

A Sports Facility for Clongriffin, Co Dublin

ARCH3001 TDS3 - Structural Design Project

Structural Systems:

In selecting a structural solution for the proposed Sports and Community Centre in Clongriffin several aspects must be considered. The site parameters and conditions, intended uses of the various areas, the availability of the structural elements locally if possible, speed and ease of construction and how the external envelope will connect back to the primary and second structure and the bearing of the loads imposed.

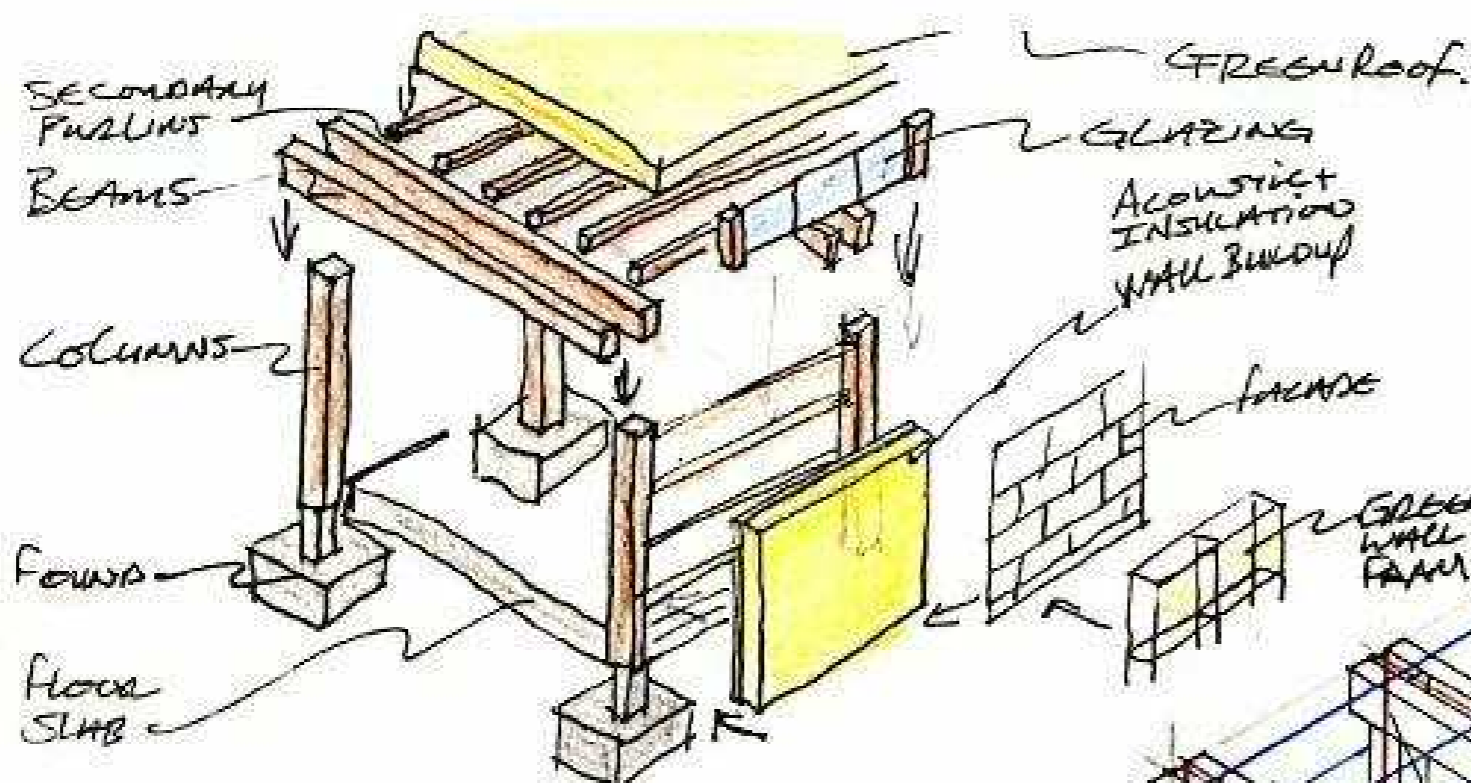
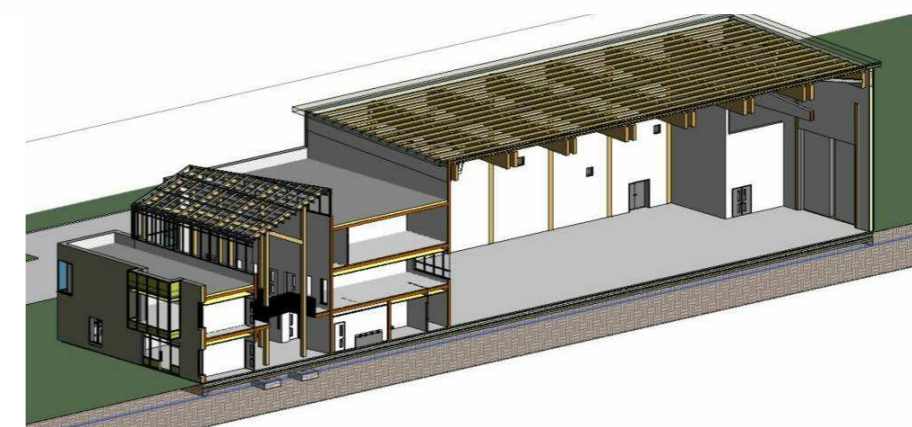
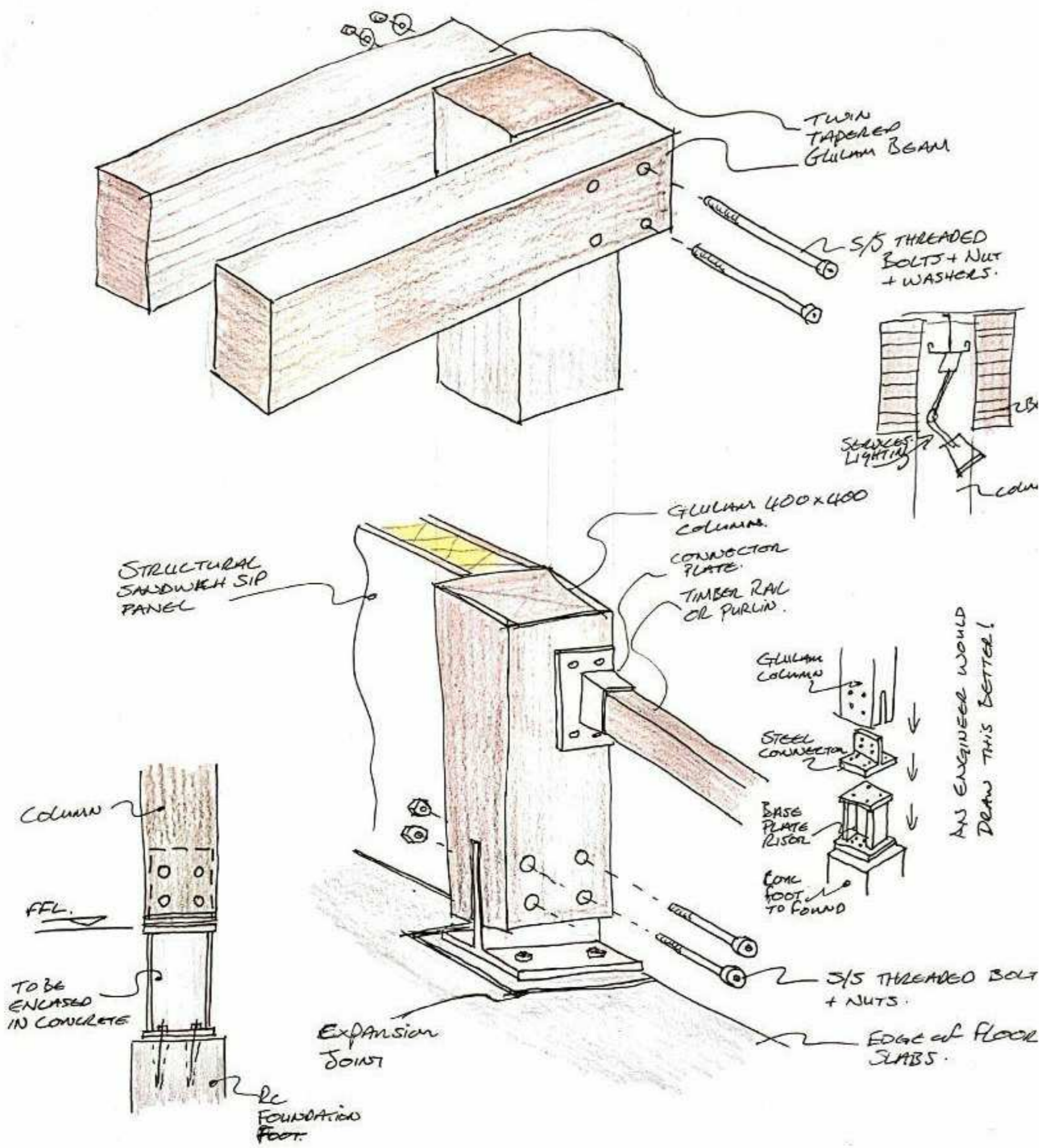
The Architect's intent is for a north, south Central Atrium with columns and rafters flanked by accommodation rooms and deliveries. Approximately 2km from the eastern seaboard the surrounding area is flat with no neighbouring buildings or obstacles to provide wind shelter therefore wind bracing the primary structure will be needed. The condition of the ground, soil load bearing capacity, level of the water table and depth of loadbearing strata will require a selection of trial holes across the site before a foundation system is selected. In this case a raft foundation has been chosen as the ground is assumed to be of poor load-bearing capacity with additional reinforced concrete pads under the hall and atrium columns.

Central Atrium: The primary structure of glulam columns will support glulam rafters with secondary intermediate timber bracing members. Steel plates and sleeve with stainless steel bolts, washers and nuts will connect the timber elements together. A series of timber purlins will also act as the secondary structure spanning between rafters and will support the atrium's glazed curtain walling system. Additional tertiary elements may be required at the gables for wind-bracing curtain wall support. The Atrium structure is self-supporting and is independent of the flanking accommodation blocks with minimal live-loading other than wind and snow and no imposed loading other than the curtain walling. The elements will be delivered and assembled on site.

Accommodation Block: These areas comprise primarily of two/three storey meeting and changing rooms therefore a CLT platform system seems the most efficient. After identifying wall heights and floor span directions/distances the KLH Structural Pre-Analysis Tables were used for thicknesses and composition of layers within the various cross laminated timber units. The CLT system is manufactured off site and delivered for immediate assembly. Connections and fixings are but way of steel angle brackets at horizontal to vertical junctions with specialist screws to stepped shear joints in floor cassettes.

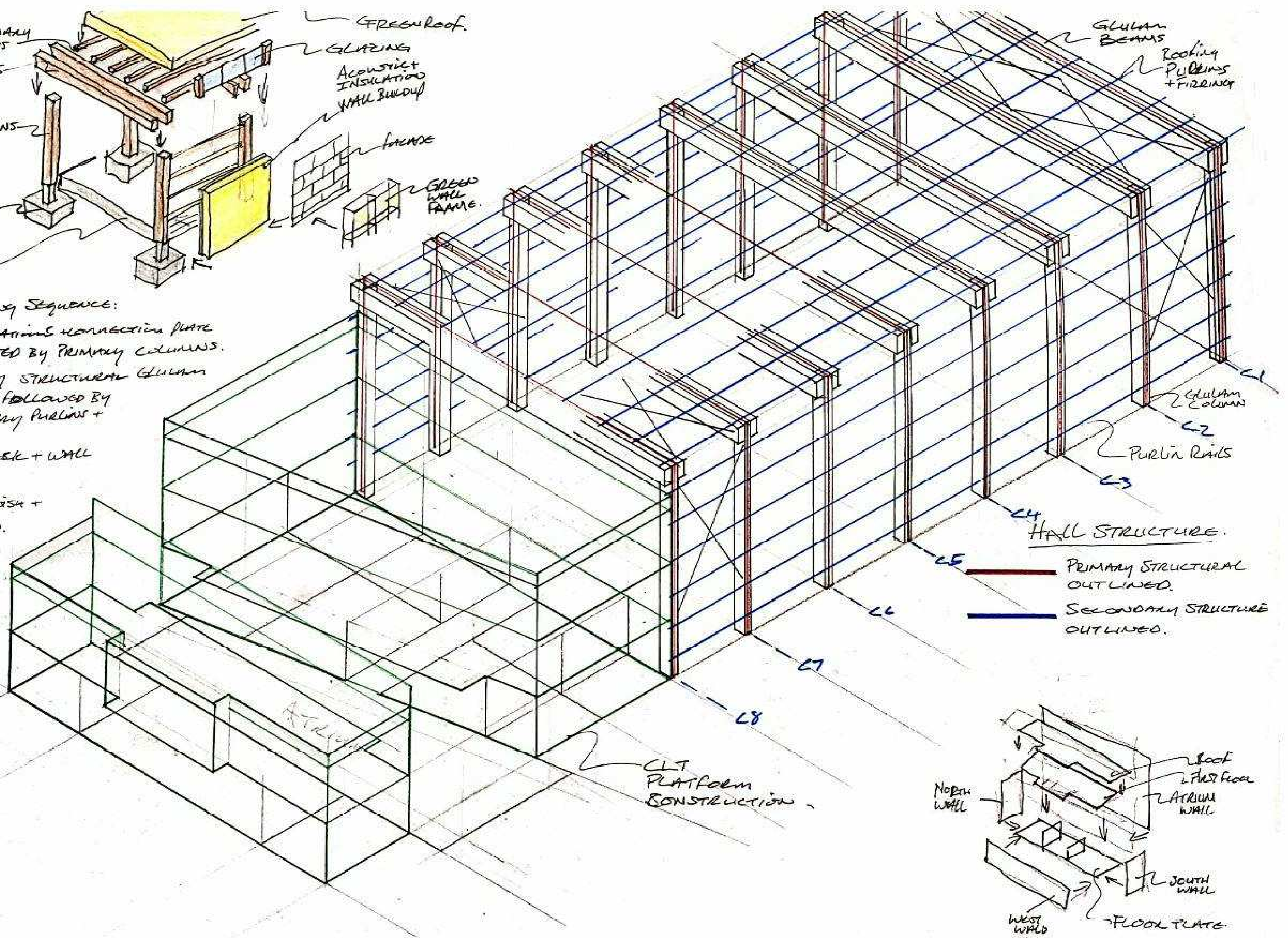
Sports Hall: To achieve a clear span of 21m across the activity area a portal frame system of columns and beams was thought to be the most efficient. 400x400mm glulam columns rising off steel connector plate and foundation risers to protect the base of the timber from moisture. Various simply supported horizontal truss types were considered and investigated. The depth of a lattice truss at approx. 2m was considered excessive for the building however assembly on site was an advantage. A bowstring truss was strongly considered as the main members depth is reduced because the compressive load is transferred into the steel bow which is in tension, but I could not model it in Revit. Eventually a series of twin straight glulam beams hung either side of the columns was selected. Fitted at a slight pitch (1:60) to the south in line with the architect's intent the depth of this glulam beam is approx. 1.09m. Lateral support for secondary timber purlins span between each portal frame at roof level with diagonal wind bracing at the start and end of the structural grid. Insulated SIP in-fill panels between the columns also prevent the structure from sideways movement.

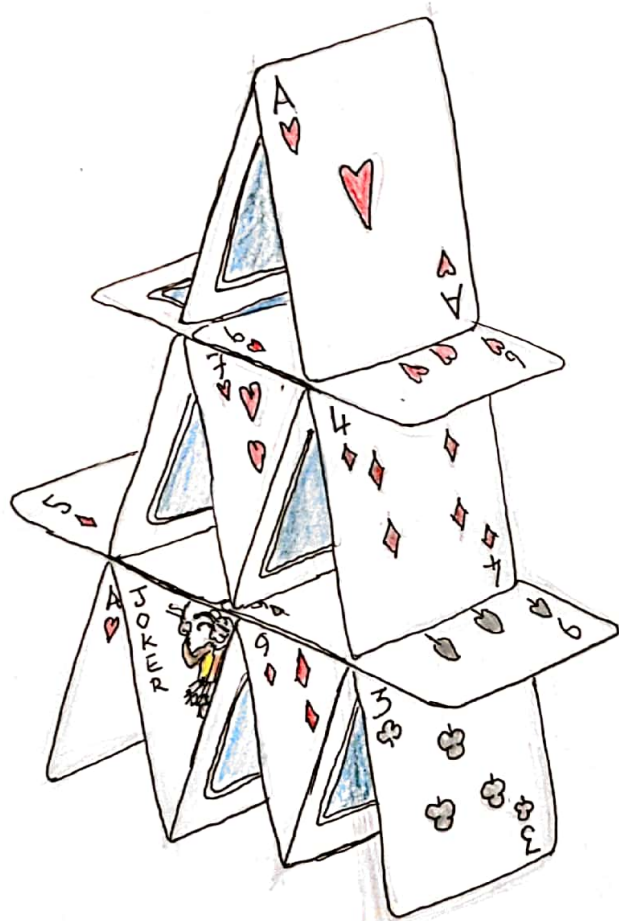
Cladding Systems: A selection of fibre cement rainscreen finished envelope the building using aluminium and timber batten subframes fixed back to the CLT wall or insulated SIP panels using bracket with thermal break isolator pads to prevent cold bridging.



Building Sequence:

- 1 FOUNDATIONS CONNECTION PLATE FOLLOWED BY PRIMARY COLUMNS.
- 2 PRIMARY STRUCTURAL GLULAM BEAMS FOLLOWED BY SECONDARY PURLINS + RAFTERS.
- 3 ROOF DECK + WALL PANELS
- 4 ROOF FINISH + FACADE.



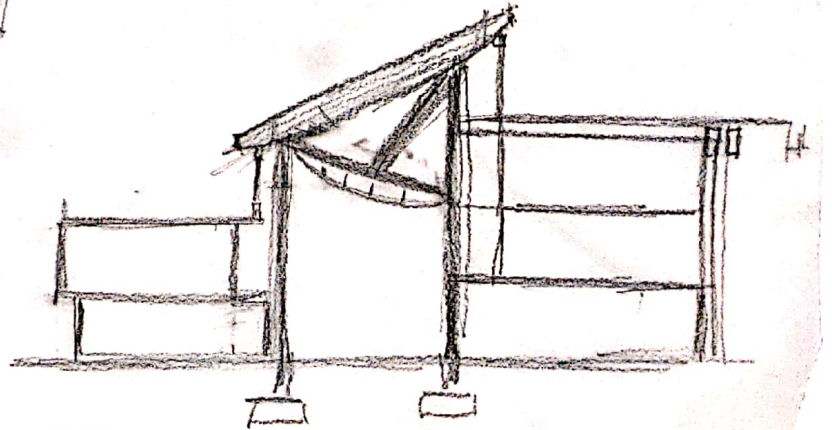
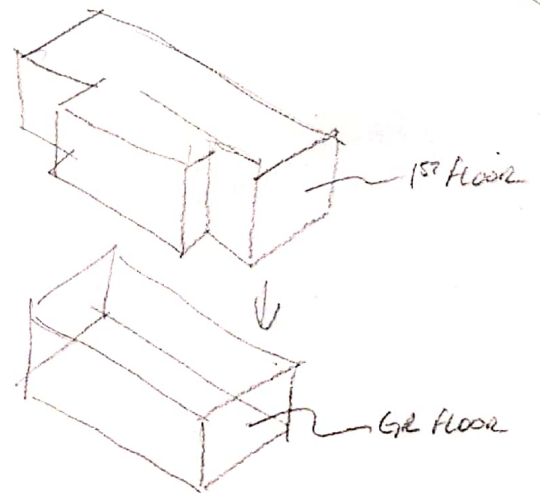
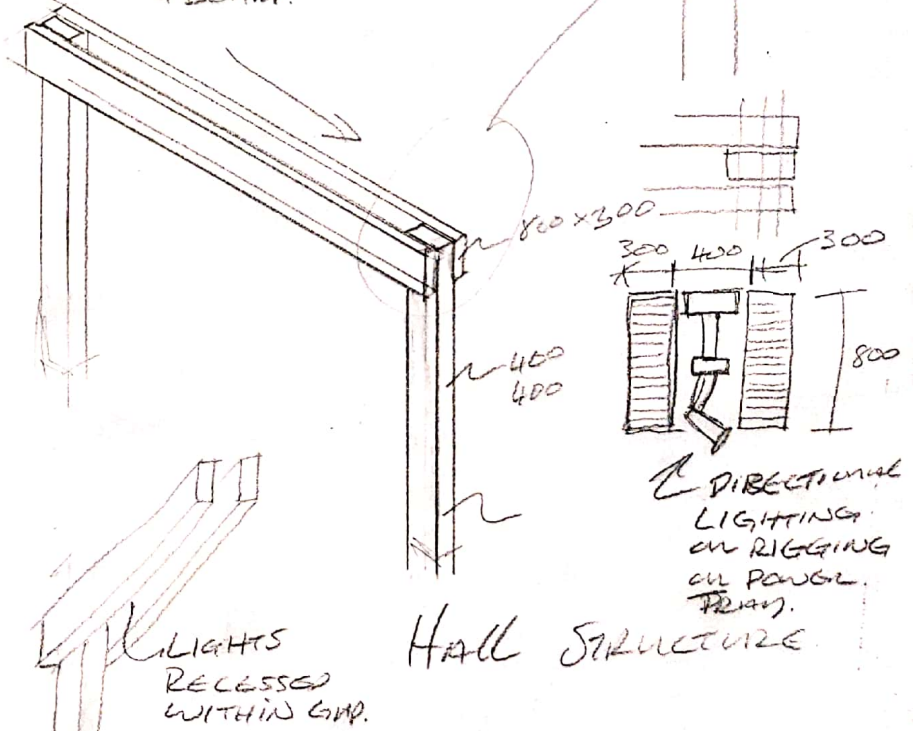
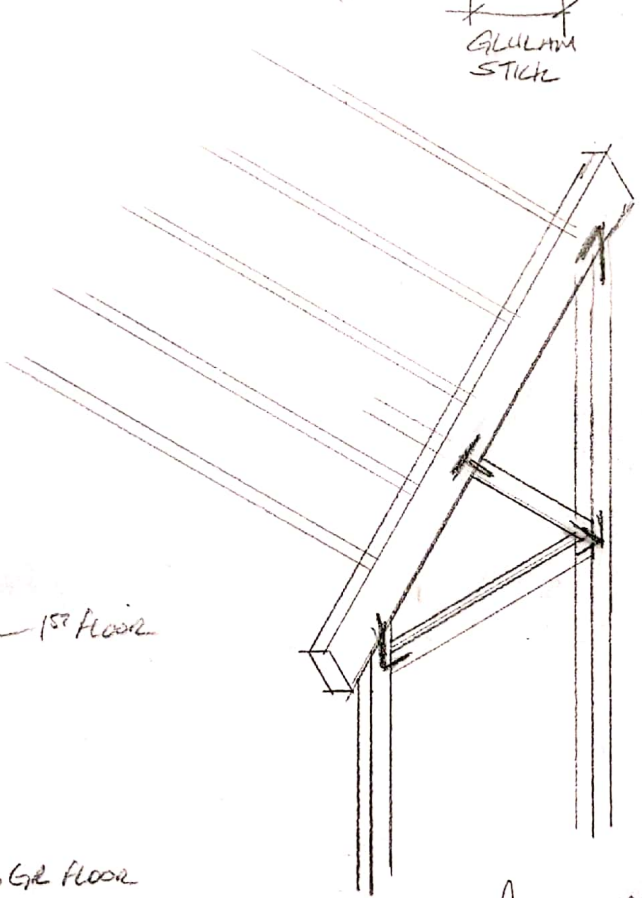
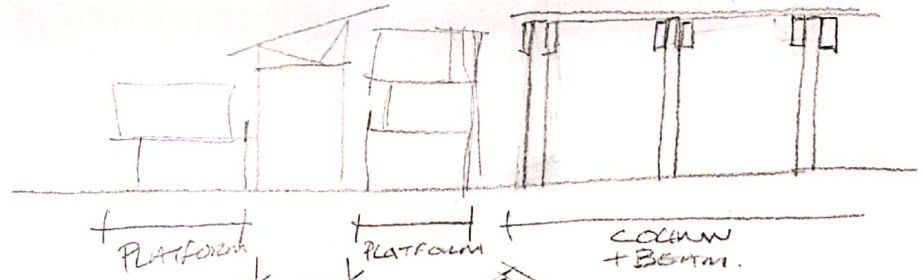
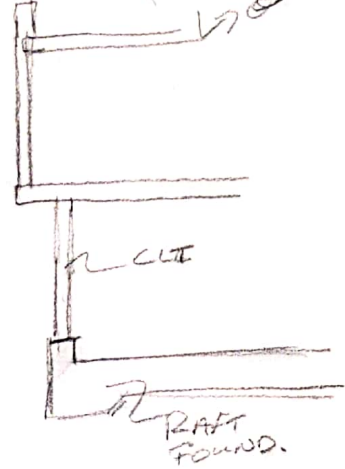


STRUCTURE

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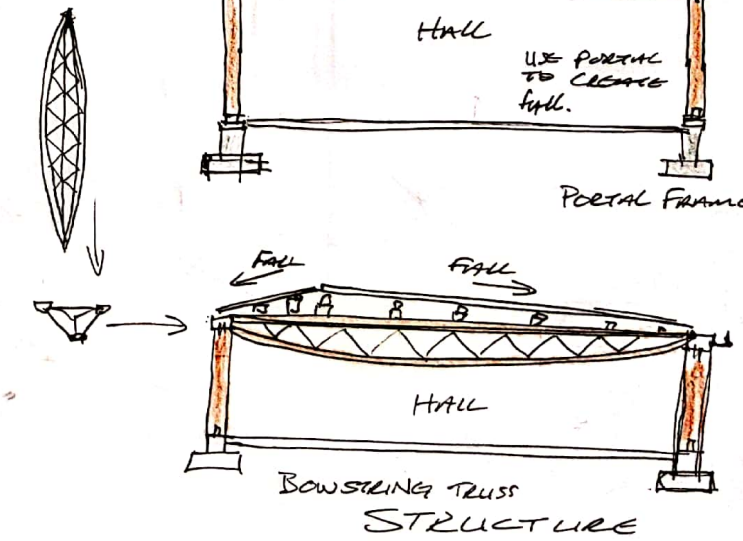
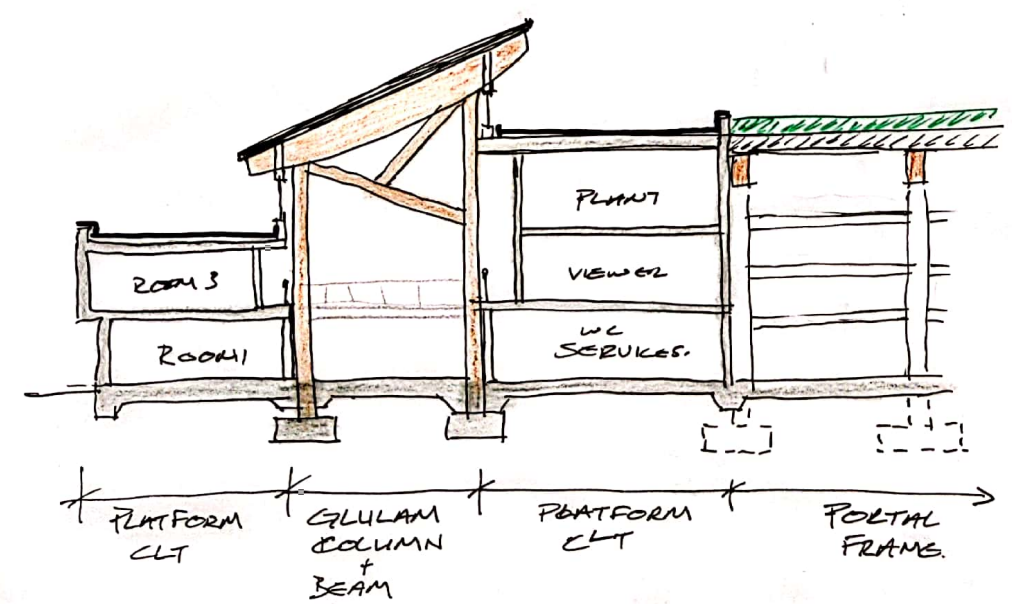
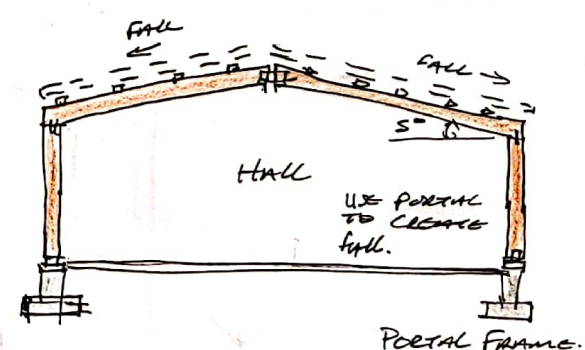
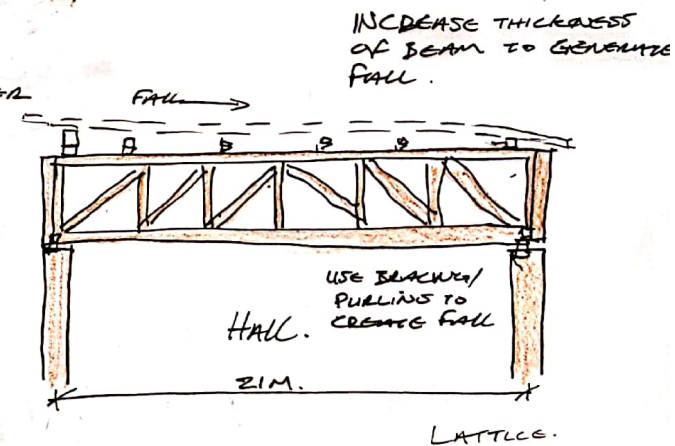
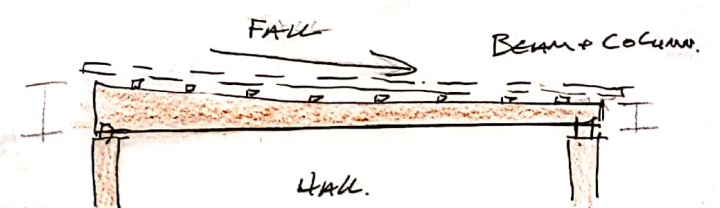
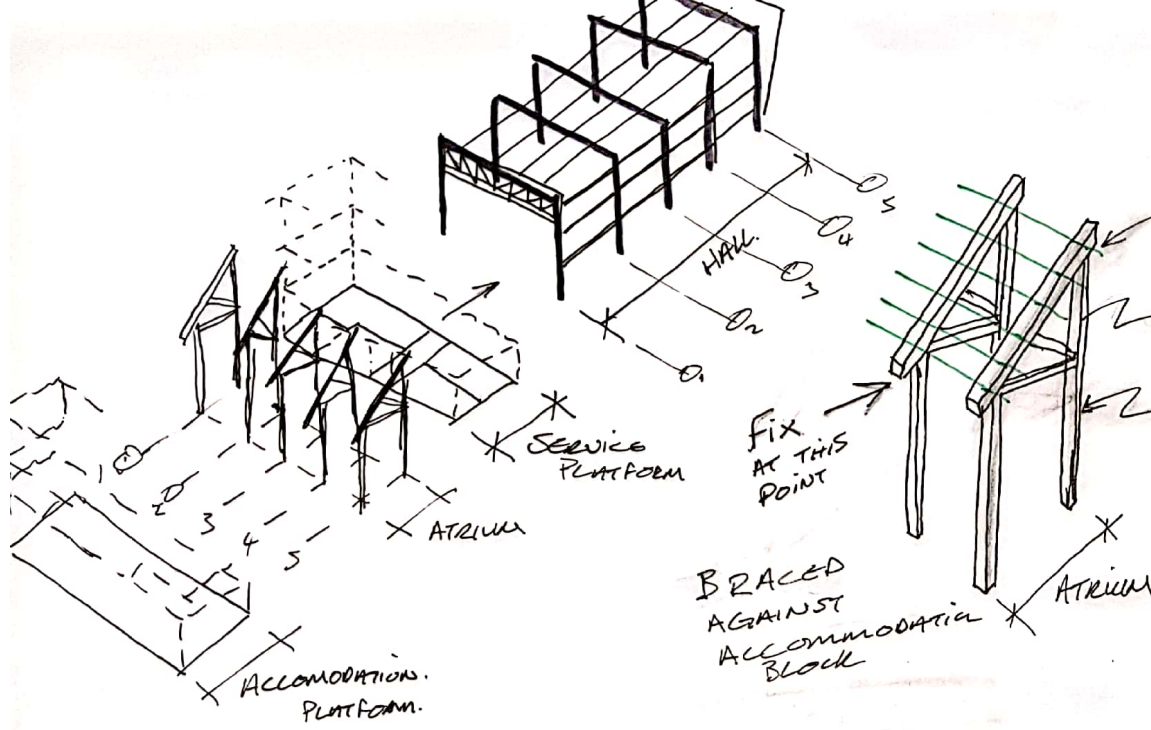
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POST + BEAM
or
WALL

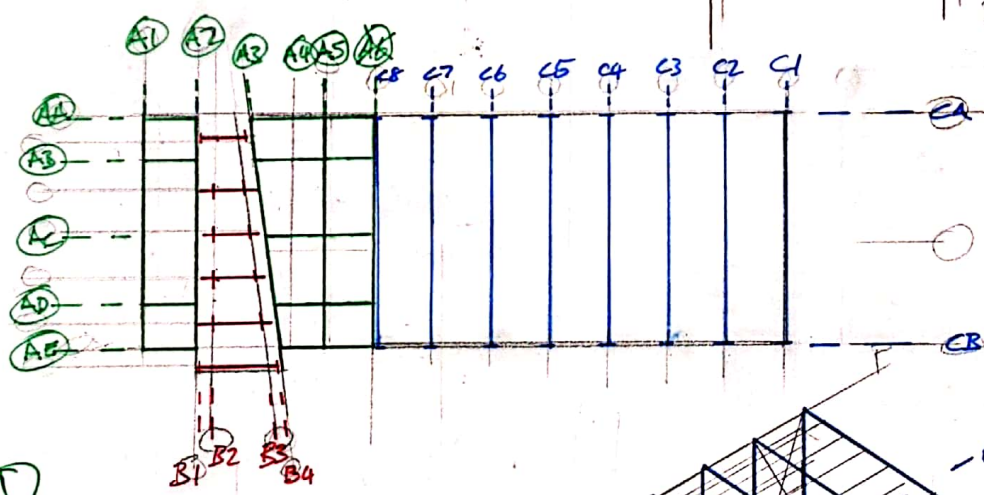
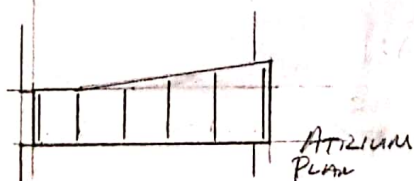
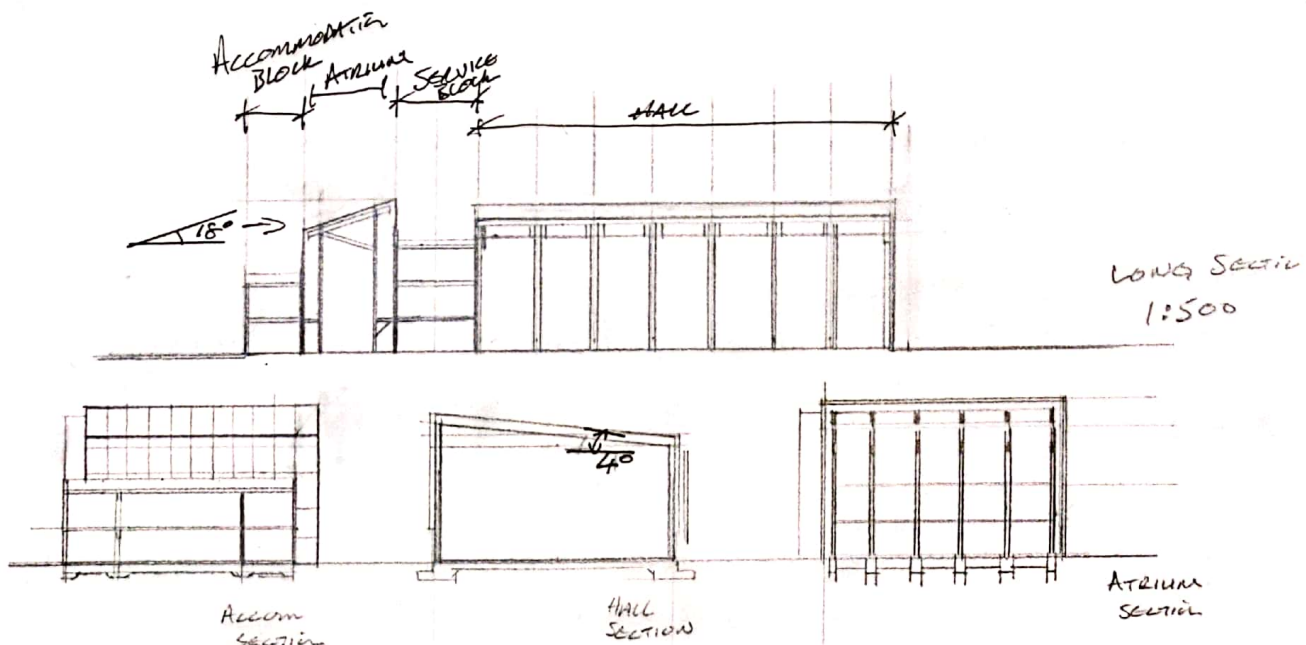


BASIC STRUCTURE.

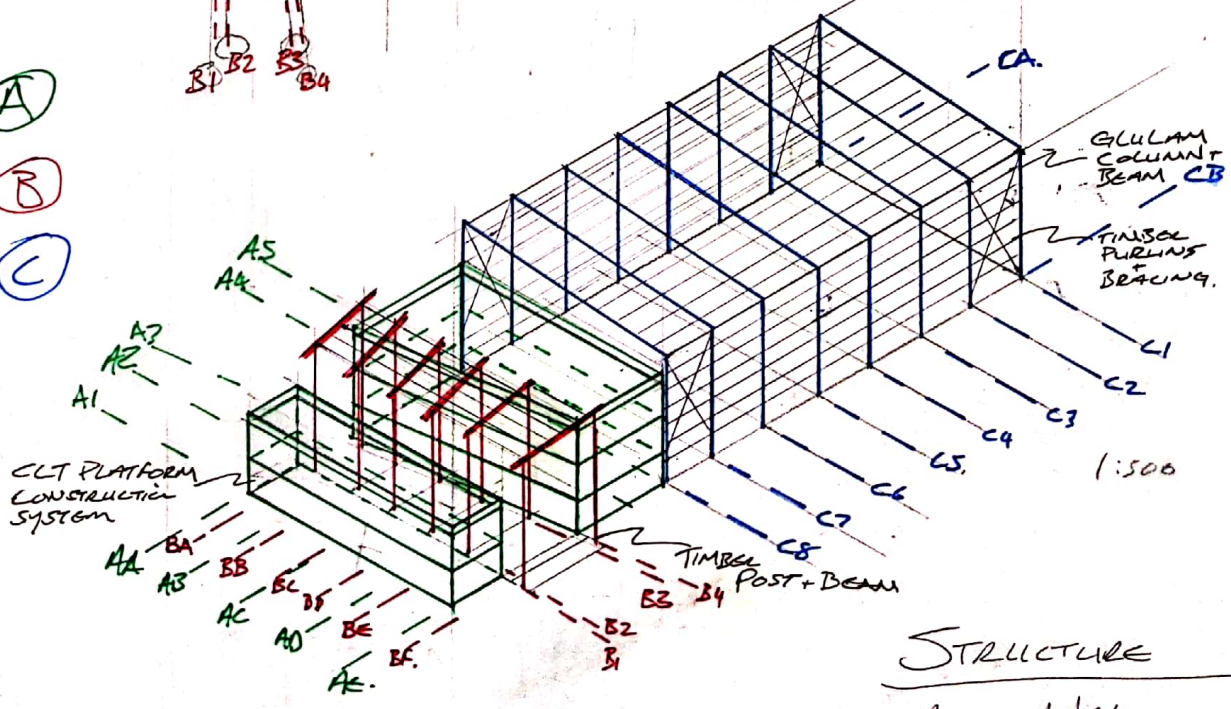
ADAM MCKENNA
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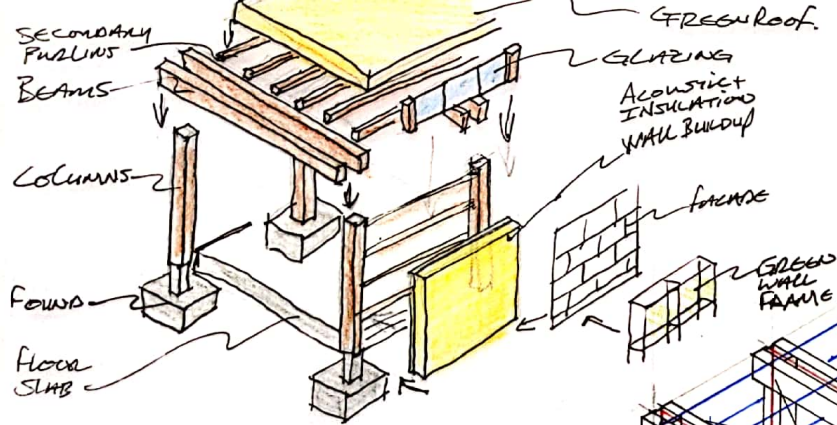
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- Accom. Rooms (A)
- Atrium (B)
- HALL GRID (C)

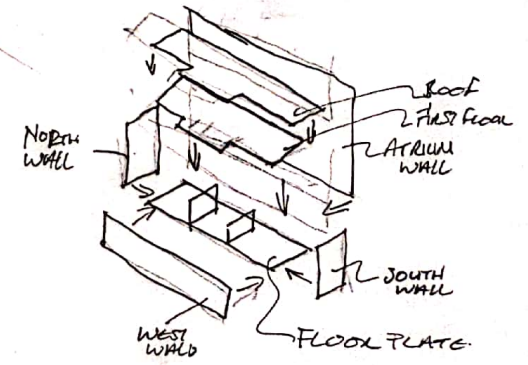
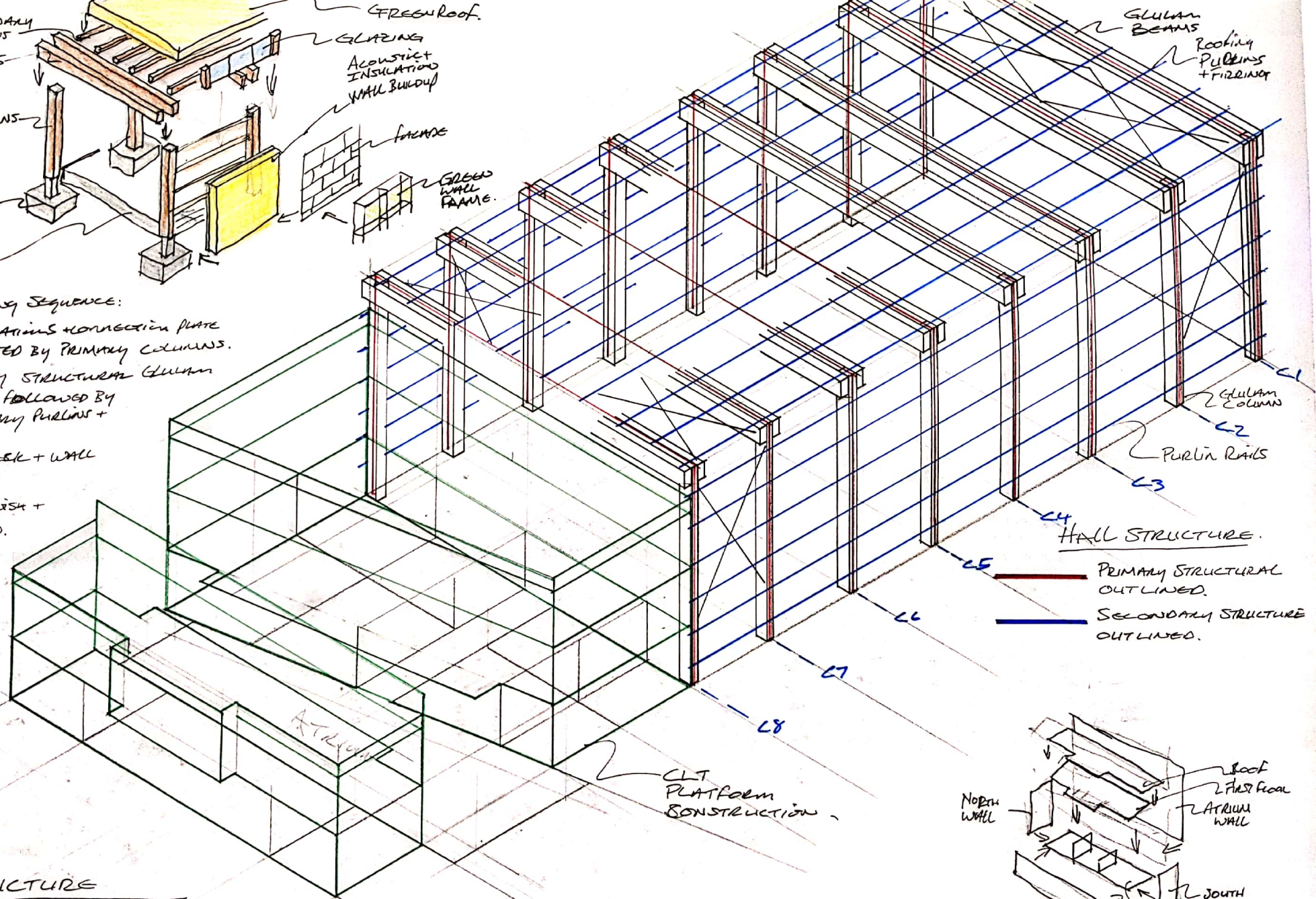


STRUCTURE
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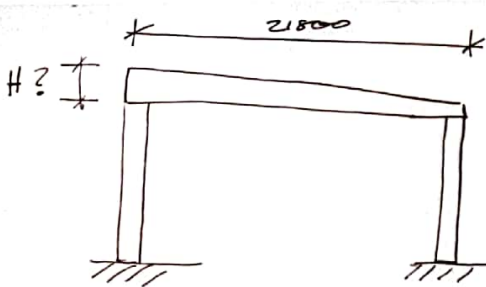
Building Sequence:

- 1 FOUNDATIONS CONNECTION PLATE FOLLOWED BY PRIMARY COLUMNS.
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- 3 ROOF DECK + WALL PANELS
- 4 ROOF FINISH + FACADE.

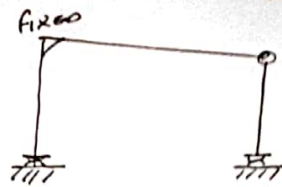


STRUCTURE

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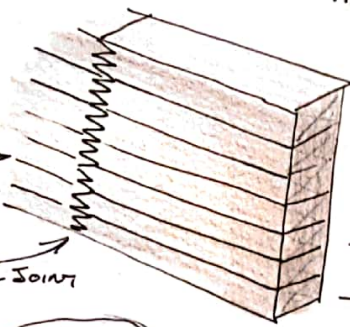


$H = L/20 = 1090\text{mm}$
 OR
 $H = L/17 = 1280\text{mm}$

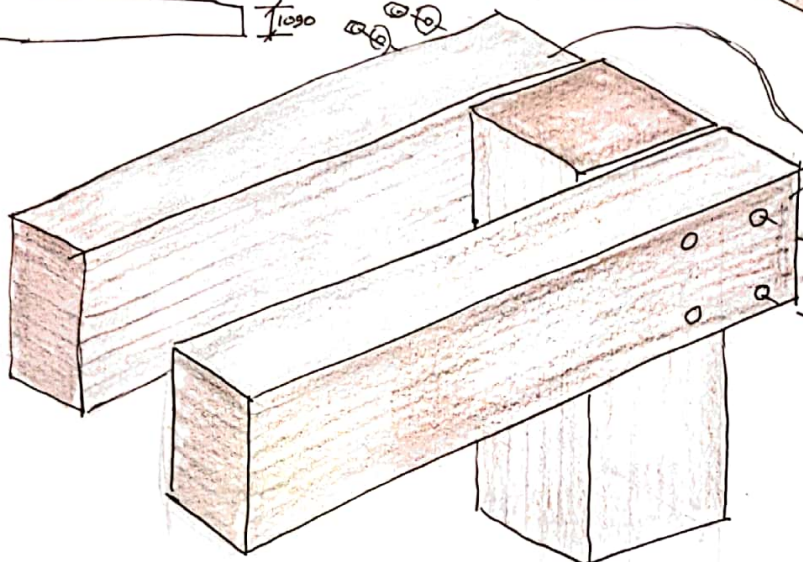


FALL REQUIRED FOR ROOF

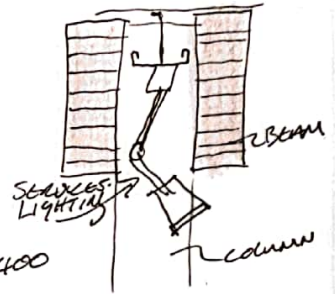
1:60 = 365mm
 MULTIPLE PLANKS
 GLUED + PRESSED
 TOGETHER.



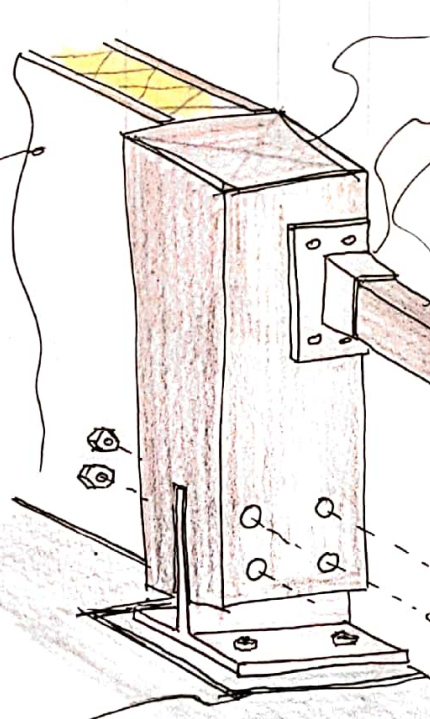
STRENGTH ZONE = BETTER
 QUALITY TIMBER
 LESS STRONG = QUALITY/STRENGTH
 NOT AS HIGH.
 STRENGTH ZONE = BETTER
 QUALITY TIMBER.



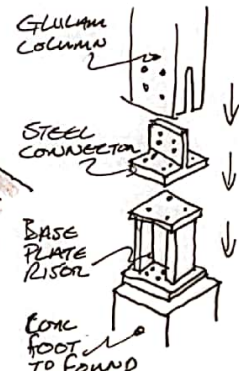
TWIN
 TAPERED
 GULAM BEAM
 5/8 THREADED
 BOLTS + NUT
 + WASHERS.



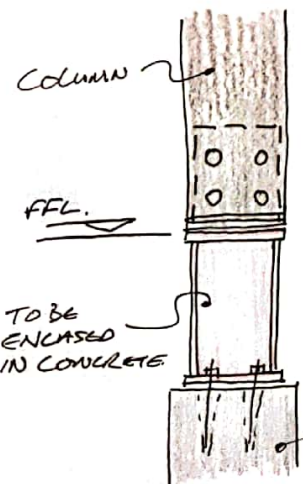
STRUCTURAL SANDWICH SIP PANEL



GULAM 400x400
 COLUMN.
 CONNECTION
 PLATE.
 TIMBER RAIL
 OR PURLIN.



AN ENGINEER WOULD DRAW THIS BETTER!




Expansion JOINT

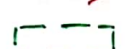
EDGE OF FLOOR SLABS.


STRUCTURES

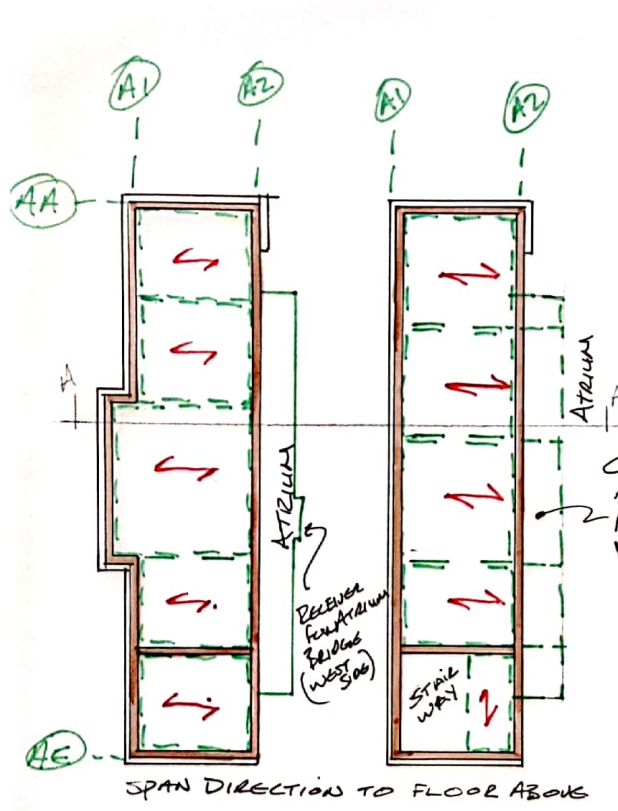
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 = CLT STRUCTURAL WALLS

 = SPAN OF FLOOR ABOVE.

 = OUTLINE of FLOOR CLT CASSETTES/ELEMENTS

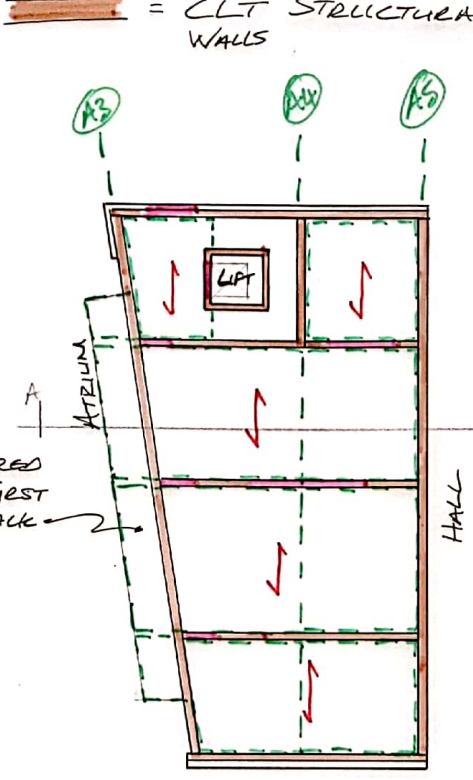
 = LOCATION of OPE SUPPORT. ABOVE.



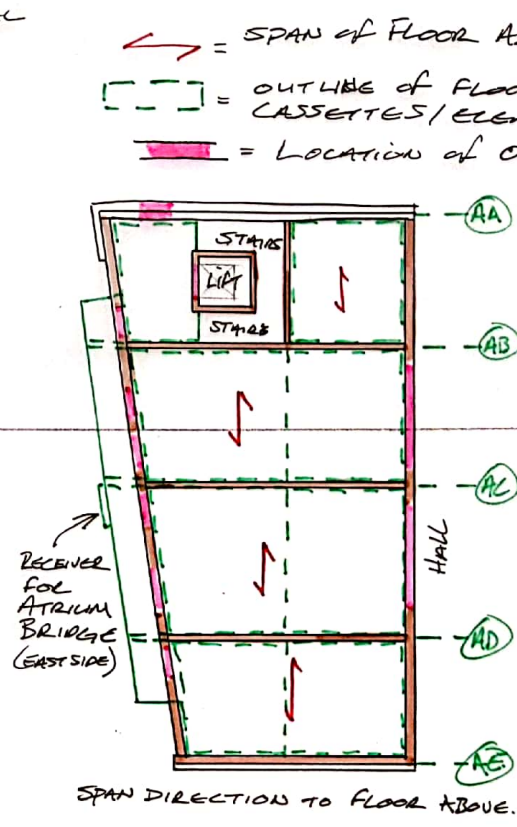
SPAN DIRECTION TO FLOOR ABOVE

1st Floor PLAN 1:200

GROUND FLOOR PLAN 1:200



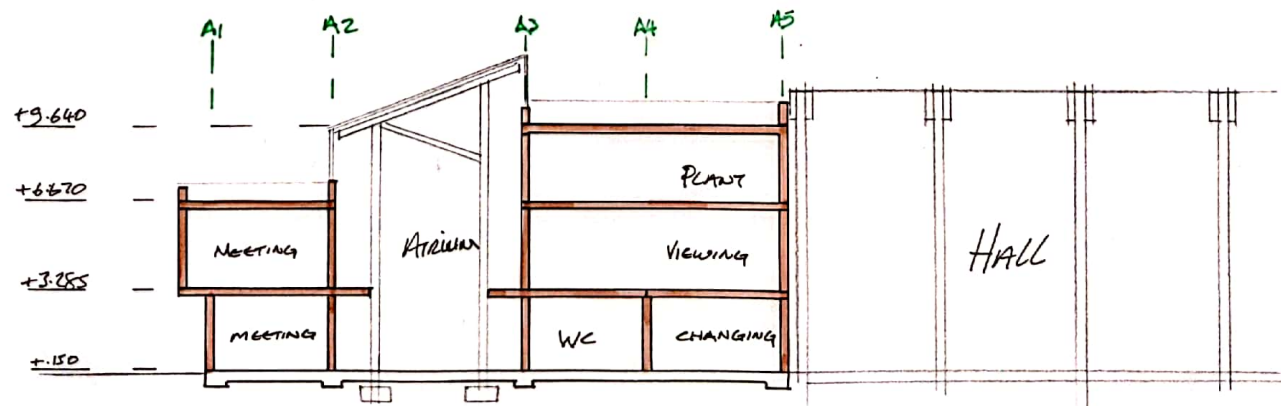
2ND FLOOR PLAN 1:200



SPAN DIRECTION TO FLOOR ABOVE.

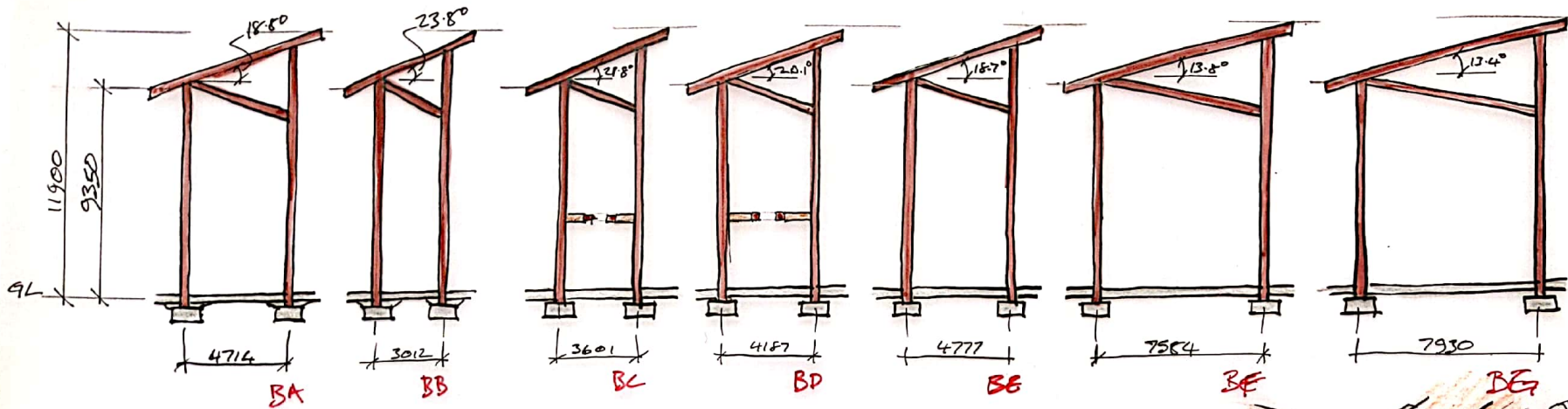
1st Floor PLAN 1:200

GROUND FLOOR PLAN 1:200

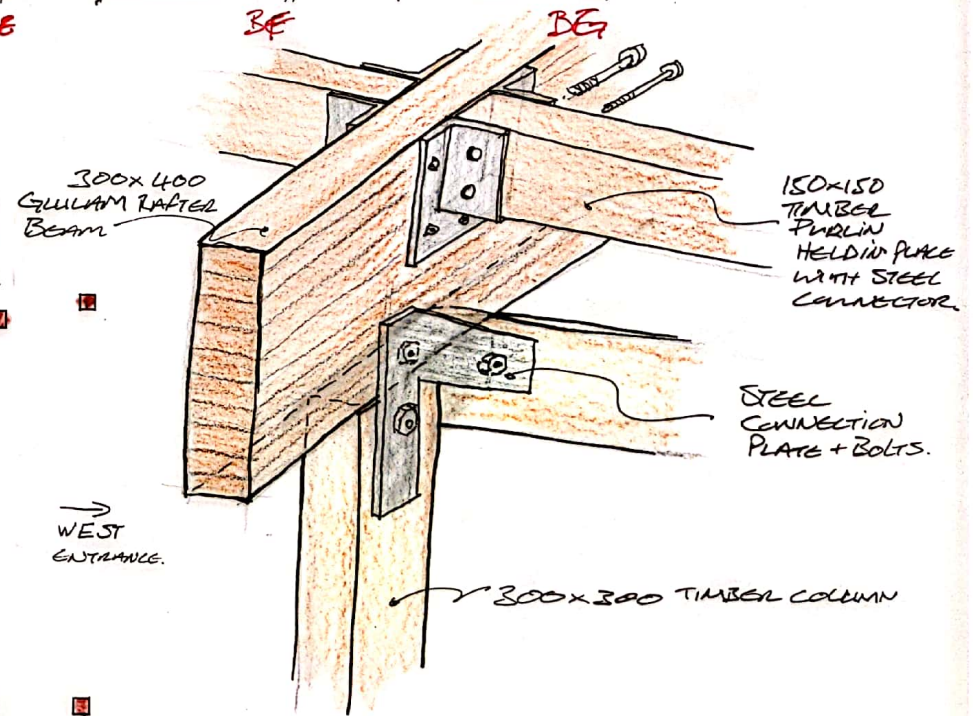
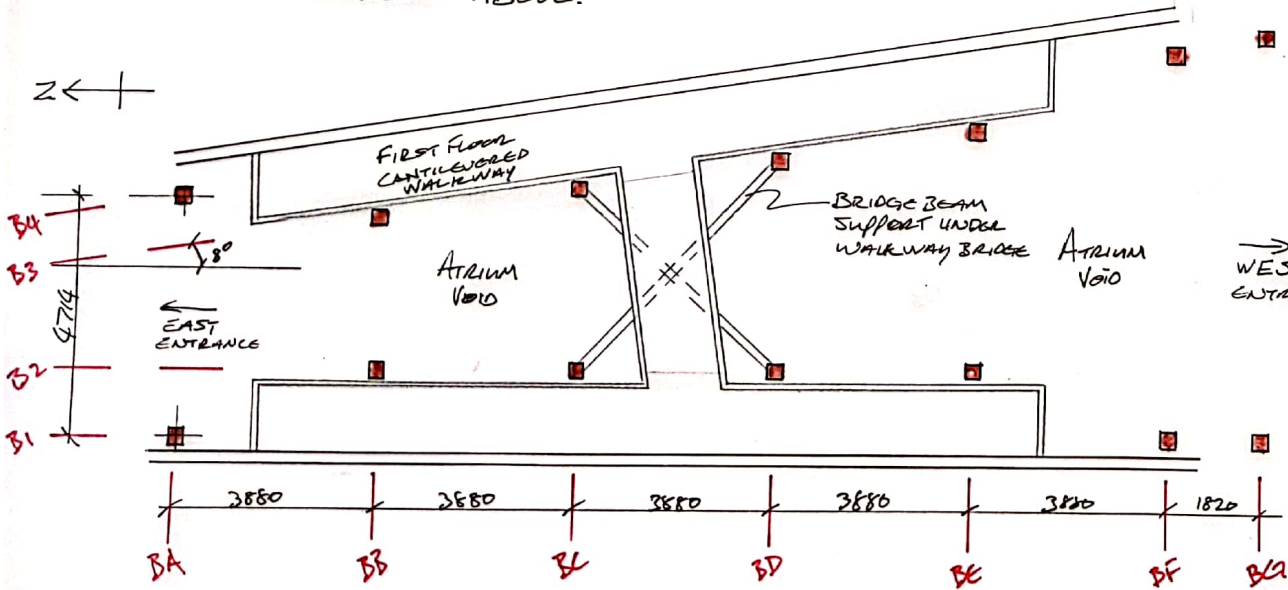


SECTION A:A 1:200

STRUCTURE
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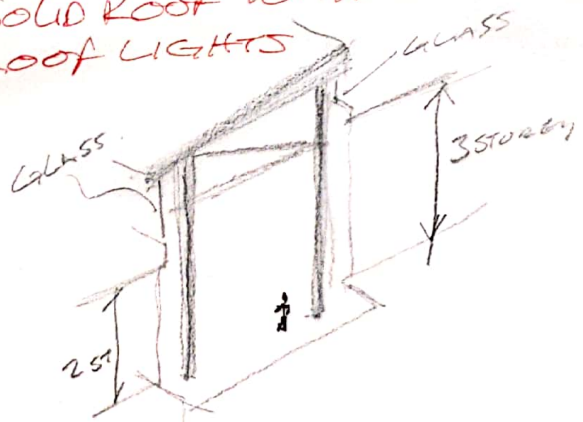


- IN ORDER TO MAINTAIN A LEVEL UPPER + LOWER RIDGE THE ANGLE OF THE RAFTER BEAMS AND HEIGHT OF THE CONNECTION WILL VARIOUS AS DETAILED ABOVE.



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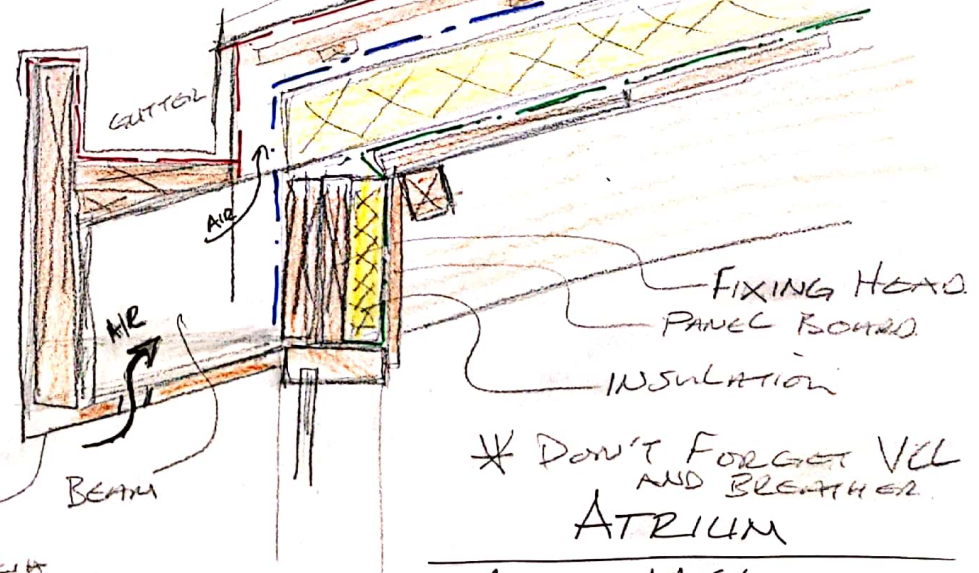
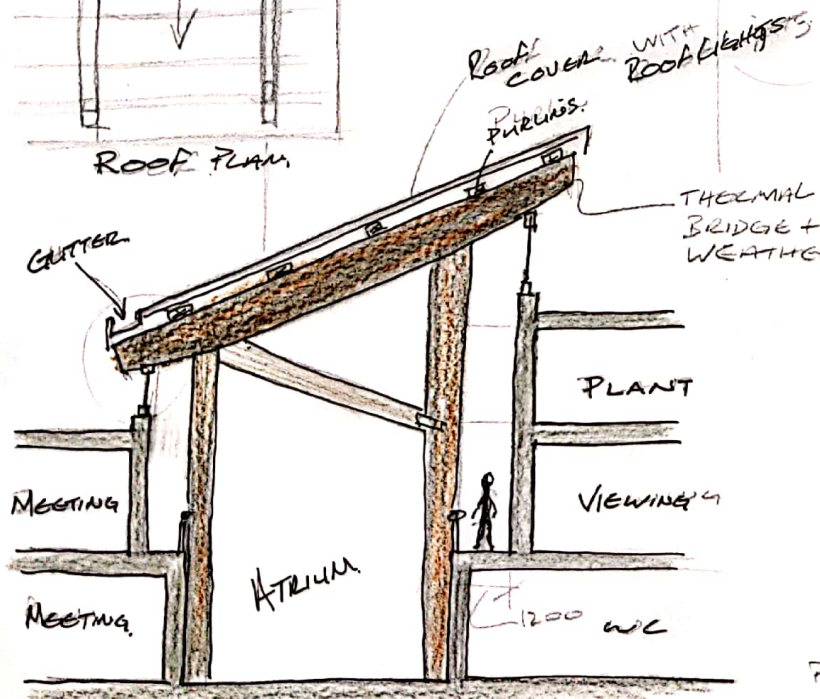
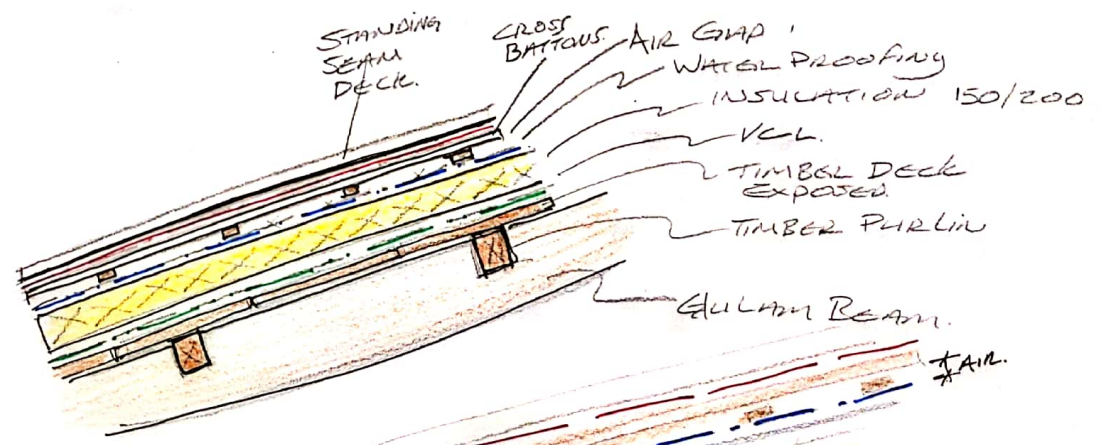
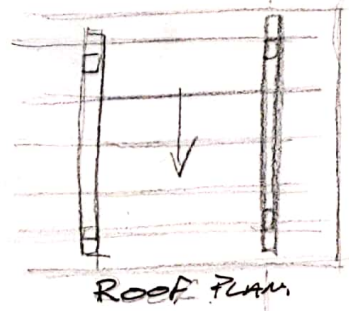
SOLID ROOF WITH ROOF LIGHTS



TIMBER BRACED CURTAIN WALL.

MATCH EXTERIOR OR TIMBER.

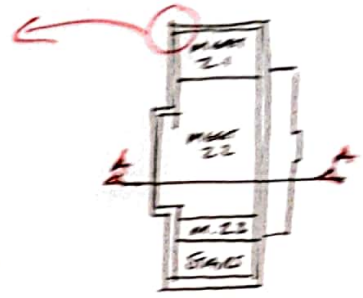
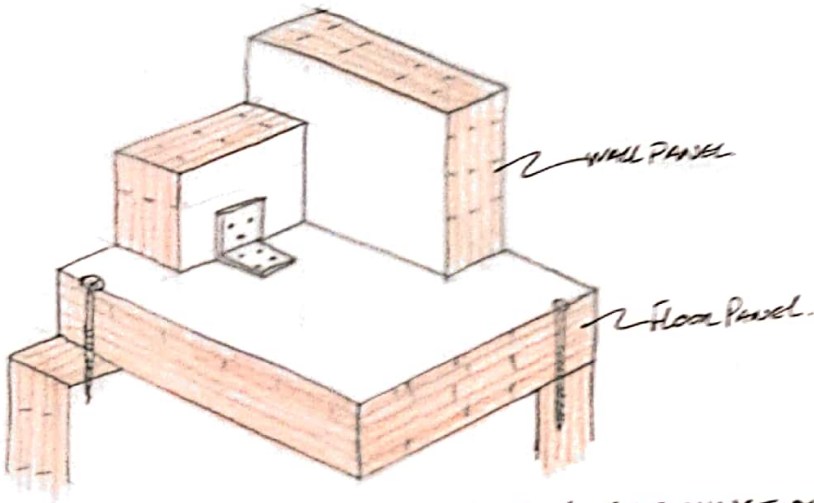
GLAZING SYSTEM + CURTAIN WALLING.



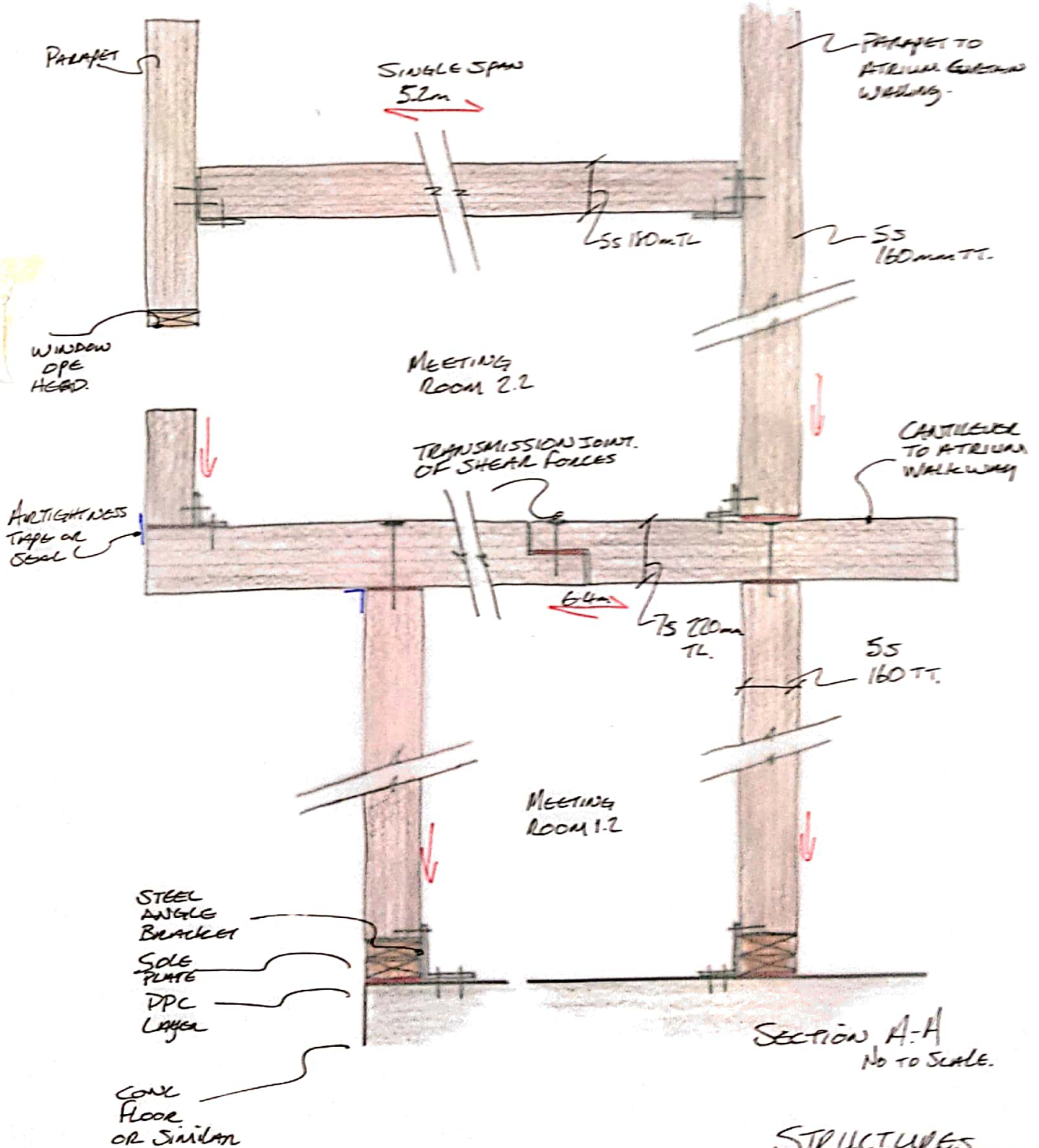
PRESSED ZINC FASCIA + SOFFIT.

* DON'T FORGET VEL AND BREATHER.
ATRIUM

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Typical CLT JUNCTIONS



All size from KLH Structural Pre Analysis Tables.

STRUCTURES

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