Koko
Dome Reinstatement

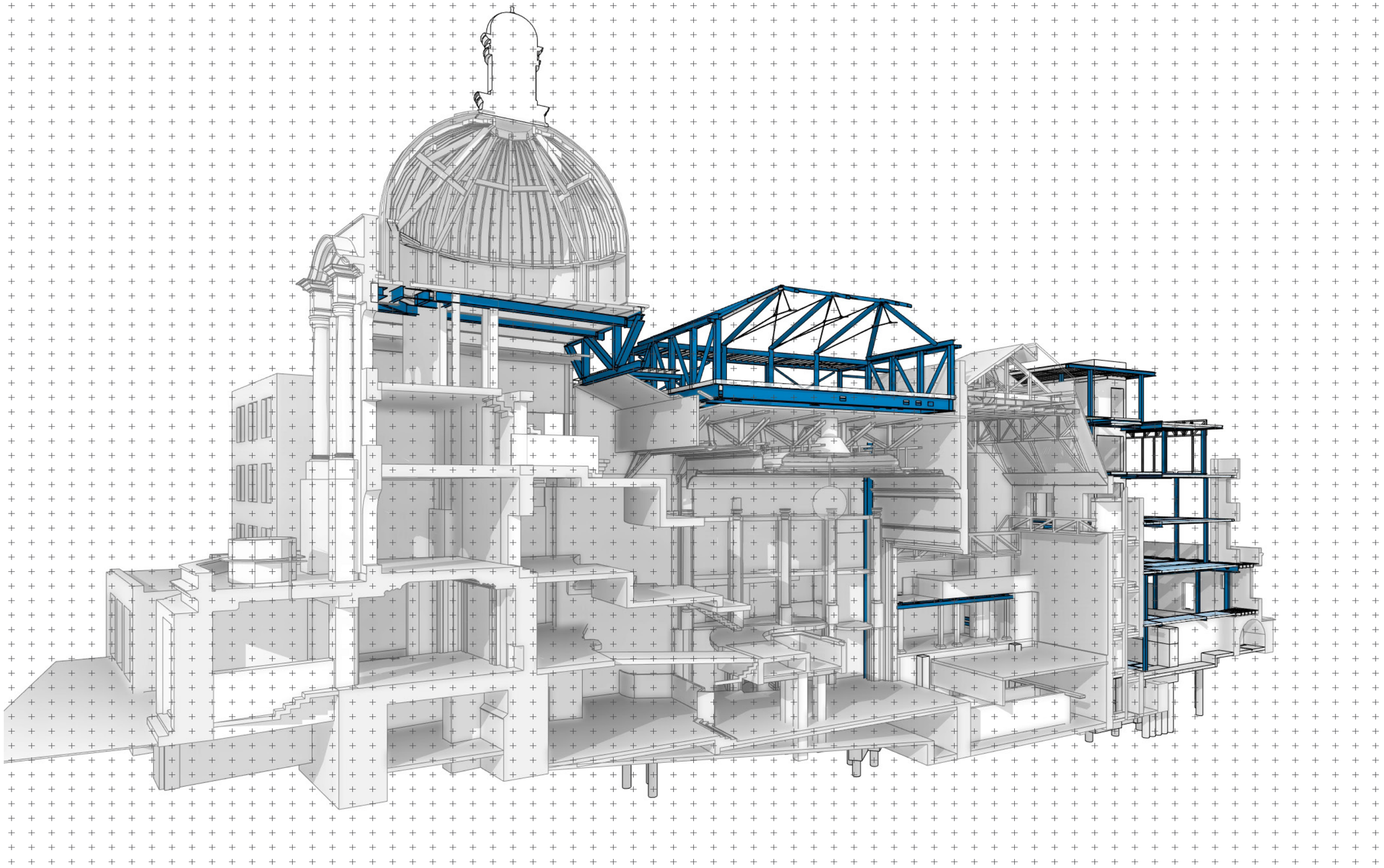
Structural Report
Heyne Tillet Steel (HTS)

Planning + Listed Building Submission
June 2020

" a great space is performance in progress."

ARCHER HUMPHRYES ARCHITECTS

1444 - Koko, Camden, Dome Slab Options Report



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Status: For Information
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Job no: 1444
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Approved by: James Morgan

1. Introduction

Two alternative solutions have been developed in recent weeks for the support of the slab below the existing dome following a review of the size of the opening required in the dome slab. One of these solutions has similarities to the previous proposal forming part of the current listed building consent while the other is prepared as a viable option with several additional benefits. The two solutions are described and compared within the text of this report.

2. Existing Structure

The existing dome slab construction is a clinker concrete infill between steel joists at approximately 1.2m centres. The joists span between four primary steel girders which span the approximately 11m between piers to the front elevation of the club and the replacement truss on the opposite elevation of the dome area. It was identified early in the design programme that the capacity and condition of the existing filler joists did not allow for the additional loading and robustness requirements associated with using the area as a bar, and as such some strengthening was seen to be required. The strengthening method originally proposed included for large steel beams running below the slab to reinforce it while the alternative option proposed here includes for replacement of the concrete slab so as to mitigate the need for the additional strengthening steels.

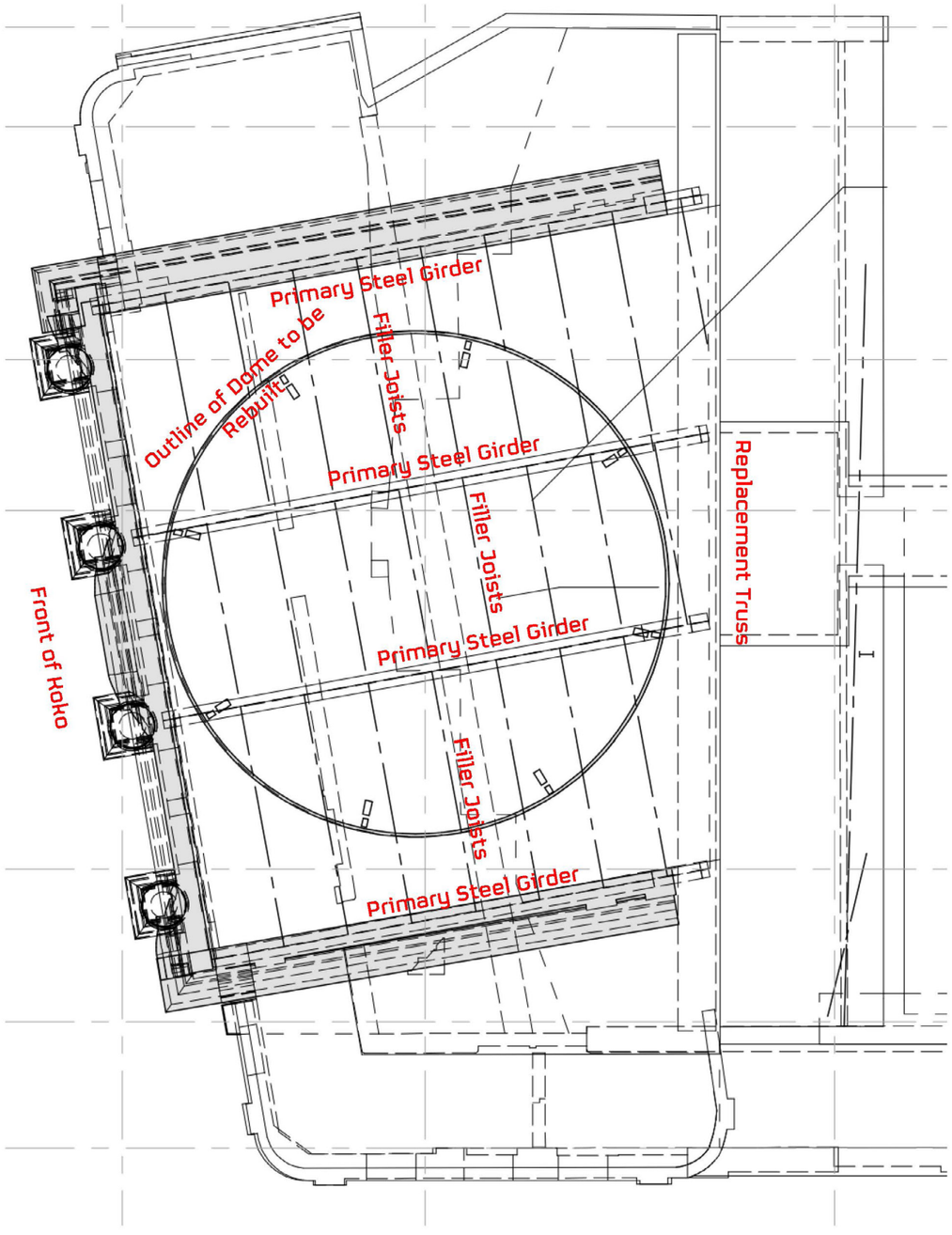


Image 1 - Existing Layout

3. Proposed Options

3.1 Option 1 – Steel Option

This option, most similar to that of the previously agreed solution includes large steel beams spanning below the existing slab to add additional support to the filler joists. An 850mm deep beam is proposed to span along the front elevation of the building to transfer loads between piers. This beam is to be partially chased into the existing brick parapet so that it can sit behind the new dome construction.

Positives

+ Similar to agreed solution
+ Clinker concrete retained

Negatives

+ Some large temporary works required to install steelwork which may impact historic fabrics
+ Strengthening works to front piers is likely to be more significant (but within the limits of what has been previously agreed)
+ A large opening to be formed in the dome slab, and existing primary steels removed
+ Primary load-path is through edge piers which are more difficult to access

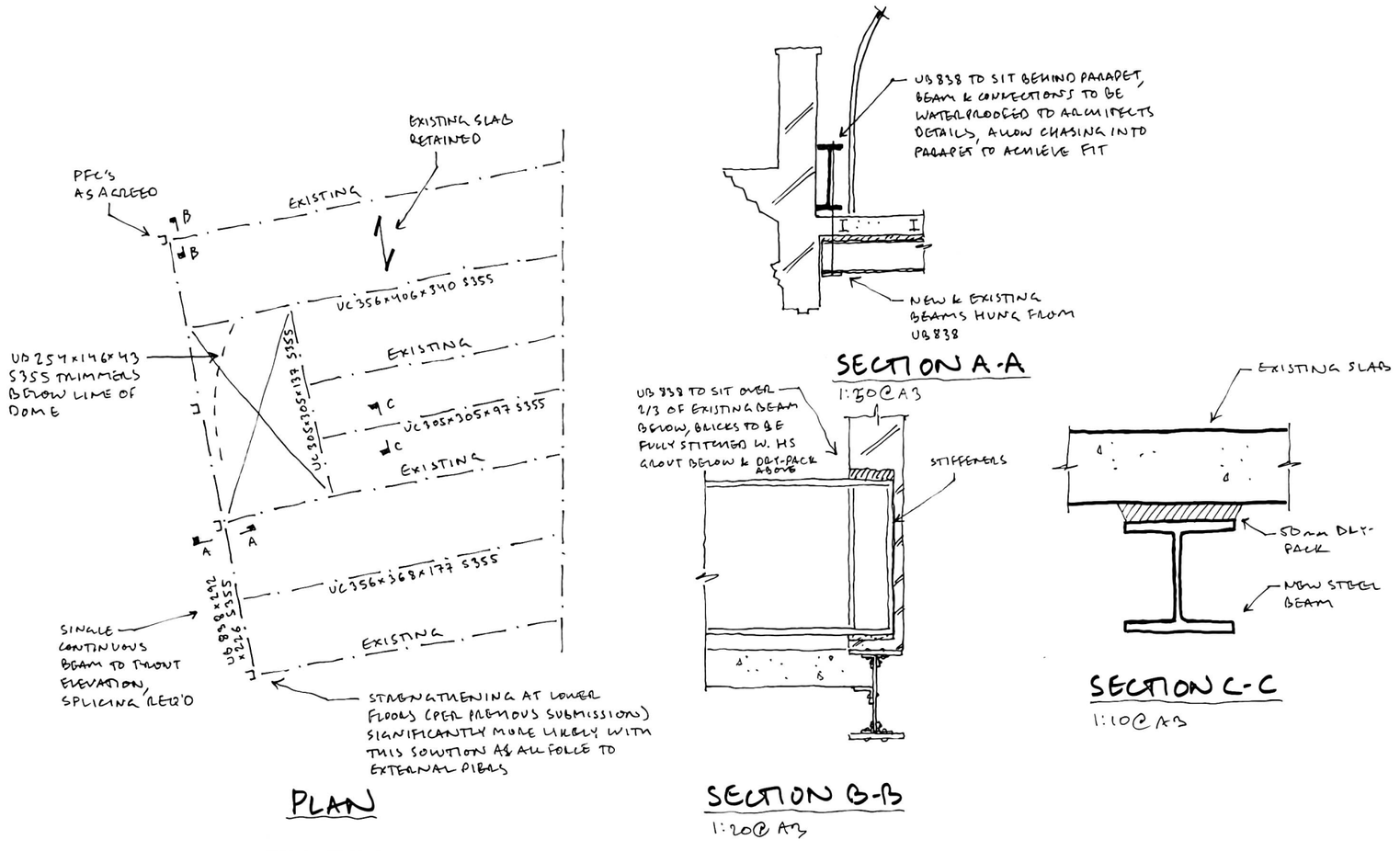


Image 2 - Option 1 Scheme

3.2 Option 2 – Slab Option

In order to achieve this option, we've worked with the architect to minimise the required stair opening and locally modify the existing beams to achieve regulation head height. This has in turn allowed us to develop a solution with significantly less deviation from the historic design solution. For this option to work, the existing clinker concrete filler-joist slab needs to be replaced with a new lightweight reinforced concrete slab sitting between the retained filler-joists and spanning between the existing primary girders.

Positives

+ Reduced requirement for modification to the existing load-path
+ Reduced steelwork requirement
+ Reduced temporary works requirement
+ Removal of the 850mm deep beam running along the front elevation of the building
+ Reduced opening in the existing dome slab

Negatives

+ Clinker concrete replaced with a new reinforced concrete slab
+ Solution has less similarities to the currently agreed solution

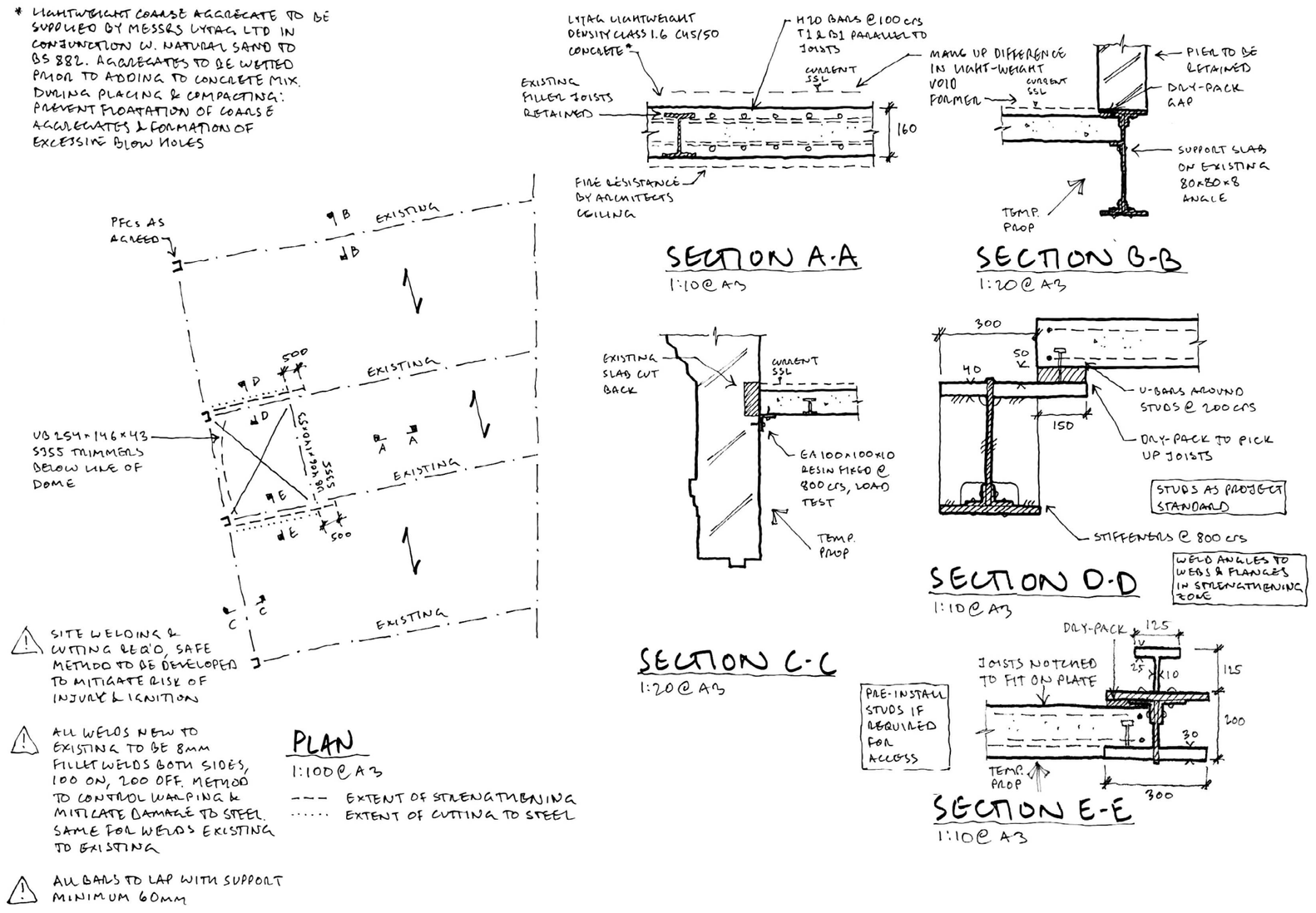
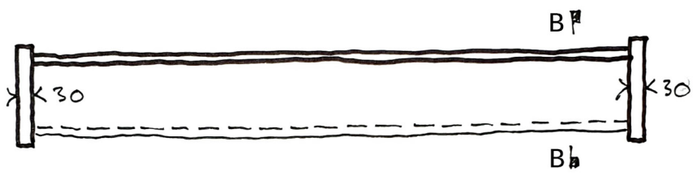


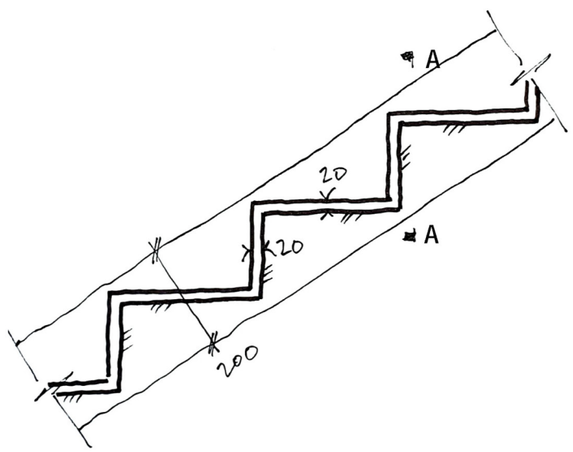
Image 3 - Option 2 Scheme

3.3 Stair

The architectural design of the stair has been interrogated to facilitate option 2. It is critical that the stair fits within the new opening in the slab, and the architectural solution shows a folded plate stair with approximately 280mm goers and 175mm risers. We have reviewed this solution and believe that it can be achieved with a curved steel plate stringer 200x30 S355 on each side with the risers and goers as 20mm thick steel plates S355 fully welded into the stringers to control rotational overturning of the stair. These are envisaged to fix into the side of the modified steel beam at the top of the stair with the remaining steps infilled above this point. A detailed vibrational analysis of the stair construction is required, and the final design is by the contractor.



CROSS SECTION A-A



THROUGH SECTION B-B

Image 4 - Indicative Stair Solution

4. Conclusion

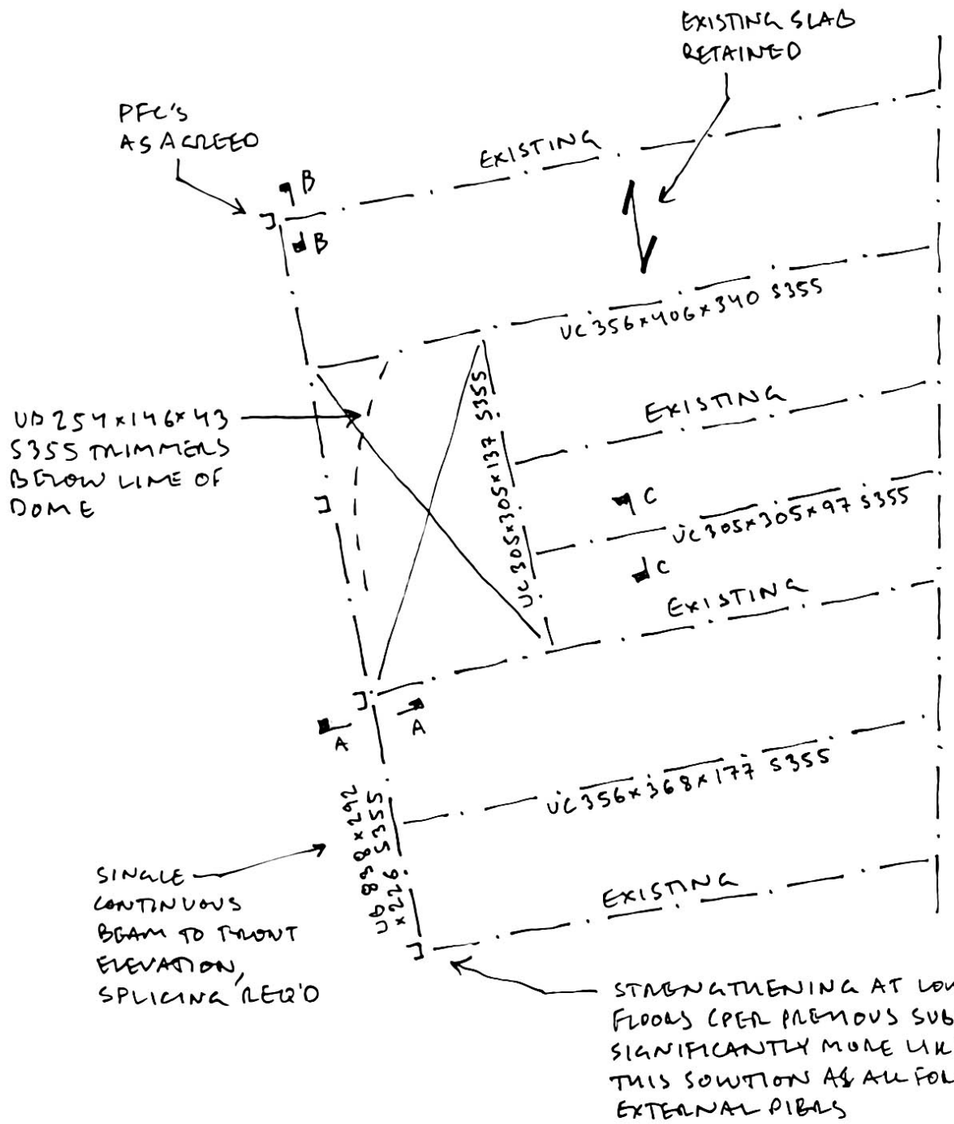
Two solutions are presented within, both achieving the geometrical requirements for the proposed use of the space, and both requiring some modification to the existing fabric. While option 1 is more aligned with the currently consented scheme, it is seen that option 2 may better respect the historic structure by retaining the existing aesthetic and the existing load-path. This second option was not originally feasible with the dome retained, but in line with the proposed reconstruction it can now be achieved.

The HTS structural recommendation is that option 2 is pursued as it keeps the original load-path intact, reduces the need for large and complex temporary works and helps de-risk the works to the front piers.

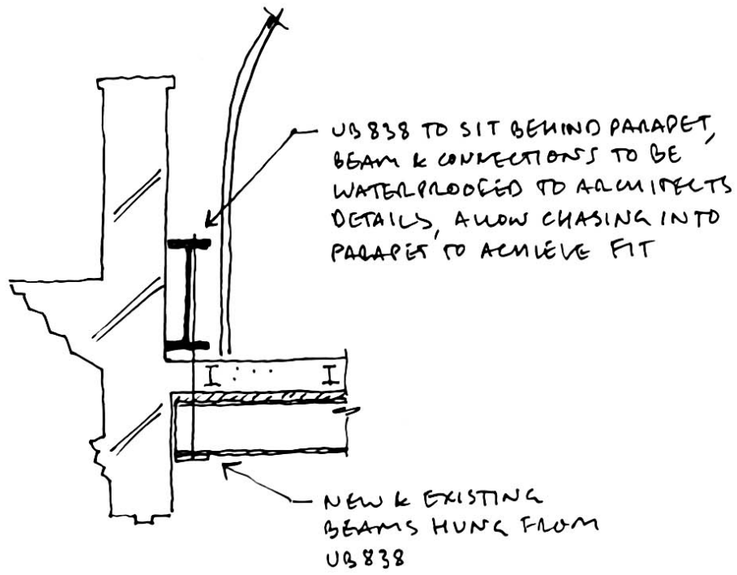
HEYNE TILLETT STEEL

Appendix A

HTS Proposed Sketches



PLAN



SECTION A-A

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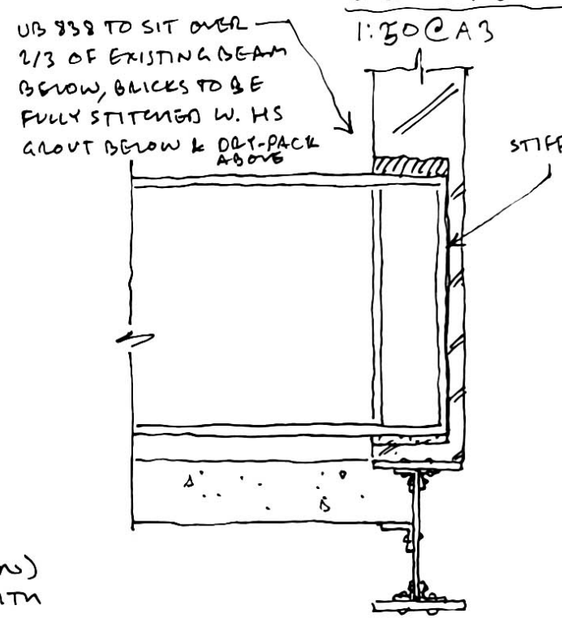

SECTION B-B

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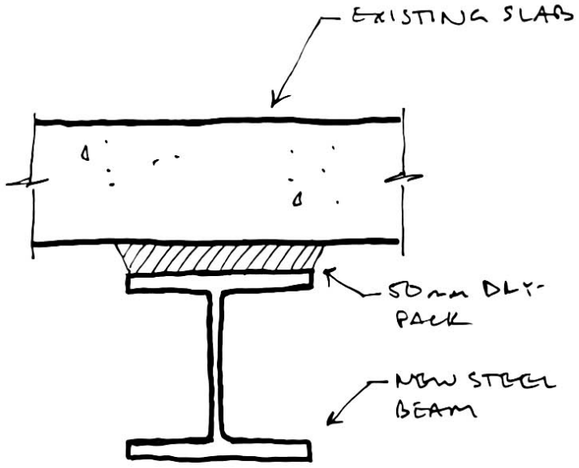

SECTION C-C

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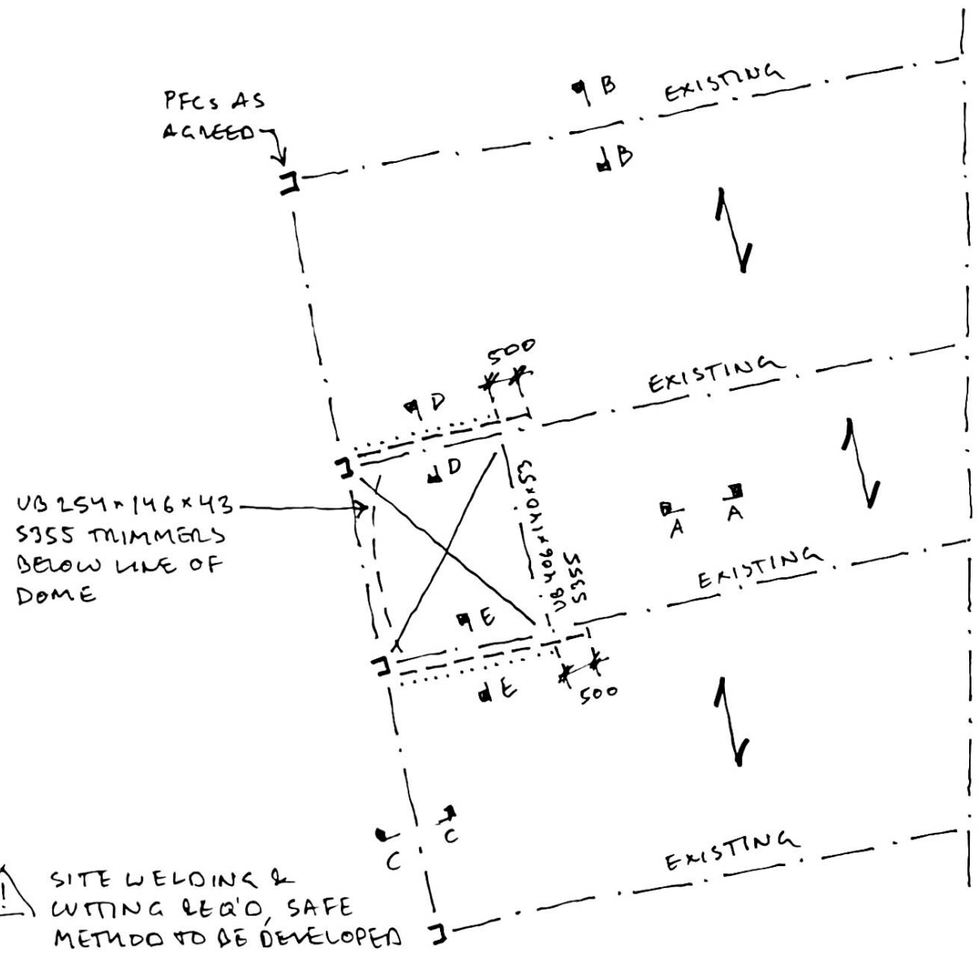
Job	KOKO	Date	06/05/20
Title	DOME 'STEEL' OPTION	Eng.	GAS
Job No.	1444	Sheet	SK246
		Rev	I 01

HEYNE TILLETT STEEL

* LIGHTWEIGHT COARSE AGGREGATE TO BE SUPPLIED BY MESSRS LYTAG LTD IN CONJUNCTION W. NATURAL SAND TO BS 882. AGGREGATES TO BE WETTED PRIOR TO ADDING TO CONCRETE MIX. DURING PLACING & COMPACTING: PREVENT FLOATATION OF COARSE AGGREGATES & FORMATION OF EXCESSIVE BLOW HOLES



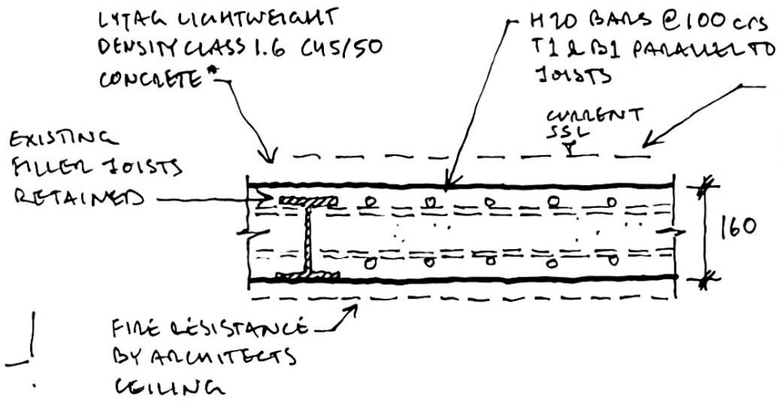
PLAN
1:100@A3

--- EXTENT OF STRENGTHENING
..... EXTENT OF CUTTING TO STEEL

⚠ SITE WELDING & CUTTING REQ'D, SAFE METHOD TO BE DEVELOPED TO MITIGATE RISK OF INJURY & IGNITION

⚠ ALL WELDS NEW TO EXISTING TO BE 8mm FILLET WELDS BOTH SIDES, 100 ON, 200 OFF. METHOD TO CONTROL WARPING & MITIGATE DAMAGE TO STEEL. SAME FOR WELDS EXISTING TO EXISTING

⚠ ALL BARS TO LAP WITH SUPPORT MINIMUM 60mm



SECTION A-A
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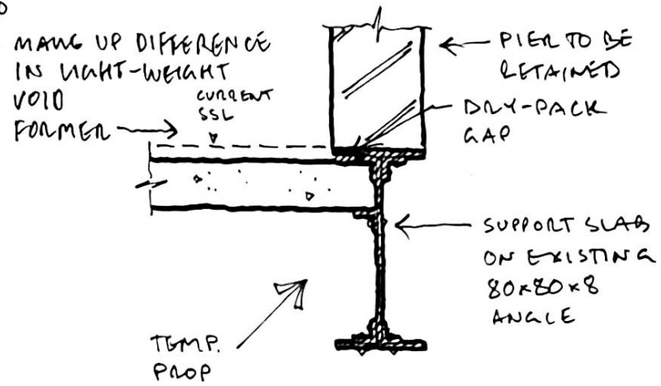

SECTION B-B
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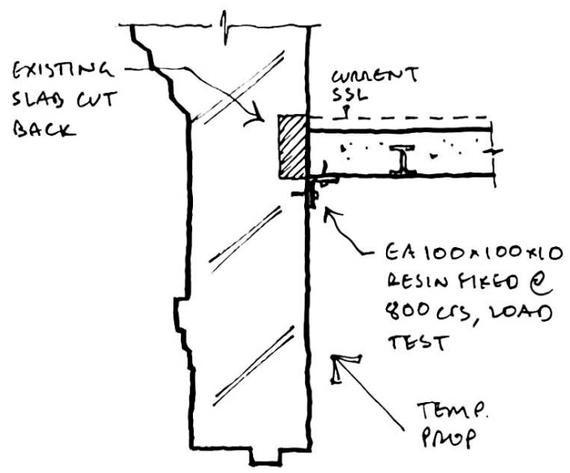

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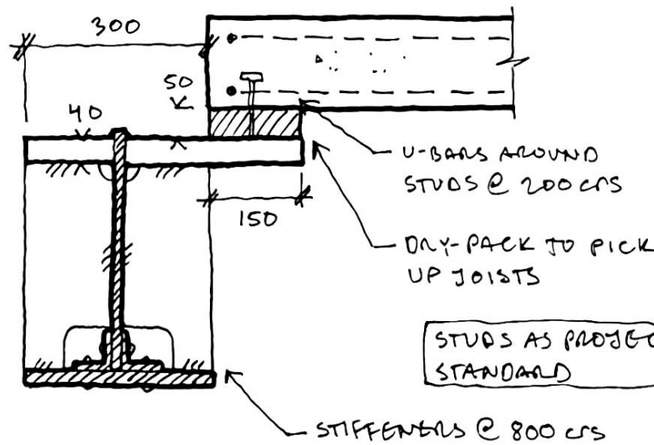
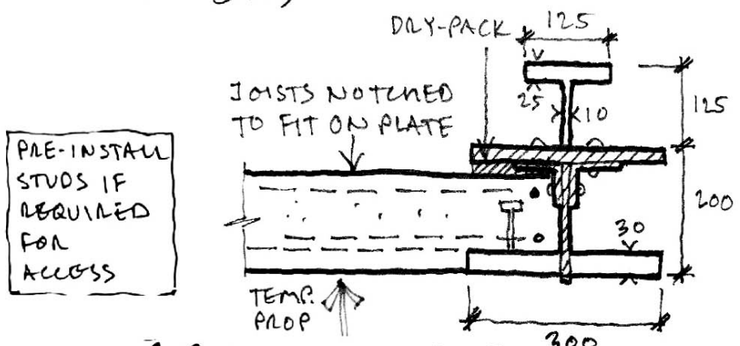


SECTION D-D
1:10@A3

WELD ANGLES TO WEBS & FLANGES IN STRENGTHENING ZONE

PRE-INSTALL STUDS IF REQUIRED FOR ACCESS



SECTION E-E
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Title	DOME 'SLAB' OPTION	Eng.	GAS
Job No.	1444	Sheet	SK245
		Rev.	I02

HEYNE TILLETT STEEL

HEYNE TILLETT STEEL

bsi. ISO 9001 Quality Management
FS 592987

Job number: 1444
Ref: GGS-01
Date: 29/05/20

Koko - Comments on Dome Connections

Introduction

HTS have carried out an assessment of the connection details provided by SLHA. The following items provide commentary on how these can achieve their required structural performance and robustness.

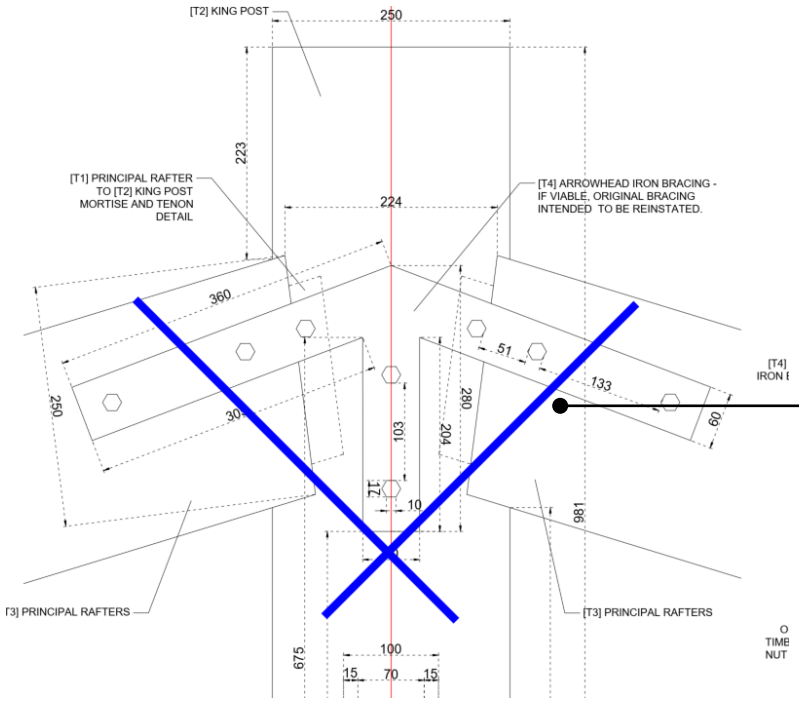
Other than the details provided below, we note that all bolts, washers, nuts and other iron elements are to be replaced with equivalent size steel elements of grade 8.8 or strength S275 as is relevant for the particular item.

Most of the connections are traditional and rely on bearing between elements, a suitably capable contractor to be appointed to carry out the works and ensure that sufficient bearing transfer is achieved through surface preparation and fit of elements.

We note further that all timber is to be of strength grade C24, and that all screws to have pre-drilled holes which are to be sized and installed per Rothoblaas requirements. All screws to be into element centre lines unless noted otherwise and to be applied to every location.

Connections

A key for the items below is presented at the back.



1. Principal Rafters to King Post

No intervention is required if the iron bracketry is replaced with S275 steel as per the introductory statement, however, and as indicated, if this is to remain as puddled iron, a further set of hidden resin dowels will be required within the timber. These are to be designed by the specialist subcontractor to carry a minimum of 10kN in shear and tension.

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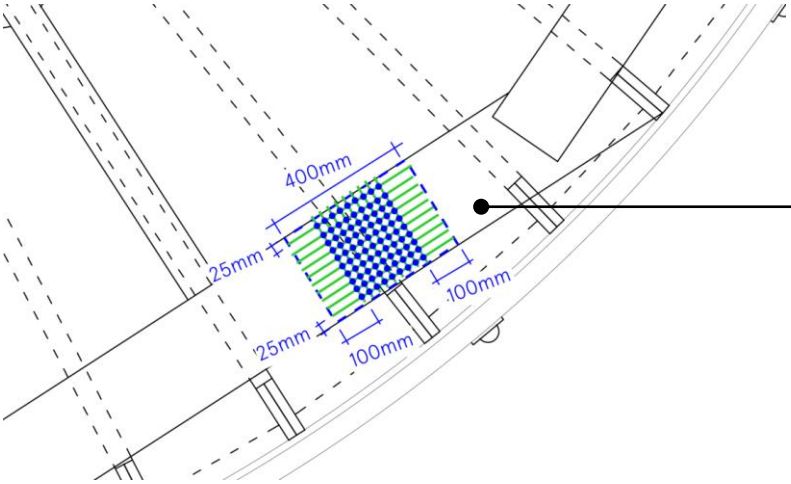
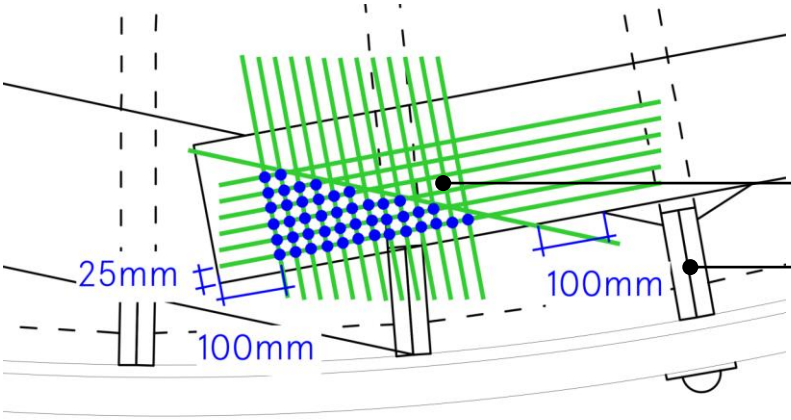


2. Lap in Wall Plate

It is proposed that the wall plate is locally lapped to achieve better head height between two trusses where a new door opening is proposed. To achieve this, the timbers are to be lapped by minimum 400mm, and screws are to be installed from above at 25mm centres with edge distance requirements as shown.

Rothoblaas TBS8200 screws @ 25mm crs.



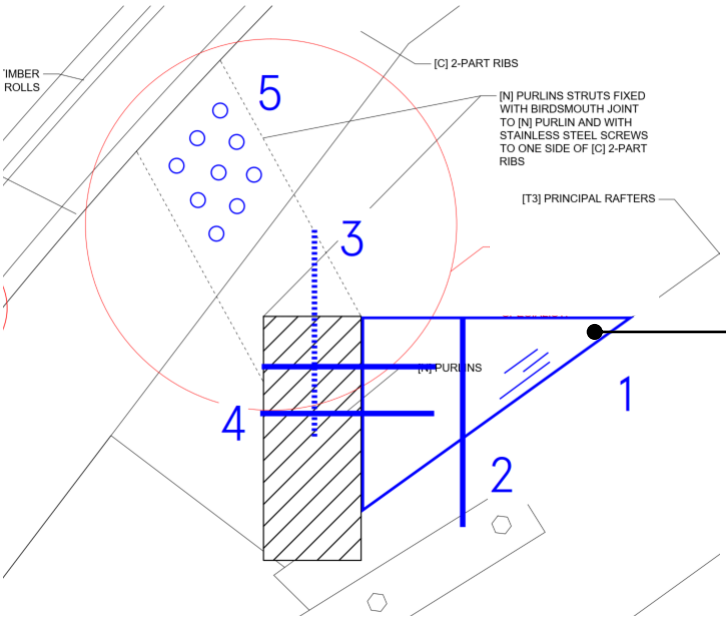
3. Wall Plate Corner Details

The lapping corner timber are to be fixed down into the wall plates with screws at 25mm crs and edge distance requirements as shown.

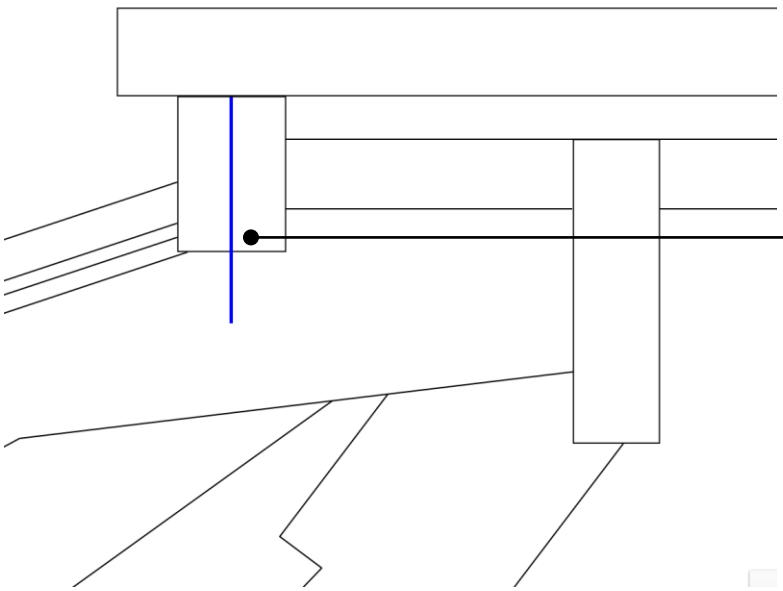
Note that a compressive force is required through the indicated bearing area between the two wall plates and that these should be prepared with a suitable surface finish and interface.

Rothoblaas TBS8120 screws @ 25mm crs.

4. Purlin Strut Connection

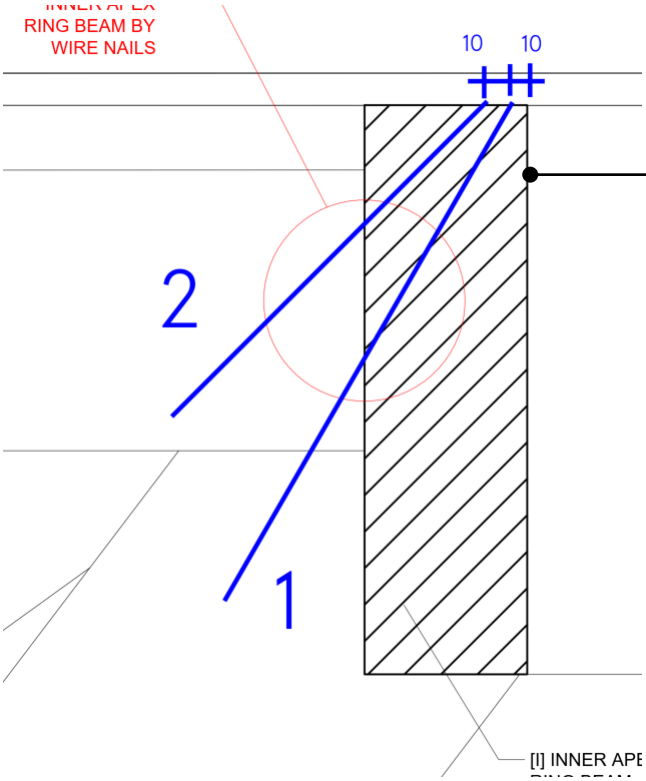


1. A new timber wedge to be introduced, width as principal rafter, grain direction as principal rafter (indicated).
2. 2No. Rothoblaas TBS8220 screws to centre of top face of wedge, 25mm crs and edge distance. To centre line.
3. Rothoblaas TBS8110 screw to member centre lines.
4. 2No. Rothoblaas TBS8160 screws, 50mm crs and edge distance. To centre line of adjoining timber.
5. Perlin struts minimum 50mm wide. Stainless steel slotted head screws, length as total depth of both elements minus 10mm, 8mm diameter, fully threaded, $M_{y,Rd}$ = 25000Nmm, $R_{t,u,k}$ = 23000N



5. Outer Apex Ring Connection

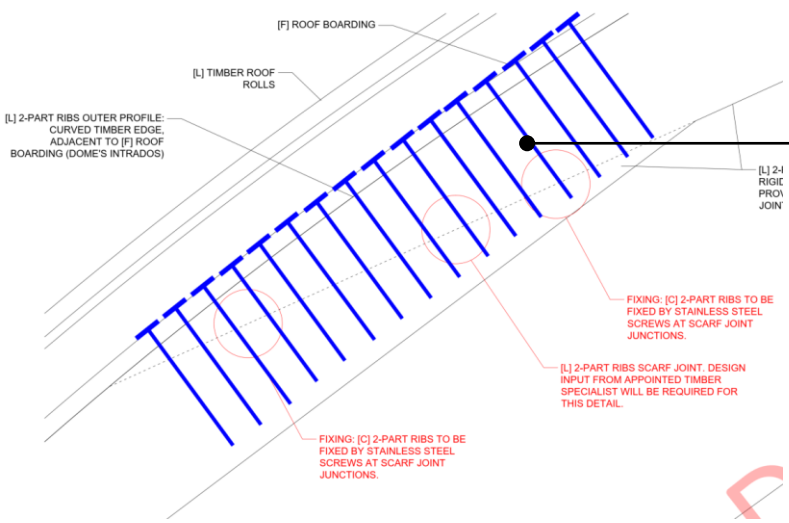
Screwed down with 1No. TBS8260 to centre of members.



6. Inner Apex Ring Connection

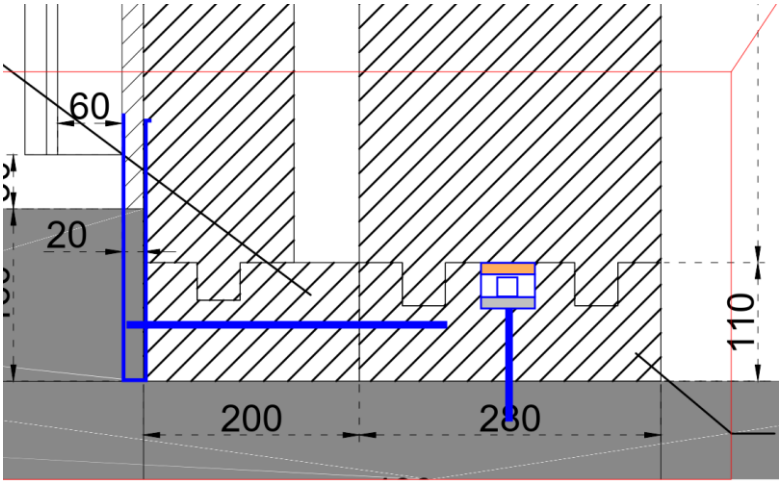
1. Rothoblaas VGZ9360 screw at 30 degrees, use template to achieve angle within 2° tolerance.
2. Rothoblaas VGZ9280 screw at 45 degrees, use template to achieve angle within 2° tolerance.

Note that this connection may need to be reinforced as part of the cupula connection once this is agreed.



7. Rib Scarf Joints

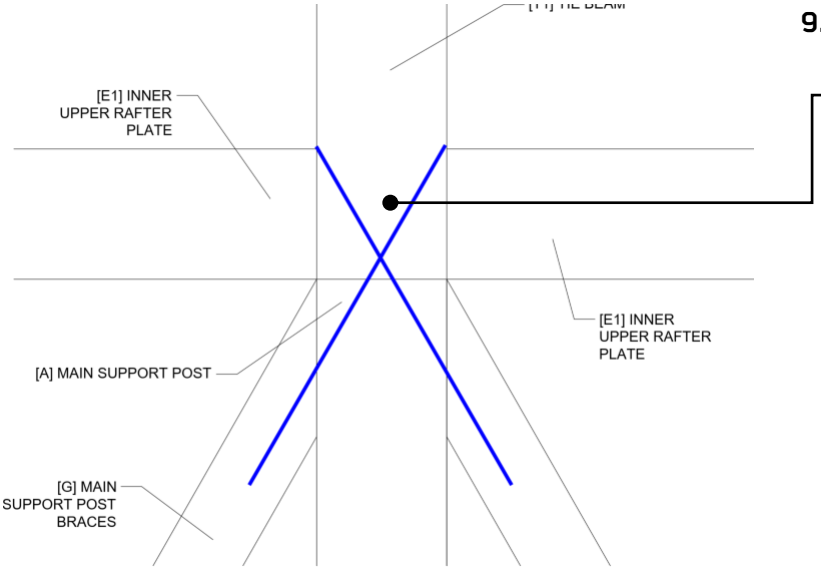
TBS8160 screws to full length of scarf joint through boarding, 40mm crs. Joint to also be glued using Rotafix epoxy, confirm suitable product with manufacturer.



8. Base connection

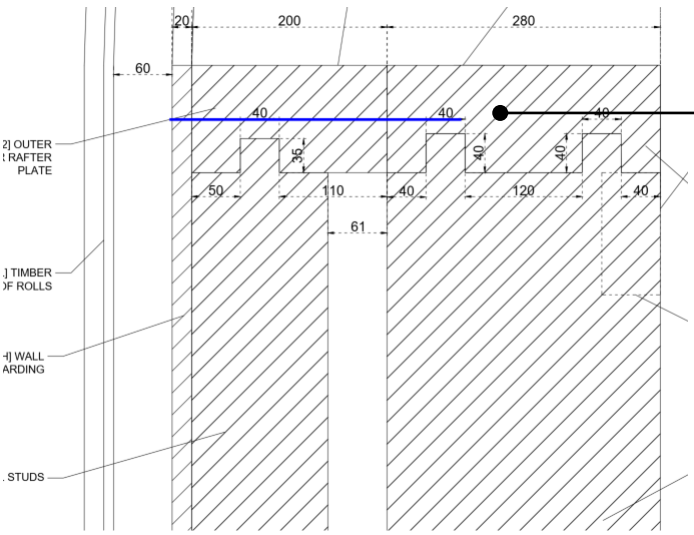
Fixing between boarding and sole plates at 300 crs Rothoblaas VGZ9300 screws.

Hilti HIT-HY 200-A + HIT-Z M12, 100mm embedment in concrete @ 500 crs, centred on sole plate. 50mm diameter, 10mm thick steel washer and timber plug and 20mm gap for anchor head, total recess of 40mm.



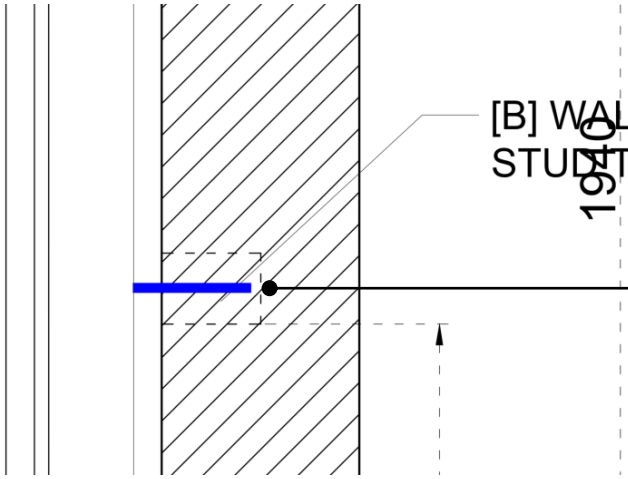
9. Main Support Brace to Wall Plate

2No. Rothoblaas VGZ9300 screws at angle to match brace, use template to achieve angle within 2 degree tolerance. Slightly misalign the screws to make sure they don't clash.



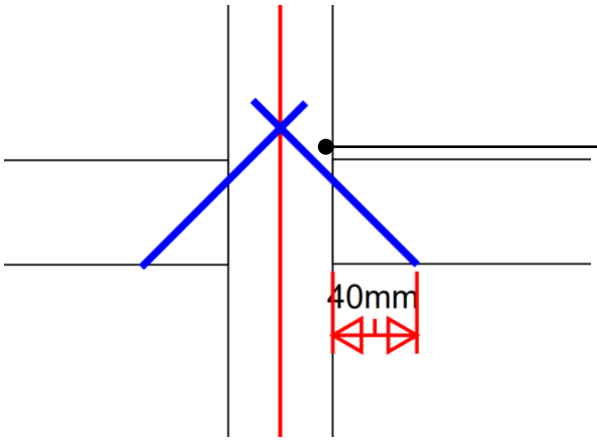
10. Boarding to Wall Plate

Rothoblaas VGZ9300 screws @ 800 crs.



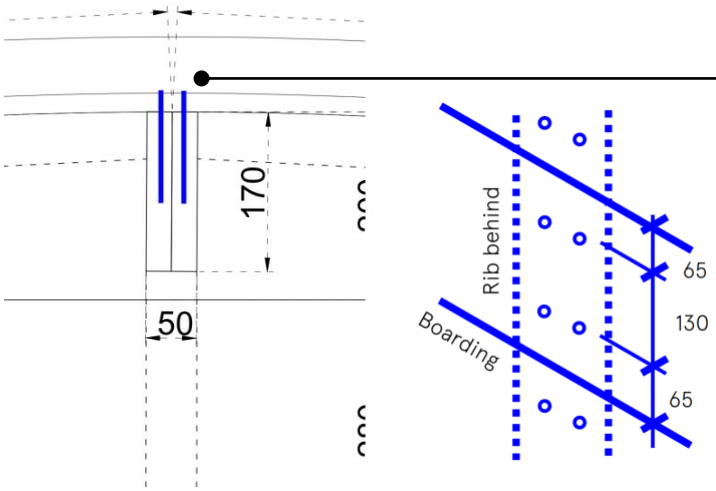
11. Wall Stud Ties to Boarding

Rothoblaas TBS880 @ 400 crs into centre of stud tie.



12. Stud Tie to Rib

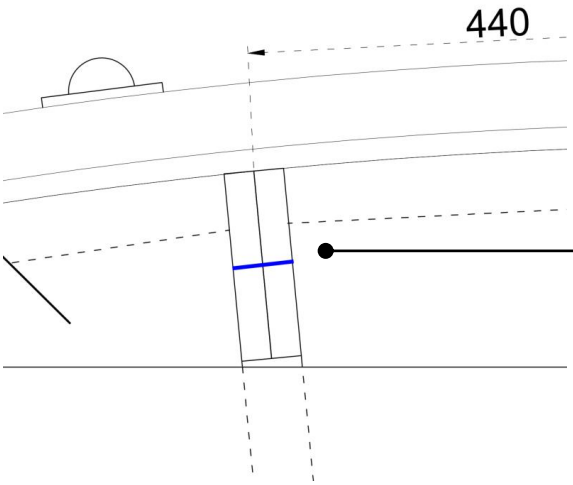
Rothoblaas HBS8120 screws from below at 45 degrees, use template to achieve angle within 2 degree tolerance.



13. Boarding to Rib

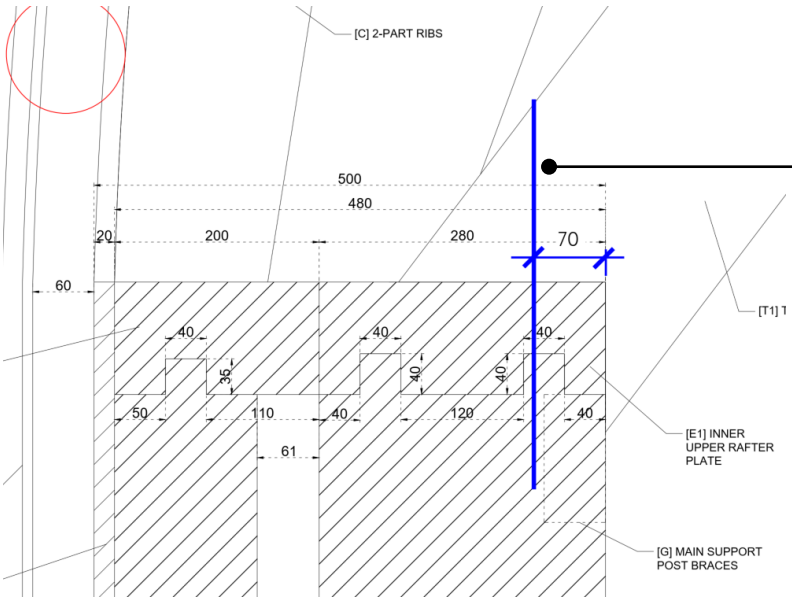
Rothoblaas TBS6100, 2No. vertically per 260mm board at quarter points (4No. total per board) to centre of both timbers. Elevation indicated for clarity. The detail applies along the full height of the dome and starts 150mm above the slab below.

Note boarding to be laid diagonally as in original design and only cut at rib mid-points, max every second timber lapped over any one rib. Boarding to be placed tight to achieve sufficient bearing between adjacent boards.



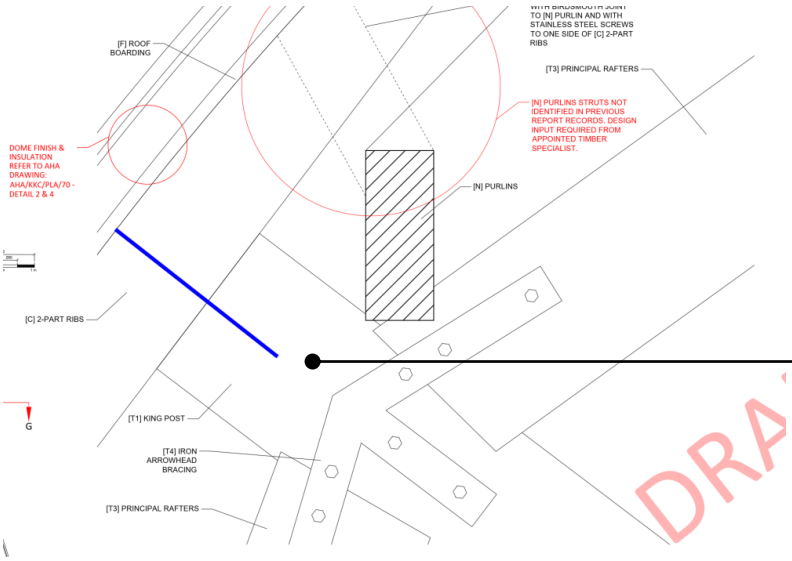
14. Rib Reinforcement

Stainless steel slotted head screws, 50mm long, 8mm diameter, fully threaded, $M_{y,Rd}$ = 25000Nmm, $R_{t,u,k}$ = 23000N @ 100mm crs, avoid clash with boarding connections.



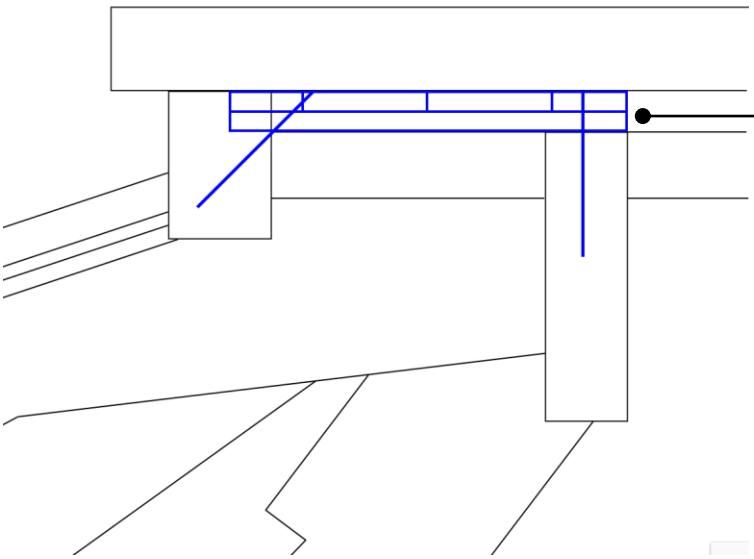
15. Tie Beam to Wall Plate

Rothoblaas VGZ9320 screw to centre of element.



16. Rib to King Post

Rothoblaas VGZ9300 screw to centre of element.



17. Roof Boarding

2 layers of 20x150mm roof boarding laid in perpendicular directions to form diaphragm above apex rings. Rothoblaas TBS8200 screws @ 100 crs into apex rings (outer at 45 degrees). Layers of roof boarding also to be fixed to one another with rothoblaas SHS3530 to element centres (150mm centres in each direction.

Key