SITE CONDITIONS AND ANALYSIS

The site for this proposal is an urban location situated in Dehradun, Uttarakhand. Currently, the vacant lot is framed by the residential colonies and many eat out spaces. The placement of the site is both urbanistic and natural, flanked by two parks, making it a suitable site to test and build a 21st century wood tower.

The building will demonstrate the ability and suitability of building with wood in a dense urban site in contrast to the old outdated dull buildings surrounding it.

CROSS-LAMINATED TIMBER :

Cross-laminated timber (CLT) is a wood panel product made from glueing layers of solid-sawn lumber together. Each layer of boards is orientated perpendicular to adjacent layers and glued on the wide faces of each board, usually in a symmetric way so that the outer layers have the same orientation. An odd number of layers is most common, but there are configurations with even numbers as well (which are then arranged to give a symmetric configuration).

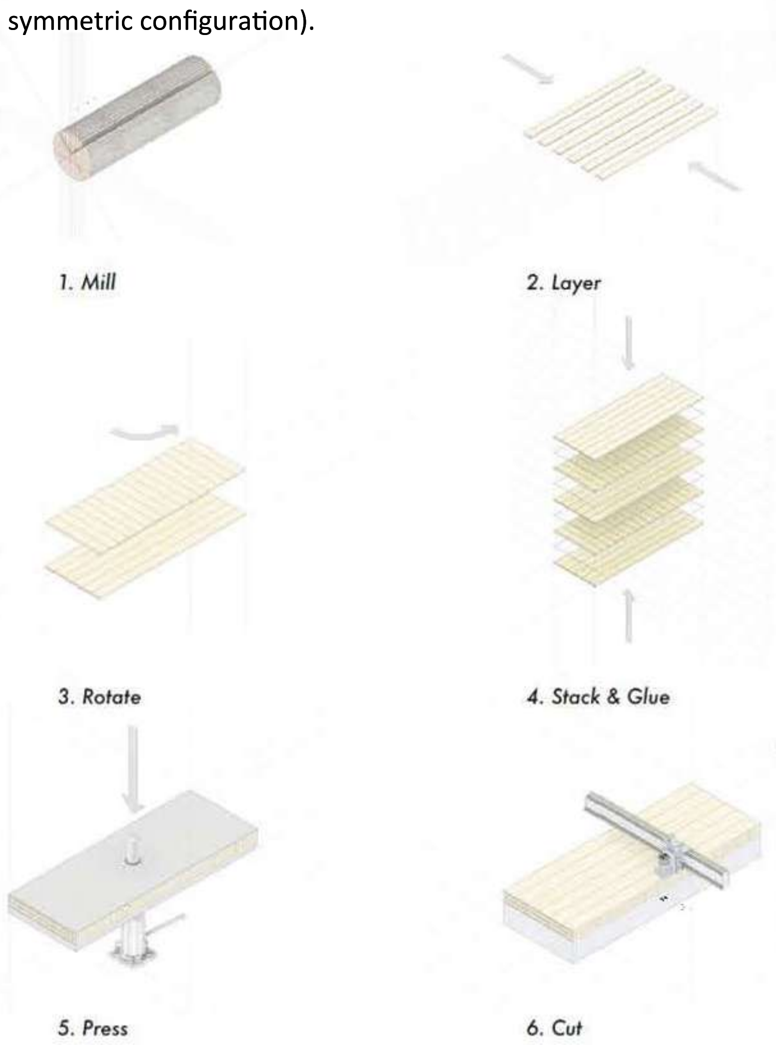


Illustration showing the process of making CLT Wood Panels.

CLT panels can be made up to 98' long, 18' wide and 19.5" thick. Such massive structural wood panels could ultimately change the notion of what wood can achieve altogether. This surpasses what concrete can offer regarding prefabricated building components and moves into new territory of prefabrication and construction. The result is a highly precise and accurate prefabricated panel that is renewable, lighter, equally durable and more versatile in application. The capacity to design large scale infrastructure and buildings from wood could shape an entirely different more promising future.

Diagram describing how Cross-Laminating wood makes a bi-directional sheer panel.

POTENTIAL OF CLT :

Applications

As a building block, CLT is very versatile and can form the entire structure and be the exposed finish of the building. CLT panels can be used to wrap, frame or support more elaborate spaces. CLT panels can serve to function as tectonic elements for all architectural applications.

Diagram illustrating the primary structural CLT applications.

EXPLORING CLT AND STEEL :

Structure (Wrapping & Passing)

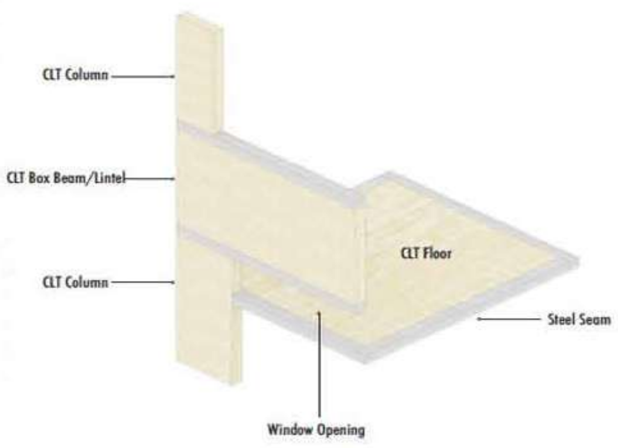
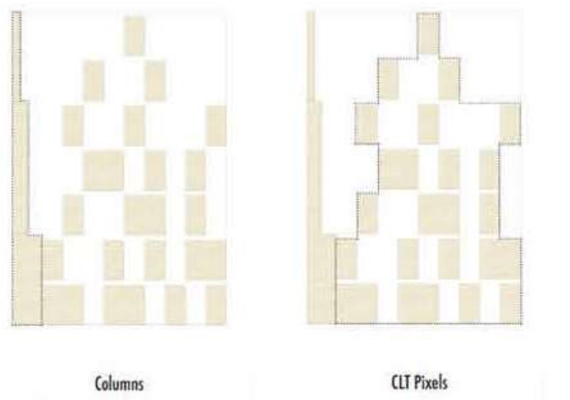


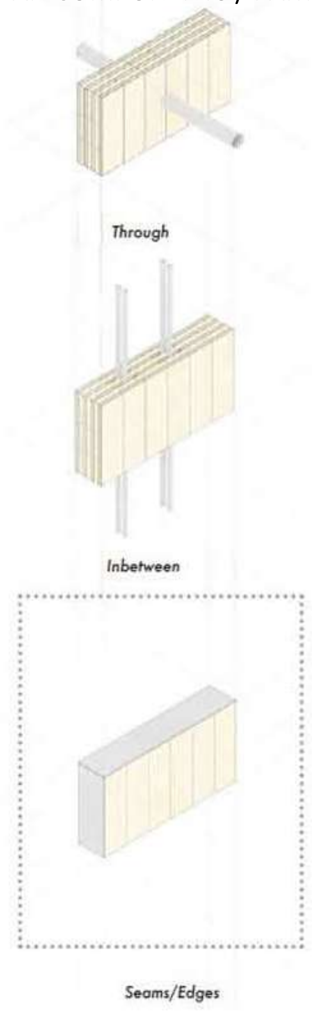
Diagram showing how CLT panels and Steel can integrate to make unified structure and space.

TAPERING

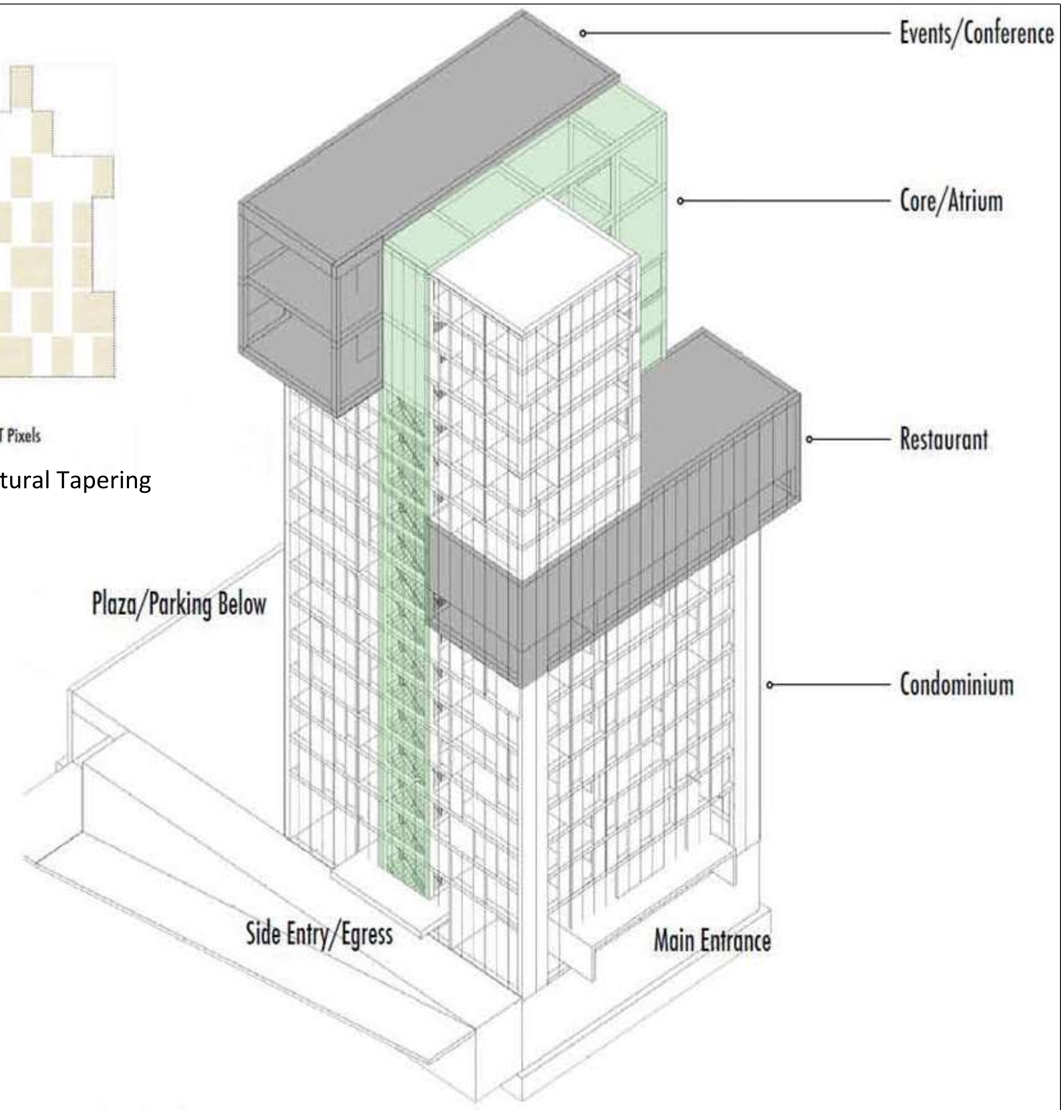


Diagrams illustratig methods of Structural Tapering

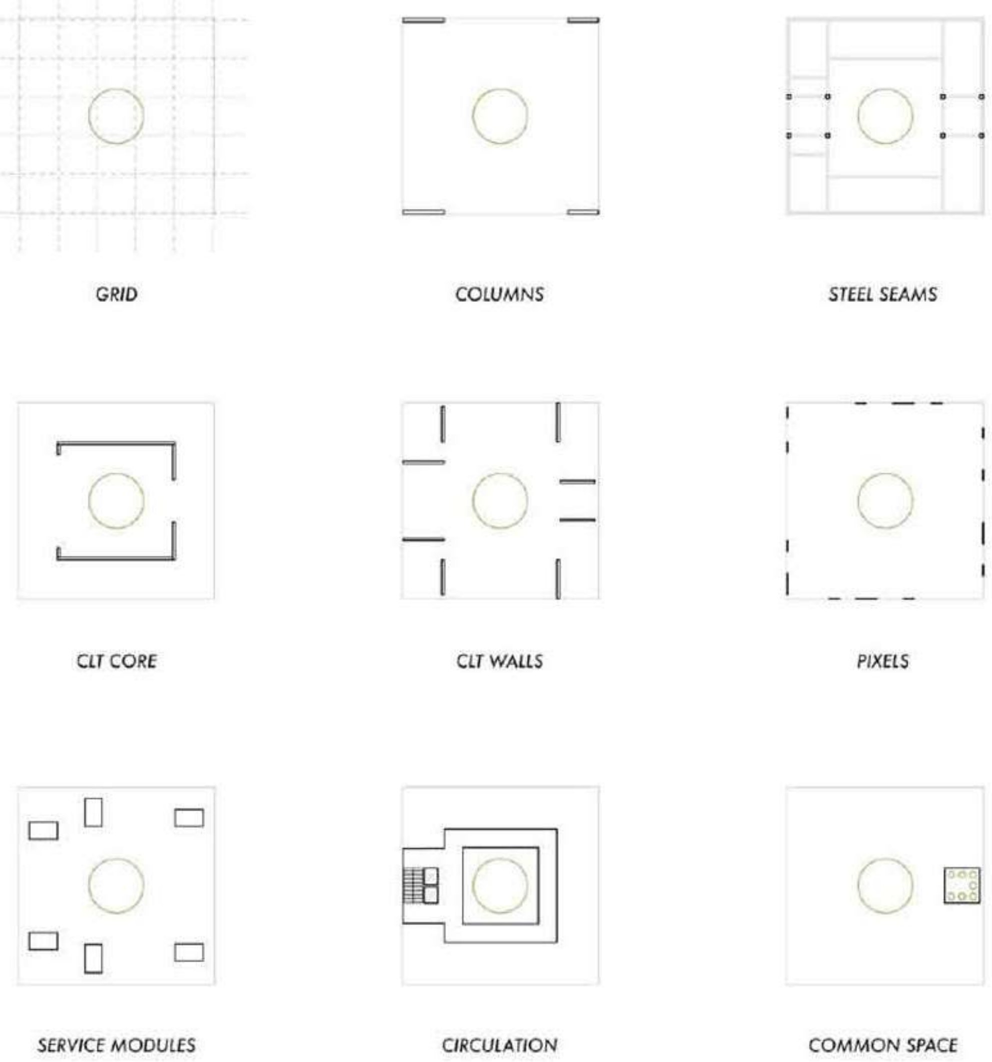
PLAN COMPONENTS / PARTS



Diagrams showing different ways of integrating systems with CLT.



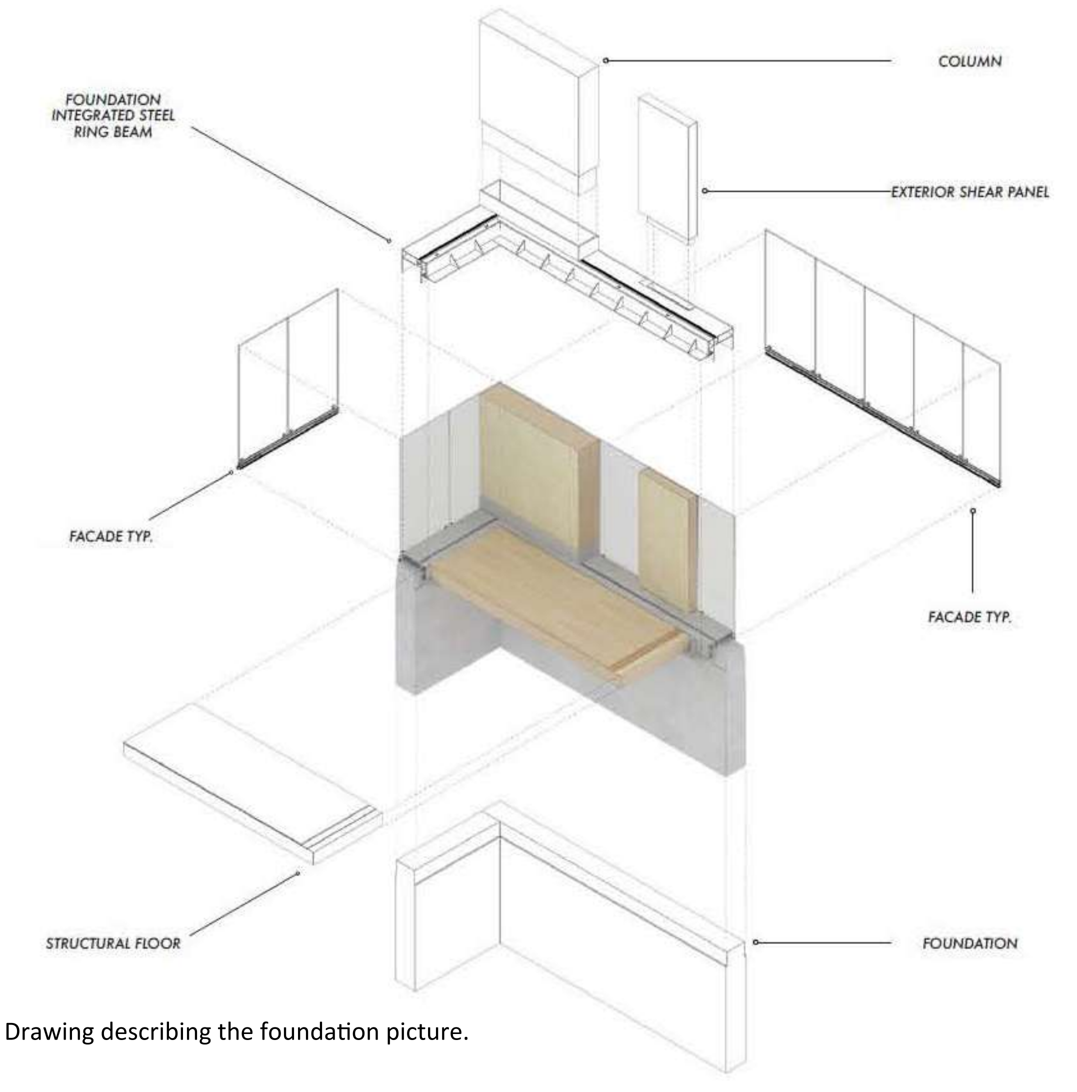
A major consideration and design intention was the idea of tapering building elements. When designing a structure, it is important to think about material efficiency; there is an inverse relationship between structure and height of a building. Towards the top of the building, there is less loading and accumulated weight compared to the bottom of the building, indicating that the structure can taper and diminish as it moves upward. This gesture is two-fold: reducing material usage, and allows for design variety and difference of building appearance and visual effects. It also makes a framework and provides legibility for the different programs in the building. The tapering idea can be achieved with two defining elements of the building: the structural columns, and the facade CLT pixelated panels. The intention is to make the building lighter.



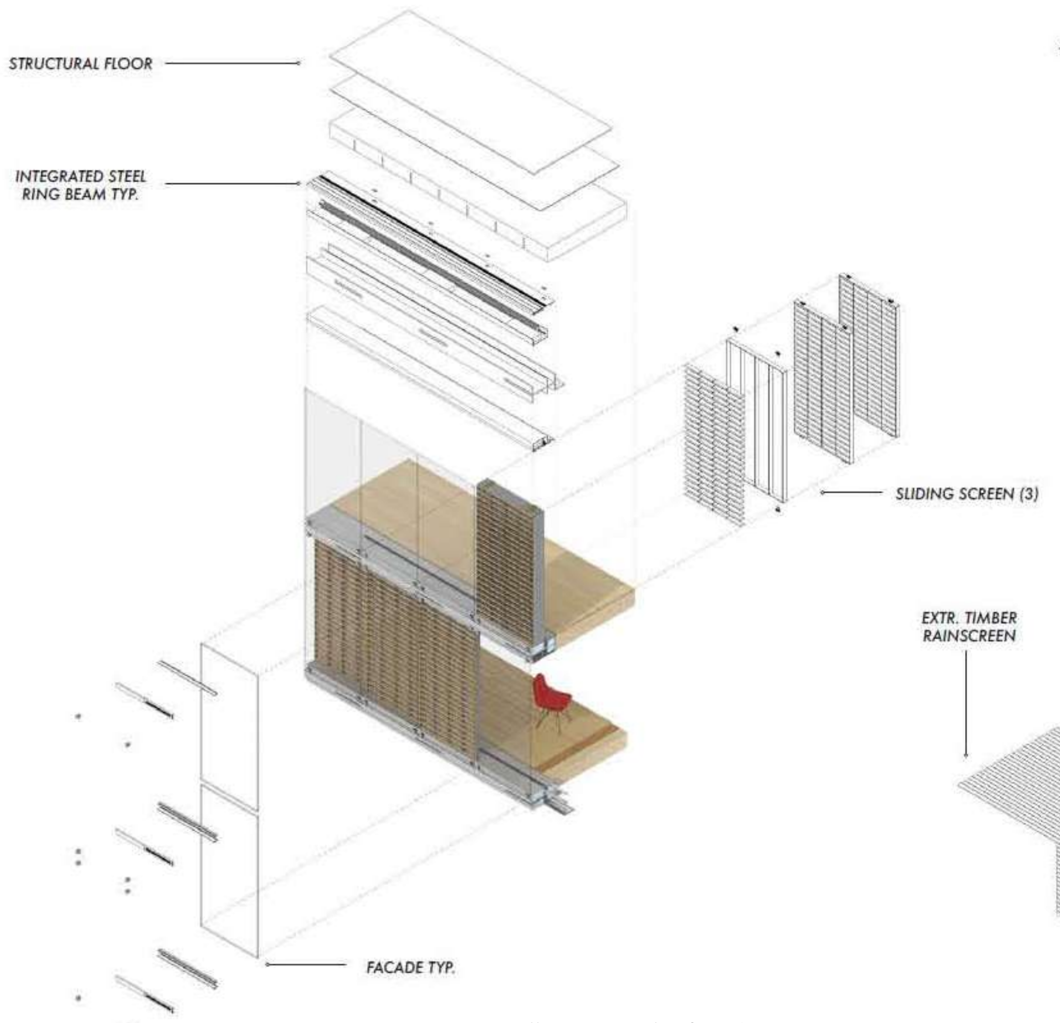
Series of diagrams showing the structural logic and parts of the building in a plan.

INTEGRATION :

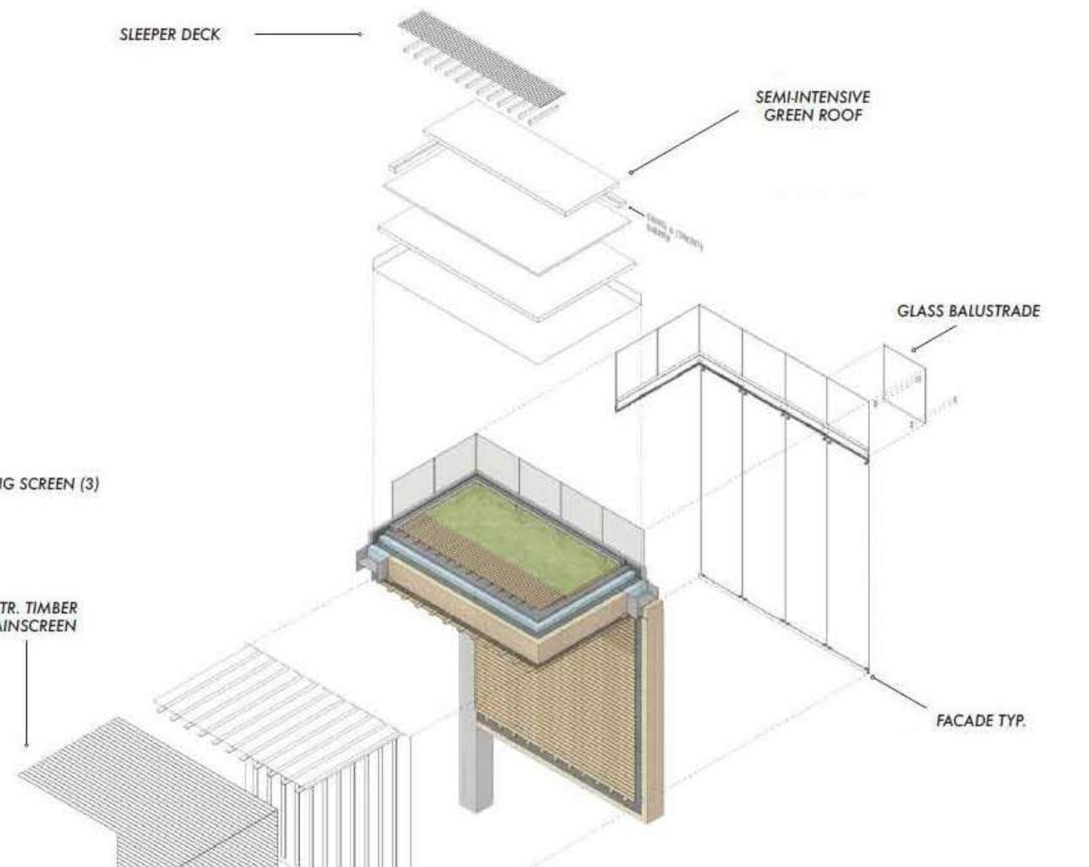
The following series of images show the developed idea of integrating steel seams at critical junctures in the building. Showcased are the five crucial building details: foundation, typical floor (corner), facade, interior (core) and the roof. The idea being that these set of details cover the fundamental parts of a building and can then be used as universal details adaptable and scalable to fit a range of building types. These features can be utilised as a toolkit for designing and conceiving buildings and spaces with CLT.



Drawing describing the foundation picture.



Drawing illustrating the facade juncture.



Drawing describing the roof juncture.

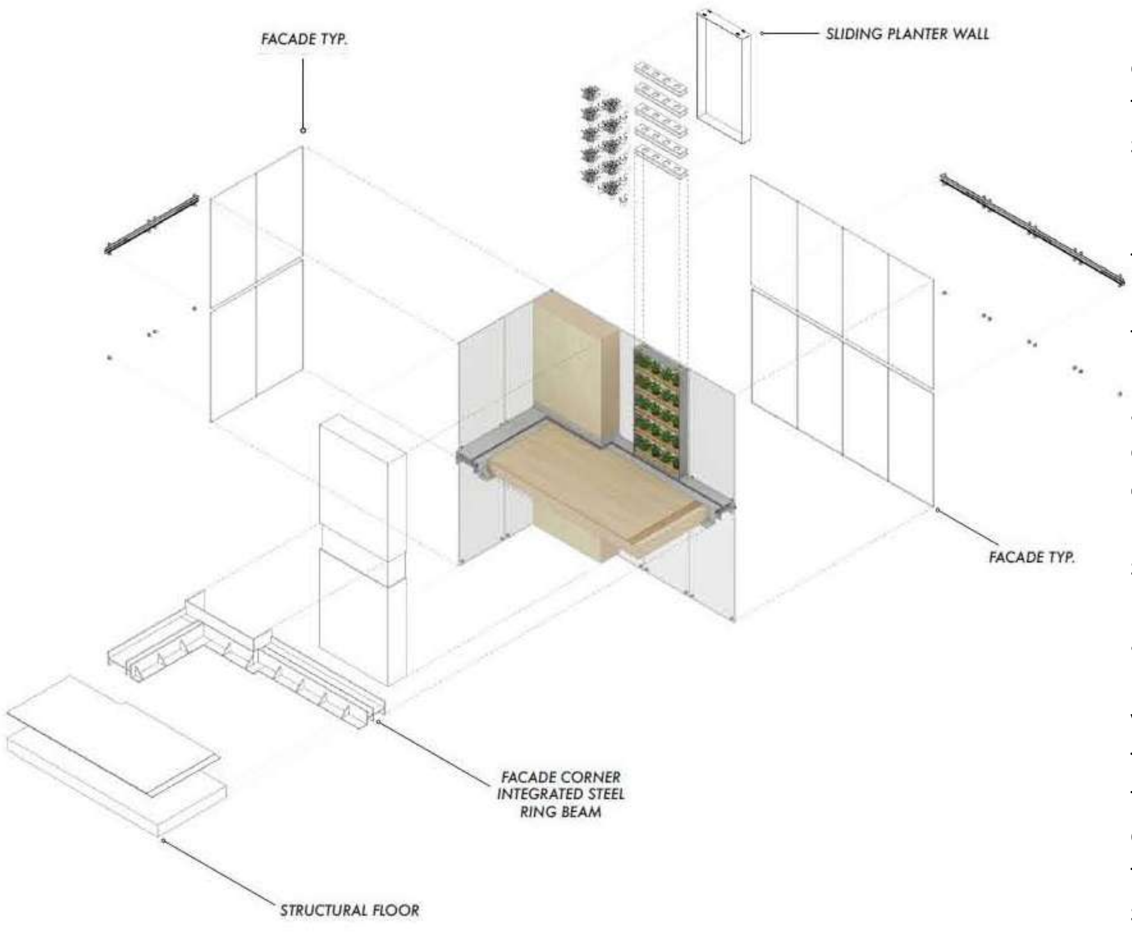


Diagram describing the corner-junction.

Building enclosure design has important implications for the energy performance and durability of the structure as well as indoor air quality and occupant comfort. The building enclosure serves a number of other functions, such as providing structural support for the building, controlling solar radiation, noise and fire, and providing an aesthetically pleasing finish.

Exterior wall and roof assemblies that use prefabricated CLT panels follow the same basic heat, air, and moisture control design principles as all building enclosures. The enclosure separates the interior environment of the building from the exterior environment, so it must handle loads such as precipitation, solar radiation, temperature gradients, humidity gradients, and air pressure differences. Building enclosure design must consider the outdoor climate as well as the intended building use and indoor environment. CLT panels are not a cladding material and are not designed to be exposed to the exterior environment. They are a moisture sensitive structural assembly and therefore must be protected from rain and other moisture sources through the use of properly designed wall and roof assemblies. During cold weather (in heating-dominated climates), when indoor vapor pressure is greater than outdoor vapor pressure (outward vapor drive), moisture might accumulate at the cold side of the assembly if the rate of diffusion into the assembly exceeds the rate of diffusion out of the assembly. In lightweight wood-frame construction, the phenomenon can occur in the exterior sheathing (OSB for example) if the interior side is too vapor-permeable and the insulation is placed in the stud cavity. In summary, CLT walls are expected to perform very well in cold climates when insulation is to the exterior and there is no additional interior vapor retarder.

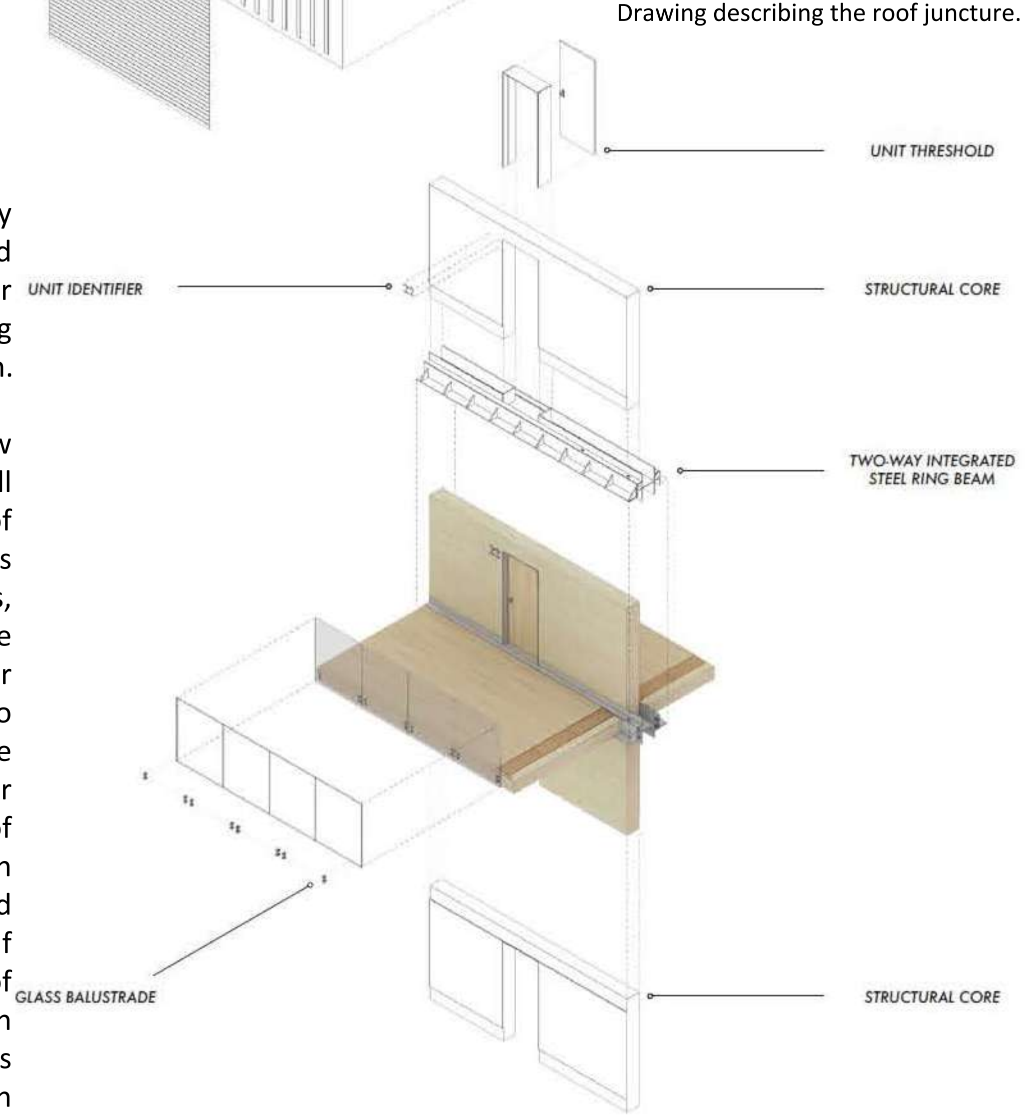


Diagram describing the core / circulation juncture.

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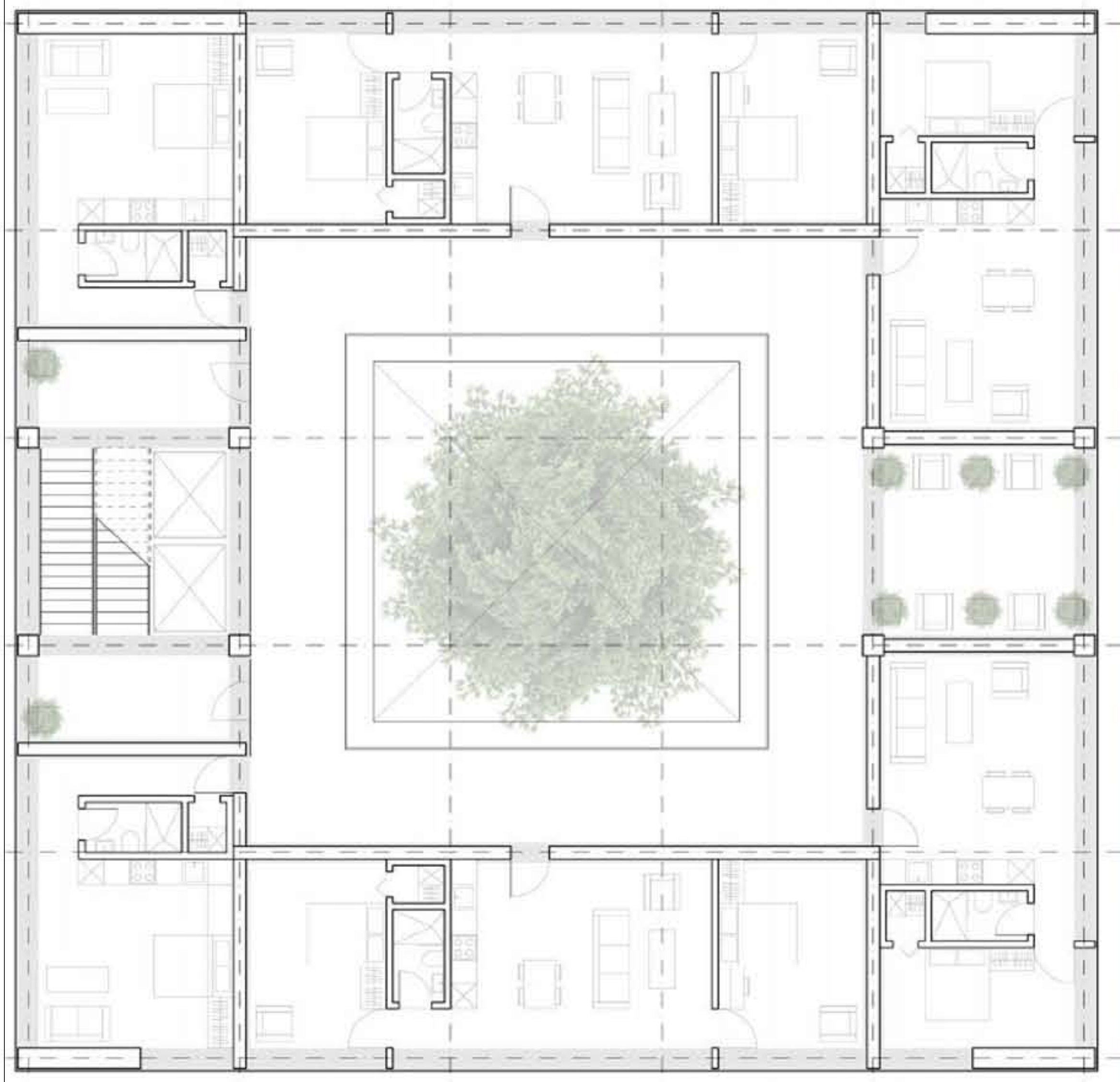
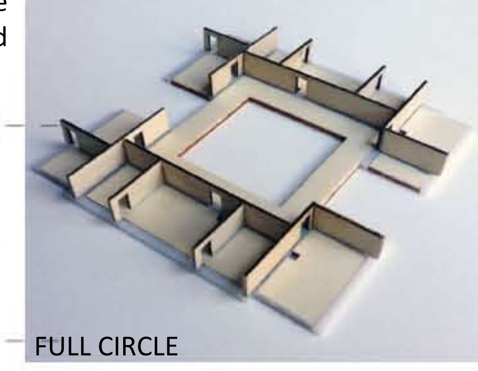
EXAMPLE OF A PROTOTYPE DESIGNED USING THIS CONCEPT :

To test the steel system with the CLT a host of different spaces and programmatic elements compose the wooden tower. Single, double and triple height large span volumes prove the versatility of the system. Below is a figure showing the locations of the integrated junctures and the different program elements of the building design.

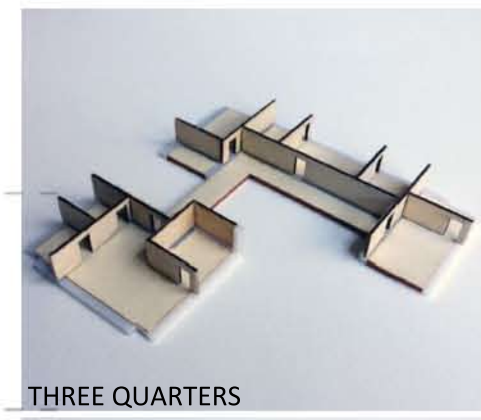


Floor Plan_Top left clockwise: Bachelor, 2 bed, 1 bed, Common Space (vertical garden), 1 bed, 2 bed, Bachelor and Circulation Core.

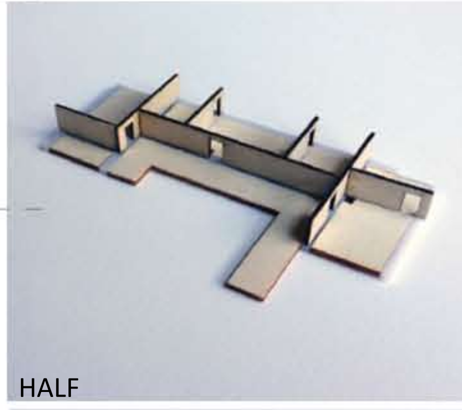
Drawing of floor plan unit layouts.



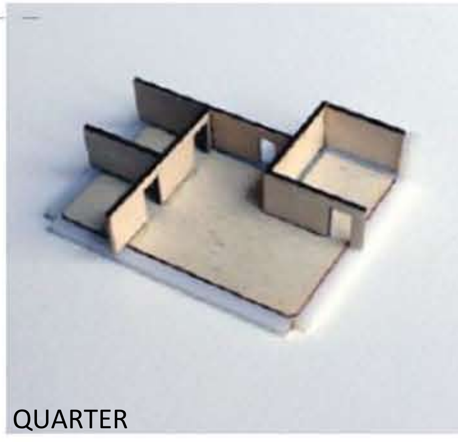
FULL CIRCLE



THREE QUARTERS



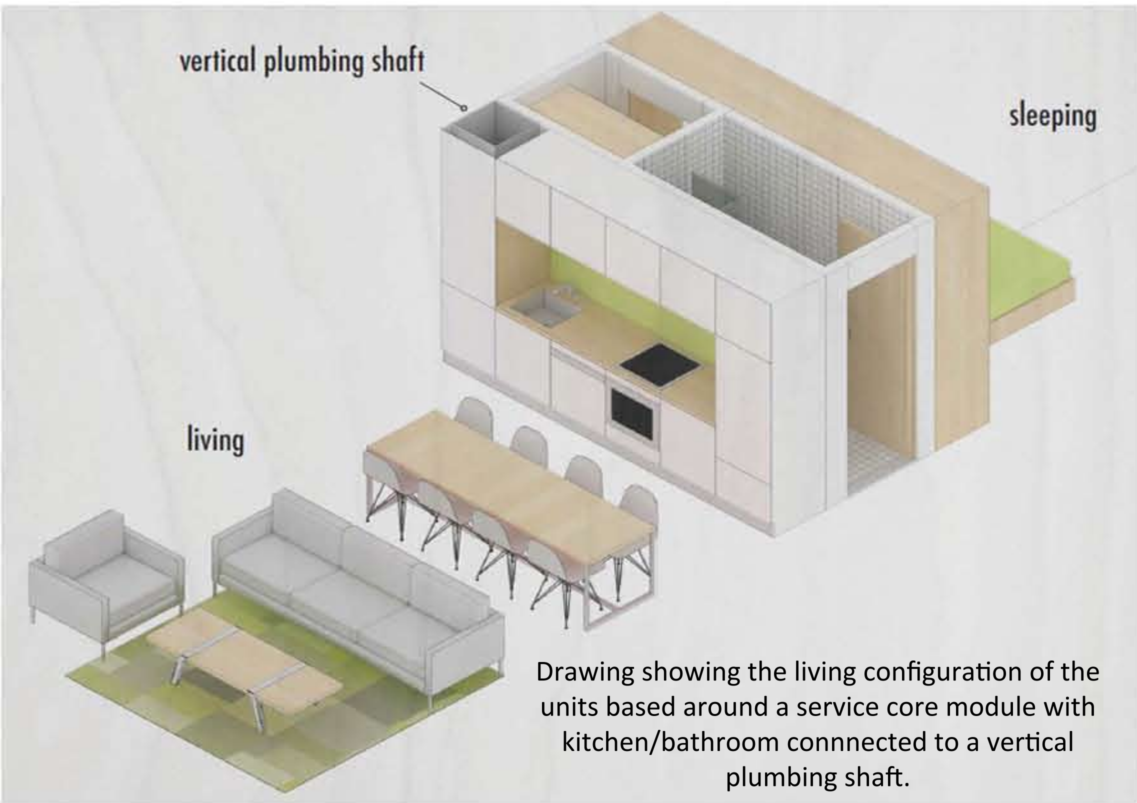
HALF



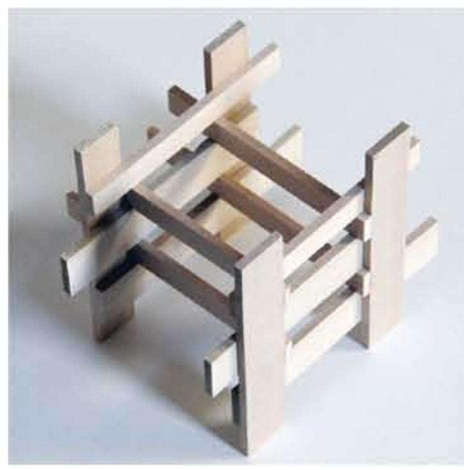
QUARTER

Image showing South-West Corner

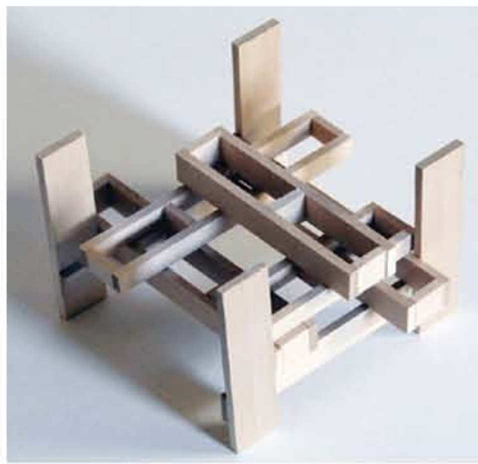
Image showing North-West Corner



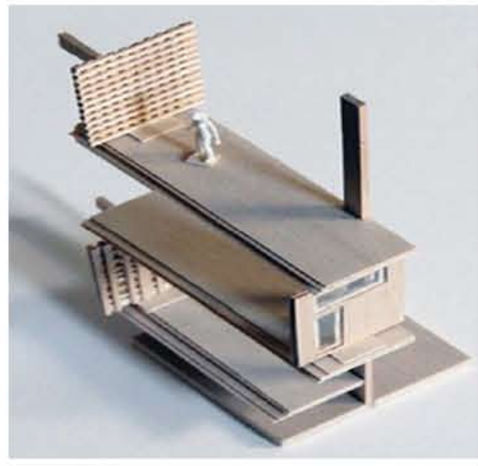
Drawing showing the living configuration of the units based around a service core module with kitchen/bathroom connnected to a vertical plumbing shaft.



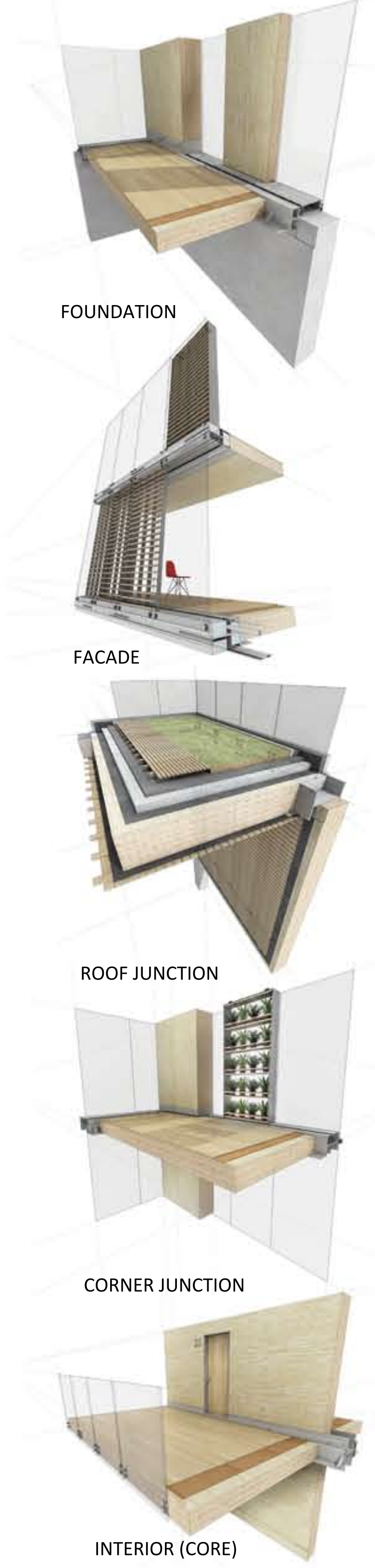
HORIZONTAL & VERTICAL INTEGRATION



SPATIAL PROJECTIONS



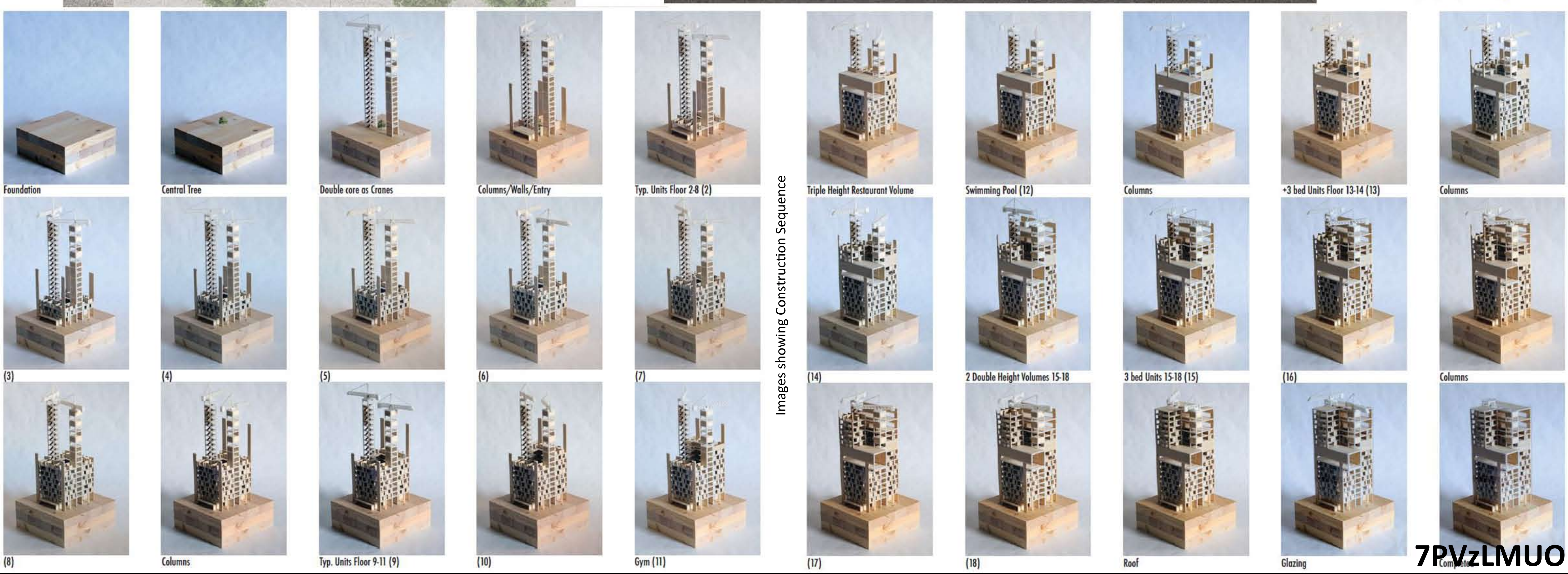
SHADING / PRIVACY



Diagrams illustrating Critical juncture locations (Integration with Steel)

GROUND FLOOR PLAN

SECTIONAL DRAWING OF THE BUILDING FACING NORTH



Images showing Construction Sequence

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