

Six Over Two Podium Buildings Analog & Moraine Tacoma Case Studies

Presented by: Paul Del Vecchio | Ethos Development

Adam Hostetler | Works Progress Architecture

Alex Davis | PCS Structural Solutions

W.PA ethos
works progress architecture DEVELOPMENT

 **PCS**
Structural Solutions

Disclaimer: This presentation was developed by a third party and is not funded by WoodWorks or the Softwood Lumber Board.

Project Descriptions

- Analog | 115 Units | 65,000 SF
- Moraine | 171 Units | 118,000 SF
- Both Six Stories Type IIIA wood over Two Stories 1A Concrete



Cost Benefit

- Analog is amongst the first projects in Washington to be permitted with 6 stories of Type IIIA.
- The cost of one IIIA deck on Analog is \$32/SF vs. 1A at \$44/SF.
- This amounts to a total of \$104k for the transitional deck on Analog and \$175k for Moraine.
- The relative ease of routing MEP chases in wood vs concrete is relevant.
- This is primarily a cost-based choice as there is no degradation in value or resident experience.



PROJECT CONTEXT
Tacoma, WA



120' x 75.5' Site

17.2' E-W Elevation Change.

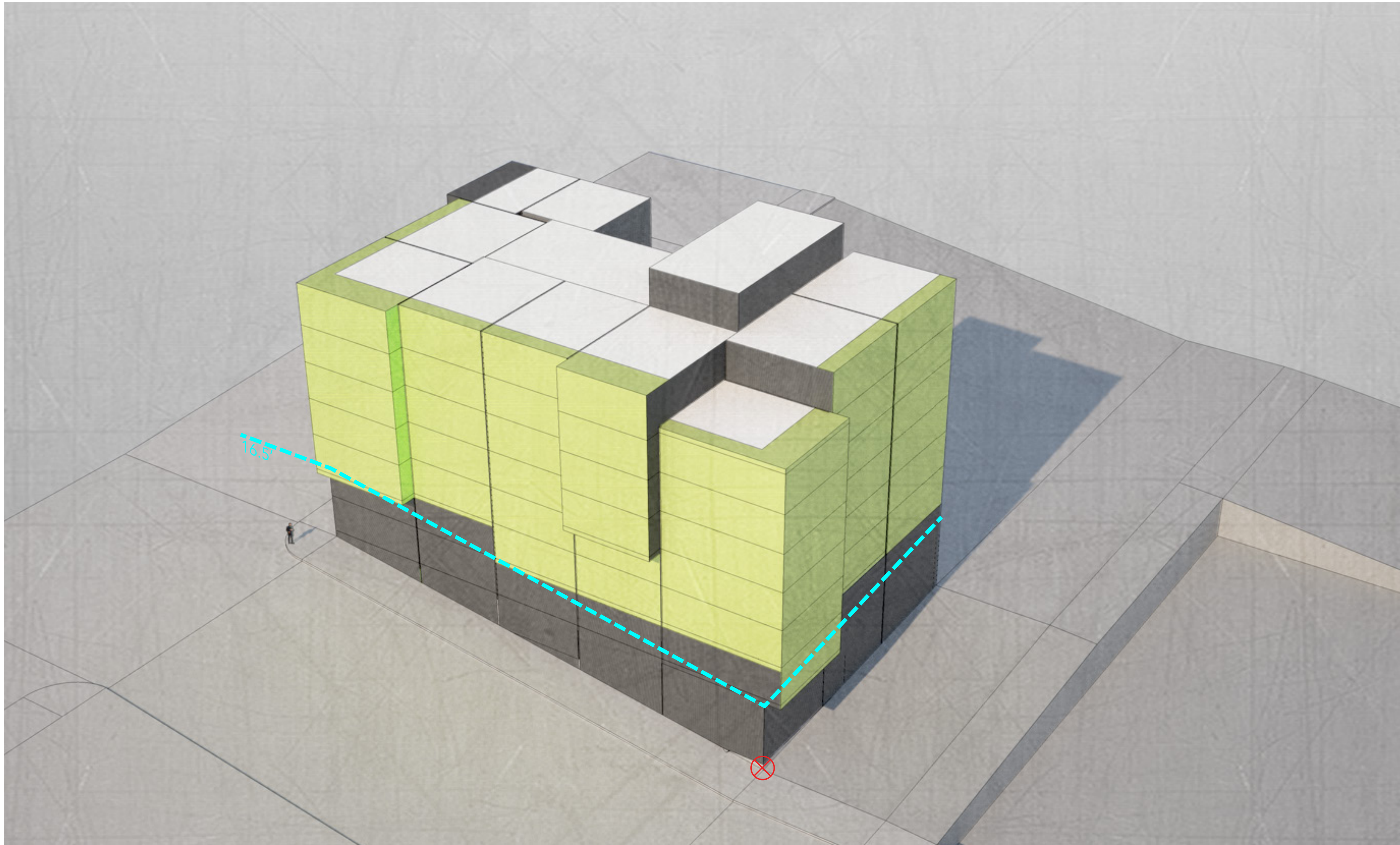
4.1' N-S Elevation Change.

115 Units

Mix of Micros, Studios, 1-Bed,
2-Bed, and 3-Bed Units

6-Stories of III-A Over
2-Story I-A Podium and a
Basement

ANALOG PROJECT
Tacoma, WA



Three-Story Podium +
Basement per WSBC 510.2.

All Encroachments off Concrete
Decks.

ANALOG

MASSING STRATEGY

Prior to Using Six Stories of III-A

Tacoma Municipal Code

2.02.140 Amendment to IBC Section 504.4 – Number of Stories – by amending subsection 504.4.1 WA State amendment to the IBC and by addition of a new Section 504.4.1.1 – Type B occupancies within R-1 and R-2 occupancies.

The following section amends Section 504.4.1 of the State Building Code amendments to IBC Section 504.4 – Number of Stories, by replacing 504.4.1 in its entirety, and by addition of a new Section 5.4.4.1.1.

504.4.1 Stair Enclosure Pressurization Increase.

For Groups R-1 and R-2 in buildings of Type VA or IIIA construction, or I-1 Condition 2 Assisted living facilities licensed per chapter 388-78A WAC and residential treatment facilities as licensed by Washington state under chapter 246-337 WAC located in buildings of Type VA construction equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, the maximum number of stories permitted in Section 504.4 may be increased by one provided the interior exit stairways and ramps are pressurized in accordance with Sections 909.11 and 909.20. Legally required standby power shall be provided for buildings constructed in compliance with this section and be connected to stairway shaft pressurization equipment, elevators and lifts used for accessible means of egress, hoistway pressurization equipment (if provided) and other life safety equipment as determined by the authority having jurisdiction. For the purposes of this section, legally required standby power shall comply with most currently adopted NEC Section 701.12, options (A), (B), (C), (D), (E), (F), or (G) or subsequent revised section number(s).

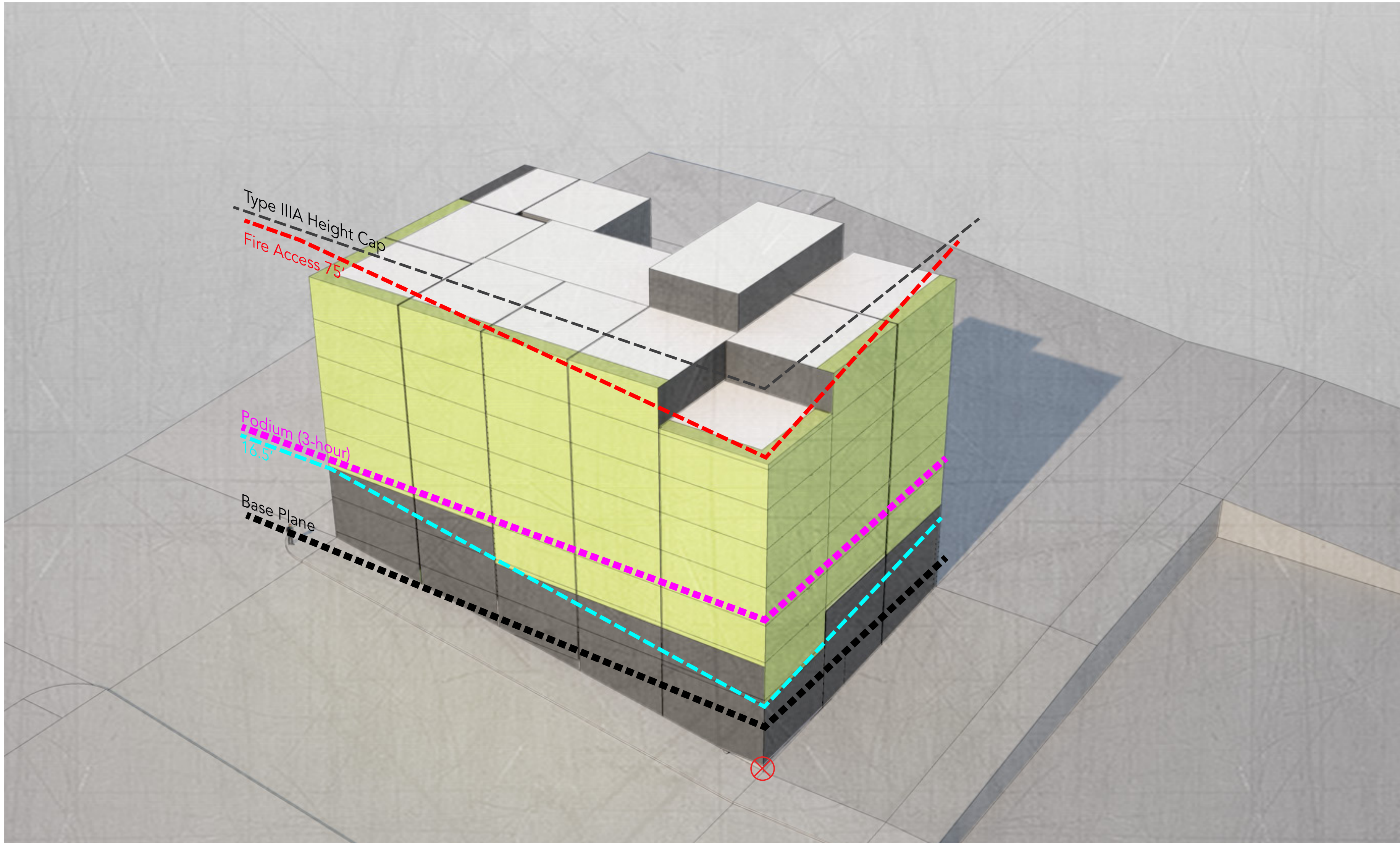
504.4.1.1 Type B Occupancies within R-1 and R-2 occupancies.

Provided the building meets the additional requirements in Section 504.4.1 as amended by the State Building Code, Type B occupancies that are considered accessory to and for the exclusive use of the R-1 and R-2 uses, including such uses as assembly areas, exercise rooms, or other amenity spaces with less than 50 occupants, may be permitted on all stories that the R-1 and R-2 uses are permitted. These spaces must also meet all the additional provisions as specified in the State Building Code amendment (WAC 51-50-0504) to IBC 504 – Building Height and Number of Stories.

(Ord. 28729 Ex. A; passed Jan. 26, 2021; Ord. 28590 Ex. A; passed Jun. 18, 2019; Repealed and reenacted by Ord. 28363 Ex. A; passed Jun. 14, 2016; Repealed and reenacted by Ord. 28155 Ex. A; passed Jun. 11, 2013; Repealed and reenacted by Ord. 27890 Ex. A; passed Jun. 15, 2010)

TCM CODE AMENDMENT

Prior to Using Six Stories of III-A



85' Max. Type IIIA Height per
WSBC 504.3

Three-Story Podium +
Basement per 510.2.

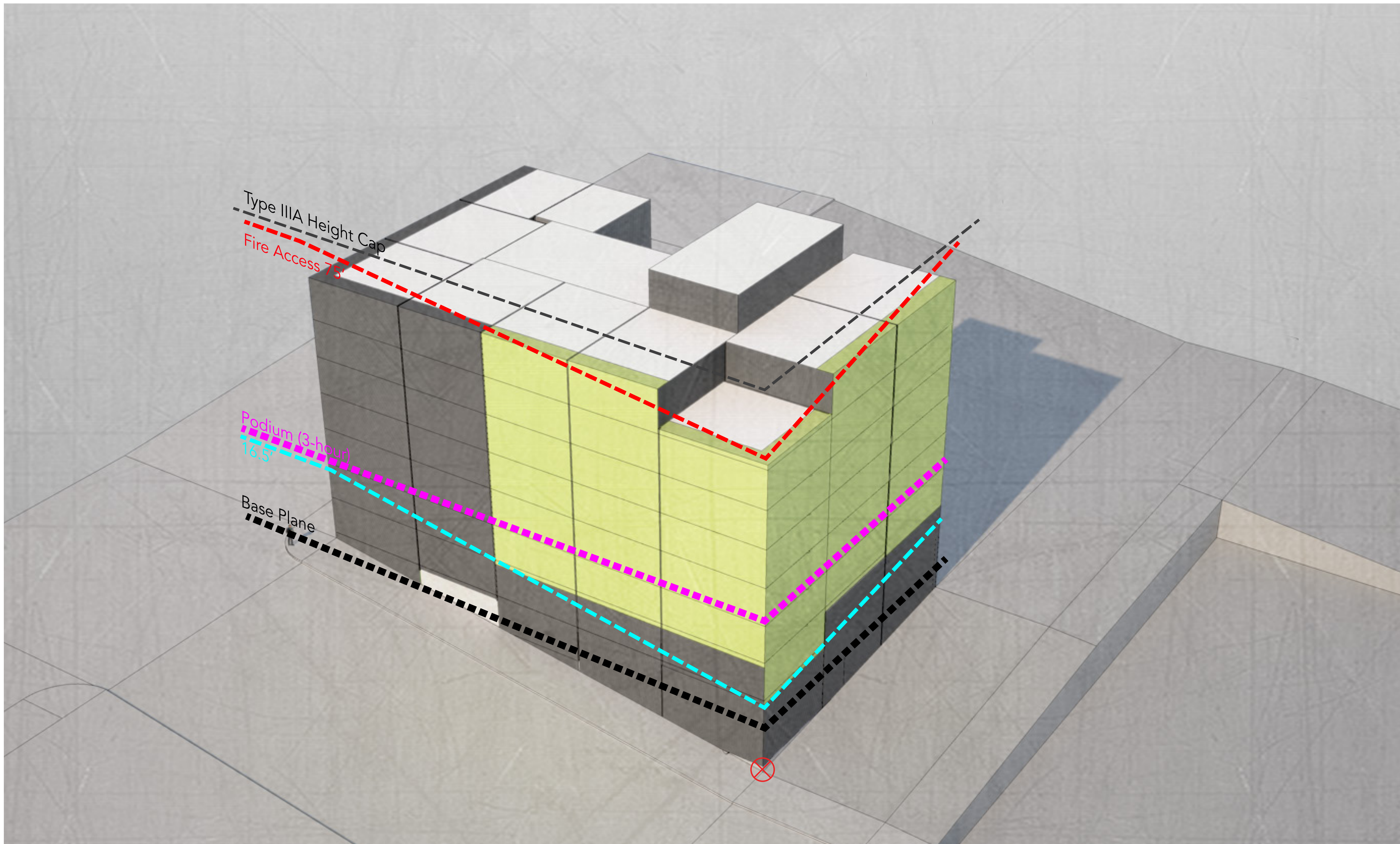
All Encroachments off Concrete
Decks.

Fire Marshal Definition of High-
Rise Taken from Lowest Access
Point.

ANALOG

MASSING STRATEGY

Prior to Using Six Stories of III-A



Two-Story Podium + Basement.

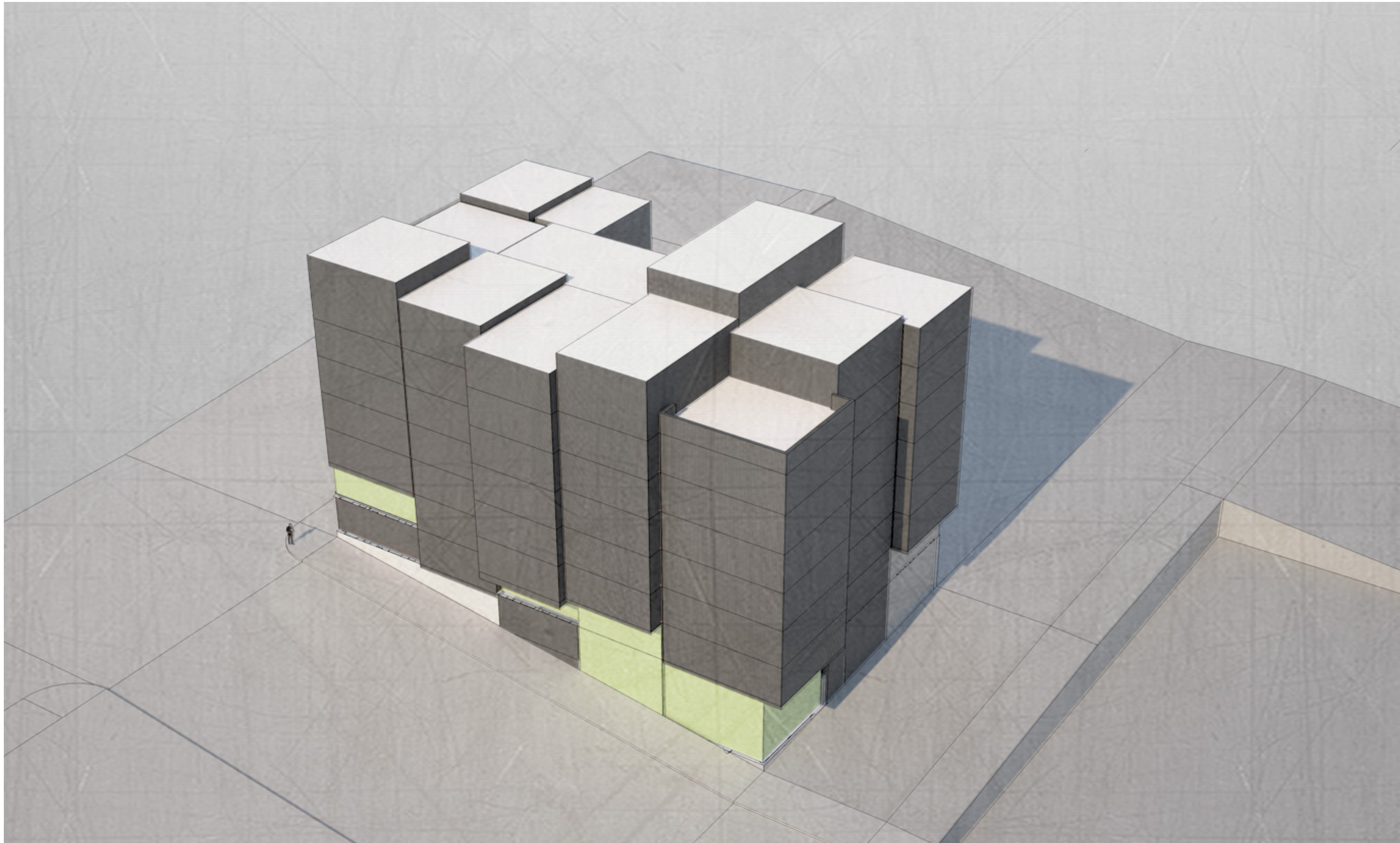
All Encroachments off Concrete Decks.

Fire Marshal Definition of High-Rise Taken from Lowest Access Point.

ANALOG

MASSING STRATEGY

Using Six Stories of III-A



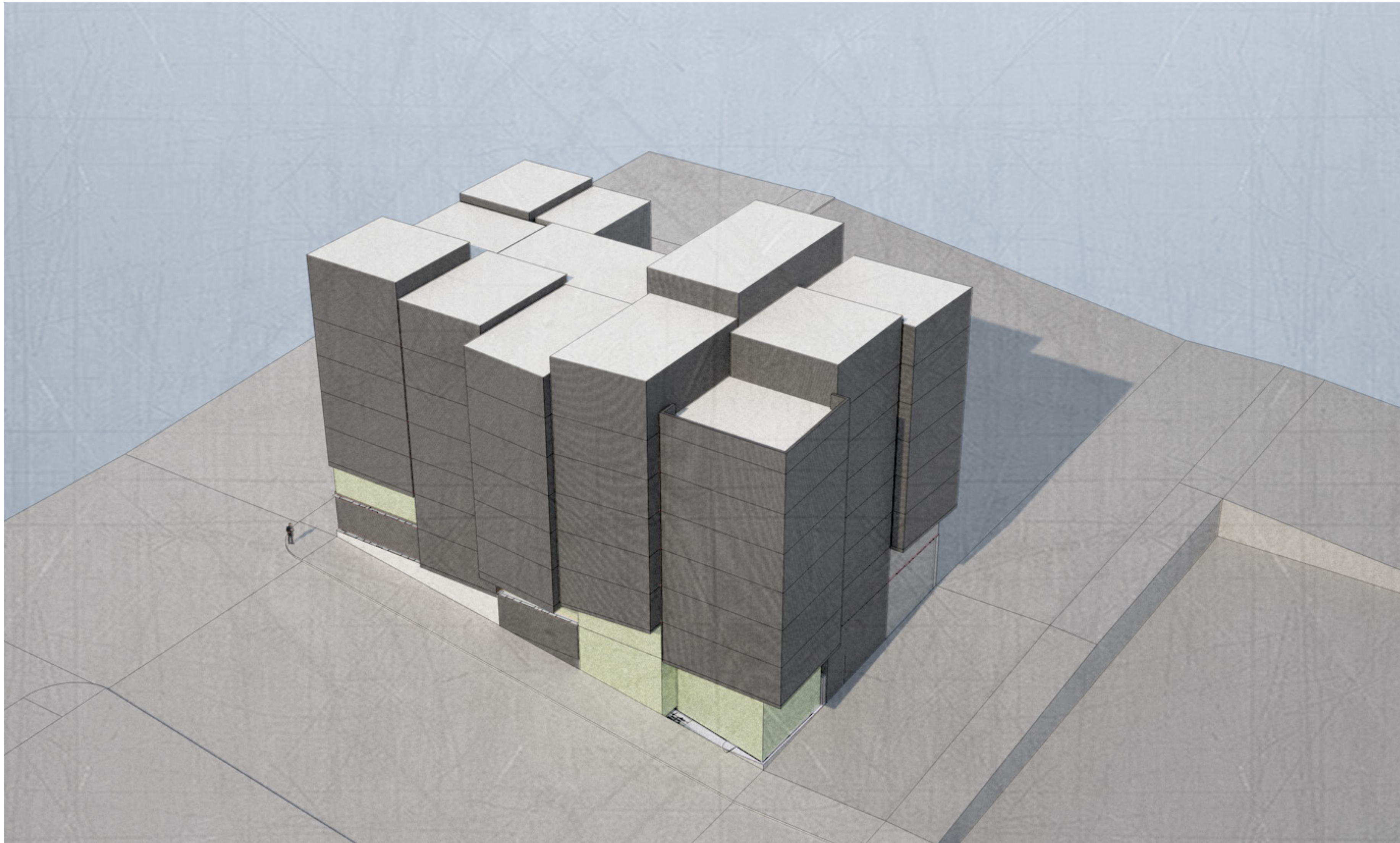
Two-Story Podium + Basement.

All Encroachments off Concrete
Decks.

ANALOG

MASSING STRATEGY

Using Six Stories of III-A



Two-Story Podium + Basement.

All Encroachments off Concrete
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ANALOG

MASSING STRATEGY

Using Six Stories of III-A



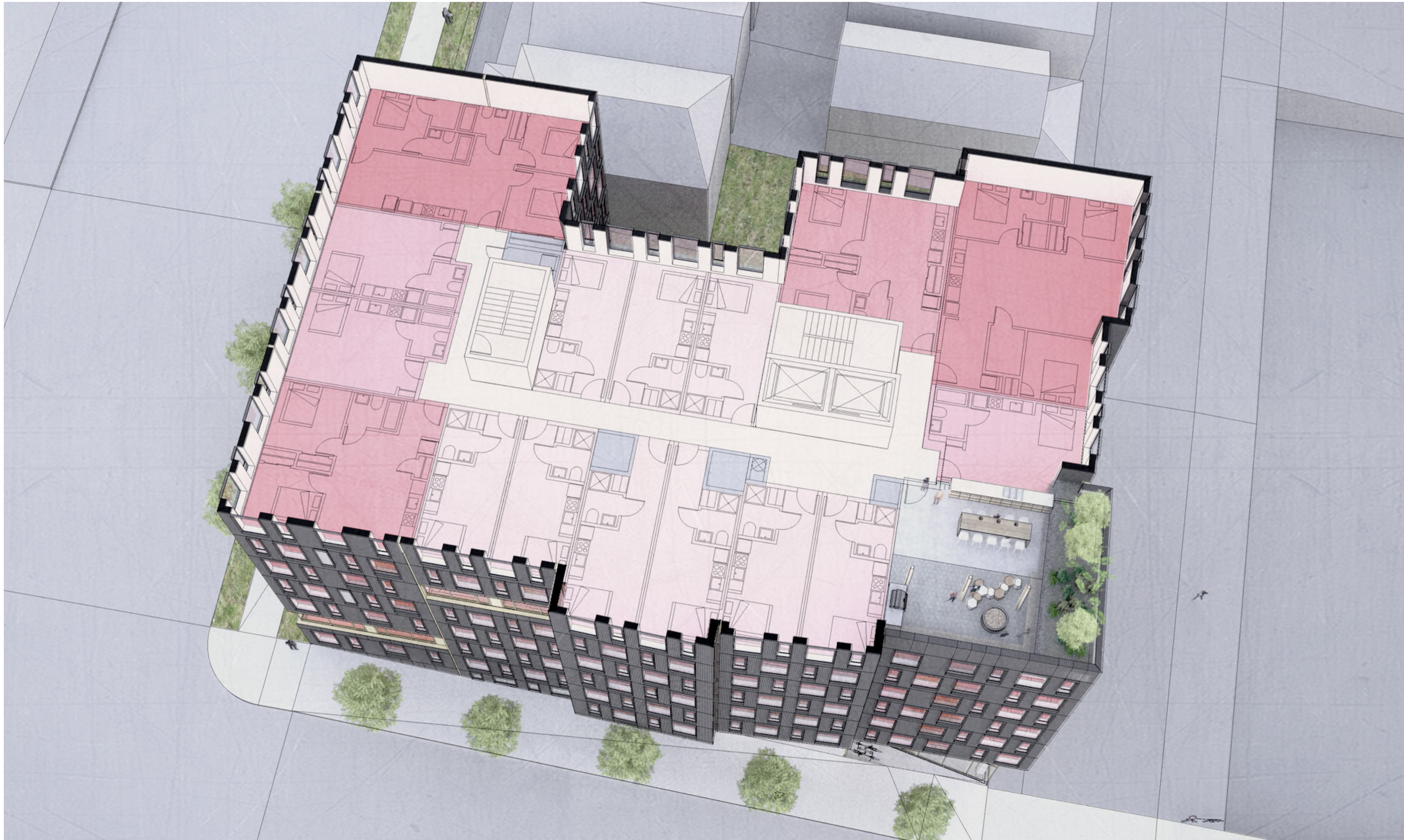
Two-Story Podium + Basement.

All Encroachments off Concrete Decks.

ANALOG

MASSING STRATEGY

Using Six Stories of III-A



ANALOG

FLOOR PLANS

Level 8



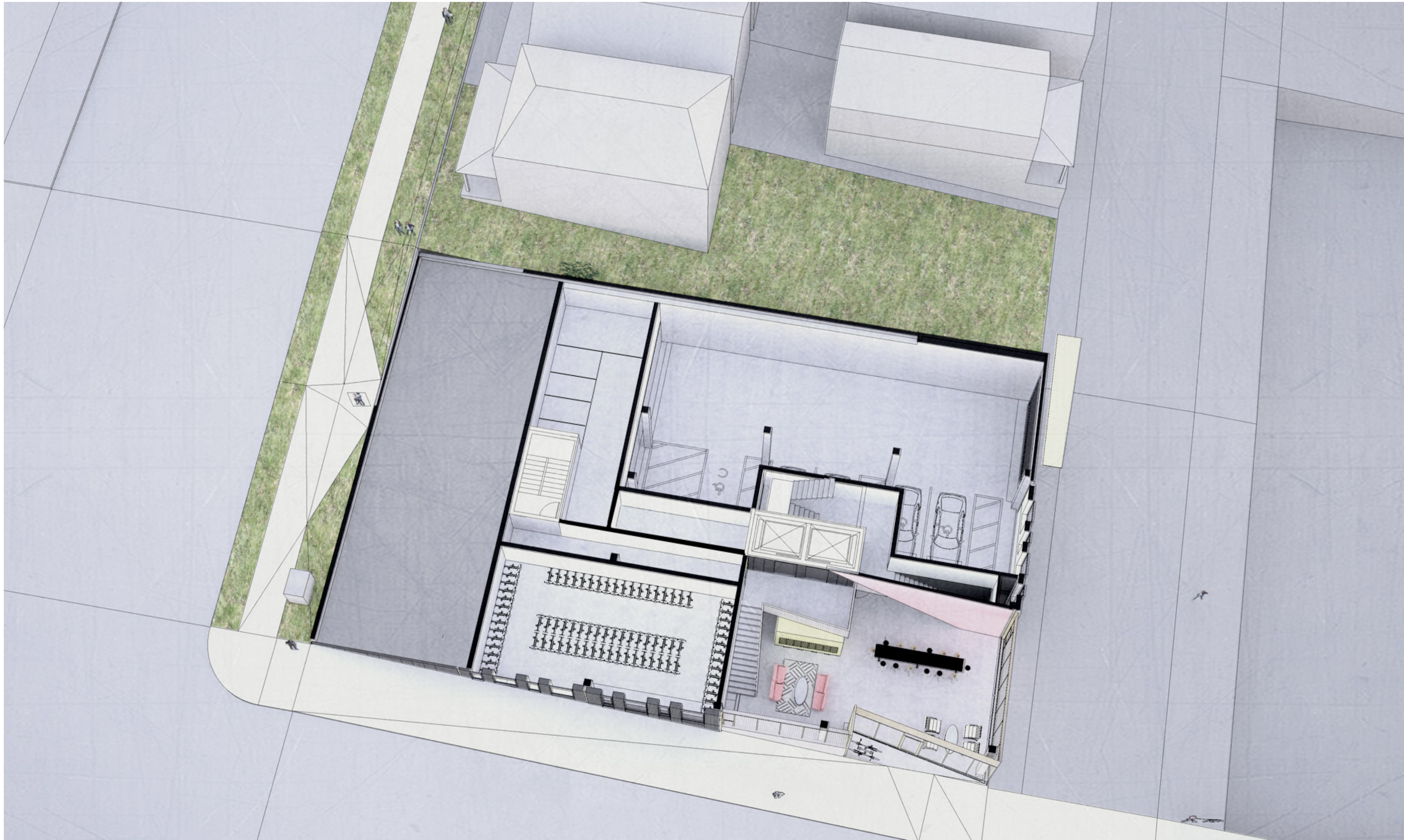
ANALOG

FLOOR PLANS
Typical Residential Floor



ANALOG

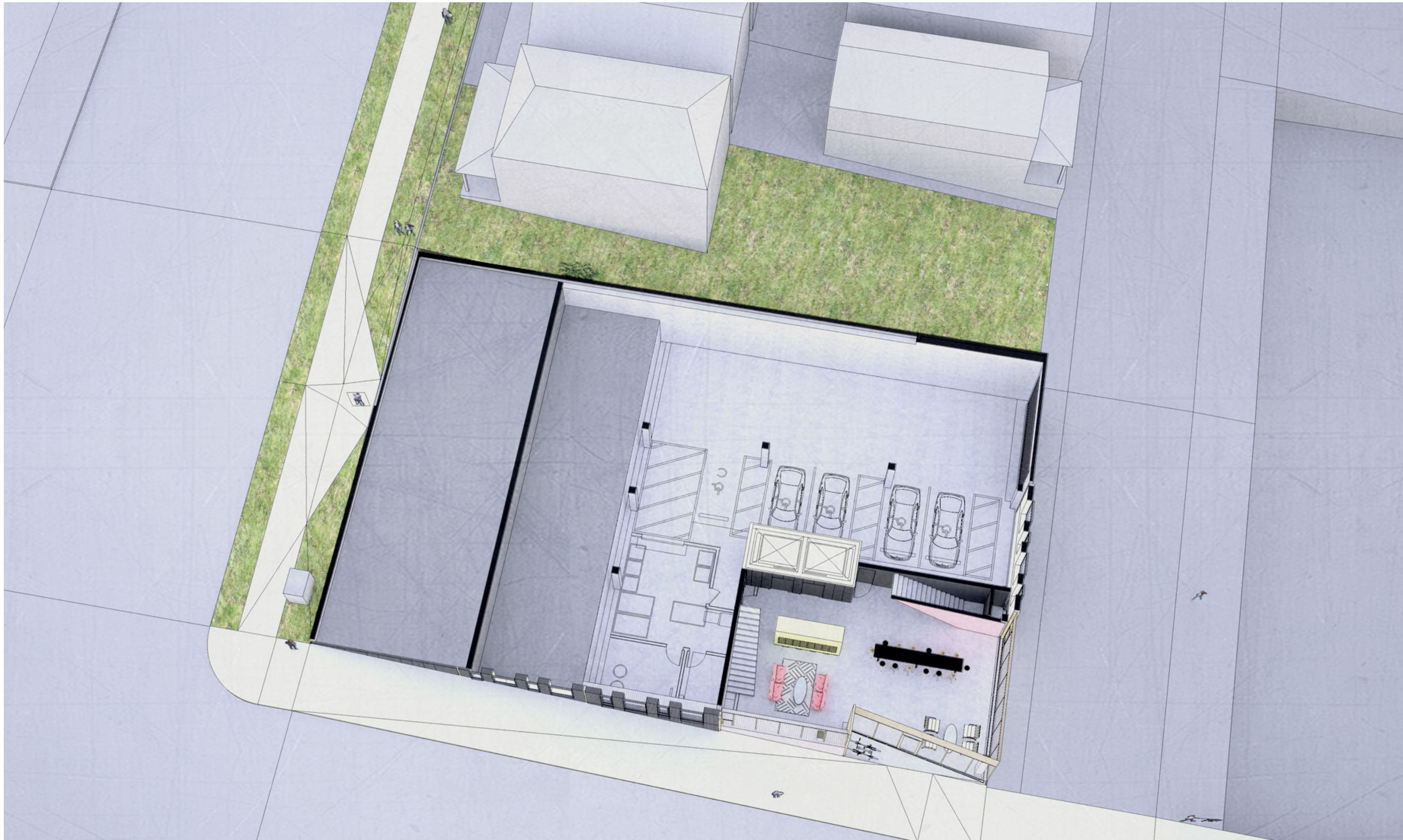
FLOOR PLANS
Level 2



ANALOG

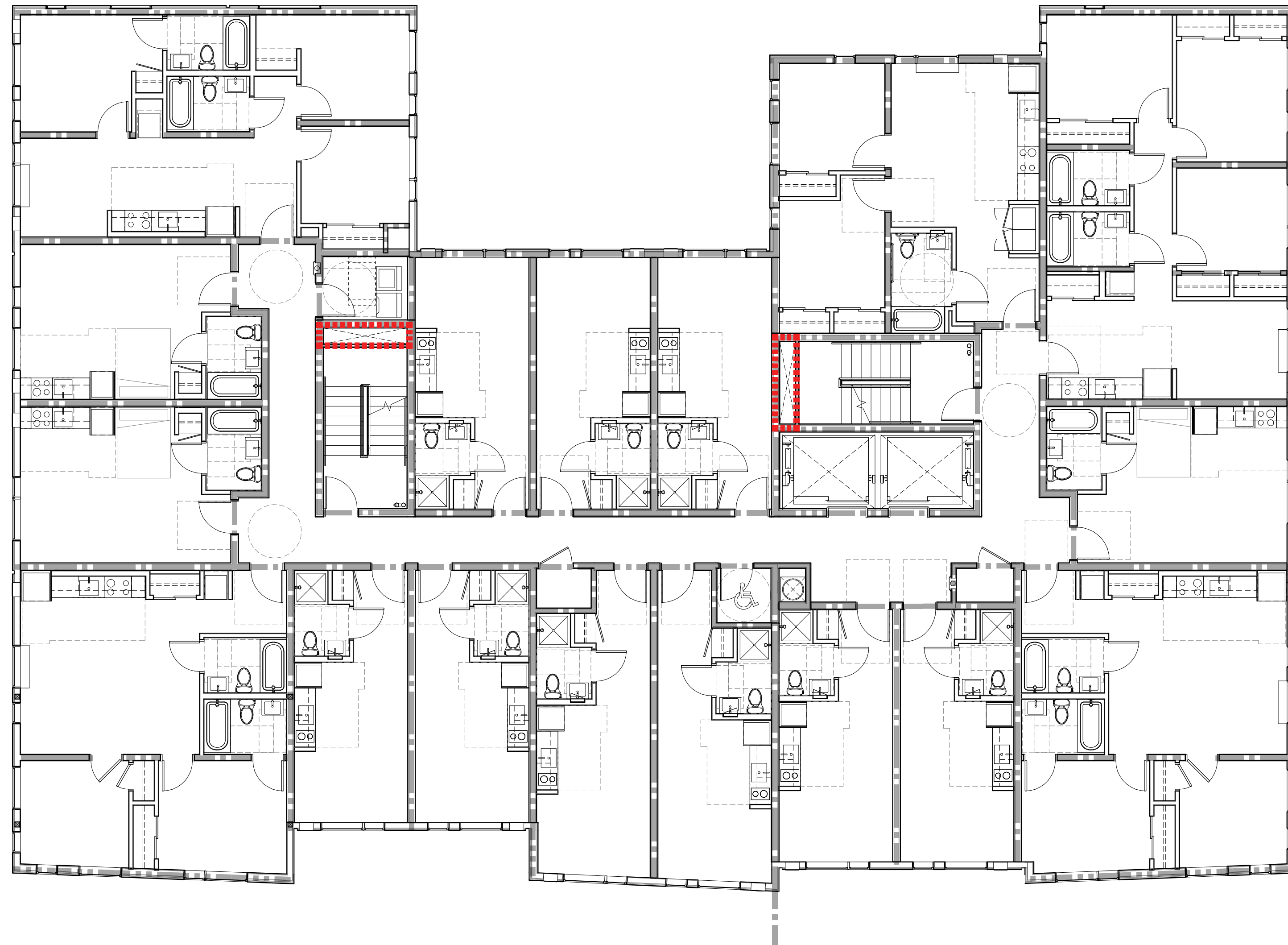
FLOOR PLANS

Level 1



ANALOG

FLOOR PLANS
Basement



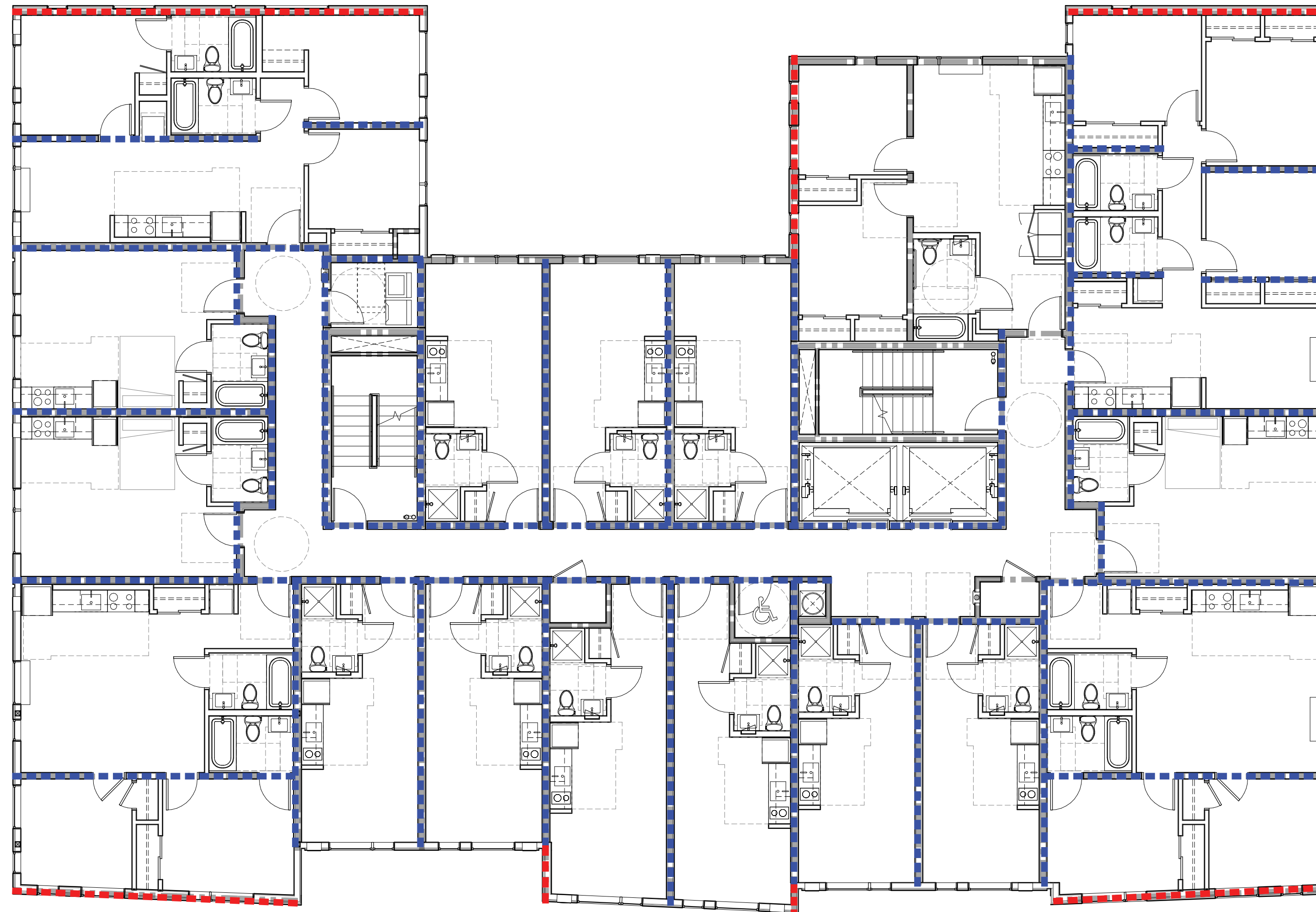
Stair Pressurization Shafts

Opportunity to Eliminate Smoke
Doors on the Elevator Shaft by
Tying it into the Same System.

ANALOG

SIX-STORY WOOD ELEMENTS

Stair Enclosure Pressurization



Bearing Walls Are Located Like Any Other Type III Building, with an Eye Toward Minimizing Exterior Bearing Walls.

Per Table 601
----- 1-hr Wall
----- 2-hr Wall

Walls and Doors in Them Need to Stack.

The AHJ Did Not Accept Asymmetric Assemblies on This Project.

ANALOG

SIX-STORY WOOD ELEMENTS

Bearing Walls



130' x 137.5' Site

19.5' E-W Elevation Change.

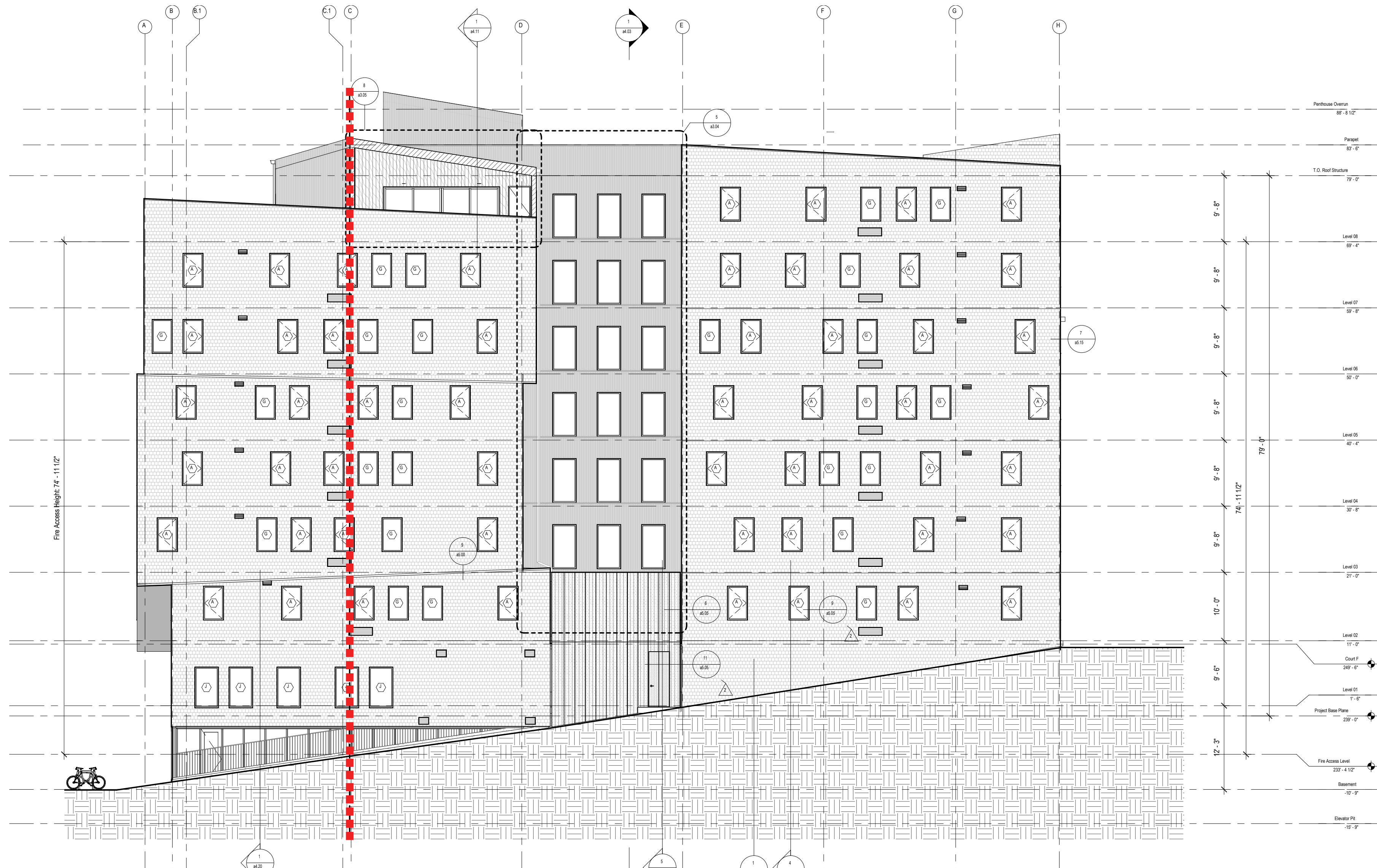
1.0' N-S Elevation Change.

171 Units

Mix of Micros, Studios, 1-Bed,
2-Bed, and 3-Bed Units

6-Stories of III-A Over
2-Story I-A Podium and a
Basement

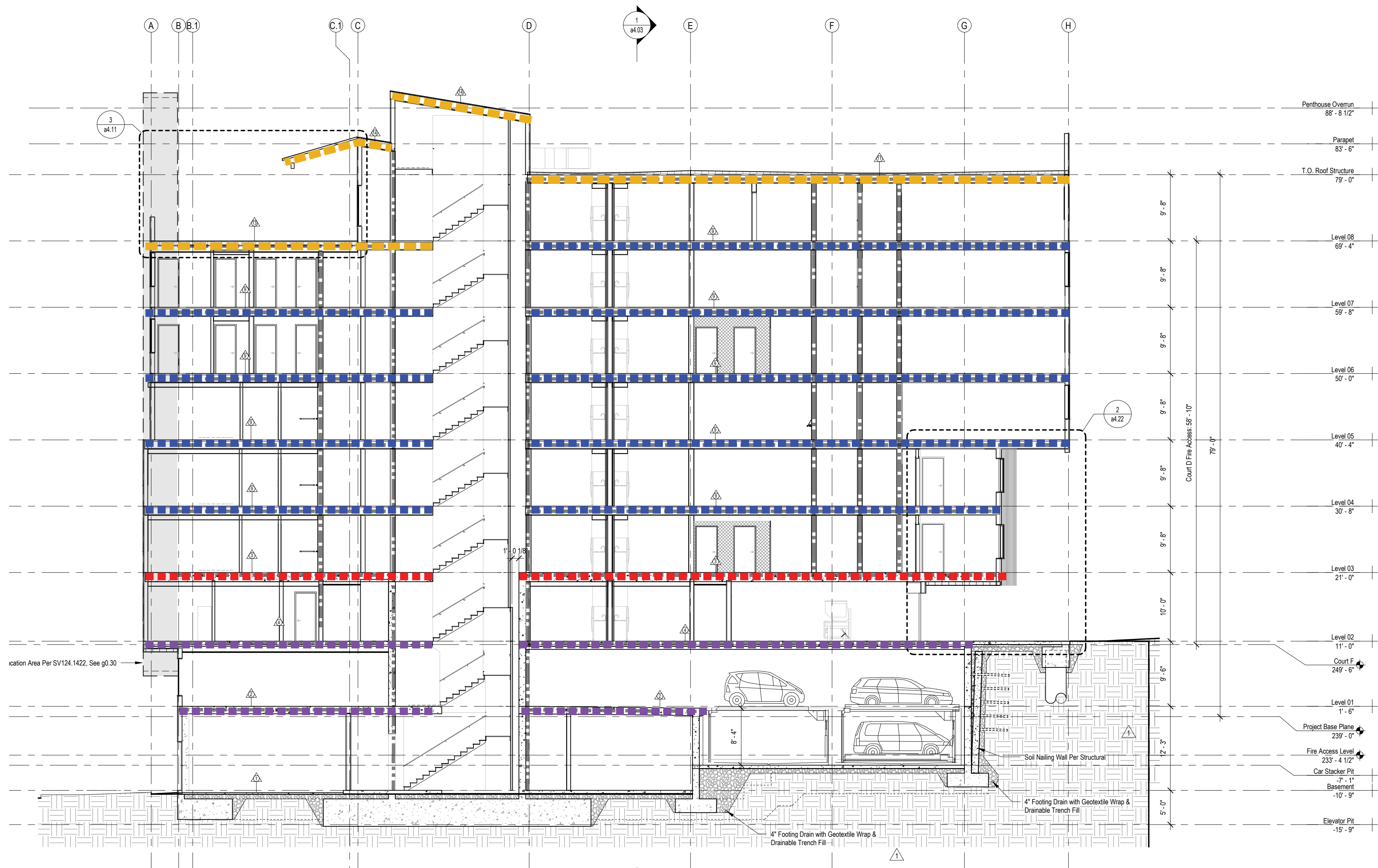
MORaine PROJECT
Tacoma, WA



Lessons Learned:
Considered Fire Access Height
Early in the Design Process

MORaine

BUILDING ELEVATIONS



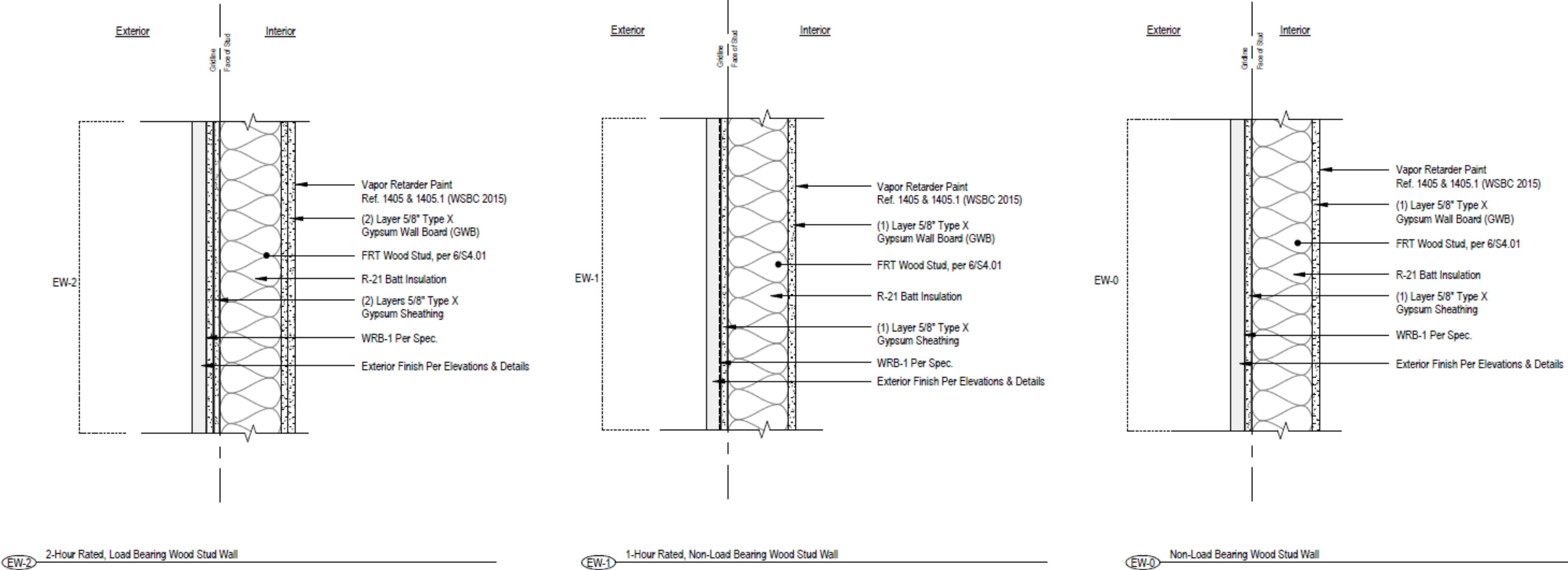
Bearing Walls Are Located Like Any Other Type III Building, with an Eye Toward Minimizing Exterior Bearing Walls.

- 1-hr Floor (601)
- 1-hr Roof (601)
- 2-hr Wall (601)
- 3-hr (510.2)

Walls and Doors in Them Need to Stack.

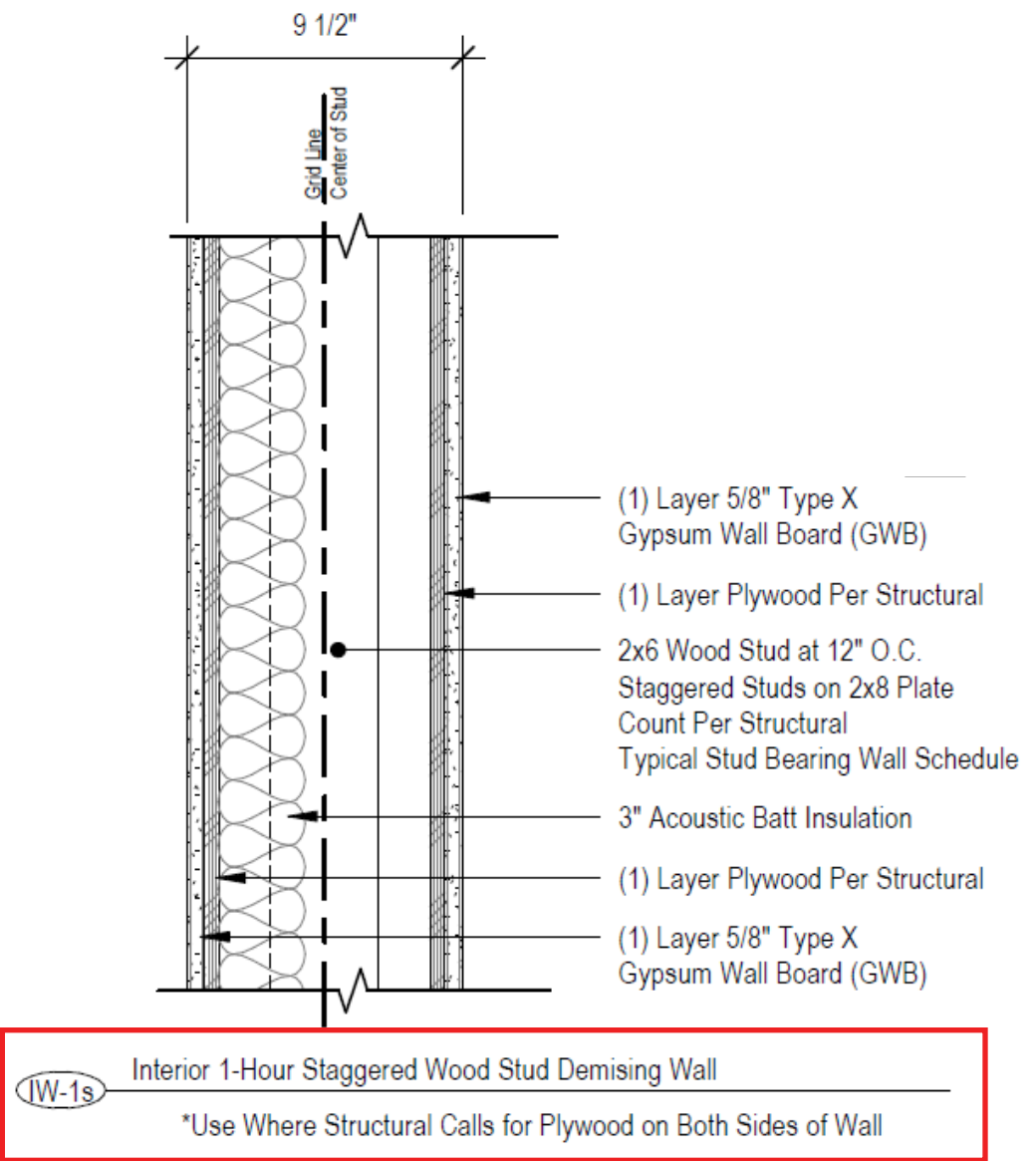
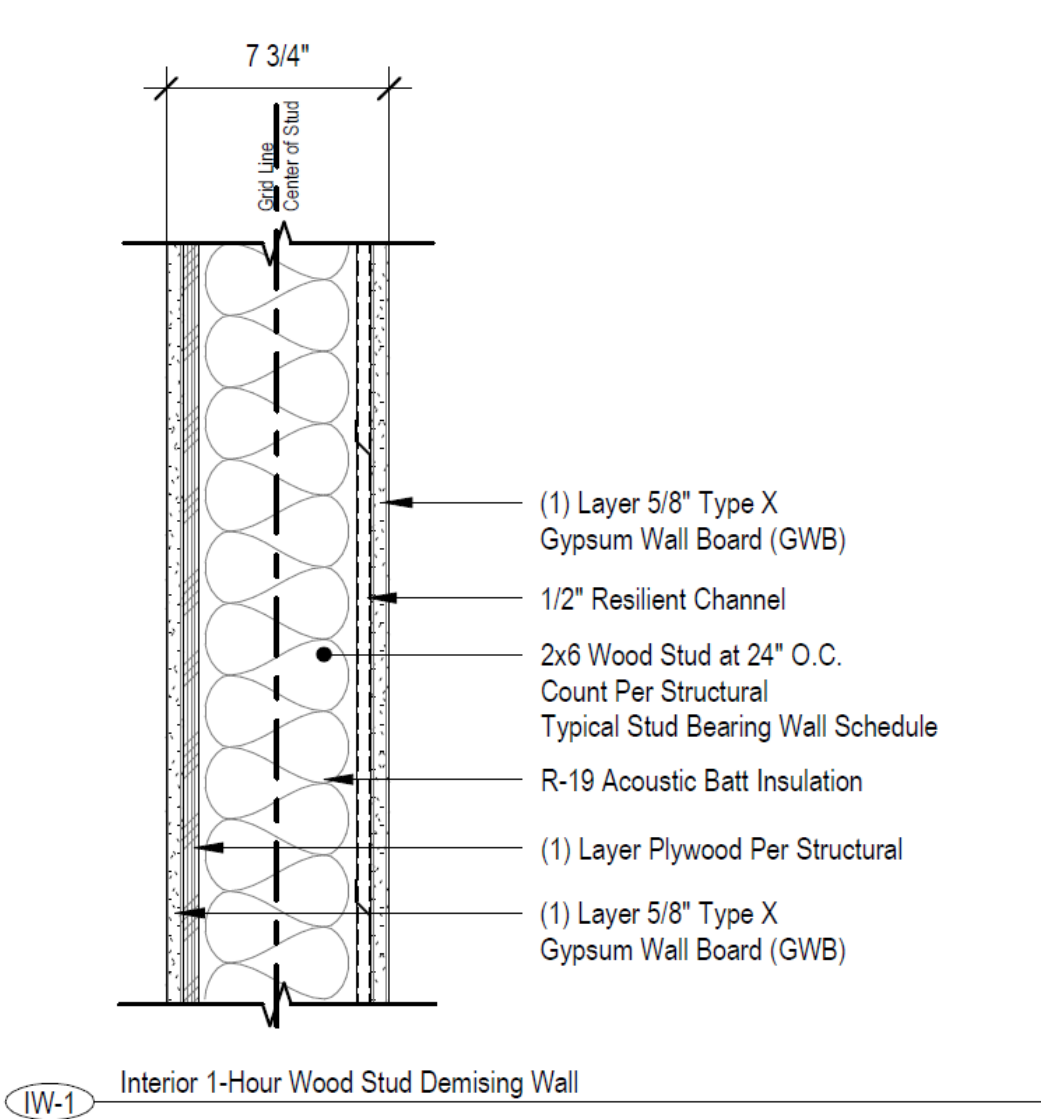
The AHJ Did Not Accept Asymmetric Assemblies on This Project.

Lessons Learned:
Set Exterior Wall Types
Early and Designed with
them in Mind.



Lessons Learned:
Double-sided Shear is
Common on Lower Floors
which Changes Acoustic
Performance and Makes
Trade Work Difficult.

Multi-Stud Pack is Common
on Lower Floors.



STUD WALL CONSTRUCTION SCHEDULE									
TABLE 1 - SHEAR WALL REQUIREMENTS									
MARK	WALL SHEATHING	SIDES WITH SHEATHING	SHEATHING NAILS NOTE 2	EDGE NAILING ON CENTER	EDGE FRAMING NOTE 5	FIELD NAILING ON CENTER	BOTTOM PLATE NOTE 6	BOTTOM PLATE CONNECTION	5/8" ANCHOR BOLT SPACING (EMBED 7" MINIMUM)
A	15/32"	(1)	1Ød	6"	2x	12"	2x	(2) 16d @ 8" O.C.	48" O.C.
B	15/32"	(1)	1Ød	4"	3x	12"	2x	1/4x6 SDS @ 6" O.C.	32" O.C.
C	15/32"	(1)	1Ød	3"	2x	12"	2x	1/4x6 SDS @ 6" O.C.	32" O.C.
D	15/32"	(1)	1Ød	2"	3x	12"	3x	(2) 1/4x6 SDS @ 16" O.C.	16" O.C.
E	15/32"	(2)	1Ød	6"	2x	12"	2x	(2) 1/4x6 SDS @ 12" O.C.	16" O.C.
F	15/32"	(2)	1Ød	4"	3x	12"	3x	(2) 1/4x6 SDS @ 8" O.C.	16" O.C.
G	15/32"	(2)	1Ød	3"	3x	12"	3x	(2) 1/4x6 SDS @ 6" O.C.	16" O.C.
H	15/32"	(2)	1Ød	2"	3x	12"	3x	(2) 1/4x6 SDS @ 6" O.C.	16" O.C.
I	SUREBOARD	(2)	1Ød	4"	2x	6"	2x	(2) 16d @ 8" O.C.	-

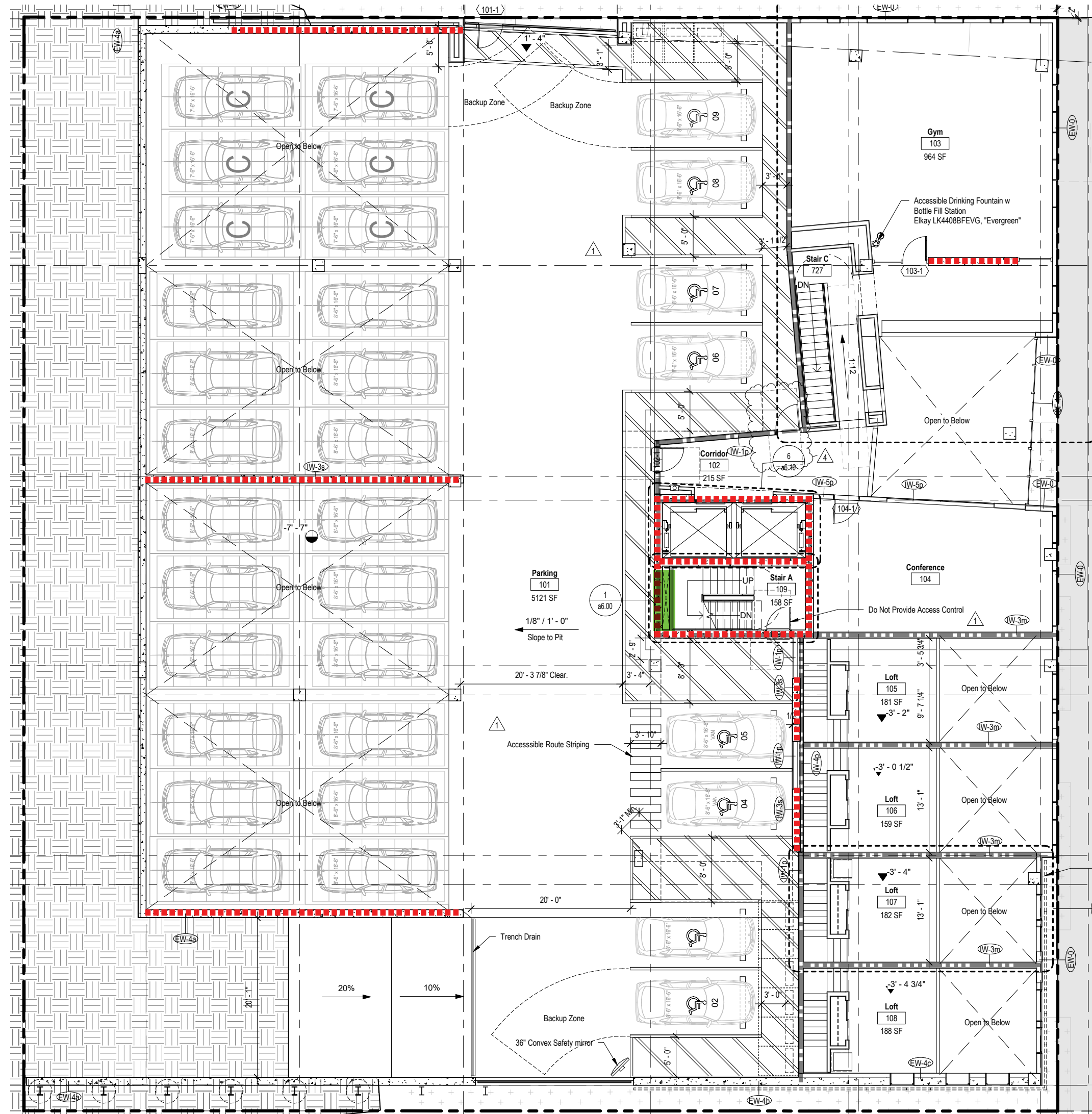
TABLE 2 - STUD REQUIREMENTS		
MARK	STUD SIZE AND SPACING	NUMBER STUDS REQUIRED AT MEMBER BEARING
1	2x6 @ 16" O.C.	(1)
2	(2) 2x6 @ 16" O.C.	(2)
3	(3) 2x6 @ 16" O.C.	(3)
4	2x4 @ 16" O.C.	(1)
5	(2) 2x4 @ 16" O.C.	(2)
6	(3) 2x4 @ 16" O.C.	(3)



Carrying Shear Down Through the Podium Proved the Most Difficult Part with This Program

MORaine

BUILDING PLANS
Basement

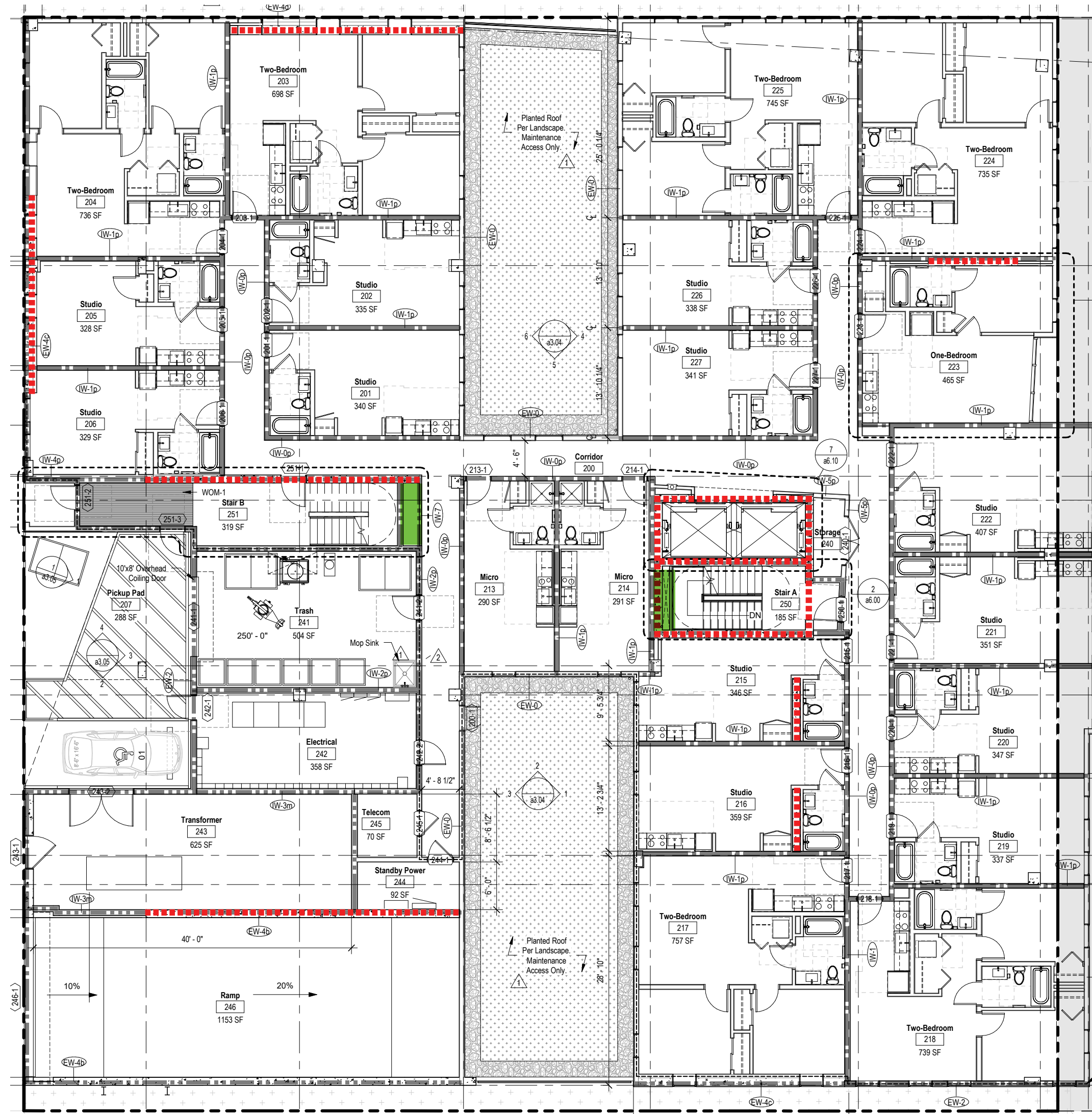


Carrying Shear Down Through the Podium Proved the Most Difficult Part with This Program

MORaine

BUILDING PLANS

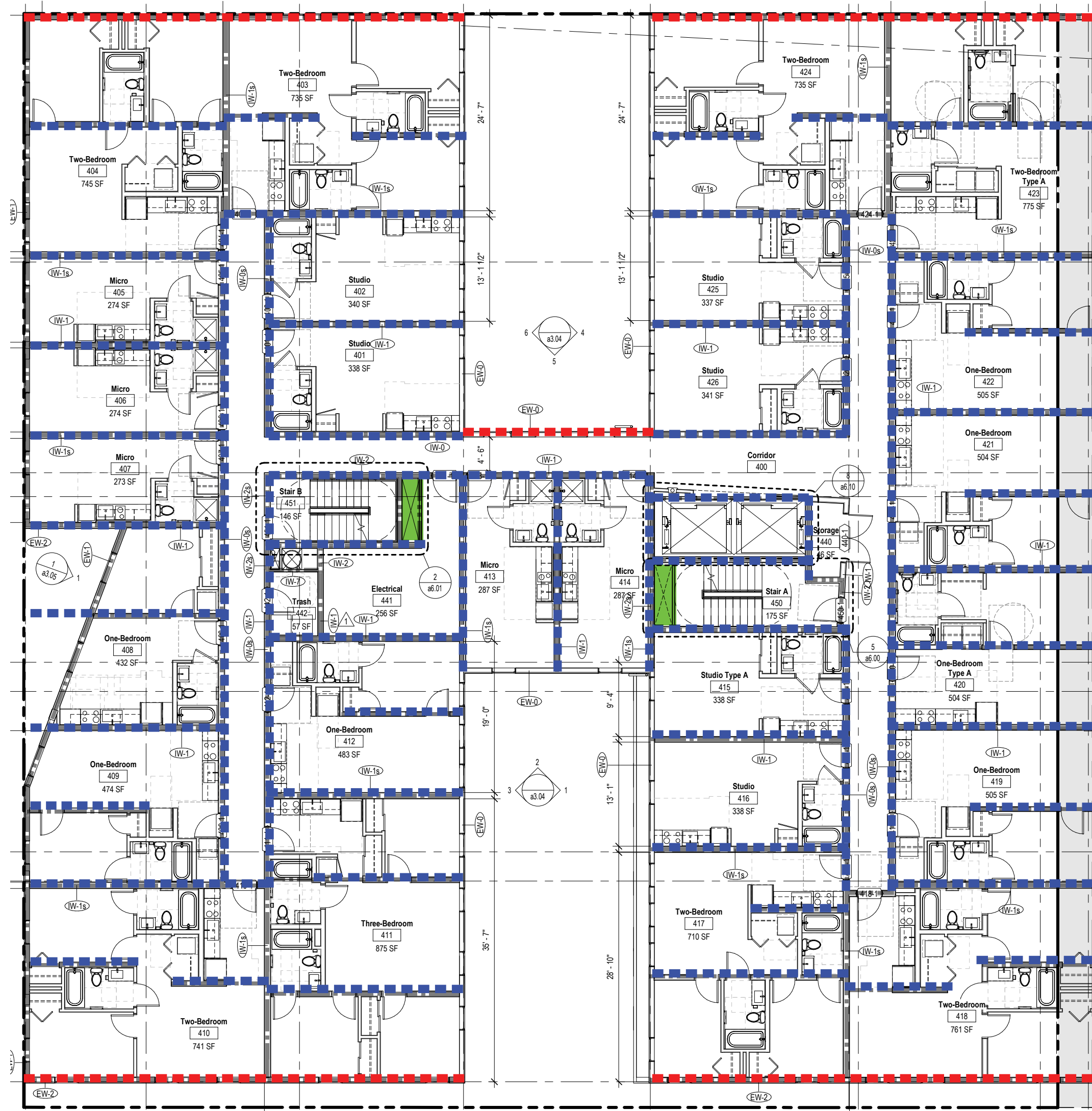
Level 1



Carrying Shear Down Through the Podium Proved the Most Difficult Part with This Program

MORaine

BUILDING PLANS
Level 2



Once into the Wood, the Logics are Very Similar to Fawcett.

Per Table 601
 ---- 1-hr Wall
 ---- 2-hr Wall

Walls and Doors in Them Need to Stack.

Provide Stair Pressurization



Once into the Wood, the Logics are Very Similar to Fawcett.

Per Table 601
 ----- 1-hr Wall
 ----- 2-hr Wall

Walls and Doors in Them Need to Stack.

Provide Stair Pressurization



MORaine

MAIN ENTRANCE



MORaine

GROUND FLOOR LOUNGE



MORaine

EAST DECK



MORaine

NORTH LOUNGE DECK



MORaine

SOUTH LOUNGE

Six Story Type IIIA Structural Impacts

Gravity System:

- All exterior type IIIA wood walls are required to be constructed of fire retardant treated (FRT) lumber. Reference design values for these members are reduced per manufacturer adjustment factors. IBC Table 721.1(2), note m provides some capacity reduction guidance as well.

ADJUSTMENT FACTORS	SPECIES			
	Southern Pine	Douglas Fir	Spruce	Other Species
Compression Parallel, F_c	0.99	0.77	0.92	0.77
Horizontal Shear, F_v	1.00	0.94	0.84	0.84
Tension Parallel, F_t	0.83	0.85	0.94	0.83
Bending: Modulus of Elasticity, E	0.93	1.00	0.99	0.93
Bending: Extreme Fiber Stress, F_b	0.87	0.98	0.86	0.86
Fasteners/Connectors	0.90	0.77	0.90	0.77

Six Story Type IIIA Structural Impacts

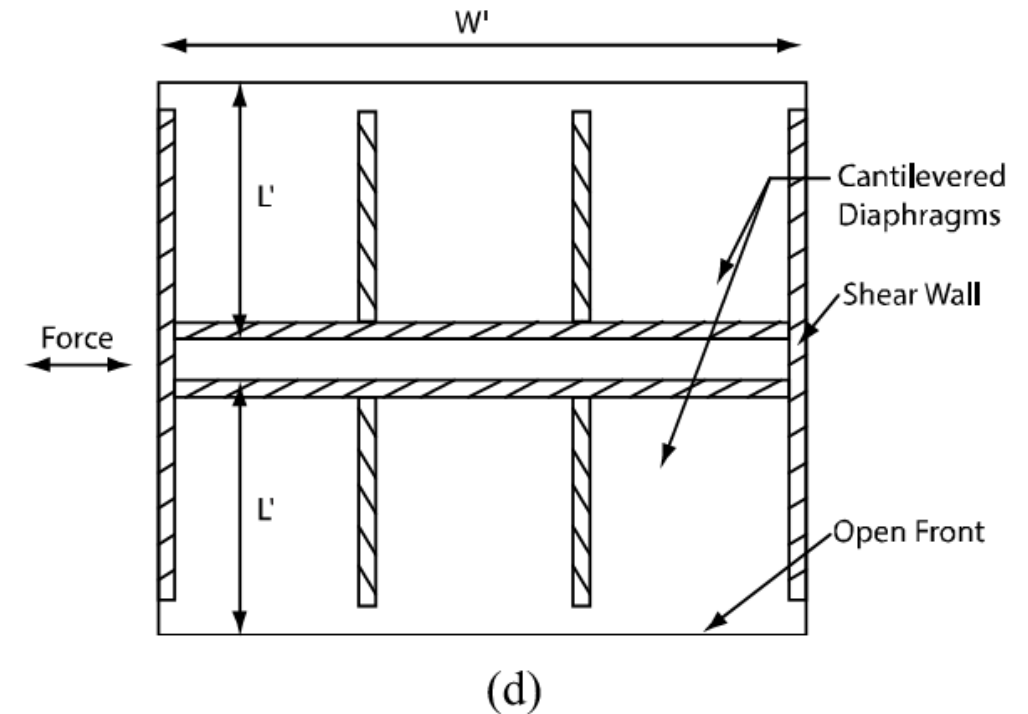
Gravity System:

- Joist bearing at the exterior walls was limited by framing joists parallel to the exterior walls where possible. This reduced the amount of 2-hr rated walls.
- Loads from added story result in additional studs and closer spacing especially at 2x4 walls. Compression perpendicular to grain and crushing of plates important considerations for design.

Six Story Type IIIA Structural Impacts

Lateral System:

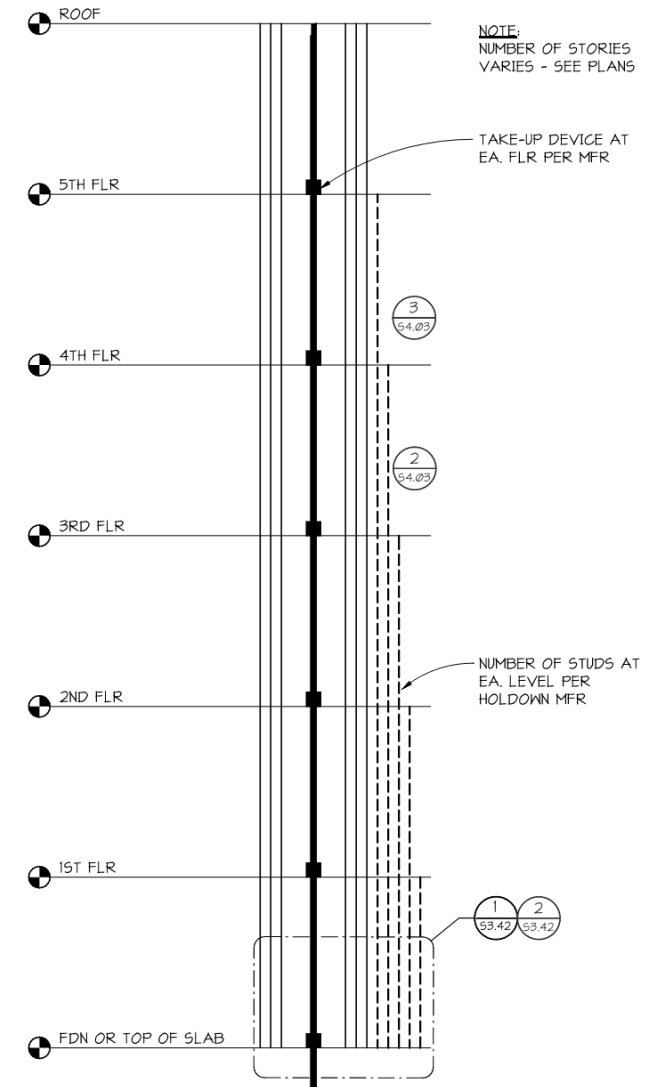
- To reduce 2 hour rated exterior walls, any exterior shear walls were eliminated. This created an open-front cantilevered diaphragm condition.
- An enveloped solution of rigid & flexible analysis was performed to meet the requirements listed in SDPWS Section 4.2.5.2.



Six Story Type IIIA Structural Impacts

Lateral System:

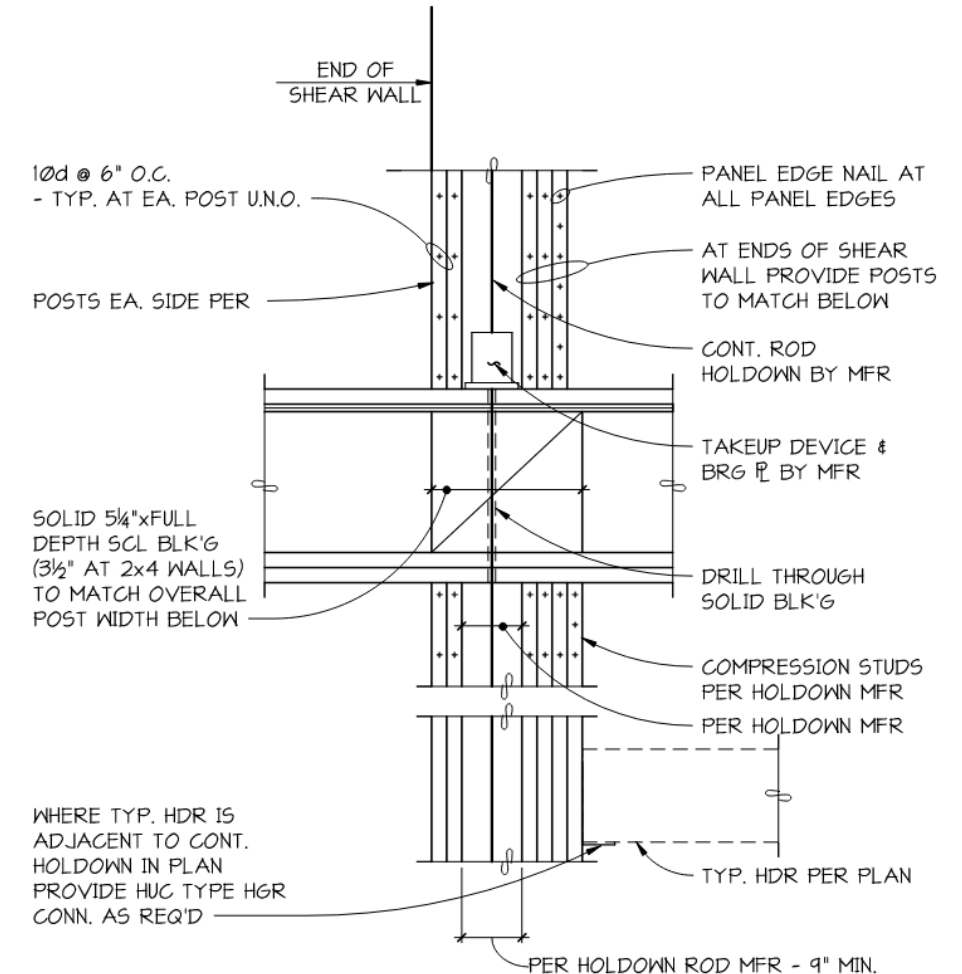
- With the additional story comes increased deflections and higher overturning/shear demands for shear walls. Solutions involved using more stringent holdown deflection allowances and increasing double sided walls to provide additional stiffness and capacity.
- Holdown forces should be included in localized podium slab anchorage & global slab design when over 30 kips.



Six Story Type IIIA Structural Impacts

Shrinkage:

- Ensure continuous rod holdowns have shrinkage compensating take up devices capable of accommodating additional shrinkage from added story.
- Stacking of vertical and lateral elements key to avoiding continuous steel elements and prevent localized shrinkage issues.



TYPICAL CONTINUOUS ROD HOLDOWN ELEVATION

➤ QUESTIONS?

Paul Del Vecchio

Ethos Development LLC

paul@ethosdevelopmentllc.com

Adam Hostetler

Works Progress Architecture

adam@worksarchitecture.net

Alex Davis

PCS Structural Solutions

adavis@pcs-structural.com