High Density Multi-Family Design

Product, Code, Cost and Density Issues

By: Dick Knapp

Architectural Code Consultation and Drawings by Brian Gobell of hord|coplan|macht

ULI Fall Meeting
Dallas, Texas

Thursday, October 27th
3:00pm-4:15pm
<table>
<thead>
<tr>
<th>Product Type</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>Garden</td>
<td>AKA ‘WALKUPS’; MULTI-LEVEL APARTMENTS WITH NO ELEVATORS; ONLY STAIRS; OPEN BREEZEWAYS</td>
</tr>
<tr>
<td>Donut</td>
<td>AKA ‘WRAPPERS’; STRUCTURED PARKING GARAGE SURROUNDED BY RESIDENTIAL APARTMENTS</td>
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<td>Podium</td>
<td>TALL BUILDING OF NON-COMBUSTIBLE CONSTRUCTION</td>
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### Multi-Family Ecology

(Washington Metro As Example)

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**Higher rents drive higher land value**

**Higher land value drives higher density product**
Construction Types (2009 IBC)

**Type V:** COMBUSTIBLE CONSTRUCTION [Wood Frame Gardens & Donuts]

**Type IV:** HEAVY TIMBER CONSTRUCTION
(not used for multi-family)

**Type III:** NON-COMBUSTIBLE EXTERIOR WITH COMBUSTIBLE INTERIOR ELEMENTS [Podium]

**Type II:** NON-COMBUSTIBLE, LIMITED CONSTRUCTION*
[Not Used]

**Type I:** NON-COMBUSTIBLE, UNLIMITED CONSTRUCTION*
[Hi-Rise]

* REGARDING BUILDING HEIGHT, NUMBER OF STORIES AND ALLOWABLE AREA
## Products & Construction Types

<table>
<thead>
<tr>
<th>Multi-Family Product</th>
<th>Avg. Density Units/Acre</th>
<th>IBC Const Type</th>
<th>Applicable Materials</th>
<th>Building Height Limit</th>
<th>Stories Allowed</th>
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<tbody>
<tr>
<td>Garden</td>
<td>20-40</td>
<td>$\text{V}_A$</td>
<td>Standard Wood</td>
<td>60’ or 70’ Depending on 13R or 13 sprinkler system</td>
<td>4</td>
</tr>
<tr>
<td>4 Story Donut</td>
<td>70-90</td>
<td>$\text{V}_A$</td>
<td>Standard Wood</td>
<td>60’ or 70’ Depending on 13R or 13 sprinkler system</td>
<td>4</td>
</tr>
<tr>
<td>4 over 1 Podium</td>
<td>90-110</td>
<td>$\text{V}_A$</td>
<td>Standard Wood</td>
<td>60’ or 70’ Depending on 13R or 13 sprinkler system</td>
<td>4</td>
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<tr>
<td>5 Story Donut</td>
<td>90-120</td>
<td>$\text{III}_A$</td>
<td>Exterior – Non-combustible including Fire Retardant Treated Wood (FRTW)</td>
<td>75’ or 85’ Depending on IIB or IIIA</td>
<td>5</td>
</tr>
<tr>
<td>“5 over 1” Podium</td>
<td>150-200</td>
<td>$\text{III}_A$</td>
<td>Interior – Standard Wood</td>
<td>75’ or 85’ Depending on IIB or IIIA</td>
<td>5</td>
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<td>“5 over 2” Podium</td>
<td>175-230</td>
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<td>Interior – Standard Wood</td>
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<td>“5 over 3” Podium</td>
<td>200-260</td>
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<td>Interior – Standard Wood</td>
<td>75’ or 85’ Depending on IIB or IIIA</td>
<td>5</td>
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<tr>
<td>Hybrid</td>
<td>275+/-</td>
<td>$\text{I}_B$</td>
<td>Concrete, Steel Metal Studs (proprietary systems)</td>
<td>95’ +/-</td>
<td>8-12 Structurally limited</td>
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<tr>
<td>High-Rise</td>
<td>200-600+</td>
<td>$\text{I}_A$</td>
<td>Concrete, Steel Metal Studs</td>
<td>Unlimited</td>
<td>12+</td>
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</table>
Type VA: 4-Story Donut Product

**Building Height:**
- 60’ – NFPA 13R or
- 70’ – NFPA 13

**Density:** 70-90 Units/Acre

**Key Features:**
- Centralized parking garage
- Wrapped with Residential
- Single- and Double-loaded corridors
- Enclosed garage requires 3 hour fire wall
- Precast Garage
Key Features:

- Code allows for extra story
- 5 stories effectively
- Combustible construction above podium
- Non-combustible construction below podium
- Residential now allowed below podium

**Building Height:**

- 60’ – NFPA 13R or
- 70’ – NFPA 13

**Density:** 90-110 Units/Acre
**Type III: 5 Story Donut**

**Building Height:** 75’ – IIIb or 85’ – IIIa

**Density:** 90-120 units/ Acre

**Key Features:**
- Centralized parking garage
- Wrapped with residential
- Single- and Double-loaded corridors
- Open garage better
- Precast Garage
- “Catwalks”
Type III: Podium “5 over 1”

**Building Height:**
- 75’ — IIIb or
- 85’ — IIIa

**Density:** 150 - 200 Units/Acre

**Key Features:**
- Vintage code allows for extra story
- 6 stories effectively
- Non-combustible exterior walls/combustible interior elements above podium
- Fire Retardant Treated Wood (FRTW)
- Non-combustible construction below podium
- Residential allowed below podium
Type III: IIIA vs. IIIB

IIIA

- Generally Preferred
- More Allowable Area — 72,000 s.f.
- 85’ Allowable Height
- Less Exterior Stairs & Firewalls
- Interior bearing walls and roof assemblies: 1 hour

IIIB

- Less Allowable Area — 48,000 s.f.
- 75’ Allowable Height
- More Fire Stairs & Fire Walls
- Interior bearing walls and roof assemblies: 0 hour
Type III\textsubscript{A}: Potential Podium “5 over 2”

Density: 175-230 Units/Acre

Code Amendment (IBC Section 510.2):

- Strikes existing Condition 2 that now limits only one story above grade plane below the ‘podium’ level
- Allowable height still limited by lesser construction type- no change
- Only Hazardous use group is excluded from being allowed use below the podium
Type III<sub>A</sub>: Podium “5 over 3”

Density: 200-260 Units/Acre

Key: Avoid high rise requirements (IBC Section 403) otherwise subject to the following:

- Enhanced emergency systems including: standpipes, fire command center, stair pressurization, standby power, fire alarm, smoke detection, voice/alarm communication, responder radio and fire pump (likely)

- Maybe others?
Type I: High-Rise

**Building Height:**
- **Code:** 75 feet min — unlimited
- **Sweet spot:** 12 – 17 Stories

**Density:** 200 – 600+ Units/Acre
HYBRID: A MIXTURE OF STRUCTURAL FLOOR AND PANELIZED WALL SYSTEMS THAT OFFER ECONOMICAL ALTERNATIVES FOR HIGH-RISE CONSTRUCTION

When is a HYBRID system appropriate for consideration?

- Need more height than a “5 over 2” and less than a high-rise
- Rents higher than stick but less than high-rise
- Height Range: 8 to 12 stories (structurally limited)
- Lighter Structural Alternative
- Allows cost savings over high-rise
- Speed and design benefits (?)
<table>
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<tr>
<th>HYBRID SYSTEMS</th>
<th>PRACTICAL BUILDING HEIGHT LIMITATIONS</th>
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<tr>
<td>Hallow Core Plank</td>
<td>8 Stories</td>
</tr>
<tr>
<td>Prescient</td>
<td>12 stories</td>
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<tr>
<td>Epicore / Infinity</td>
<td>8 Stories</td>
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<tr>
<td>Hambro</td>
<td>9 Stories w/ Metal Studs</td>
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Type Ib: Hybrid - Hollow Core Plank

PRECAST HOLLOW CORE PLANK: STRUCTURAL CONCRETE FLOOR SYSTEM
**Key Features:**
- 1 ½” cement board floor decking with gypsum concrete underlayment topping
- Panelized load bearing metal stud wall system using steel columns at ends
- Turnkey solution
- Lightweight building can reduce foundation costs

**Challenges:**
- Production capacity
- All load bearing elements must be on a 2’x2’ grid
- Balcony solution not optimal
**Type Ib: Hybrid – Infinity & Epicore**

**Key Features:**
- Concrete slab between 3 1/2” to 6” thick
- Panelized metal stud bearing walls allow for speedy erection time
- Thinner slabs allows for reduced building heights

**Challenges:**
- Finish of metal deck ceiling
- STC rating of the floor system
- Limited spans limits possibility of open floor plans
Key Features:

- Steel bar joists spaced 49.25” with shear connectors on center
- Reusable 4’ plywood forms for use on load bearing metal wall system
- 2 ½ - 5” concrete floor slab
- Open plenum space allows easy mechanical install

Challenges:

- Acoustical performance w/o Gypcrete topping slab less than other systems
- Deeper floor system compared to other solutions adds to bldg. height
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