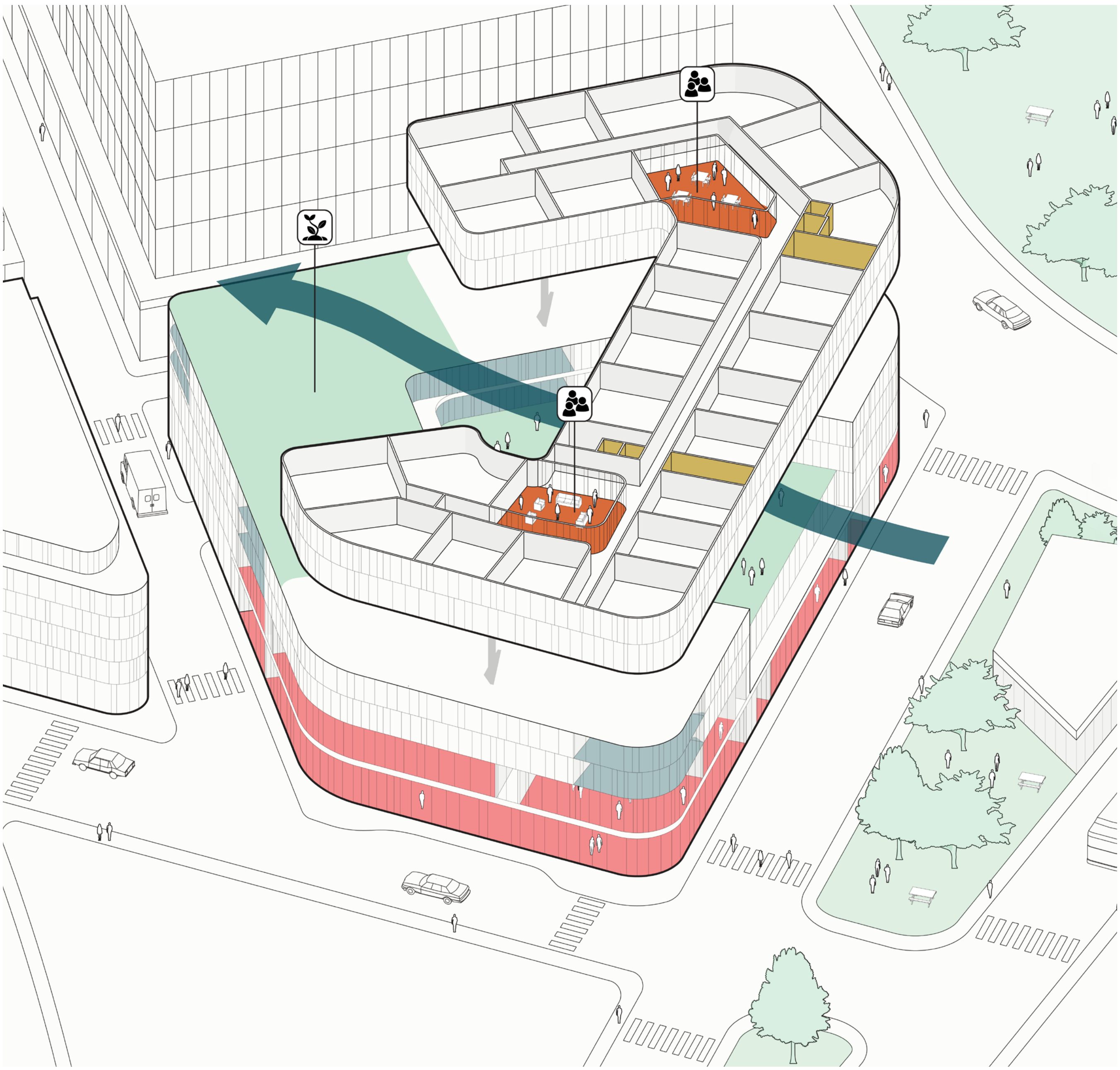
PROJECT Q

MASS TIMBER ACCELERATOR

FINAL REPORT FOR BOSTON PLANNING & DEVELOPMENT AGENCY
AND BOSTON SOCIETY FOR ARCHITECTURE
JULY 15, 2022



DIMELLA
SHAFFER

project team

DiMella Shaffer / Architect

Project Q Communities / 501c3 Owner + Community Partner

HYM Investment Group / Development Partner + Owner of Suffolk Downs

OnePoint Partners / Development Partner

Commodore Builders / Cost Estimator

L.A. FUESS / Structural Engineer

AKF / MEP/FP + Code Consultant

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EXECUTIVE SUMMARY

SUMMARY REPORT

This report summarizes a mass timber study through the Boston Planning and Development Agency (BPDA) and Boston Society for Architecture (BSA) Accelerator Grant for one of two parcels located at Suffolk Downs in East Boston. The project is developed by Project Q Communities, OnePoint Partners, and HYM Investment Group. Project Q Communities, a 501c3 non-profit focused on developing LGBTQ friendly senior housing partnered with OnePoint Partners, a national firm who specializes in the development, marketing, and financing of senior housing, and HYM Investment Group as developers of the former Suffolk Downs racetrack. The project pioneers urban, entry fee senior housing in Boston. Project Q Communities aims to build one of the largest developments of this kind and will lead New England in providing market-rate urban housing with a focus on the LGBTQ senior community.

This partnership seeks to develop 205 units of market-rate senior housing and related amenities. The site includes parcels B018 and B019, which allow for the construction of two buildings. DiMella Shaffer focused on the eight-floor high-rise building on parcel B018. The first floor includes amenities such as the reception lobby, fitness room, restaurant, and large gathering room; the second and third floors are dedicated to assisted living and memory care units, and the upper five floors consist of independent living apartments. A large terrace is located at the second floor providing access to outdoor space, a priority of the building design. The smaller site, parcel B019, is not covered in this report.

Parcel B018 is approximately 306,700 gross square feet and given the buildings' size and complexity is the focus of the mass timber study. The original design envisioned podium construction with five floors of wood over three floors of steel and concrete. In contrast, mass timber lowers the embodied carbon, is a renewable resource, offers design opportunities, and is feasible for this occupancy type without significant added cost. In addition, mass timber contributes to a biophilic environment, establishing a connection to nature, a beneficial feature for senior living.

By designing eight floors of mass timber construction instead of the traditional steel and concrete podium, we maximized the use of the lower embodied carbon structural system throughout the entire building. Over a typical building life cycle, embodied carbon can have a similar importance as operational carbon emitted from heating and cooling and it is thus imperative to consider low-embodied carbon in the design process. It is also necessary for projects to understand the practicality of a mass timber approach and scaling it up for larger buildings. This study is a catalyst for future high-rise construction projects in the Boston area.

Our study shows that mass timber is applicable to both orthogonal and complex forms; mass timber is flexible and can be applied to a large range of building shapes and occupancy types, including senior living. It is also critical to balance the architecture with the structure and to review them in tandem to rationalize the structural efficiencies.

From the beginning of the study, our goal has been to use mass timber throughout the building which drove various decisions during the process. Given the mixed-use occupancy, the need is for a structure with long spans for the first floor amenity spaces, as well as stacked structure for the senior living units above. We established a bay of 25', 16', 25' across the building width, which reduces the number of columns within the amenity program and works for a typical one-bedroom independent living unit but introduces common beams. This in turn is a challenge for mechanical systems, but through the study we illustrate how this can be conceptually solved. 25' maximizes the mass timber structural capacity and the central 16' grid spacing allows for a column free corridor and a reduced girder depth.

Except for steel structure within the automated parking and loading dock zone at the first floor, the composite slab below the second floor terrace, and cast-in-place concrete cores for shear requirements, all other structure is comprised of mass timber. The application of mass timber includes the 5-ply cross-laminated timber (CLT) deck, 18" by 18" glue-laminated (glulam) timber columns, two 6.75" thick by 22" deep glulam girders aligned with the unit demising walls, and perpendicular 8.5" thick by 16.5" deep glulam common beams. The girders reduce in size to 6.75" by 16.5" within the corridor, facilitating MEP distribution. Two girders are necessary for an economical connection, a key component to the study.

At the second floor terrace, a long span opening was originally designed to promote airflow from the nearby ocean through the eastern façade into the elevated courtyard, and the form is carved to allow sunlight to reach the terrace floor. We evaluated multiple options for the 92' opening and determined that the best embodied carbon approach is exposed glulam columns that follow the grid spacing above. The basis of design species is Alaskan Yellow Cedar, due to its' naturally decay resistant properties.

Given the occupancy use classification and construction type IV-C, parcel B018 is limited to a height of 85', which results in the following floor-to-floor heights: 12'6" (first floor), 11' (second floor), 11'6" (third floor), 10' (upper five floors). The 10' floor-to-floor height is a challenge from a mechanical standpoint, which drove us to study in-unit energy recovery ventilators (ERV) for the upper five floors to minimize cross ductwork with the framing. In addition, corridor ventilation is provided by rooftop dedicated outdoor air system (DOAS) units and delivered via stacked vertical shafts and sidewall diffusers. A central ERV system provides fresh air to the lower three floors. Minimizing rooftop mechanical allows ample area for photovoltaic panels.

While it may present added challenges as described above, and lead to additional coordination by project teams earlier in the design process, mass timber is a viable construction approach to senior housing buildings. Through the study, we've identified several hurdles, each with a different impact on the design and construction of parcel B018. In all cases, we were able to develop solutions and strategies to overcome those challenges. We've learned that the earlier in the process we understand the structural approach, the better positioned we are to look holistically at how to coordinate the structural and mechanical systems supporting the building.

WOODWORKS CARBON SUMMARY

results

Volume of wood products used:
6,770 cubic meters (239,075 cubic feet)

U.S. and Canadian forests grow this much wood in: **18 minutes**

Carbon stored in the wood:
6,014 metric tons of carbon dioxide

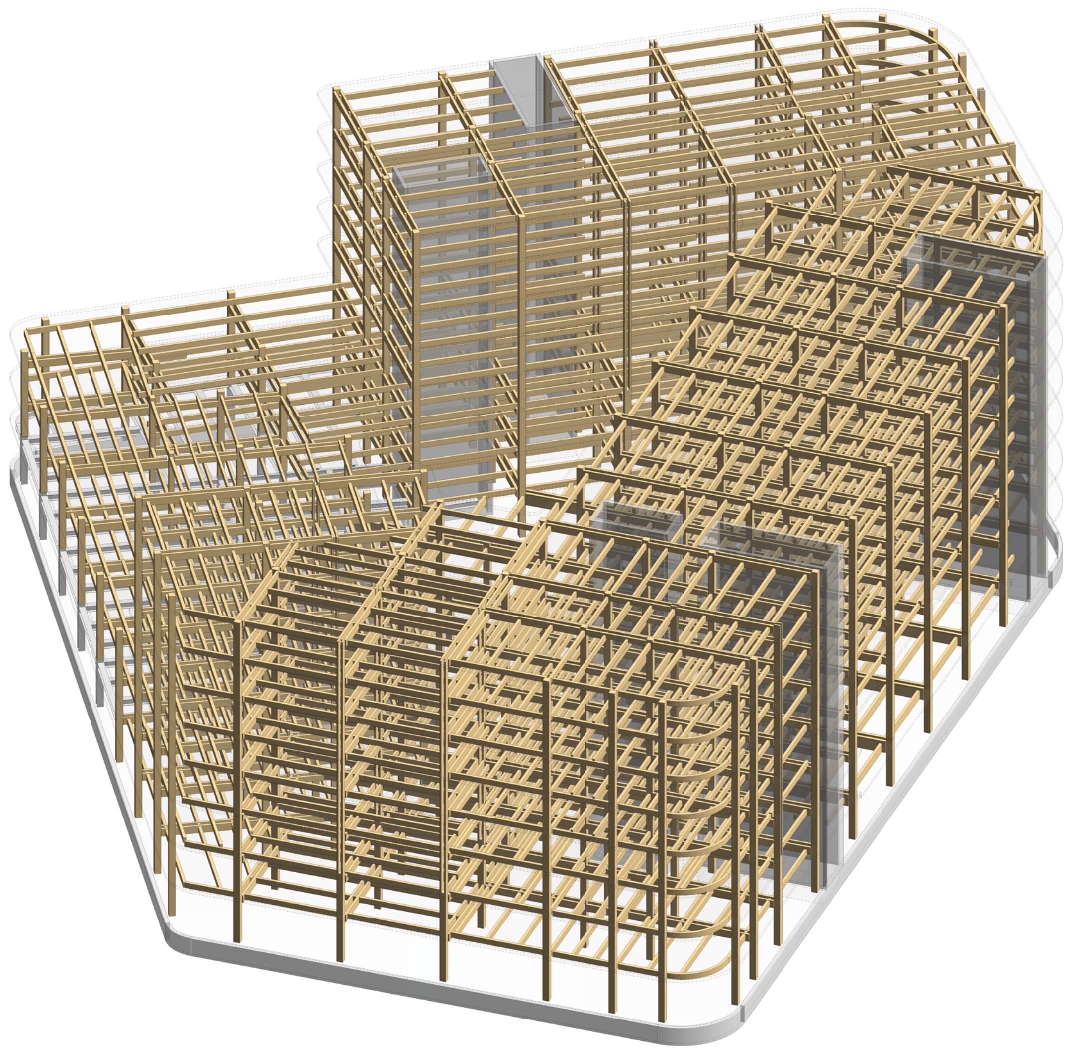
Avoided greenhouse gas emissions:
2,327 metric tons of carbon dioxide

Total potenial carbon benefit:
8,341 metric tons of carbon dioxide

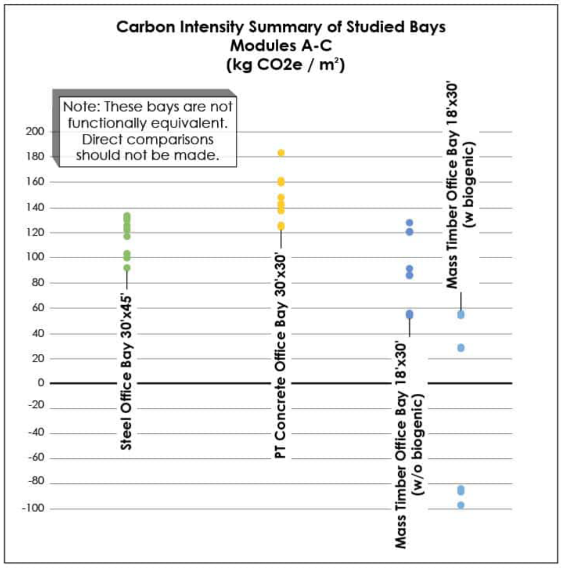
equivalent to

1,764 cars off the road for a year

Energy to operate **881 homes** for a year



LIFE CYCLE ANALYSIS



Source: SE 2050

DiMella Shaffer created two life cycle assessments using Tally, to study the following:

Analysis A (concrete cores & gypcrete)

- Includes CLT floors, glulam frame, cast-in-place concrete stair and elevator cores, composite slab at second level, slab on grade and foundation walls, steel frame at ground level, and gypcrete topping
- **2,270,632 kg CO2e** total global warming potential
- **80 kg CO2e per m2**

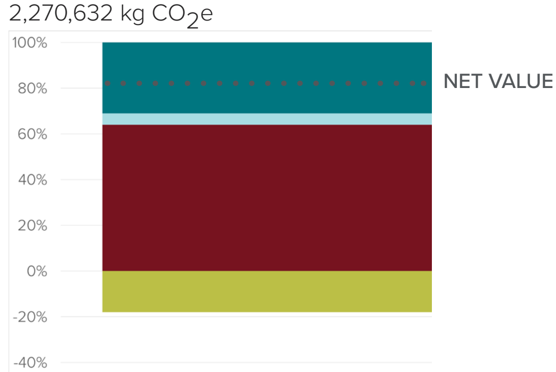
Analysis B (concrete cores w/out gypcrete)

- Includes CLT floors, glulam frame, cast-in-place concrete stair and elevator cores, composite slab at second level, slab on grade and foundation walls, and steel frame at ground level
- Gypcrete is excluded because it is not a structural element and therefore this analysis provides a more direct comparison to the SE 2050 carbon intensity summary
- **1,404,406 kg CO2e** total global warming potential
- **50 kg CO2e per m2**

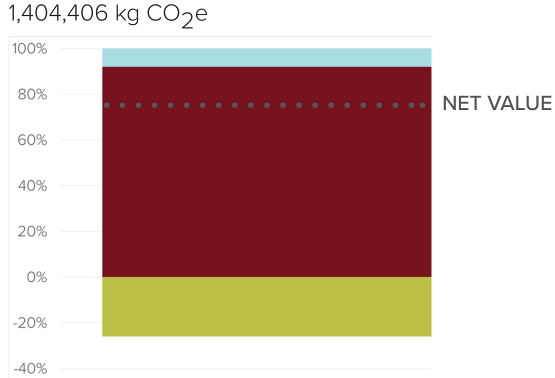
We assumed 30% fly ash for the cast-in-place concrete cores and 20% fly ash for the composite floor slab. The sum of the Global Warming Potential (GWP) includes Module D and is with biogenic carbon.

GLOBAL WARMING POTENTIAL

ANALYSIS A
2,270,632 kg CO_2e



ANALYSIS B
1,404,406 kg CO_2e



BENEFITS / OUTCOMES

DESIGN AND CONSTRUCTION STRATEGIES

Mass timber is often used with orthogonally stacked forms; however, orthogonality is not the only solution, and we show that more complex forms can be effectively built using mass timber.

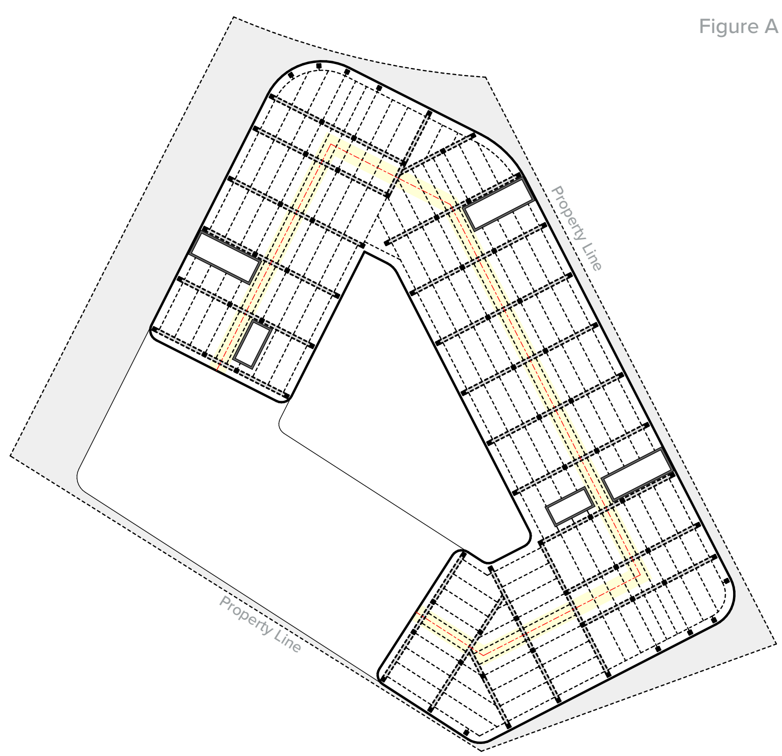
Our strategies from the beginning of the study have been to balance mass timber with the original angular form and to promote the use of mass timber throughout the entire building. The zoning designation for the site is a zero-lot line and therefore allows for maximum gross area which drove the original form. However, the site does not have 90-degree angles. To solve for angles, we needed to diagram the corridor to understand where and how the structure would intersect. We deviated slightly from the original form and site angles to rationalize the structural grid and simplify the intersections with 90- or 120-degree angles. At the lower corner of the site, the 96-degree angle is maintained to maximize the second floor terrace footprint, an important design aspect. Additional landscaping can be accommodated at the first floor when the form is not parallel with the property line.

See Figure A to the right.

The main factors in the development of the mass timber framing layout stem from the need to fit with both a typical one-bedroom independent living unit and the amenity program at the first floor. While 12’6” bay spacing would have worked for the independent living unit layout, it would have introduced too many columns within the amenity program. Therefore, typical bay spacing is 25’ by 16’ by 25’. The column centerline is setback 2’ from the face of the exterior wall, which drives the 70’ outside wall to outside wall dimension.

The L.A. Fuess team was critical to determining if this approach was structurally feasible, as well as developing the framing sizes. The 25’ bay spacing results in glue-laminated (glulam) timber girders and perpendicular glulam common beams. Common beams, while necessary to the structural system, present a mechanical challenge, which will be discussed later in the report. However, because the CLT

Figure A



floor deck needed to be 5-ply to meet the required 2-hour fire rating, a thicker floor afforded common beam spacing flexibility. In addition, common beams are located an additional 2' in from the outermost columns, which allows for potential mechanical distribution and greater window height if desired. Where the form returns at each end, columns and beams are located 4' in from the outside face of the wall, maintaining the exterior corner curvature.

To satisfy the shear requirements, the stair and elevator cores are designed to be cast-in-place concrete. However, based on the life cycle analysis in Tally, concrete embodies a substantial percentage of the project's global warming potential. We have begun to explore opportunities to decrease the embodied carbon through the replacement of concrete with supplementary cementitious materials (SCM's) and preliminarily established 20% fly ash for the concrete floors and 30% fly ash for the concrete walls. Higher strength rebar within the concrete core walls could also help to reduce the embodied carbon. We also investigated the use of steel brace frames in lieu of cast-in-place concrete; however, additional brace frames would be required beyond the core locations which was not desired from a programming perspective. Concrete masonry units were also studied but would not be able to meet the structural requirements.

At the second floor terrace, a 92' span opening was originally designed to promote airflow from the nearby ocean through the eastern facade. The study allowed for multiple strategies to be evaluated: hybrid mass timber and steel truss, steel truss, and exposed mass timber columns. The hybrid mass timber and steel truss was determined to not be feasible due to the significant loads from the five floors above.
The steel truss would have created additional embodied carbon. Therefore, we proceeded with exposed glulam columns that follow the grid spacing above. L.A. Fuess and WoodWorks provided feasibility feedback, precedents, and helped to select an applicable wood species for the weather exposure. The team chose Alaskan Yellow Cedar for the basis of design, due to its' naturally decay resistant properties. Some precedent examples include: The Soto, DC Southwest Library, and the Mystic Seaport Museum.

Mystic Seaport Museum

Architect: Centerbrook
Photo Credit: Jeff Goldberg/Esto

.The typical floor structure consists of a finish floor over 2" of gypcrete, over .5" acoustic mat, over 5-ply (6.875") CLT deck. The floor assembly meets the requirements of the 2-hour floor fire rating. The glulam columns are 18" by 18". The face of the double demising wall aligns with the face of the column. Two 6.75" thick by 22" deep glulam girders are centered along the 25' bay spacing and coincide with the unit demising walls. The girders reduce in size at the corridor to 6.75" by 16.5", which facilitate MEP distribution. The column is notched by 3" on each side to accept each girder, which results in a 1' gap between the girders. The notch allows for the girders to continue, which takes the shrinkage out of the connection and uses the wood naturally to do the work, and results in an economical connection. The added benefit of the 1' gap allows plumbing piping to stack throughout the building, which was also evident at 11 East Lenox. We had initially thought that the gap would be a good opportunity for mechanical ductwork but decided against the approach due to acoustic and fire considerations. 8.5" by 16.5" glulam common beams connect to the girders perpendicularly.

See Figure C below.

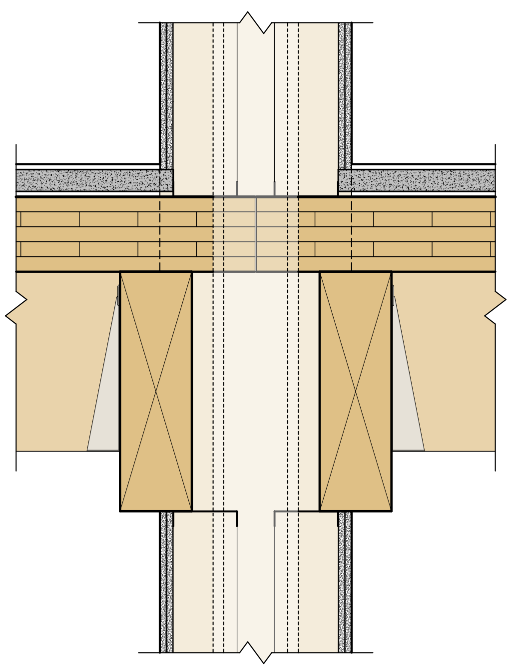


Figure C

BUILDING CODE STRATEGIES

Up until this time, the advancement of tall structures with mass timber has been limited, in part due to the building code.

IBC 2021 is a catalyst for the design of tall mass timber structures, with the addition of construction types IV-A, IV-B, and IV-C.

Initially B018 was designed to meet the requirements of the 2015 International Building Code: five floors of construction type 3A over three floors of construction type 1. With the premise of the study requiring the exploration and validity of using mass timber, the 2021 International Building Code gives us the most flexibility. Under the new building code, which is yet to be adopted, B018 is designed to meet the requirements of type IV-C construction.

With the variety of mixed-use occupancy that we have within our program, floors two and three have the most restrictive code requirements as it pertains to the type of construction as well as the type of occupancy. Occupancy type I-1, Condition 2 limits the height of assisted living program to be a maximum height of 65' and four floors tall. The independent living apartments at the upper floors have a maximum building height of 85' and eight floors.

The mechanical, electrical, plumbing and fire protection distribution was crucial for us to study with the structure of mass timber. Each independent living unit on the upper five floors will consist of an ERV unit which will have the intake and exhaust routed directly through the exterior wall. This helps to minimize the amount of ductwork compared to routing the ducts through the roof. It also aids in providing as much roof area as possible for photovoltaic panels. In addition to the ERV, each unit will be supplied with conditioned air by a rooftop variable refrigerant flow (VRF) unit. Each VRF unit will serve several living units to optimize the energy usage of the equipment. There will be one fan coil unit (FCU) in each unit as part of the VRF system. Dedicated outdoor air systems (DOAS), located on the roof, provide the corridor ventilation, and fresh air is delivered via stacked vertical shafts and sidewall diffusers. This limits the amount of horizontal distribution through the corridors to electrical, plumbing, and fire protection.

See Figure D below.

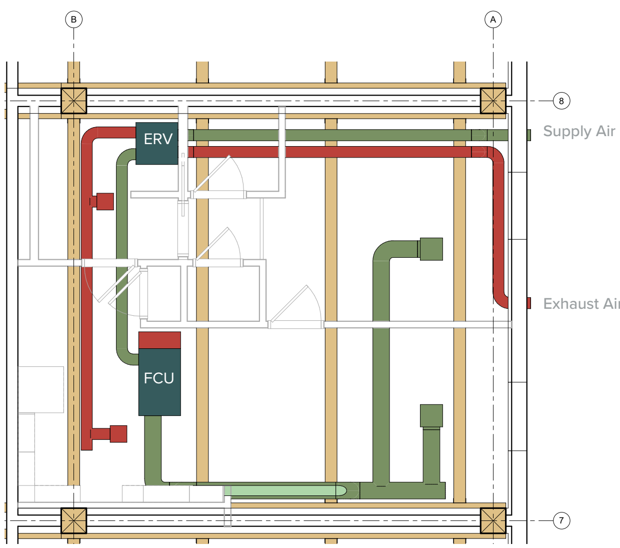


Figure D

At the assisted and memory care units on floors two and three, a central ERV system will provide fresh air as well as remove exhaust air from the units. A central VRF system will provide conditioned air to each unit. The central ERV and VRF units will be located on the roof above floor three, where there is a green roof space. We want to take full advantage of the higher floor-to-floor heights at these floors which is why we decided to use the central approach. We will run the ductwork in the ceiling space of the corridors and then into the units.

COST ANALYSIS

Typically, when the idea of mass timber is mentioned, there's an assumption that it means an increase to the cost of construction which tends to be well outside of project budgets. However, in our high-level cost comparison between the original five over three podium construction and mass timber, we found the additional cost of mass timber to be relatively low.

For the cost of construction, we worked with Commodore Builders to evaluate the price per square foot of B018. For the podium, the cost primarily includes steel framing, concrete, fireproofing, finished ceiling spaces and traditional 2x wood framing. With the gross square feet of the building at 306,700, the price per square foot is $67.72.

For the mass timber approach, the price primarily includes the limited steel framing at the parking area and loading dock, concrete, mass timber members, and the exclusion of fireproofing as well as finished ceiling spaces. The price per square foot is $79.18.

If we are to look at the cost comparison of these two construction types against the overall project budget of B018, the cost increase for mass timber construction is less than two and half percent.

OPPORTUNITIES REALIZED AND LESSONS LEARNED

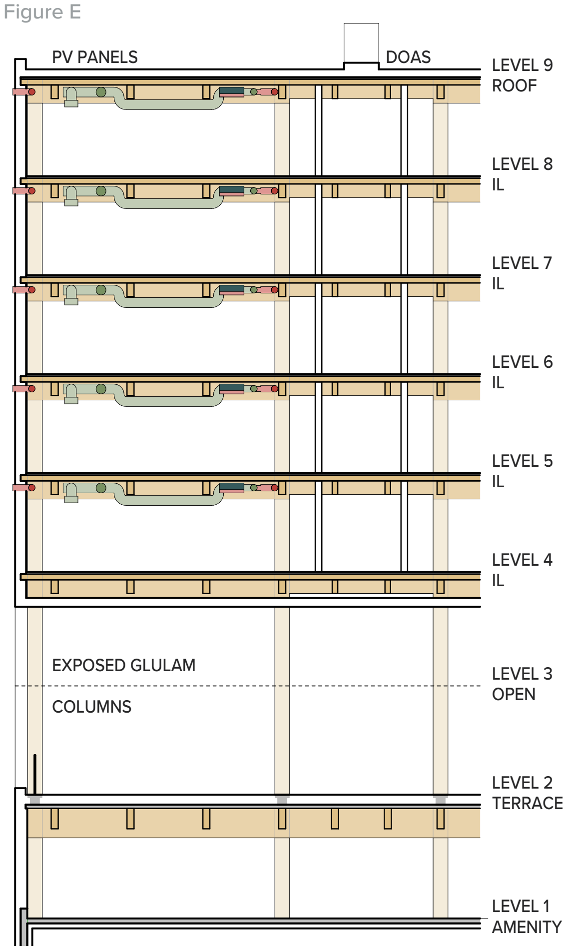
Throughout the mass timber study, the sustainability goals of DiMella Shaffer have been at the forefront of key decisions. This includes the construction type (IV-C), exposure of mass timber elements, exterior continuous insulation, efficiency in building layout and the optimization of mechanical systems.

Even though not part of the mass timber study, the team will continue to evaluate and incorporate Passive House design principles and review the potential for Mass Save Passive House incentives. In addition, the building will be all-electric with the exception of the commercial kitchen serving all building residents.

Given the occupancy use classification and construction type IV-C, as described above, parcel B018 is limited to a height of 85', which also takes advantage of labor agreements between HYM and the Carpenters Union. The floor-to-floor heights are as follows: 12'6" (first floor), 11' (second floor), 11'6" (third floor), 10' (upper five floors). The 10' floor-to-floor height is challenging from a mechanical standpoint, because the common beams provide an obstacle to the duct distribution within the units. However, a conceptual mechanical layout was established with AKF, where we determined that the Energy Recovery Ventilator (ERV) and the Fan Coil Unit (FCU) could be tucked to the underside of the CLT deck in between common beams, leaving 8' clearance below. Ductwork could bend below common beams, as needed, and run along both unit demising walls. The lowest clearance below the supply ductwork is approximately 6'9", but this occurs directly adjacent to the demising wall.

See Figure E upper ight.

Figure E



We also took this as a learning opportunity to research three other mass timber projects and apply lessons learned: 11 East Lenox, Brock Commons, and Mystic Seaport Museum. Due to construction type IV-C, non-combustible exterior framing is required. Therefore, metal studs are necessary in lieu of fire retardant treated (FRT) wood studs, which short circuits the interior insulation thermal properties within the stud cavity, and a code variance for FRT wood studs is unlikely. Taking note from 11 East Lenox, we researched the ArmorWall exterior assembly, which consists of an air and water-resistive barrier on magnesium oxide sheathing fused to a poured polyurethane insulation layer. The sheathing can accommodate various exterior claddings, which are attached directly to the sheathing instead of the stud wall and do not penetrate the insulation layer. The result is a high R-value based on different thicknesses (R-10, R-15, and R-21) and continuous insulation. The ArmorWall system has the potential to result in labor savings given that there is only one installer, one inspection, less staging required, and MEP trades can begin their work earlier than anticipated in the schedule timeline.

See Figure F below.

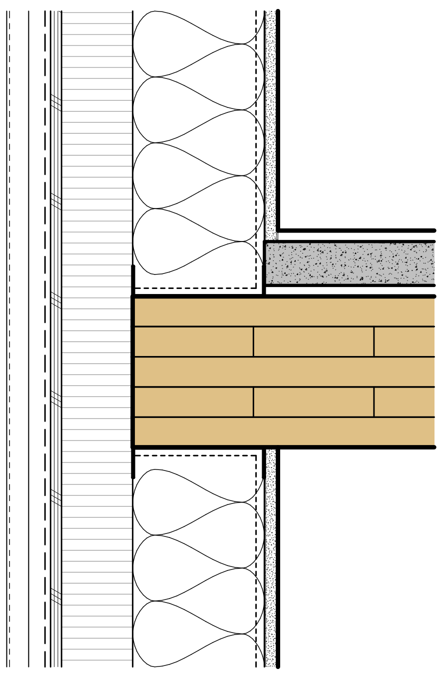


Figure F

Brock Commons is another mass timber project that capitalized on schedule savings through the installation of panelized construction. The exterior wall for Project Q could be panelized similarly and utilize the 25' bay spacing to drive the panelized exterior wall.

Brock Commons

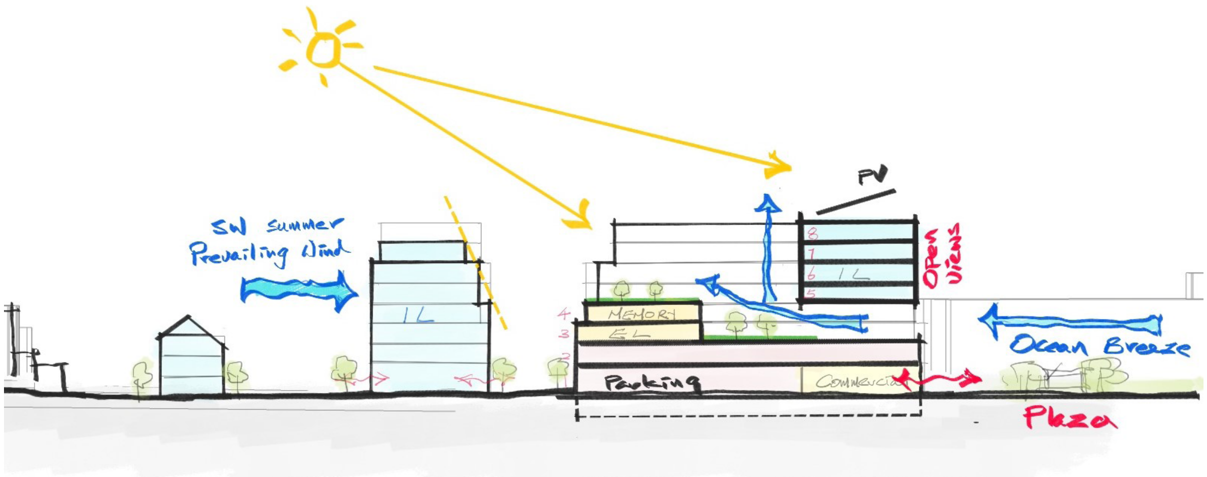
Architect: Acton Ostrey Architects Inc
Photo credit: KK Law / Naturally Wood

Mystic Seaport Museum is another mass timber project, which established concealed connections where the exposed mass timber column connects to the structure below the pavers. We would design a similar detail, where the wood is held above the waterproofing plane but the connection is covered.

NEXT STEPS

Mass timber discussions with the clients are ongoing. However, this study influences other projects in our office to consider mass timber as a structural option and provides a firm-wide educational opportunity.

PROGRAM IMPACT



PROGRAM EVALUATION AND IMPACT

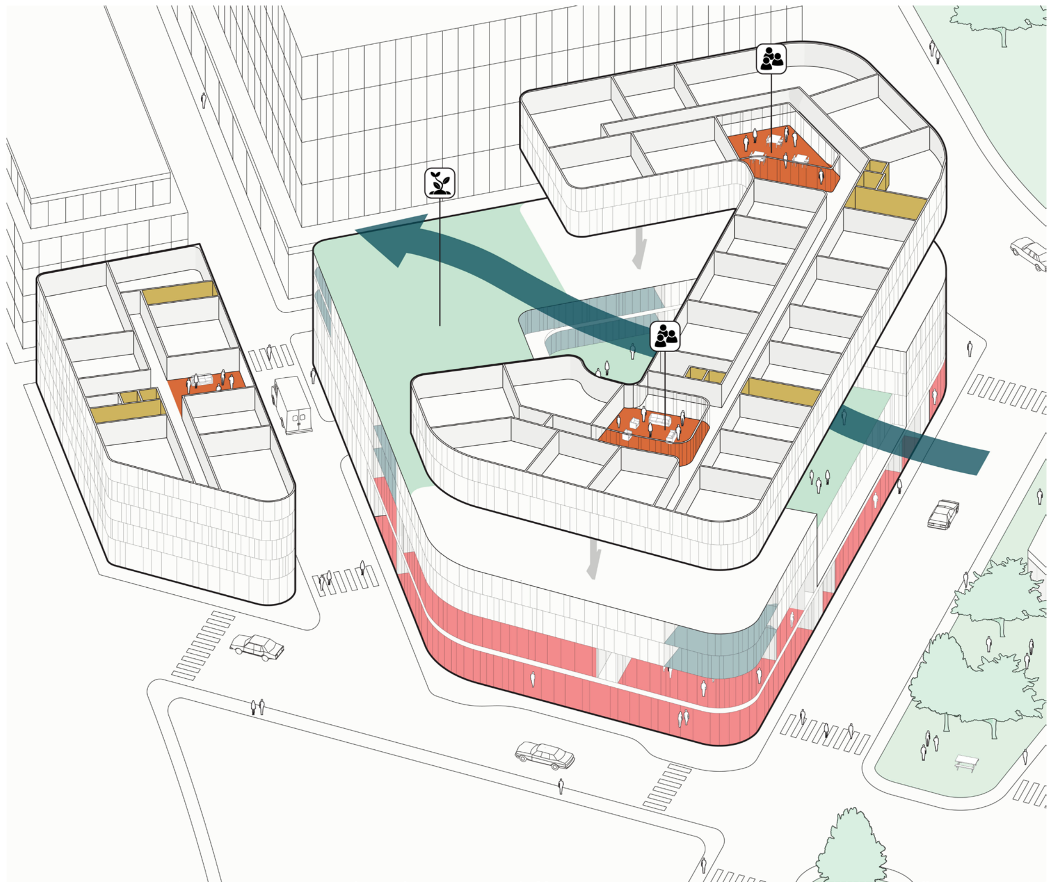
Without this grant, we may not have had the opportunity to evaluate mass timber to this level of detail and perhaps the discussion would have only surrounded cost. Questions came up such as, what is the maximum grid spacing, or when are common beams necessary, or can a 10' floor-to-floor height work for mass timber? The depth of these discussions alone has had some of the greatest impact on our thinking and approach to mass timber. It was beneficial that we started with the most constraints because the challenges pushed us to think creatively.

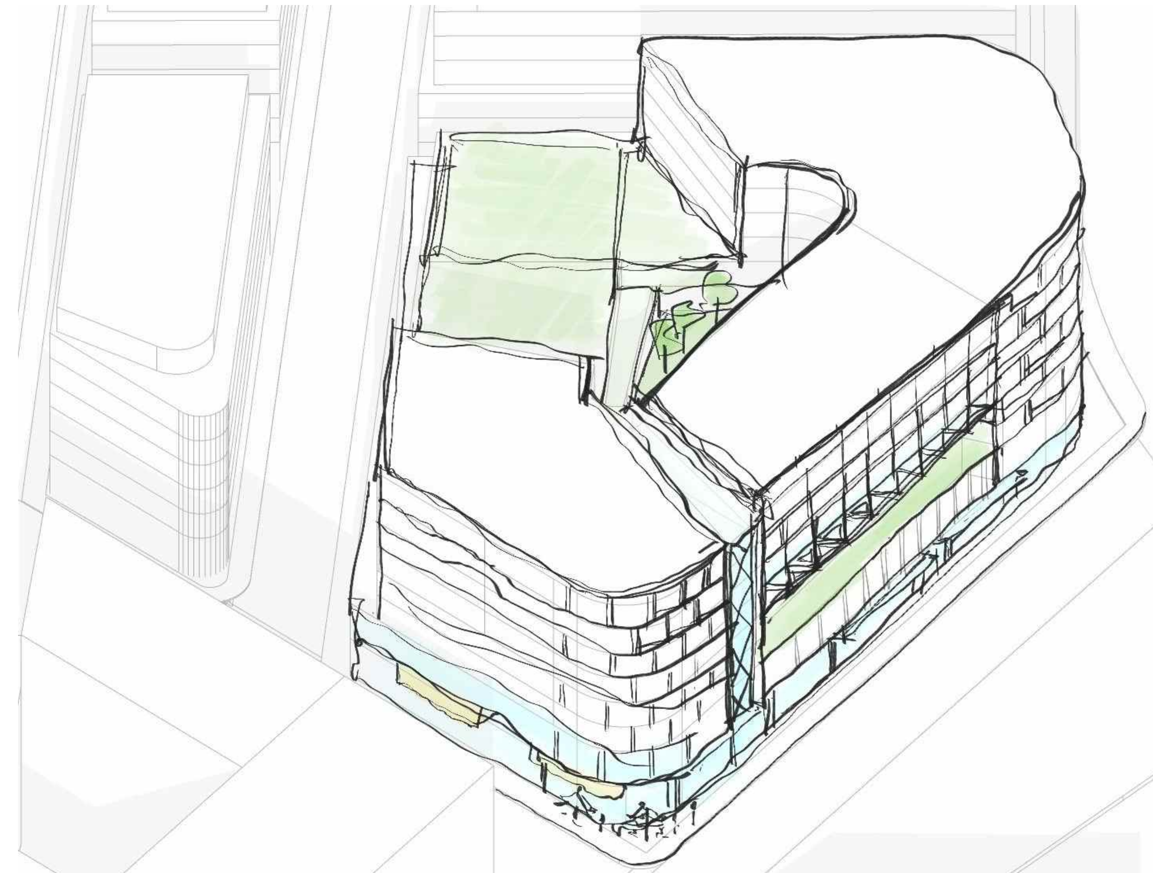
We attended many of the weekly roundtable meetings, which we thought were valuable to learning more about the upcoming 2021 IBC code update specific to mass timber, as well as the technical assistance provided during these calls. Towards the end of the study, the calls could have been bi-weekly instead of weekly, because teams were finalizing their drawings and there would not have been enough time to incorporate major feedback. The 11 East Lenox Tour provided a view into the construction realities and our team came out of the experience with a better understanding of the physical components.

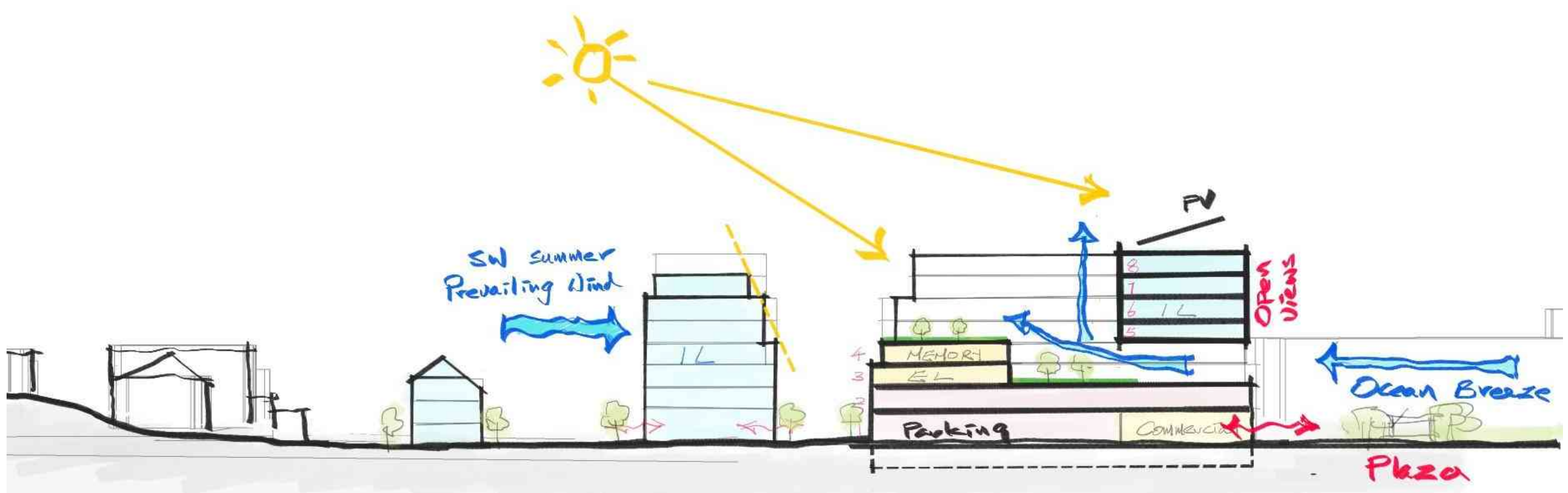
The midterm and final presentation structure were optimally organized to allow us to understand how other project teams approached mass timber and where teams had overlapping strategies. In-person meetings facilitated the presentations and discussions that occurred. This forum allowed for city-wide interaction which is crucial to the advancement of architecture.

PROJECT Q
MASS TIMBER ACCELERATOR

FINAL DRAWINGS FOR BOSTON PLANNING & DEVELOPMENT AGENCY
AND BOSTON SOCIETY FOR ARCHITECTURE
JULY 15, 2022



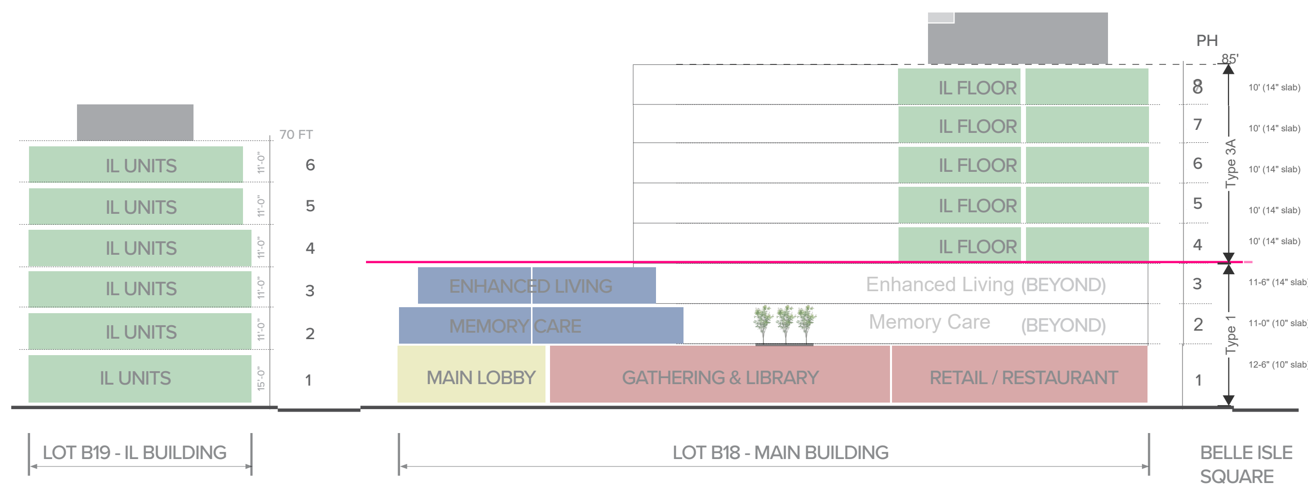


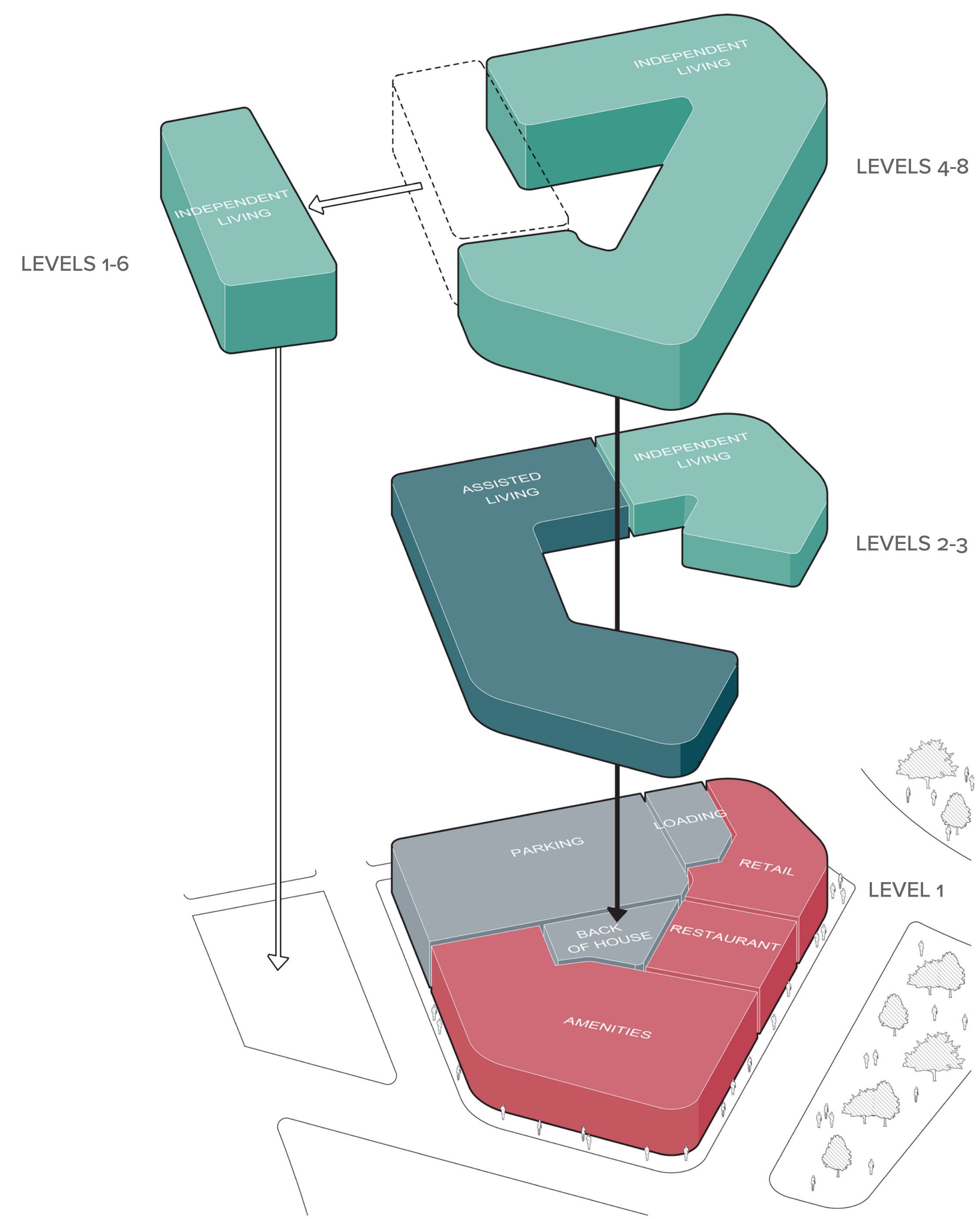


ProjectQ BOSTON | HYM | onepoint PARTNERS | DIMELLA SHAFFER | Commodore Builders | L.A. FUESS PARTNERS Structural Engineers | AKF

INITIAL CONCEPT

LOT B18 - PODIUM CONSTRUCTION: TYPE 3A (5 FLOORS) OVER TYPE 1 (3 FLOORS)
LOT B19 - PODIUM CONSTRUCTION: TYPE 3A (5 FLOORS) OVER TYPE 1 (1 FLOOR)





MASS TIMBER APPROACH

TABLE 504.3 ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE

CONSTRUCTION TYPE: IV-C

OCCUPANCY CLASSIFICATIONS:

- A,B,E,F,M,S,U (SPRINKLER) - 85'
- I-1, CONDITION 2 (SPRINKLER) - 65', 4 STORIES (TABLE 504.4)
- R-2 (SPINKLER) - 85', 8 STORIES (TABLE 504.4)

TABLE 504.3 ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

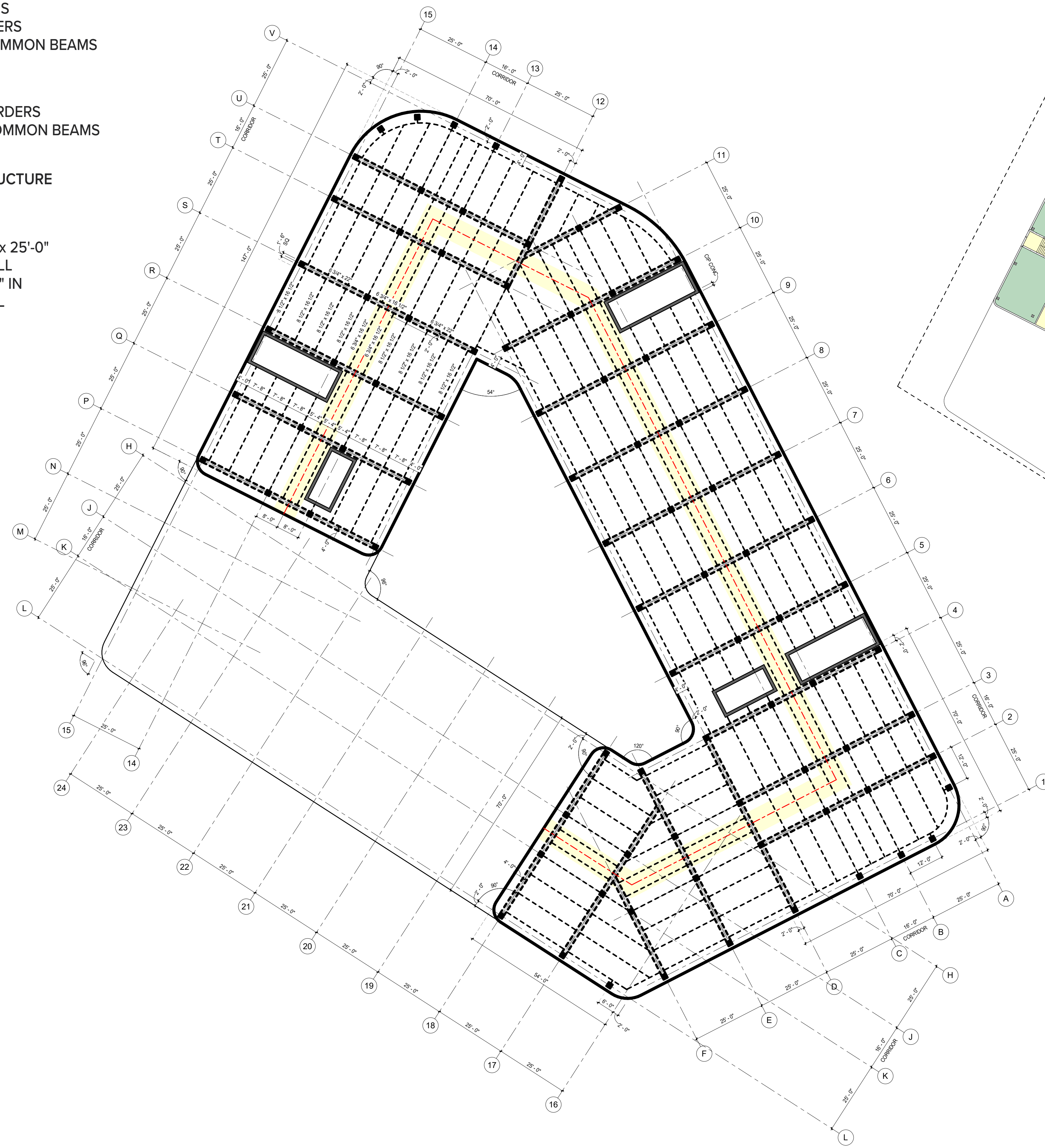
OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	270	180	85	85	70	60
H-1, H-2, H-3, H-5	NS[c, d]	UL	160	65	55	65	55	120	90	65	65	50	40
	S												
H-4	NS[c, d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	140	100	85	85	70	60
I-1 Condition 1, I-3	NS[d, e]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	180	120	85	85	70	60
I-1 Condition 2, I-2	NS[d, e, f]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85									
I-4	NS[d, g]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	180	120	85	85	70	60
R[h]	NS[d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S13D	60	60	60	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	270	180	85	85	70	60

UNIT STRUCTURE
- 18" x 18" GLULAM COLUMNS
- 6 3/4" x 22" GLULAM GIRDERS
- 8 1/2" x 16 1/2" GLULAM COMMON BEAMS
- 5-PLY CLT DECK

CORRIDOR STRUCTURE
- 6 3/4" x 16 1/2" GLULAM GIRDERS
- 6 3/4" x 16 1/2" GLULAM COMMON BEAMS
- 5-PLY CLT DECK

ELEVATOR & STAIR CORE STRUCTURE
- CIP CONCRETE

GRID
- 25'-0" x 16'-0" (CORRIDOR) x 25'-0"
- 2'-0" IN F.O. EXTERIOR WALL
- COMMON BEAMS ARE 4'-0" IN FROM F.O. EXTERIOR WALL



Legend

- 1 Bedroom
- 2 Bedroom
- 2 Bedroom Plus
- Back of House
- Circulation
- IL Lounge

ProjectQ BOSTON HYM onepoint PARTNERS DIMELLA SHAFFER

LEVELS 4-8 PLAN

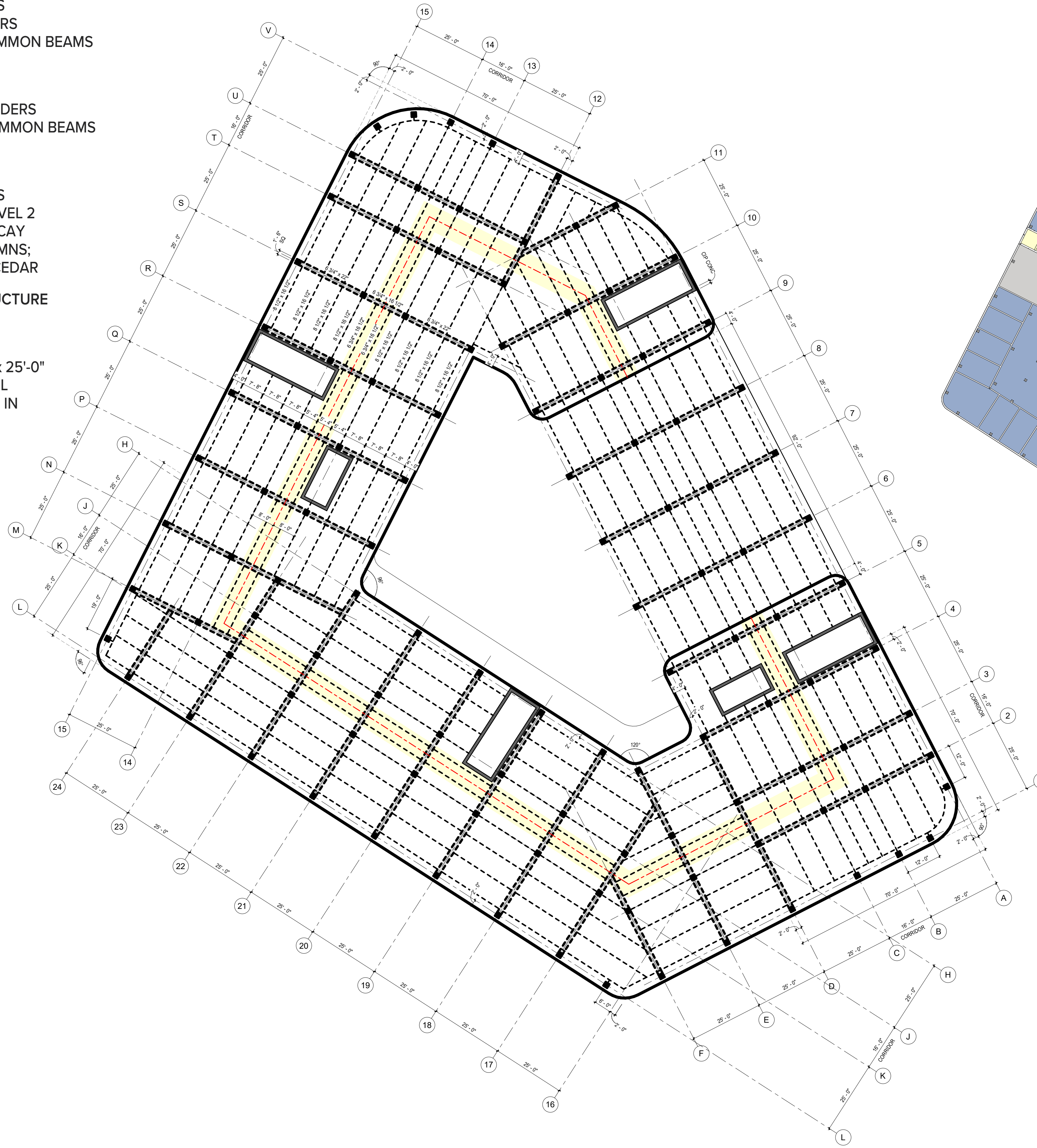
UNIT STRUCTURE
- 18" x 18" GLULAM COLUMNS
- 6 3/4" x 22" GLULAM GIRDERS
- 8 1/2" x 16 1/2" GLULAM COMMON BEAMS
- 5-PLY CLT DECK

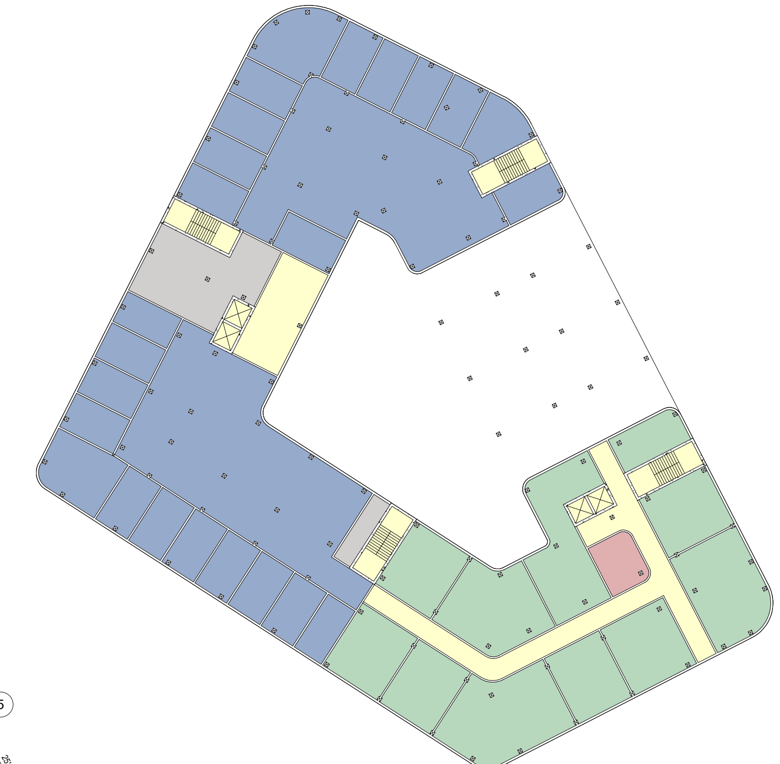
CORRIDOR STRUCTURE
- 6 3/4" x 16 1/2" GLULAM GIRDERS
- 6 3/4" x 16 1/2" GLULAM COMMON BEAMS
- 5-PLY CLT DECK

TERRACE STRUCTURE
- 18" x 18" GLULAM COLUMNS
- EXPOSED COLUMNS AT LEVEL 2 TERRACE - NATURALLY DECAY RESISTANT GLULAM COLUMNS; B.O.D. ALASKAN YELLOW CEDAR

ELEVATOR & STAIR CORE STRUCTURE
- CIP CONCRETE

GRID
- 25'-0" x 16'-0" (CORRIDOR) x 25'-0"
- 2'-0" IN F.O. EXTERIOR WALL
- COMMON BEAMS ARE 4'-0" IN FROM F.O. EXTERIOR WALL





Legend
- 1 Bedroom
- 2 Bedroom
- 2 Bedroom Plus
- Back of House
- Circulation
- IL Lounge
- Kitchen/Living/Dining
- Lounge
- MC Studio

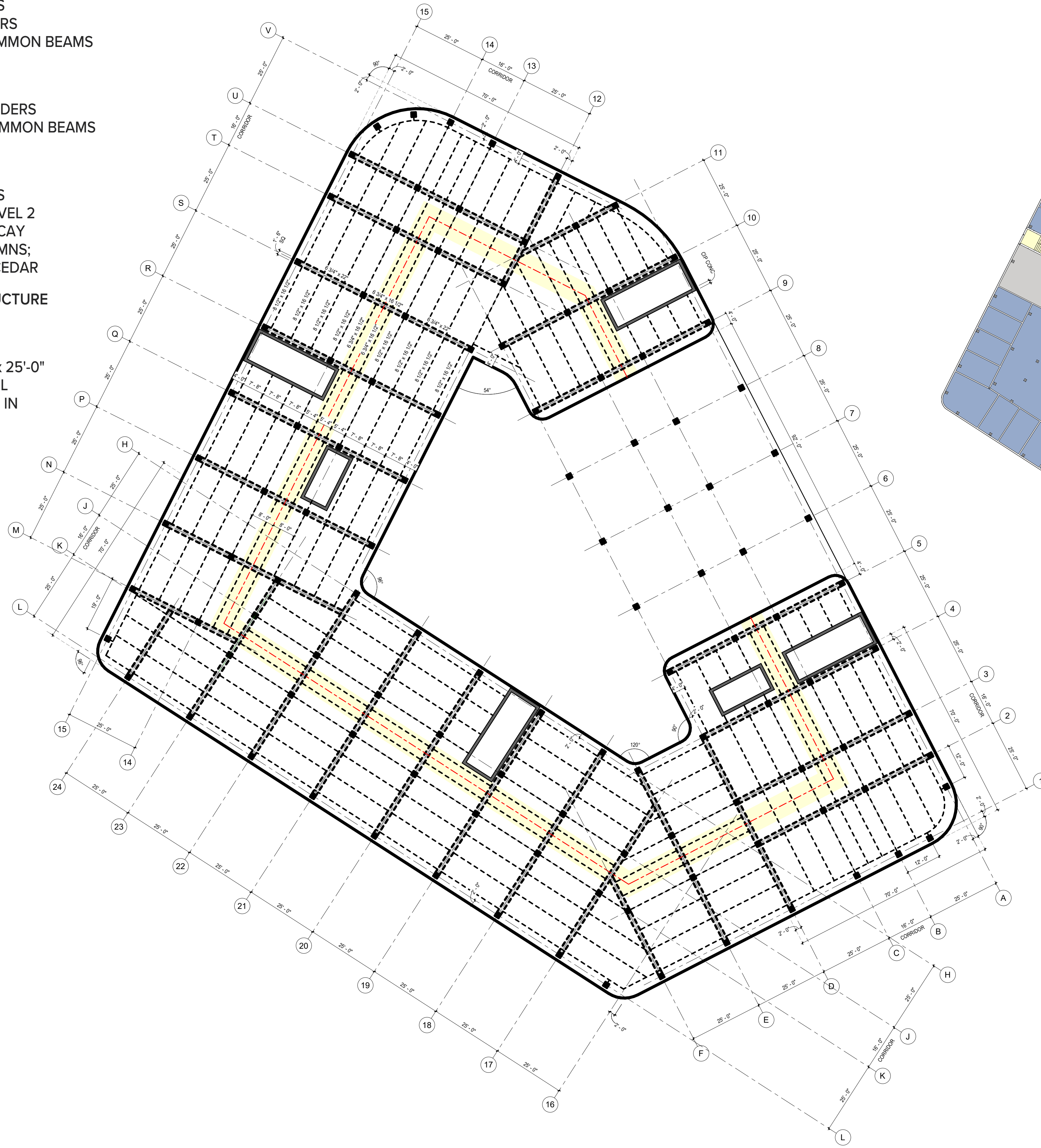
UNIT STRUCTURE
- 18" x 18" GLULAM COLUMNS
- 6 3/4" x 22" GLULAM GIRDERS
- 8 1/2" x 16 1/2" GLULAM COMMON BEAMS
- 5-PLY CLT DECK

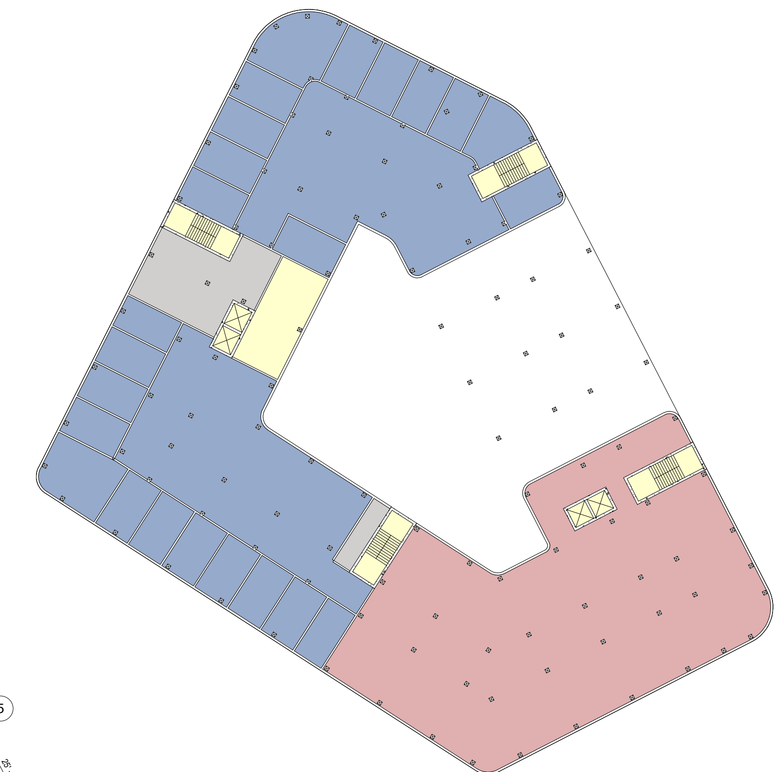
CORRIDOR STRUCTURE
- 6 3/4" x 16 1/2" GLULAM GIRDERS
- 6 3/4" x 16 1/2" GLULAM COMMON BEAMS
- 5-PLY CLT DECK

TERRACE STRUCTURE
- 18" x 18" GLULAM COLUMNS
- EXPOSED COLUMNS AT LEVEL 2 TERRACE - NATURALLY DECAY RESISTANT GLULAM COLUMNS; B.O.D. ALASKAN YELLOW CEDAR

ELEVATOR & STAIR CORE STRUCTURE
- CIP CONCRETE

GRID
- 25'-0" x 16'-0" (CORRIDOR) x 25'-0"
- 2'-0" IN F.O. EXTERIOR WALL
- COMMON BEAMS ARE 4'-0" IN FROM F.O. EXTERIOR WALL





Legend

- Admin. and Other Amenities
- Back of House
- Circulation
- EL Studio
- Kitchen/Living/Dining
- Lounge
- MC Studio

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LEVEL 2 PLAN

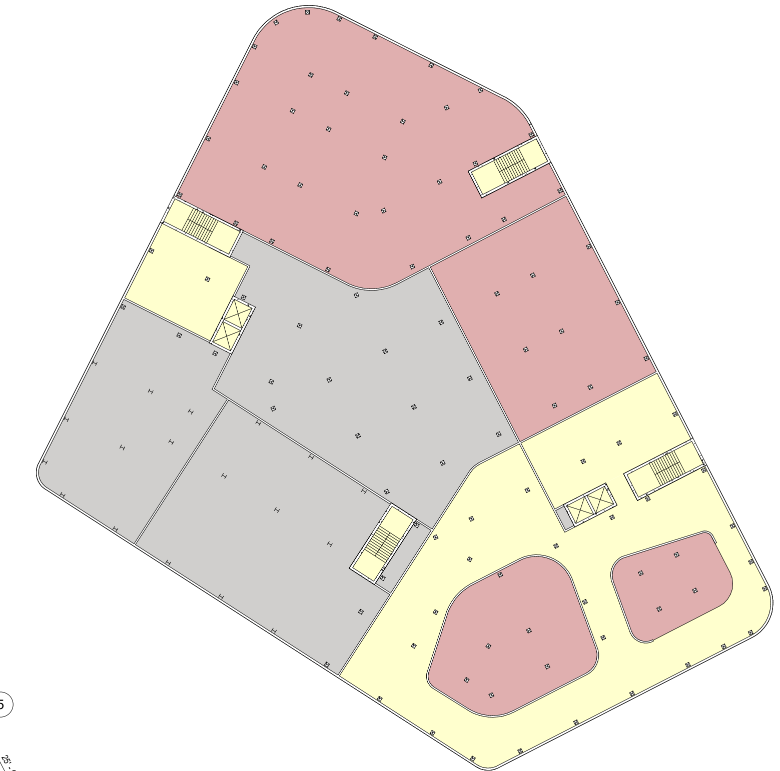
TYPICAL AMENITY STRUCTURE
- 18" x 18" GLULAM COLUMNS
- 6 3/4" x 22" GLULAM GIRDERS
- 8 1/2" x 16 1/2" GLULAM COMMON BEAMS
- 5-PLY CLT DECK

BELOW TERRACE STRUCTURE
- 18" x 18" GLULAM COLUMNS
- 8 1/2" x 35 3/4" GLULAM GIRDERS
- 8 1/2" x 24 3/4" GLULAM COMMON BEAMS
- 6 1/2" CONCRETE SLAB ON METAL DECK

PARKING & LOADING DOCK STRUCTURE
- W-FLANGE STL BEAMS & COLUMNS
- 5-PLY CLT DECK

ELEVATOR & STAIR CORE STRUCTURE
- CIP CONCRETE

GRID
- 25'-0" x 16'-0" (CORRIDOR) x 25'-0"
- 2'-0" IN F.O. EXTERIOR WALL
- COMMON BEAMS ARE 4'-0" IN FROM F.O. EXTERIOR WALL



Legend
- Back of House
- Circulation
- EL Lobby
- Fitness
- Gathering
- IL Lobby
- Library
- Loading & Trash
- Parking
- Restaurant

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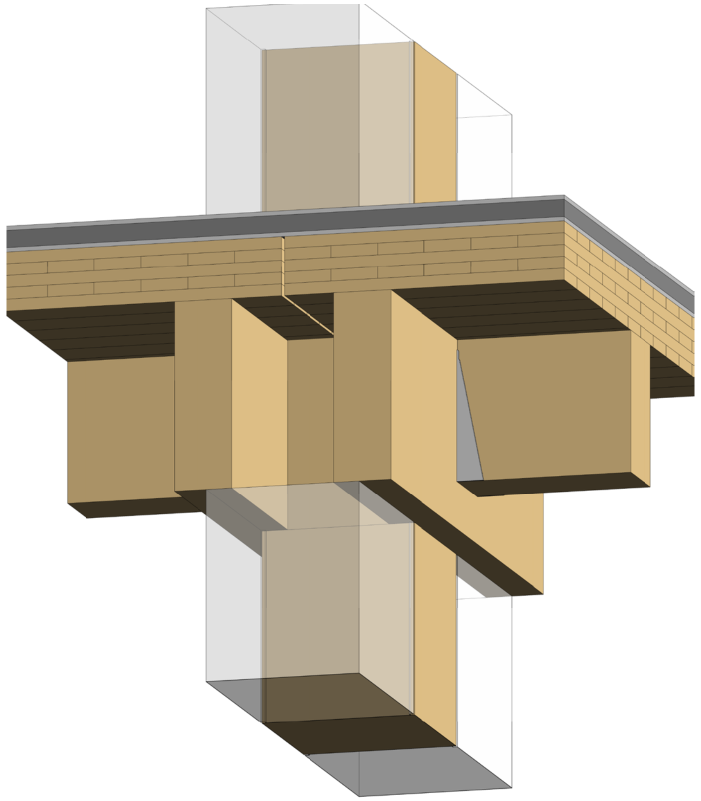
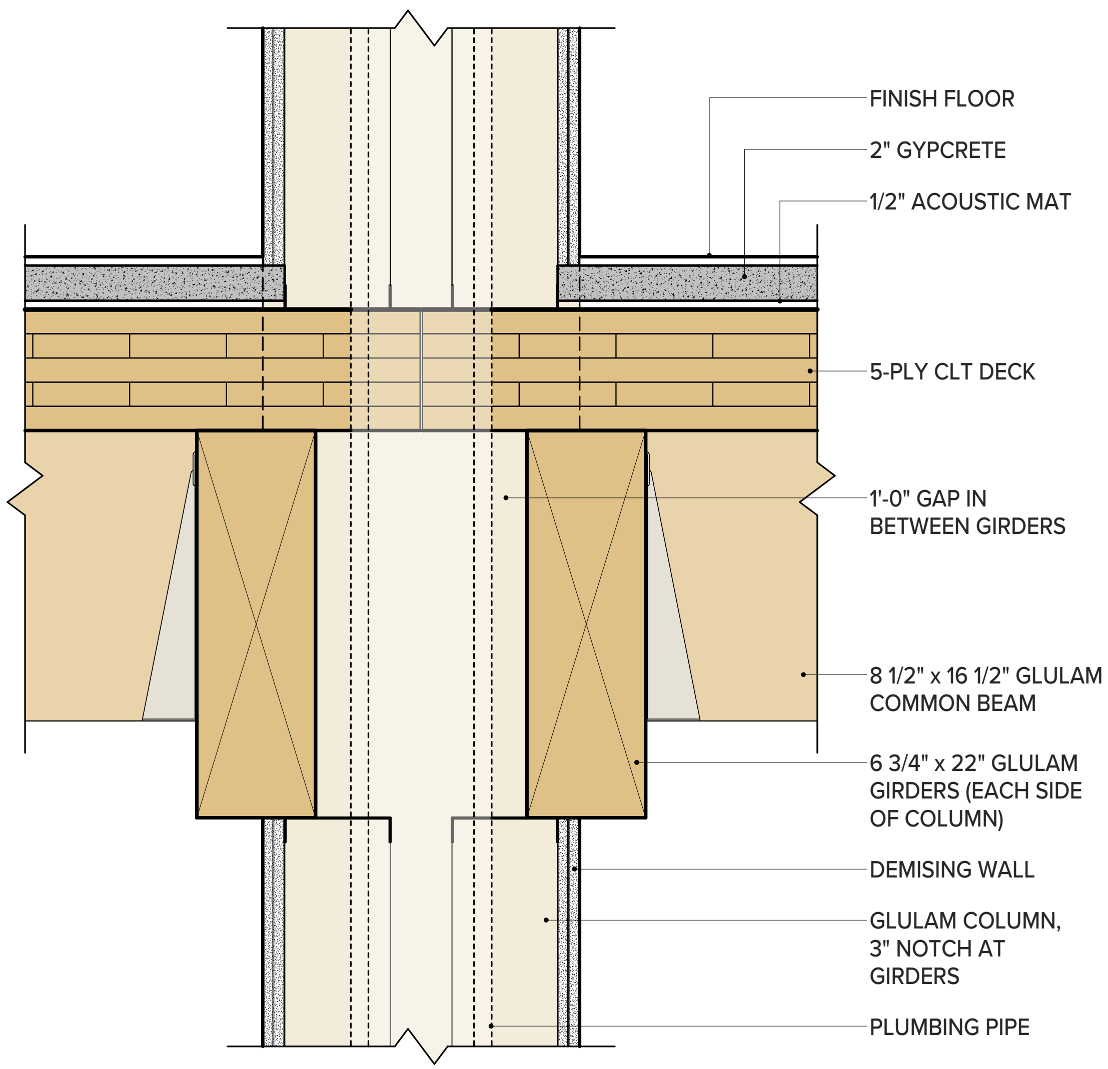
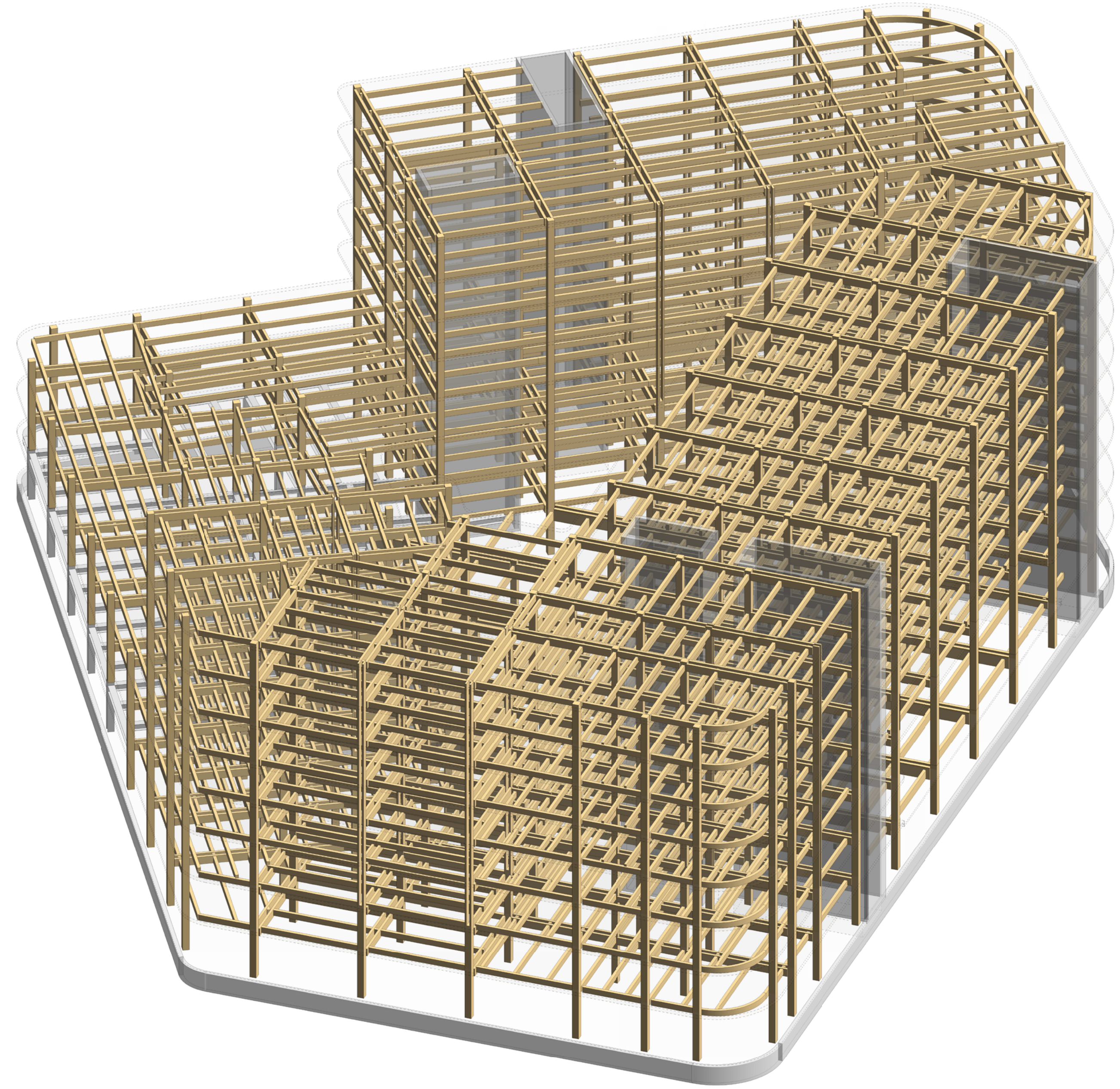
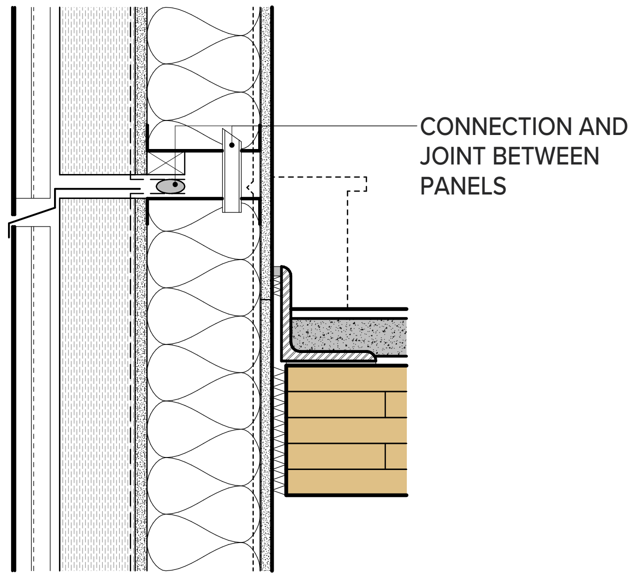
LEVEL 1 PLAN



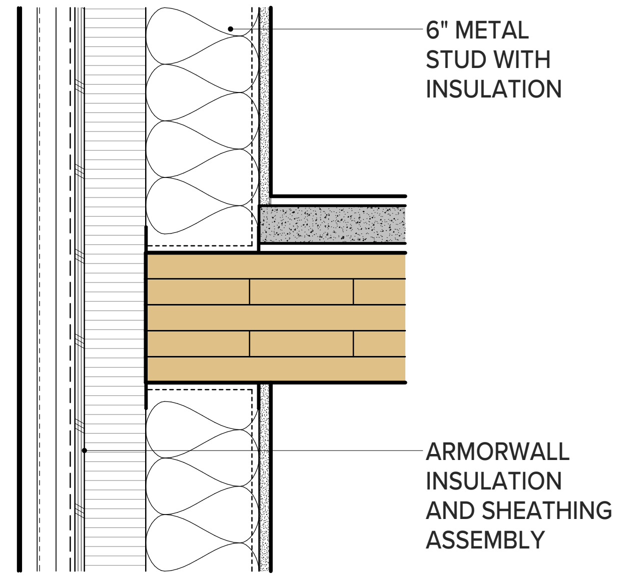




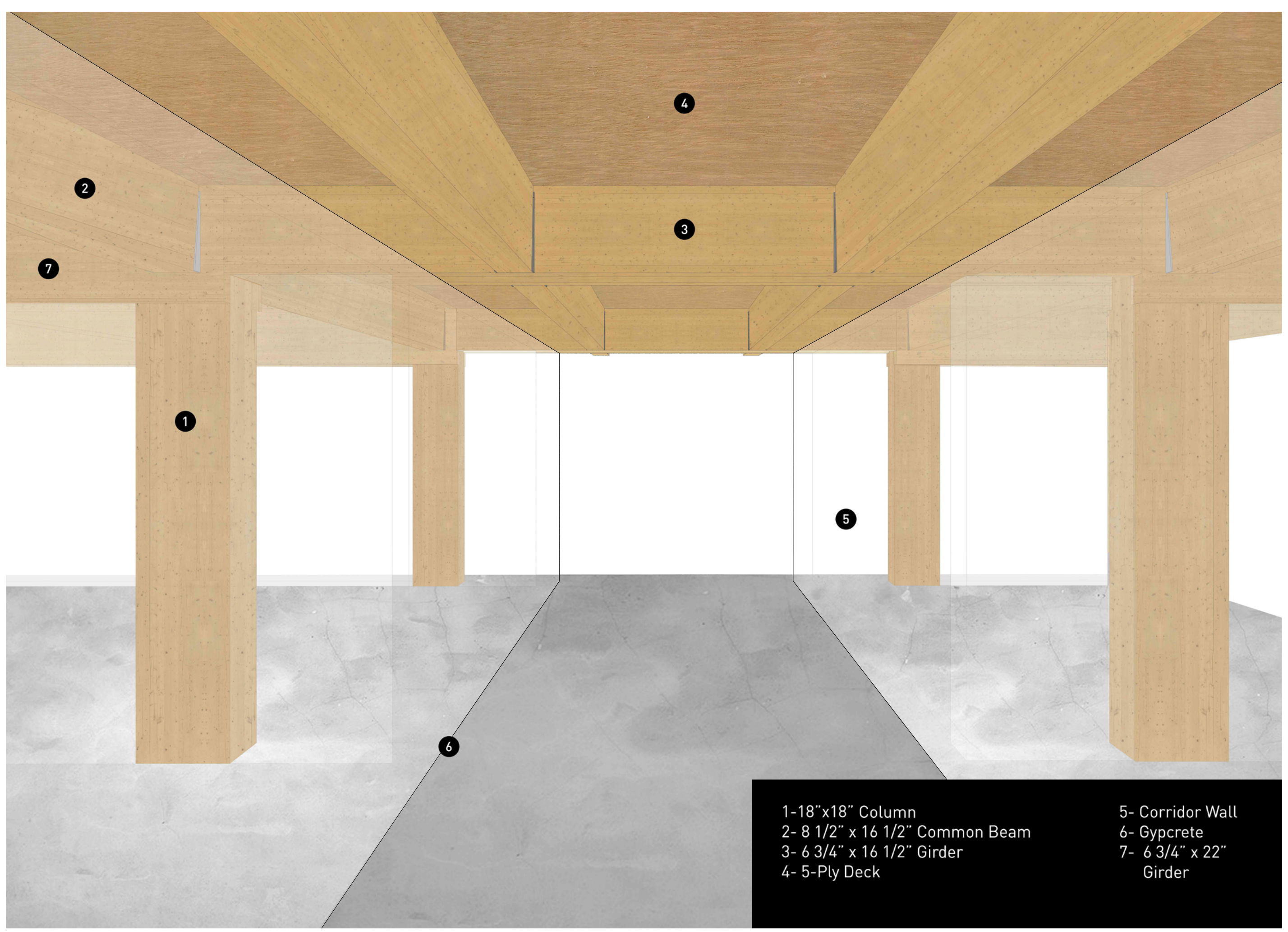
FRAMING DETAIL AND AXONS

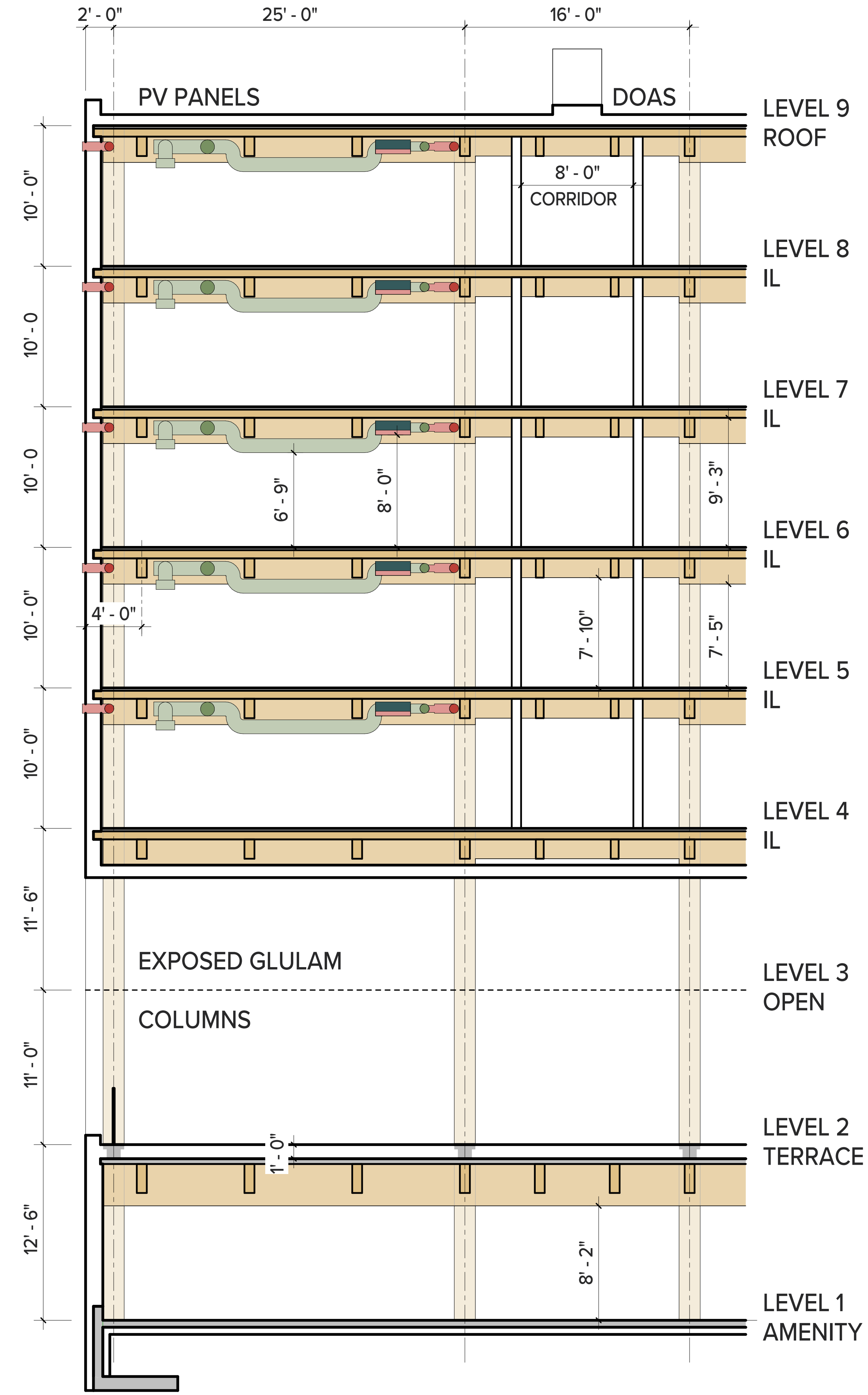


ALT. PANELIZED EXTERIOR WALL ASSEMBLY



EXTERIOR WALL ASSEMBLY

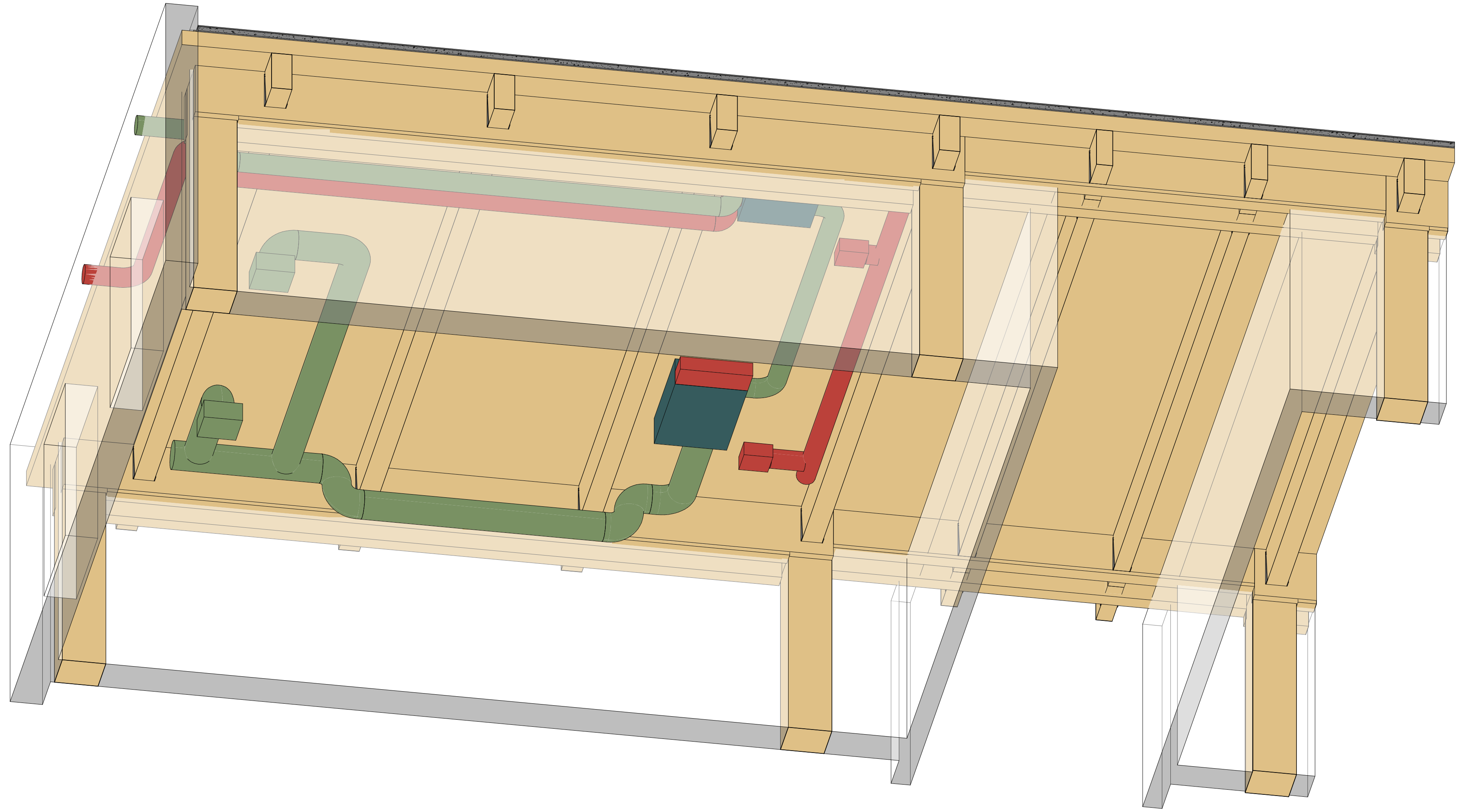


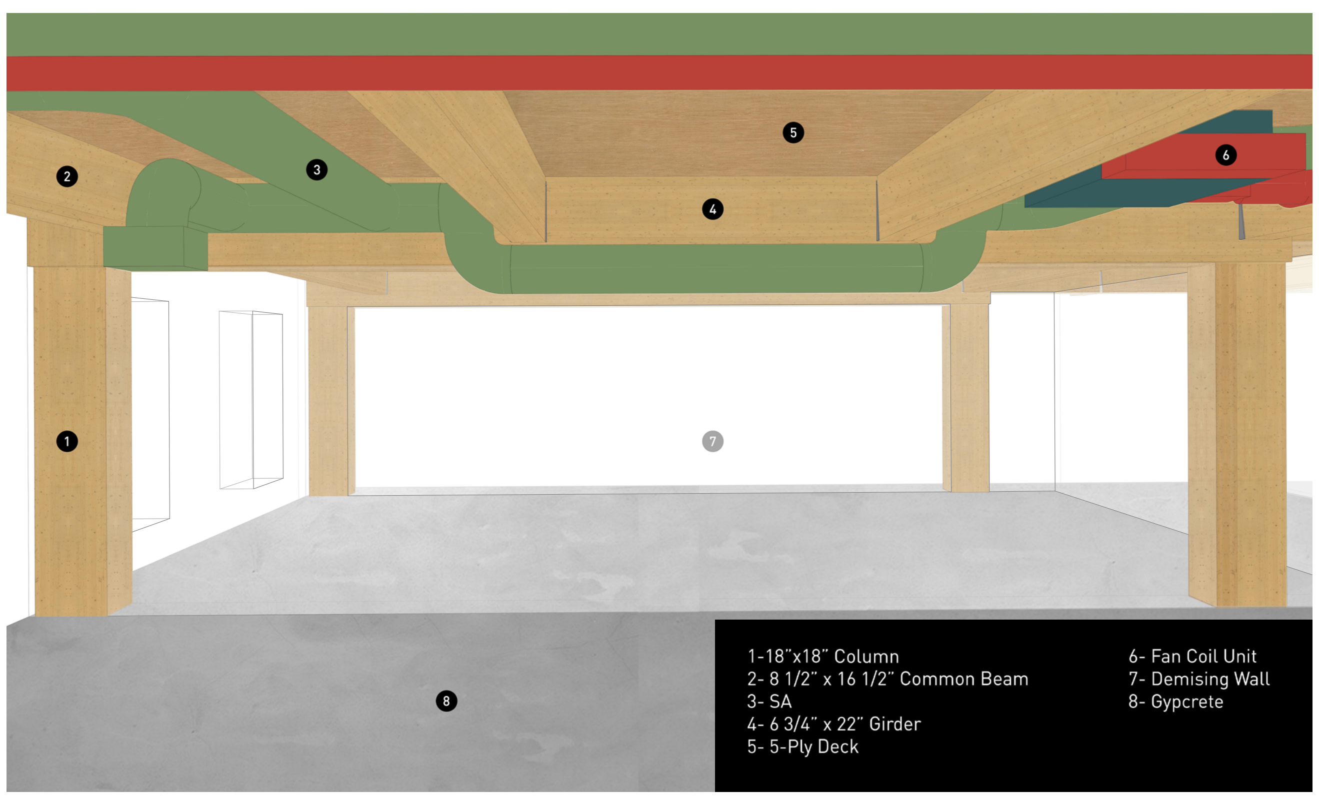


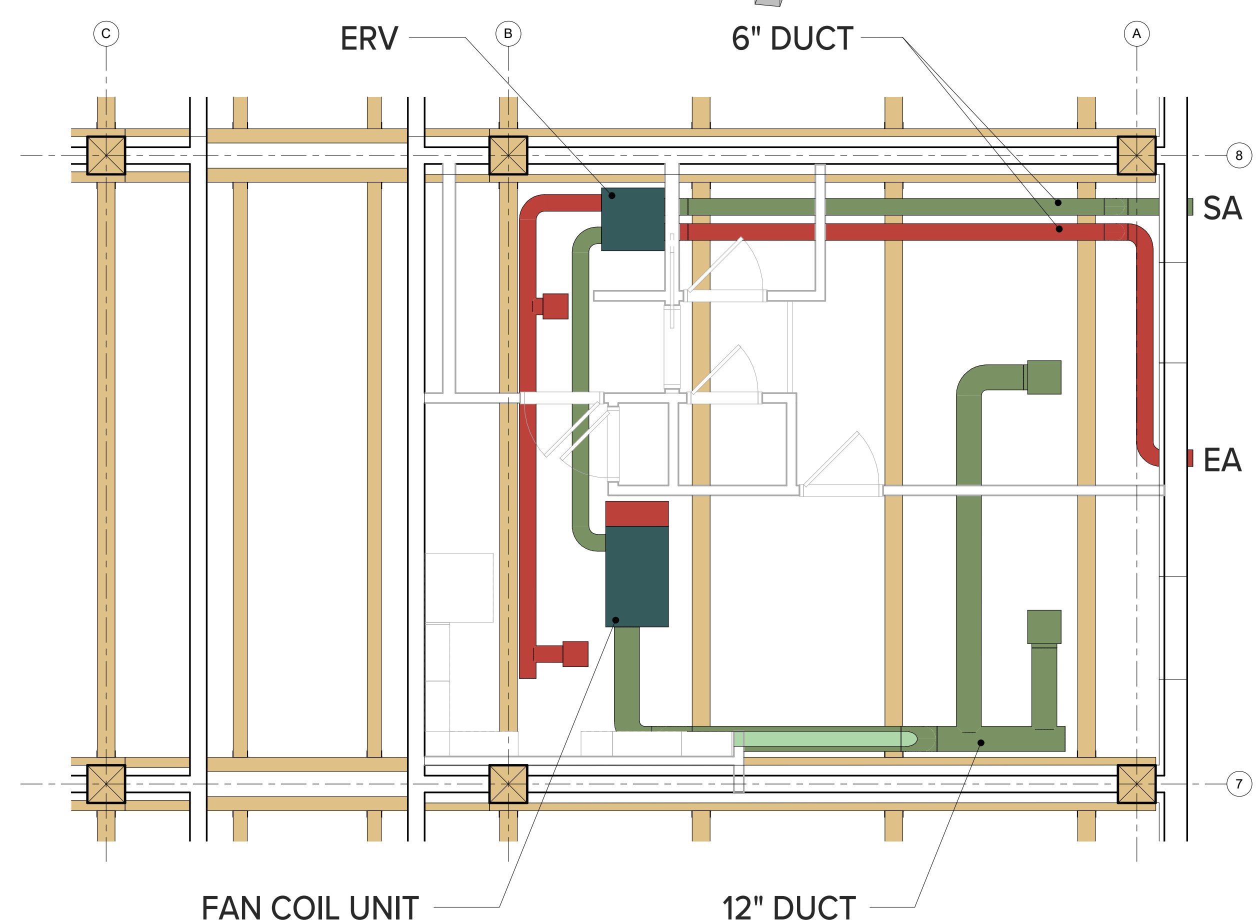
BUILDING SECTION, PERSPECTIVE, AND DETAILS

INDEPENDENT LIVING UNIT MECHANICAL LAYOUT

- INDIVIDUAL ERV W/ SIDEWALL PENETRATIONS
- GROUPED VRF AT ROOF
- FAN COIL UNIT WITHIN EACH UNIT







Stick Built over Podium (L1-3):

306,700 Gross SF

$67.72 / SF

Total Cost: $20,769,724

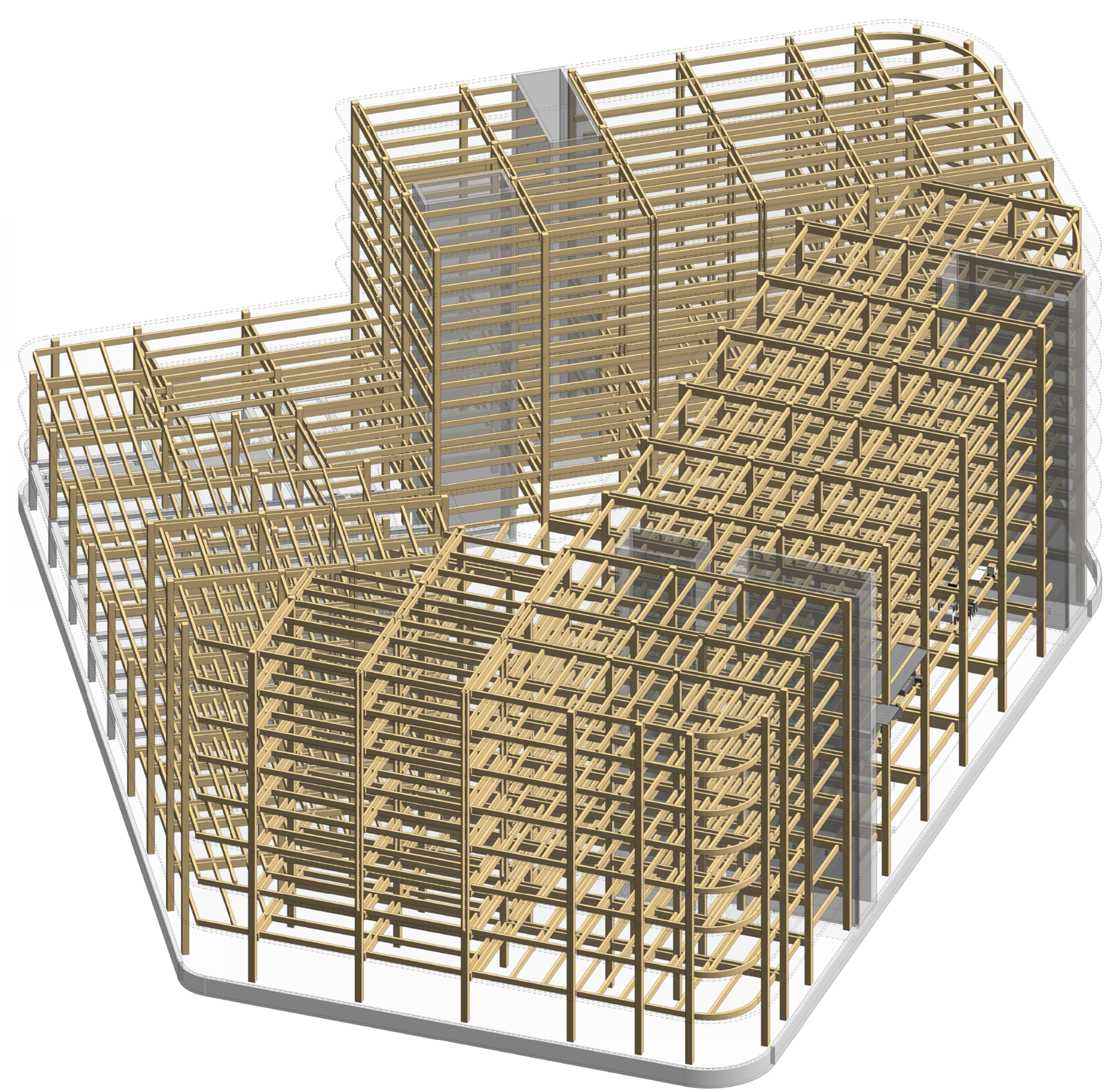
Mass Timber:

306,700 Gross SF

$79.18 / SF

Total Cost: $24,284,506
(16.9% increase)

Cost Difference: $3,514,782
Total Project Cost Impact: 2.48%



DIMELLA
SHAFFER

24 Farnsworth, 4th Floor
Boston, MA 02210
Tel 617.426.5004

dimellashaffer.com