875 SF</td>
<td>230,625 SF</td>
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<tr>
<td>R-2</td>
<td>8</td>
<td>85 ft</td>
<td>76,875 SF</td>
<td>230,625 SF</td>
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</tbody>
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Areas exclude potential frontage increase

In most cases, Type IV-C height allowances = Type IV-HT height allowances, but add’l stories permitted due to enhanced FRR

Type IV-C area = 1.25 * Type IV-HT area

Credit: Susan Jones, atelierjones
Type IV-B

Credit: Susan Jones, atelierjones

Credit: LEVER Architecture
Type IV-B Protection vs. Exposed

NC protection on all surfaces of Mass Timber except limited exposed areas

~20% of Ceiling or ~40% of Wall can be exposed, see code for requirements
## Type IV-B Height and Area Limits

<table>
<thead>
<tr>
<th>Occupancy</th>
<th># of Stories</th>
<th>Height</th>
<th>Area per Story</th>
<th>Building Area</th>
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<tr>
<td>A-2</td>
<td>12</td>
<td>180 ft</td>
<td>90,000 SF</td>
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<td>B</td>
<td>12</td>
<td>180 ft</td>
<td>216,000 SF</td>
<td>648,000 SF</td>
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<tr>
<td>M</td>
<td>8</td>
<td>180 ft</td>
<td>123,000 SF</td>
<td>369,000 SF</td>
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<tr>
<td>R-2</td>
<td>12</td>
<td>180 ft</td>
<td>123,000 SF</td>
<td>369,000 SF</td>
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</tbody>
</table>

Areas exclude potential frontage increase

In most cases, Type IV-B height & story allowances = Type I-B height & story allowances

Type IV-B area = 2 * Type IV-HT area
Type IV-A

Credit: Susan Jones, atelierjones

Photos: Structurlam, naturally:wood, Fast + Epp

18 STORIES
BUILDING HEIGHT 270'
ALLOWABLE BUILDING AREA 1,972,000 SF
AVERAGE AREA PER STORY 54,000 SF
Type IV-A Protection vs. Exposed

100% NC protection on all surfaces of Mass Timber

Credit: Susan Jones, atelierjones
## Type IV-A Height and Area Limits

<table>
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<tr>
<th>Occupancy</th>
<th># of Stories</th>
<th>Height</th>
<th>Area per Story</th>
<th>Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-2</td>
<td>18</td>
<td>270 ft</td>
<td>135,000 SF</td>
<td>405,000 SF</td>
</tr>
<tr>
<td>B</td>
<td>18</td>
<td>270 ft</td>
<td>324,000 SF</td>
<td>972,000 SF</td>
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<td>M</td>
<td>12</td>
<td>270 ft</td>
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<td>R-2</td>
<td>18</td>
<td>270 ft</td>
<td>184,500 SF</td>
<td>553,500 SF</td>
</tr>
</tbody>
</table>

Areas exclude potential frontage increase

In most cases, Type IV-A height & story allowances = 1.5 * Type I-B height & story allowances

Type IV-A area = 3 * Type IV-HT area
THE MID-RISE EVOLUTION
QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course.
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