Technology Report / **Conversation Club**

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NEWCASTLE
GATESHEAD
SCOTSWOOD
BLAYDON
ELSWICK
JESMOND
HEATON
BYKER
MANORS
CENTRAL STA.
High Level Bridge
K.E. Edward Bridge
QUAYSIDE
DUNSTON ON-TYNE
NORWOOD JUNC.
BENSHAM
LOW FELL STA.
SWALWELL
SWALWELL BRANCH
DERWENTHAUGH GOODS
From North Wylam
From Consett
From Tanfield
From Blyth
T Y N E

Working Drawings

Introduction

The Lit and Phil Conversation Club builds upon the foundations of knowledge and achievement obtained by notable members of the existing Literary and Philosophical Society. It's a space where academia meets enterprise, in order to encourage innovation through education; it's an escape from the rigid professional nature of the workplace, without the distractions of home. The Conversation Club embodies the society's core ethos: sharing knowledge.

The Scheme

Upon entering the scheme you immediately come upon the lecture space, emphasising the important role education takes within the society. When live lectures are not in progress recorded lectures such as TED Talks (released under Creative Commons license) will be projected as a centre for discussion and inspiration.

The main library accommodation is formed into rotundas which provide a variety of spaces to suit all psychologies of visitor.

Figure 1
1:500 Roof Plan

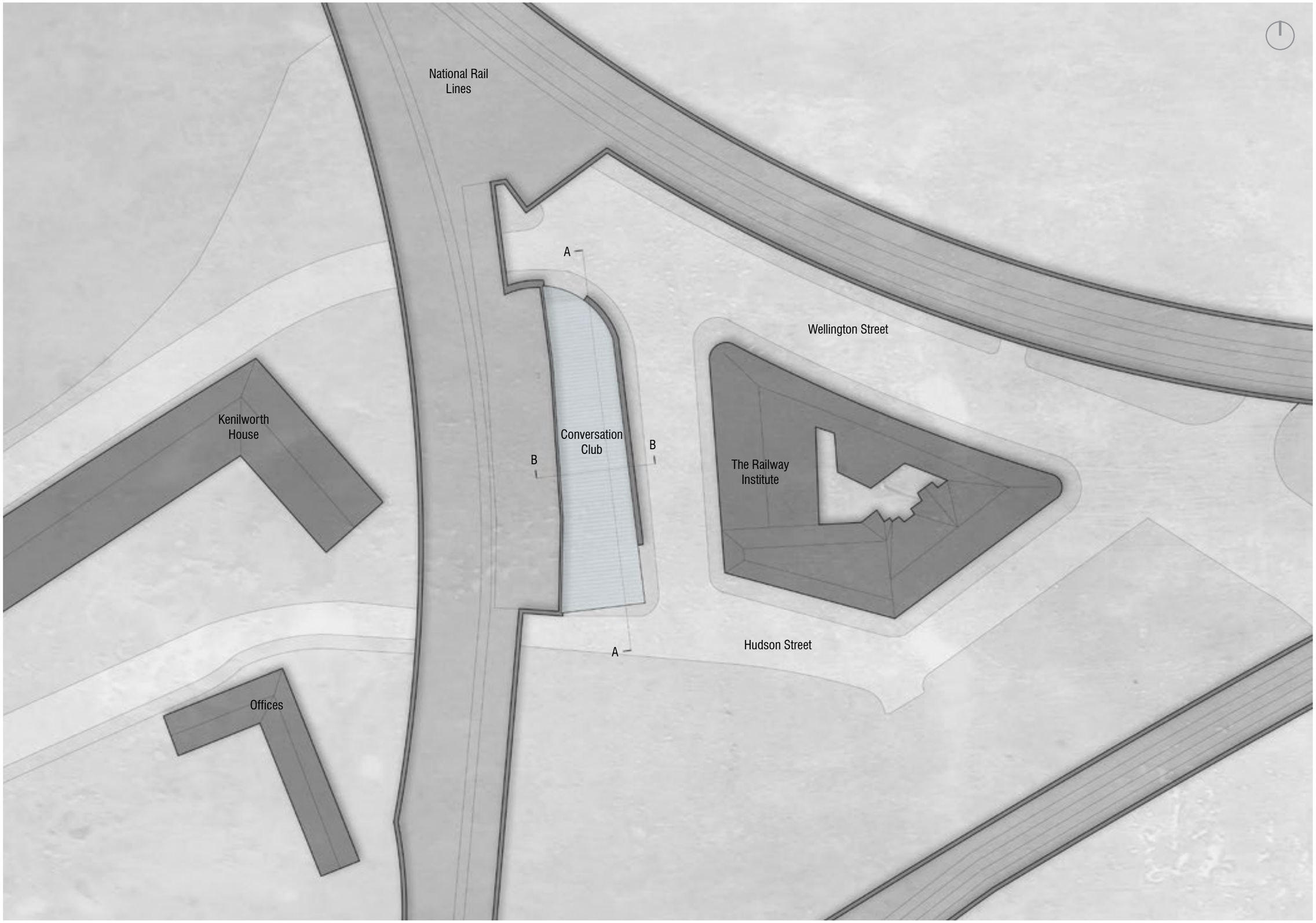


Figure 2
1:200 Lower Ground Plan

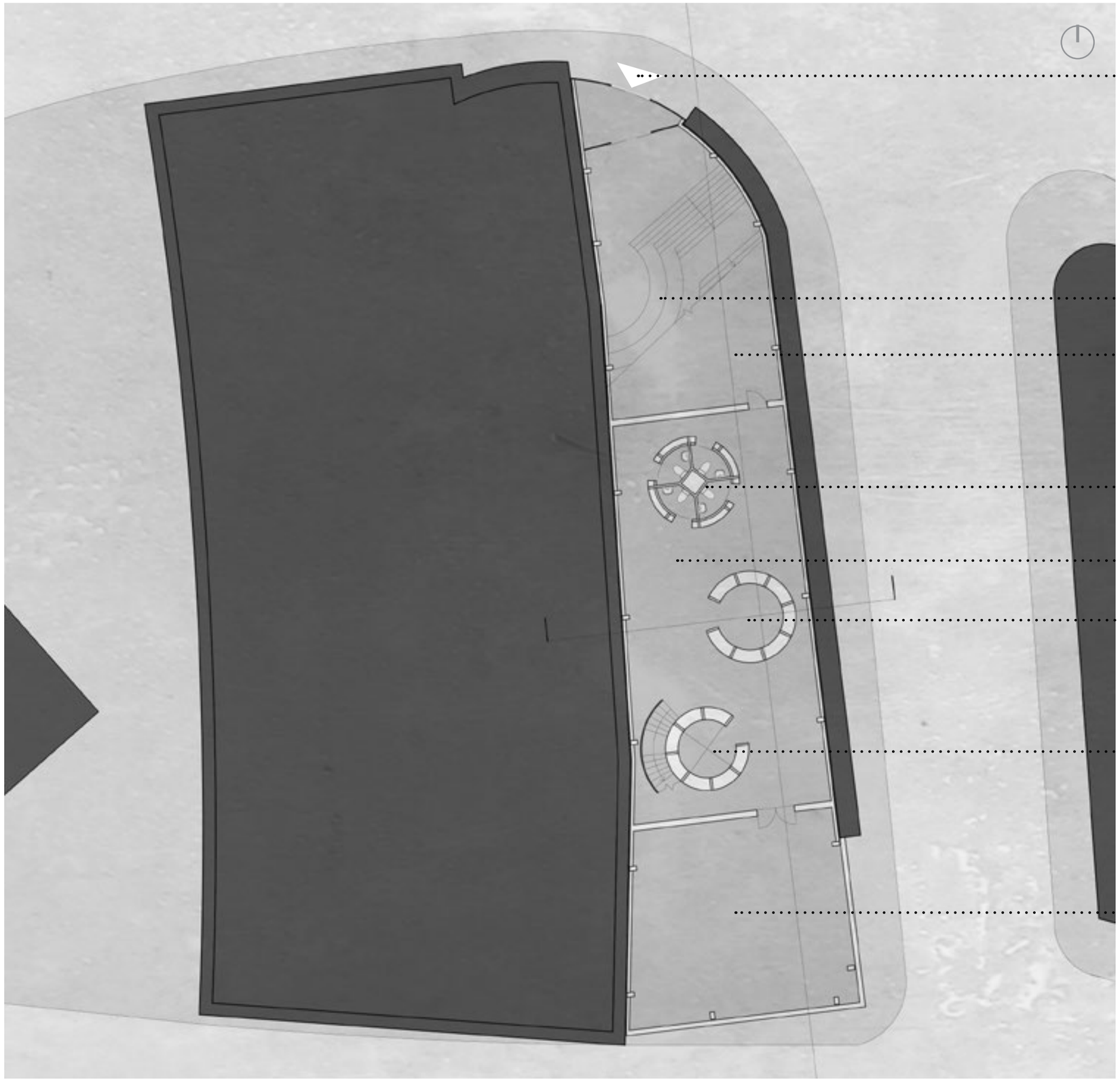


Figure 3
1:200 Upper Ground Plan

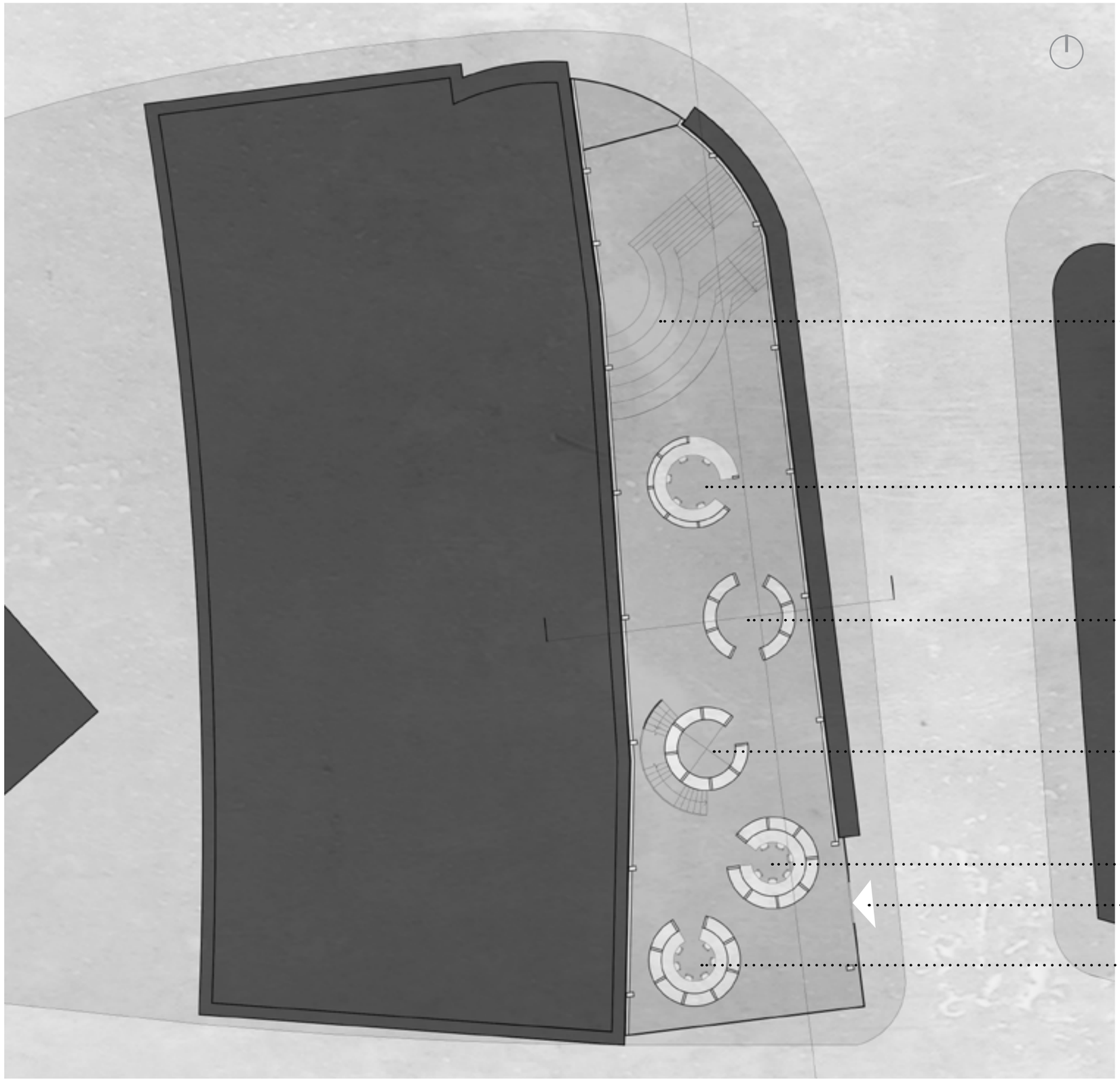


Figure 4
1:200 First Floor Plan

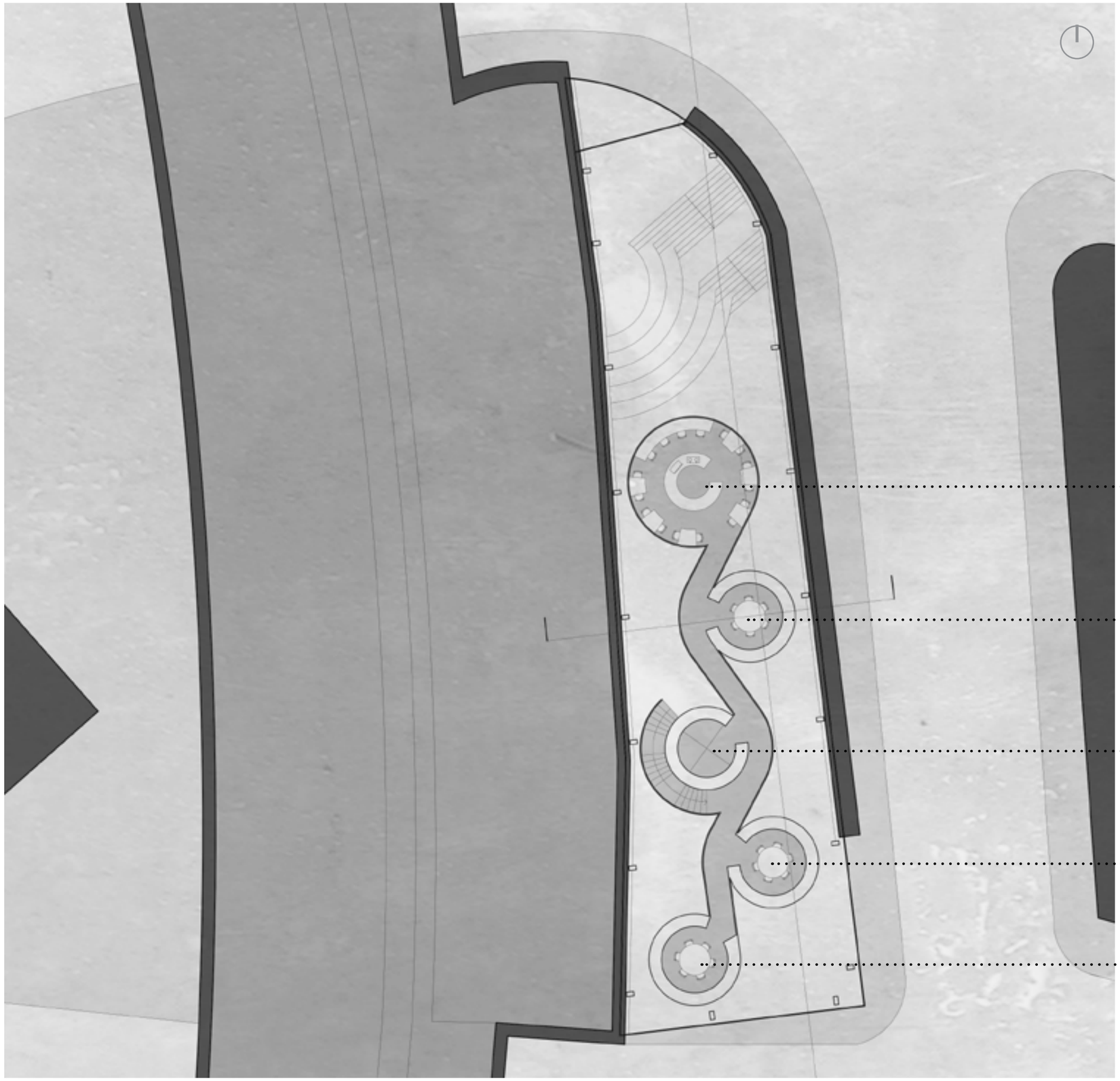


Figure 5
1:200 Section AA

Figure 6
1:200 Section BB

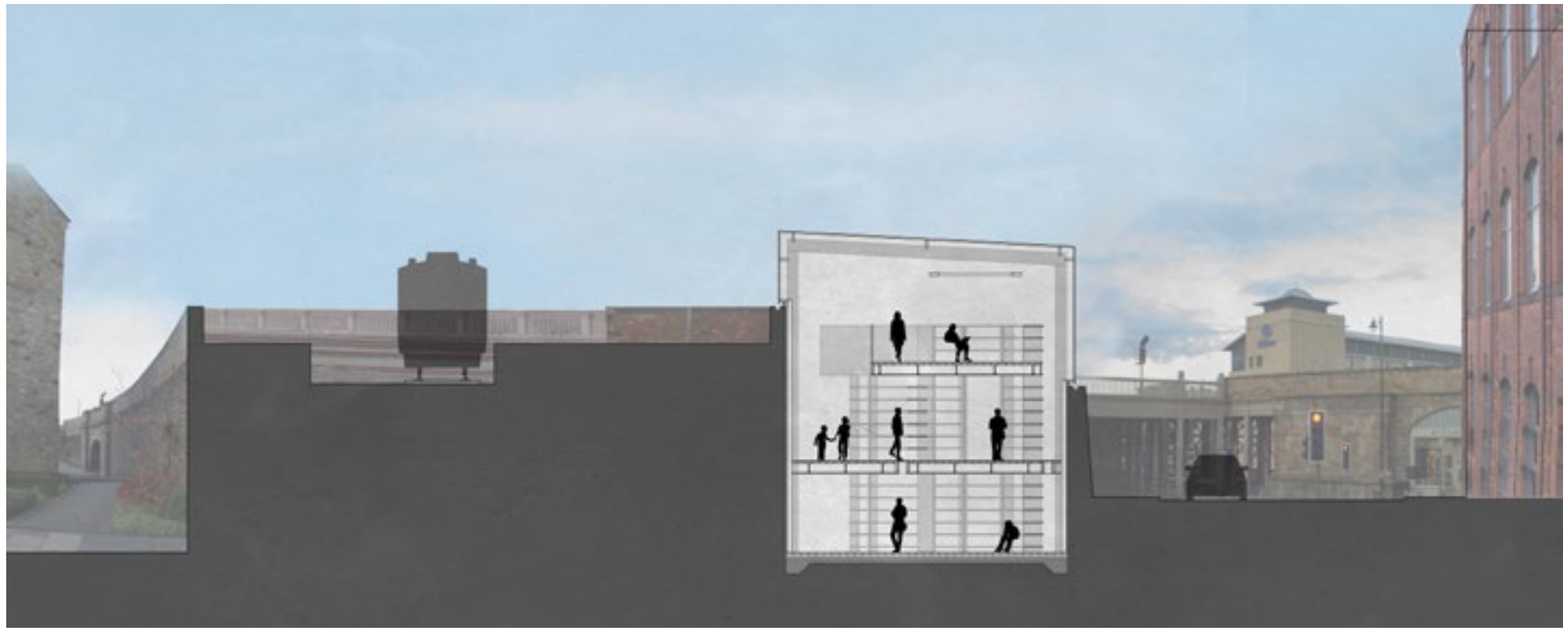


Figure 7
1:200 Elevation East

Figure 8
Organisation Section

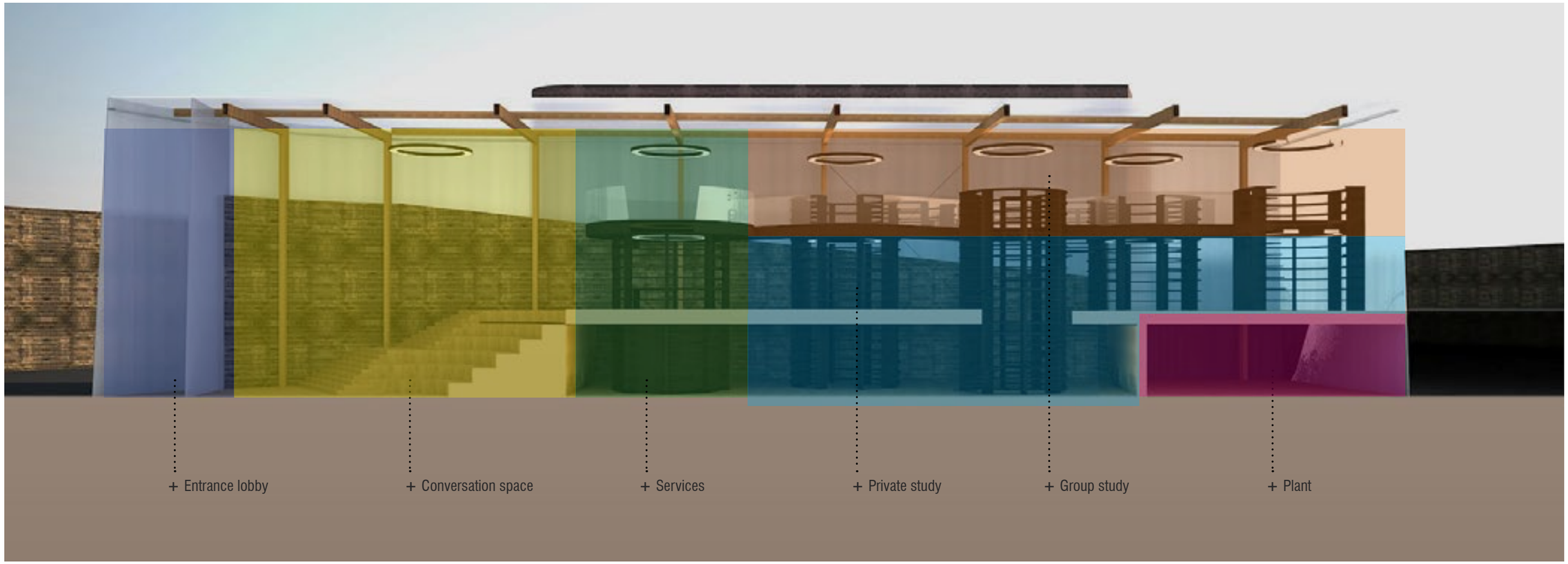
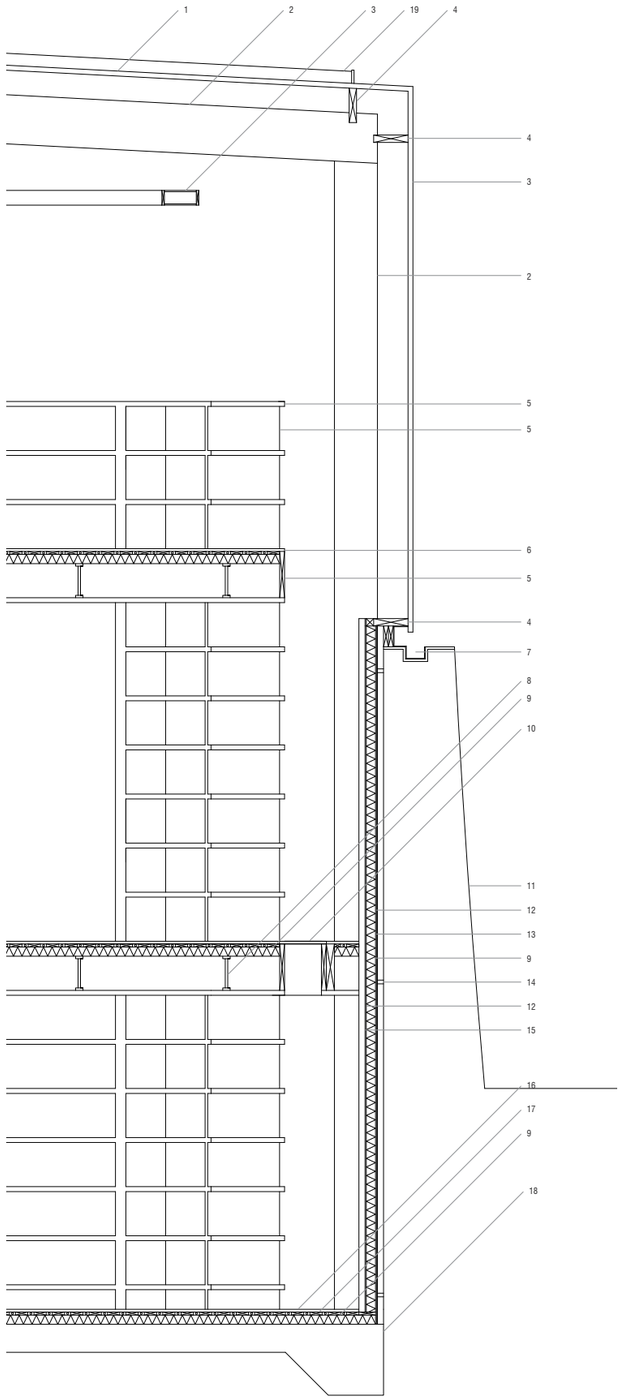
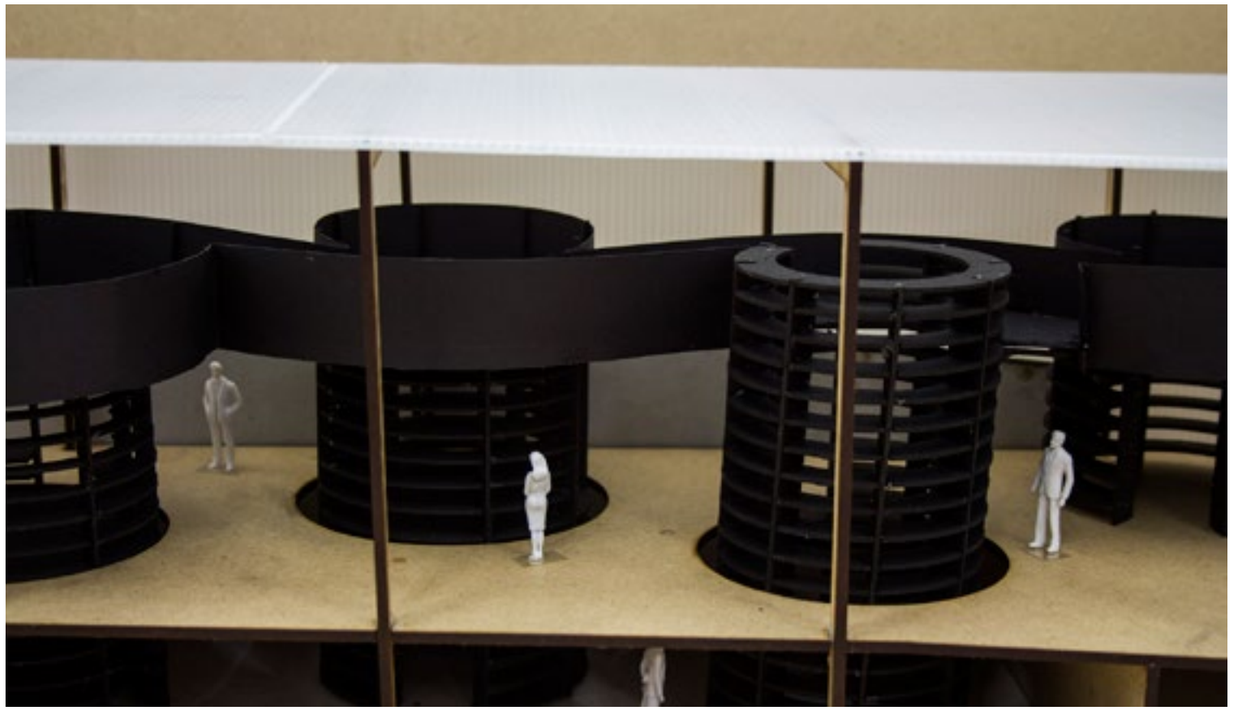


Figure 9
1:50 Technical Section



1. 60mm Rodeca polycarbonate
2. 200 mm Metsawood glulam softwood column / beam
3. Bespoke light rings
4. 60 mm Laminated softwood rail
5. Black oil stained timber
6. Junckers black stained oak timber floor
7. Guttering with lead flashing / DPM
8. Metsawood softwood I-beam
9. 75 mm rigid insulation
10. Saint Gobain Lite-Floor laminated safety glass
11. Existing stone wall
12. 6mm polythene tanking
13. 10 mm timber board
14. 30 mm diameter fixing rod
15. 50 mm Stone-crete wall system
16. 22.5 mm Junckers timber floor
17. 25 mm bearers with underfloor heating pipes between
18. Concrete raft foundation
19. Sprung rain suppression mesh



Structure and Envelope

Structure

The glulam primary structure of the Conversation Club – as illustrated in figure 10 – supports the timber floor deck and polycarbonate envelope, transferring loadings to the foundations. Glue laminated timber is used because of its sustainable, engineered aesthetic, low embodied energy and structural economy.

The rotundas act independently of the primary structure, completely supporting the second floor and rotunda linking bridges.

Structural Economy

The portal frame maximises floor space without the interruption of additional columns. Glulam is one-sixth the weight of a reinforced concrete beam and two-thirds the weight of steel (Glulam Supplies, no date) , and can easily span the width (under 10m) of the Conversation Club. Span tables (figure 11) identify the appropriate depth of laminated timber required for the span to maximises structural economy. For the 9m span of the Conversation Club a depth of 400mm is most efficient.

Loadings

The primary structure transfers the three load types to the foundations. Live loads consist of people, furniture and precipitation, dead loads are the weight the building materials and structure of the building itself. Finally environmental conditions form the wind loading, the building must be able to withstand the loadings of strong winds.

The roof form must either shed precipitation, whether rain or snow, quickly or be able to withstand its additional weight.

The rotundas independently transfer both live and dead loads to the foundations, but contained within the envelope they do not have any environmental or wind loadings. The rotundas must withstand the additional live load of the books lining the shelves.

The glulam frame is constructed in a portal frame principle and subsequently requires cross bracing within at least one of the portals (figure 26). The addition of cross bracing makes the frame completely rigid and capable of withstanding the expected wind loadings.

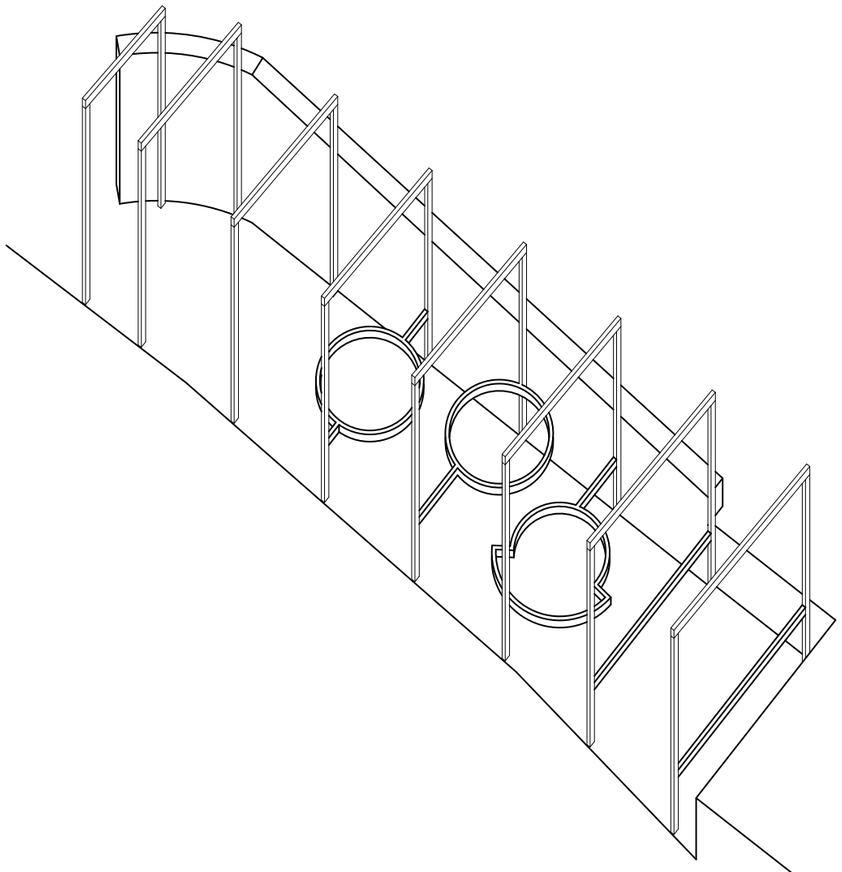
Components

Metsä Wood glulam columns and beams are made from premium Nordic timber sustainably sourced, high quality, prefabricated in factory conditions and transported to site as individual components for ease of transportation. The frame is then assembled on site.

Ring beams surround the voids where the rotundas extrude through the floor deck. The ring beams transmit the dead load of the floor deck and imposed live loads to the primary structure.

Stainless steel Ancon tension and compression systems are used for cross bracing within the portal frame. The systems are flexible and can suit a variety of usage criteria, while being aesthetically neutral.

Figure 10
Primary Structure
Axonometric



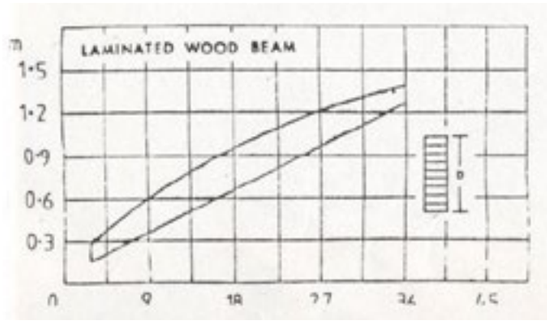


Figure 11
Glulam Span Table

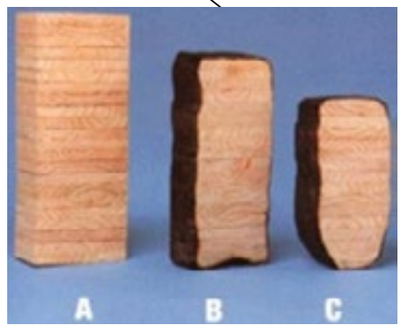


Figure 12
Timber Charring

Figure 13
Key to Axonometric Details on Section BB

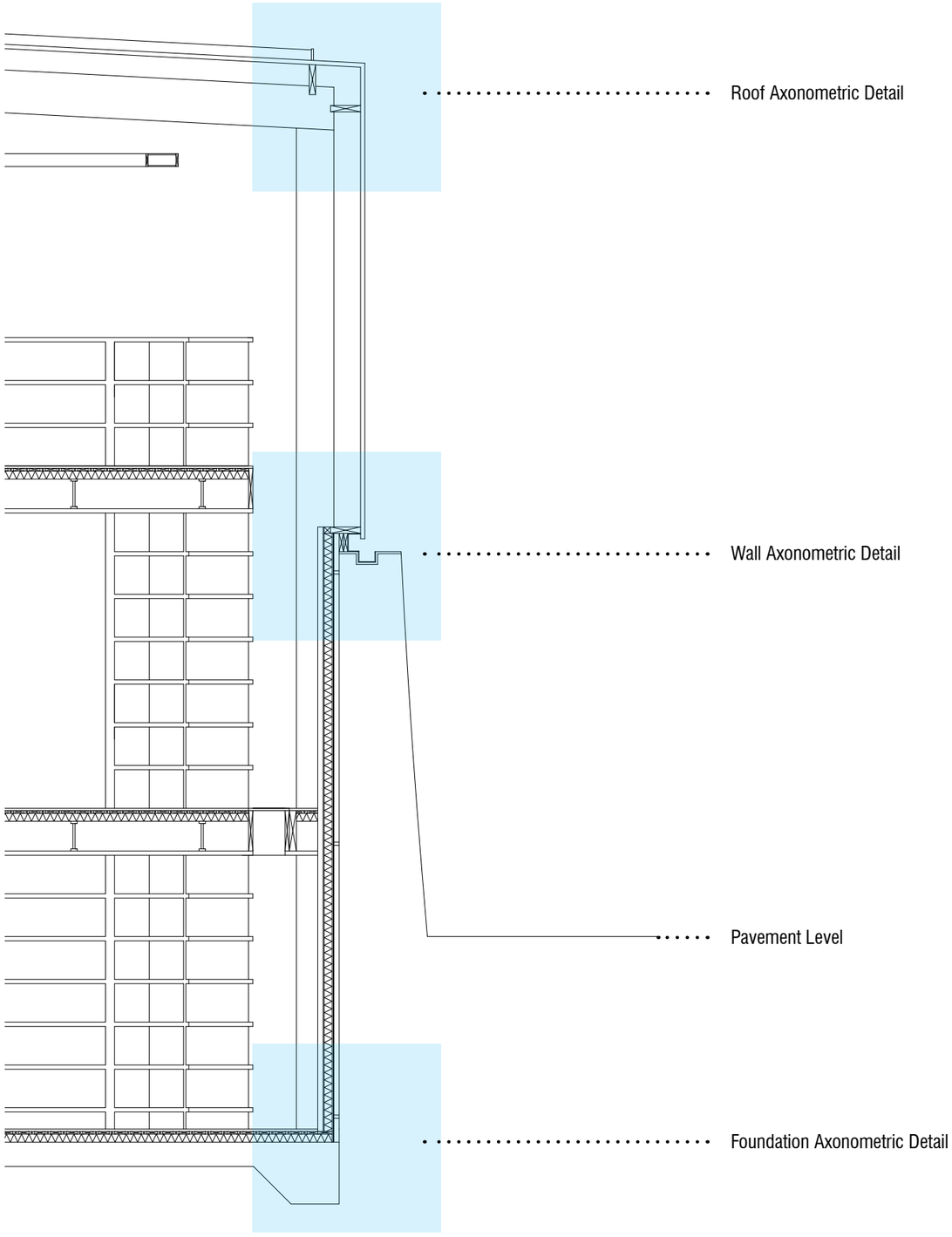


Figure 14
1:10 Roof Axonometric with Tie Plates

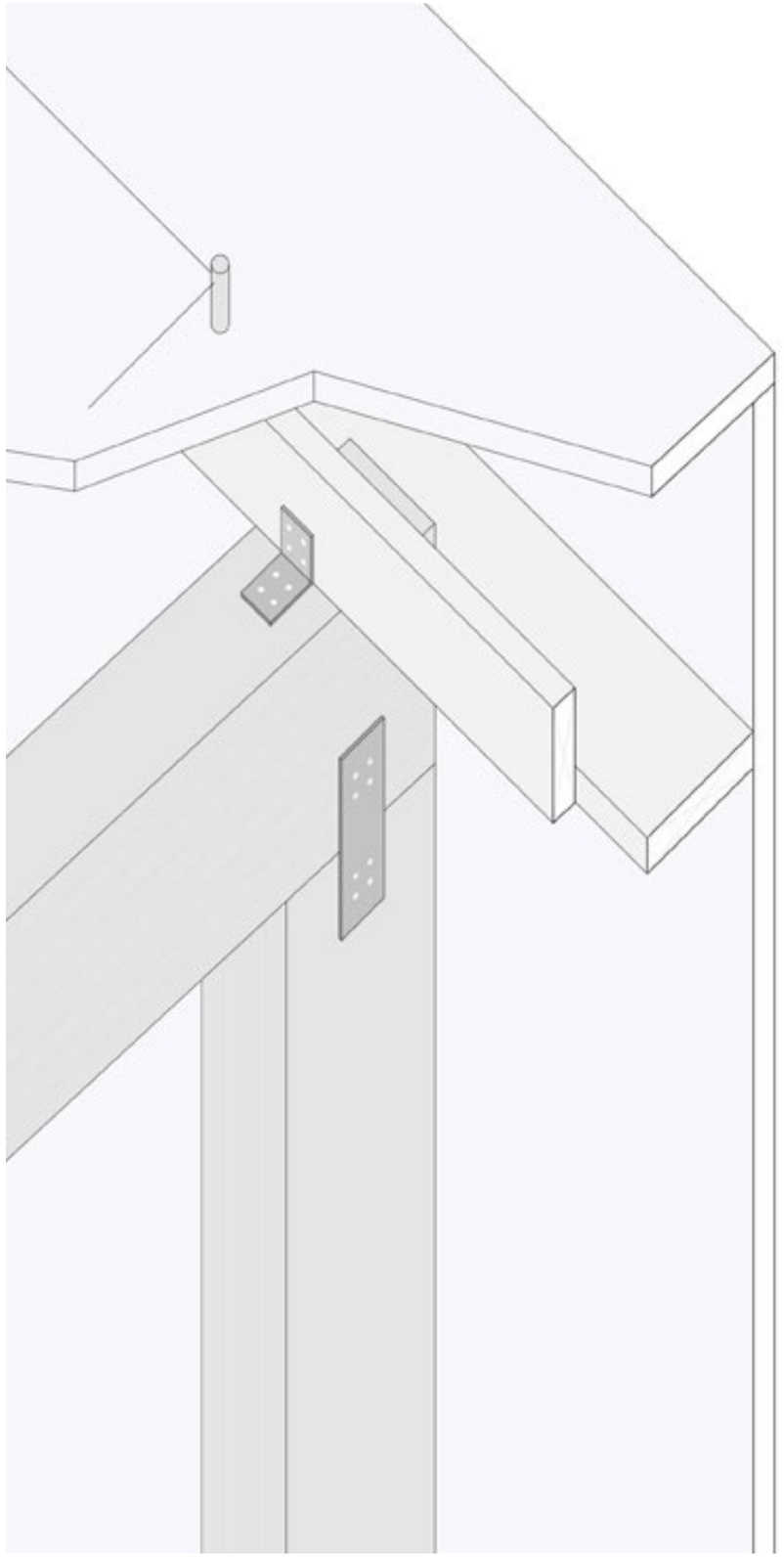
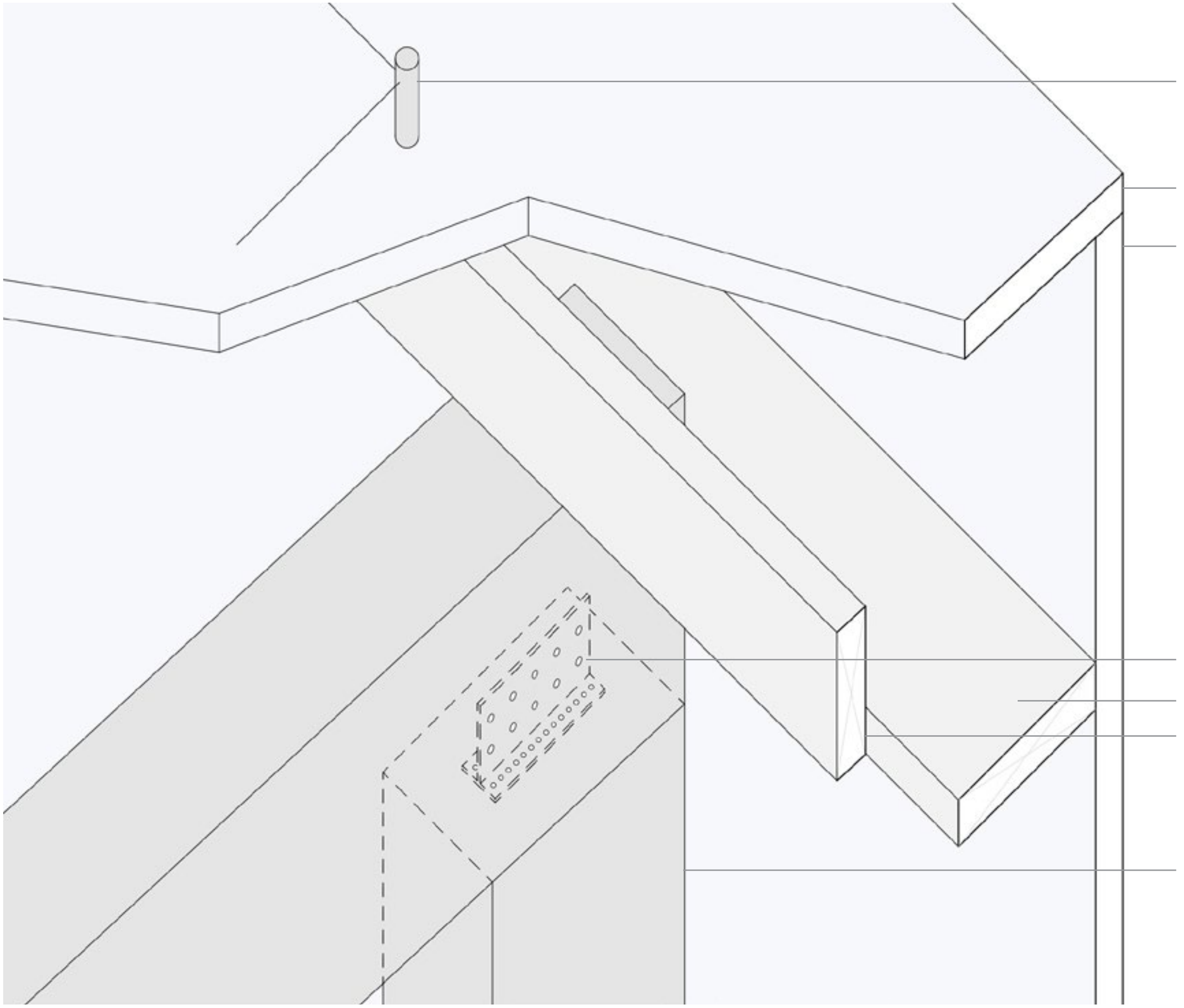
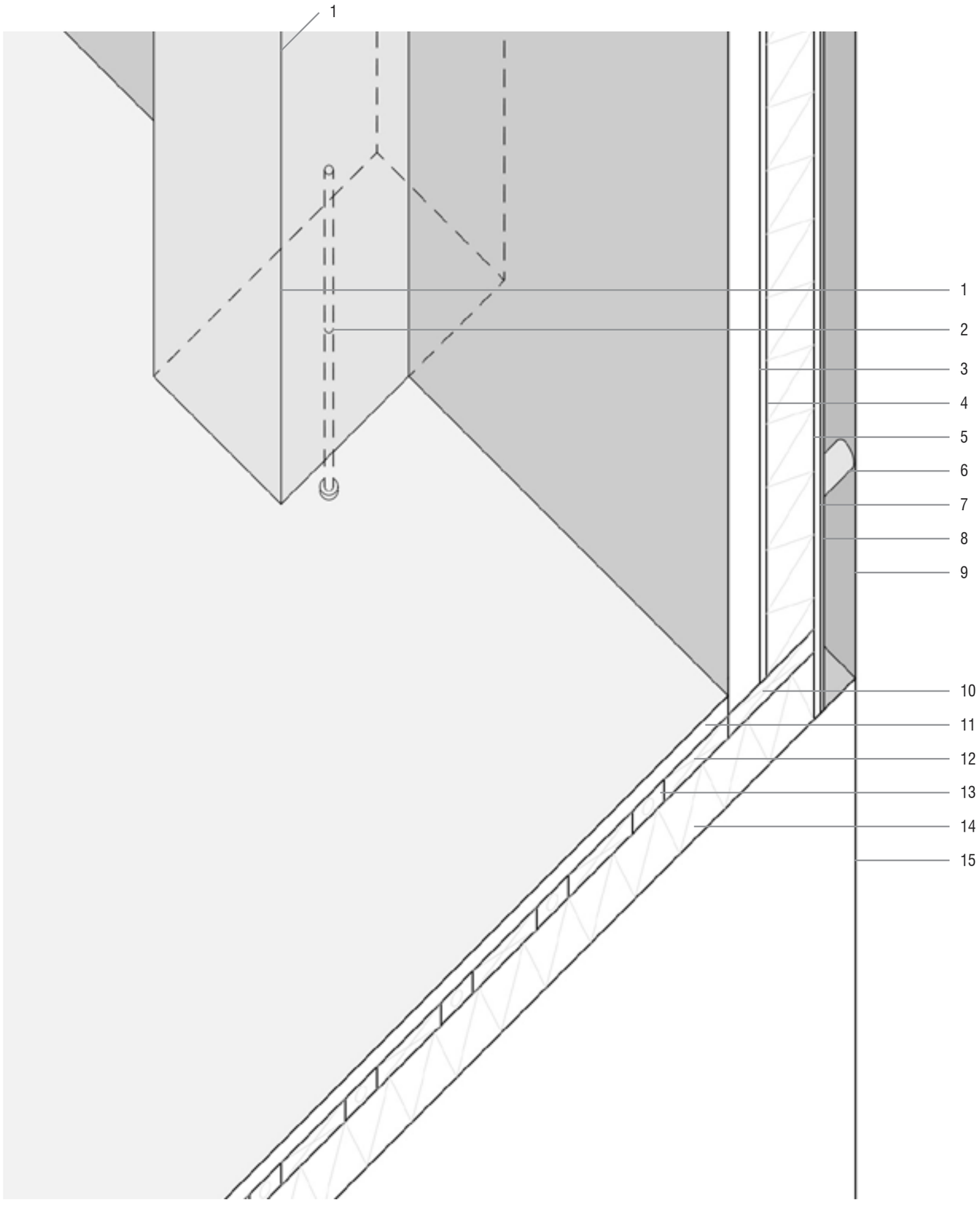


Figure 15
1:5 Roof Axonometric
with Hidden Hanger



1. Rain suppression mesh
2. 60mm Rodeca polycarbonate
3. Strong Tie hidden hanger
4. 60mm softwood rail
5. 200 mm Metsawood glulam column

Figure 16
1:5 Foundation
Axonometric



1. 200 mm Metsawood glulam softwood column / beam
2. 20 mm Strong Tie anchor bolt
3. 50 mm Stone-crete wall system
4. 10 mm timber board
5. 75 mm rigid insulation
6. 30 mm diameter fixing rod
7. 10 mm timber board
8. 6mm polythene tanking
9. Existing stone wall
10. Timber bearer
11. 22.5 mm Junckers timber floor
12. 25 mm bearers
13. Underfloor heating pipes
14. 75 mm rigid insulation with polthene tanking below
15. Concrete raft foundation

Junctions

The glulam frame is secured to the foundations by 10mm anchor bolts (figure 16). The anchor bolts are sunk into the concrete foundation, and serve a number of purposes. Initially they provide a guide for where the glulam columns are to sit, then after construction they prevent uplift of the structural frame and envelope.

Two methods for connecting the glulam beams to the columns were considered. The simplest is steel tie plates (figure 14), however this method, while practical isn't as attractive. The prefered solution is Strong Tie concealed beam hangers (figure 15) These hanger is fixed to the top of the column and the plate is fully inserted into a slot in the beam. The beam is then fixed with drilled dowel to prevent uplift.

Fire Strategy

Metsä Wood glulam has a fire resistance class of R30 (Metsä Wood, 2012), meaning it has a minimum fire resistance of 30 minutes which is sufficient given the small size of the building. However it will in theory retain its strength for longer due to natural charring. Timber retains its strength after ignition as combustible gases are released hindering passage of oxygen to the material (figure 12). If additional resistance is required timber can be treated by products such as Osmose Firepro to improve the material's fire retardance.

Groundworks and Foundations

Figure 16 illustrates a junction between the existing stone wall, the foundations and the retaining wall. The Conversation Club is built under the level of the existing ground conditions. Therefore in order for construction to commence the tarmac and supporting material of the existing ramp must be excavated. This must be carried out with care to avoid the collapse of the stone wall which is to be retained in the design of the Conversation Club.

Foundations

The concrete raft foundation is cast in situ with appropriate steel reinforcement. The raft spreads the applied loadings from the primary structure across a large ground area, avoiding overstressing the soil at a single point. The loads of the primary structure are concentrated at the perimeter of the raft; the perimeter is therefore deepened. The deeper perimeter (or toe) also prevents erosion of supporting soil, which could otherwise undermine the raft (Riley, 2009).

As a significant mass of soil / tarmac / aggregate has been excavated from the site there may be no additional load applied to the site following construction, as such ground movement should be minimal.

Insulation and Waterproofing

Figure 16 illustrates how moisture is excluded and heat retained by the foundations and retaining wall. A polyethylene waterproof membrane deters any water that penetrates the stone wall. A moisture barrier above the raft foundation prevents moisture ingress through capillary action.

The floor foundations and retaining wall are both insulated by Kingspan 75mm rigid insulation providing a U-value of 0.2 and 0.22 (Kingspan, no date) for floor and wall respectively. Figure 16 also demonstrates how the insulation is introduced in the wall detail between the timber columns. Timber – unlike metals – does not have a high thermal conductivity thus is will not act as a thermal bridge between the interior and exterior. However it may be appropriate to continue the insulation around the glulam columns to maintain the continuity of insulation.

Figure 17
Whitby Abbey Visitor Center

Figure 18
Whitby Abbey Visitor Center

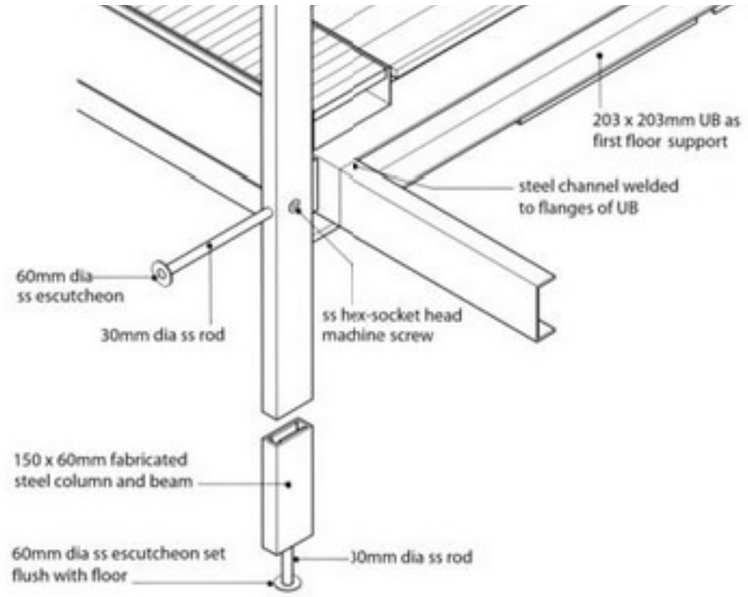
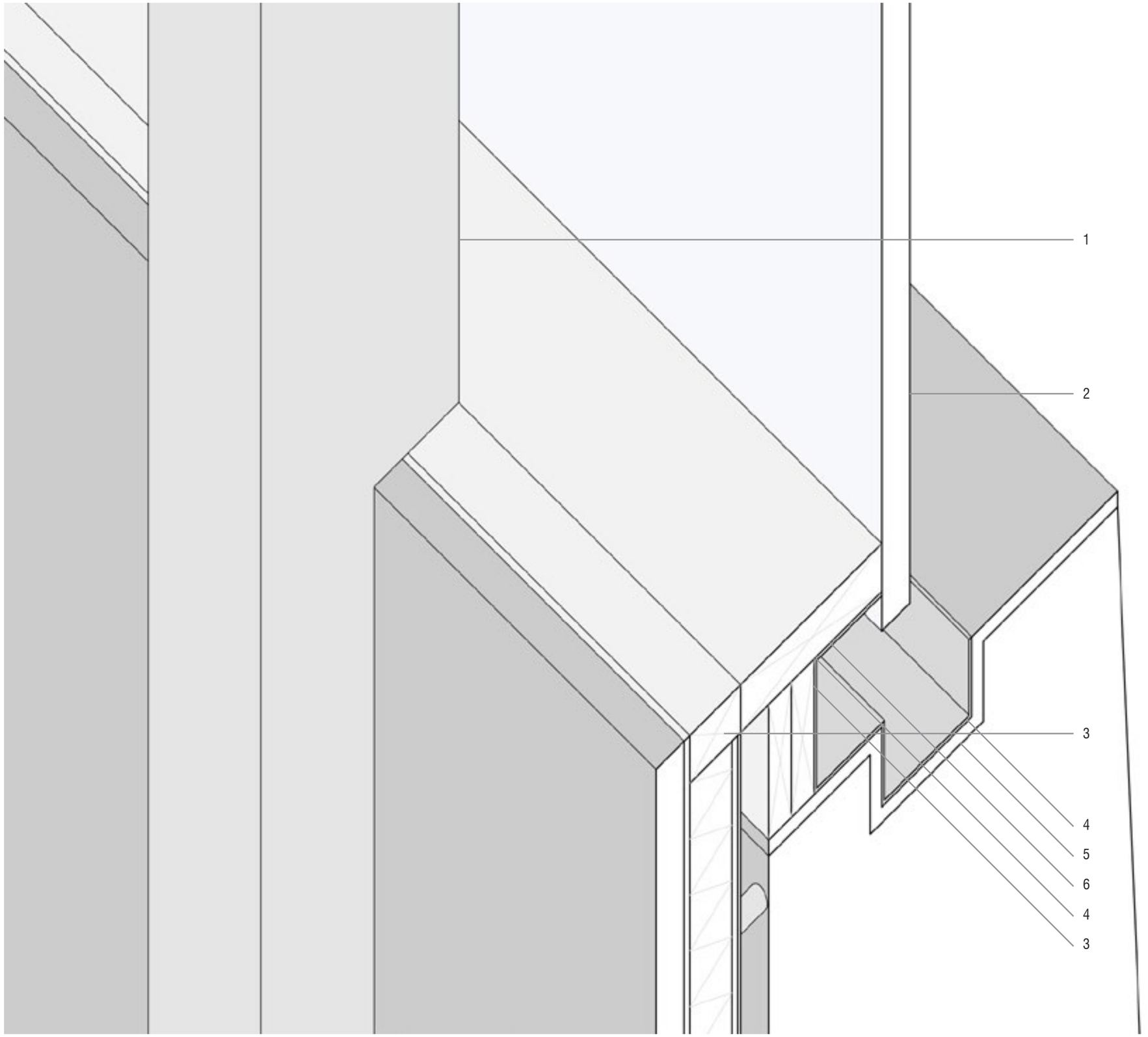


Figure 19
1:5 Wall Axonometric



1. 200 mm Metsawood glulam column
2. 60mm Rodeca polycarbonate
3. Softwood rails
4. Waterproof flashing
5. Watertight cement
6. 60mm softwood rail

Stone Wall Retention

In order to retain the existing stone wall on the site it may necessary for a degree of underpinning to secure its foundations.

Taking inspiration from the Whitby Abbey Visitor Centre (figure 17 & 18) intervention the primary structure and and stone wall are connected by steel rods. The steel rods tie the wall and primary frame together providing mutually beneficial tensional support.

Level Access

The site topography varies; at the entrance on the north elevation level access is achieved by submerging the foundations and floor deck below ground level. The entrance, to the south of the site, on the east elevation of the site is precisely 3m above the north entrance; therefore level access is possible to the upper ground floor.

Envelope

The polycarbonate envelope of the Conversation Club excludes moisture, provides thermal and acoustic insulation and admits appropriate levels of solar gain and daylight.

The polycarbonate envelope is inspired by Florian Nagler's Bobingen Factory (figure 20 & 21), the flush facade visually contrasts the rotundas and stonework, identifying each element independently.

The 60mm Rodeca polycarbonate has a U-value of 0.71, acoustic insulation of 27dB and transparency of up to 80% (Rodeca, no date) . The use of polycarbonate for both wall and roof-form maximises the potential daylighting within the scheme and the polycarbonate reduces glare.

The Conversation Club is situated beside a busy road and minor railway line, the polycarbonate provides and sufficient level of acoustic insulation to alleviate disturbance of occupants.

Precipitation

The roof slopes gentling to the East elevation where rainwater is expelled to a hidden gutter above the stone wall as shown in figure 19; this maintains an aesthetically flush facade, while also prevent rain water from spilling to the paving below.

The relative flexibility of the polycarbonate means that during heavy rainfall there is potential for the sound to resonate on the interior. This acoustic drawback is mitigated by a rain suppression mesh as is commonly used for tensile canopy roofs, such as Bath University's East Building (figure 22).

Construction

Figure 19 illustrates how the polycarbonate is fixed to the primary structure. Smooth pressed aluminium fixing clips fix the polycarbonate to timber rails which in turn are attached to the glulam columns. The fixing clips and manufactured by the polycarbonate supplier, Rodeca.

Figure 20
Bobingen Factory

Figure 21
Bobingen Factory

Figure 22
Bath University, East Building

Planning and Interiors

Figure 23
Upper / Lower Ground
Floor Plan
Disabled Access

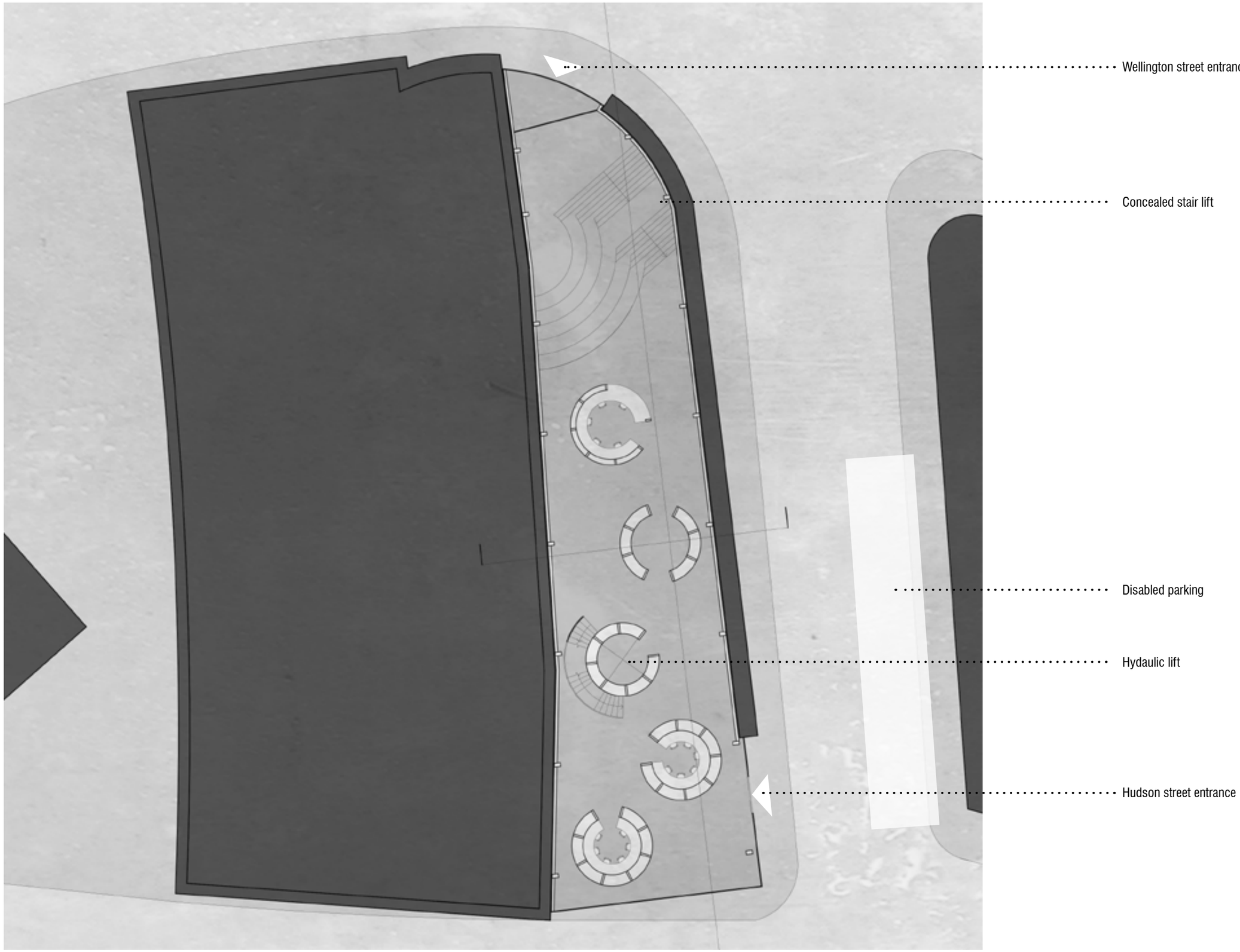
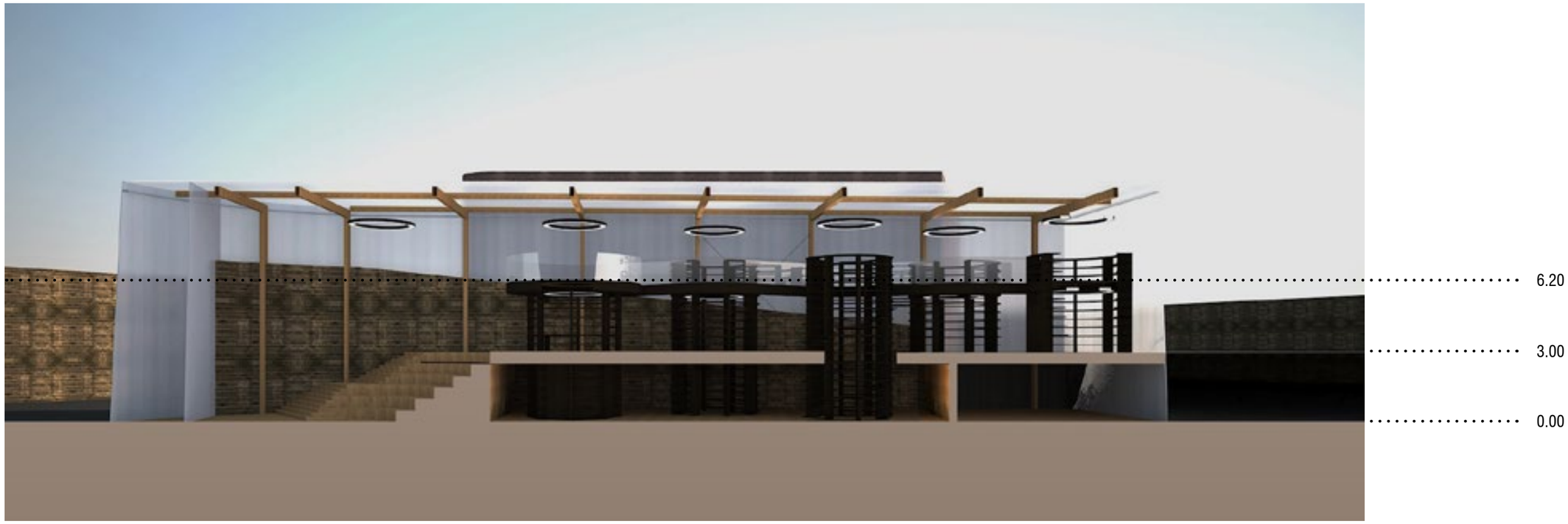


Figure 24
Floor Levels



Accessibility

Entrance

There are two entrances to the Conversation club, the main is from Wellington Street to the North (figure 23), and an alternative is available from Hudson Street to the South East. Due to the topography of the site these entrances are located at different floor levels. As such disabled access is available at both levels to the lower and upper ground floors (figure 24).

As the primary entrance the doors at the north entrance are motion activated sliding doors, and the south entrance is a push pad mechanical door (figure 25), therefore both entrances offer ease of access for disabled visitors.

The only internal doors within the scheme are to the WCs on the lower ground floor, these are each sufficiently spacious for use by a disabled user and the doors do not open inwards so there is no potential for a fallen visitor to block access.

Vertical Circulation

The steps of the conversation space present a potential hindrance to disabled users which can be mitigated with the inclusion of a platform stair lift (for which there is sufficient space). This may however be unnecessary as the southern entrance to the Upper Ground floor is easily accessible and is a shorter distance from the potential parking bays.

The conversation space steps are appropriate for the ambulant disabled as outlined in Approved Document M, a landing of 1400mm breaks the 18 steps into two sets of 9 providing a resting point.

A 50mm circular softwood handrail provides a visual contrasts with the stone wall, ‘is slip resistant and not cold to the touch’ (Approved Document M, 2013) and is clear of the wall.

The subterranean lower ground rotundas and the first floor are accessible by a hydraulic lift within the circulation rotunda. The lift has been inspired by the lift at the Louvre (figure 26 & 27).

Consideration

The reception desk is suitable for use by wheelchair uses, the desk height is 800mm and has plenty of manoeuvring space in front.

To aid those who are hard of hearing an induction hearing loop system will be integrated at the reception desk which connects with a visitors hearing aid. This will also be integrated in the conversation space to meet the regulations of part M: ‘In order to obtain the full benefit of attending public performances or taking part in discussions, a person with impaired hearing needs to receive a signal that is amplified in both volume and signal to noise ratio. … In larger spaces, a provision needs to be made for a permanent system’ (Approved Document M, 2013).

Figure 25
Push Pad Door

Figure 26
Louvre Hydraulic Lift

Figure 27
Louvre Hydraulic Lift

Figure 28
Lower Ground Plan
Fire Escape Distances

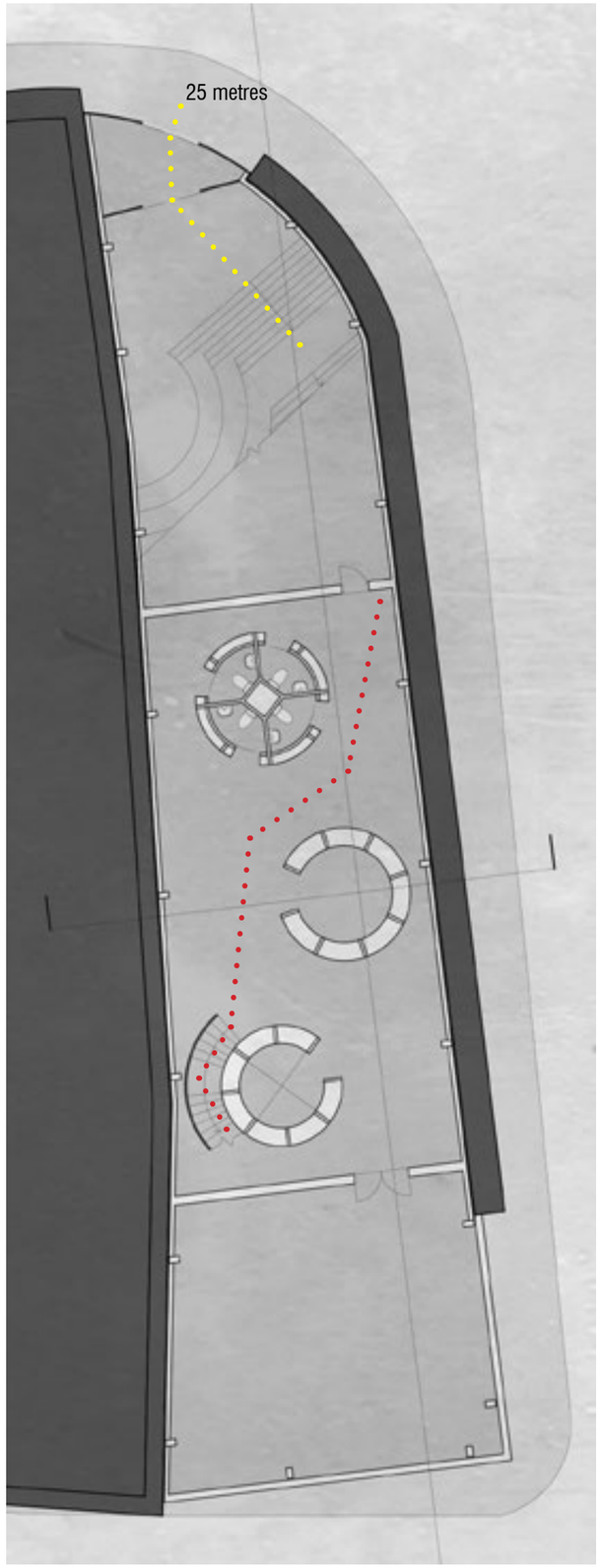


Figure 29
Upper Ground Plan
Fire Escape Distances

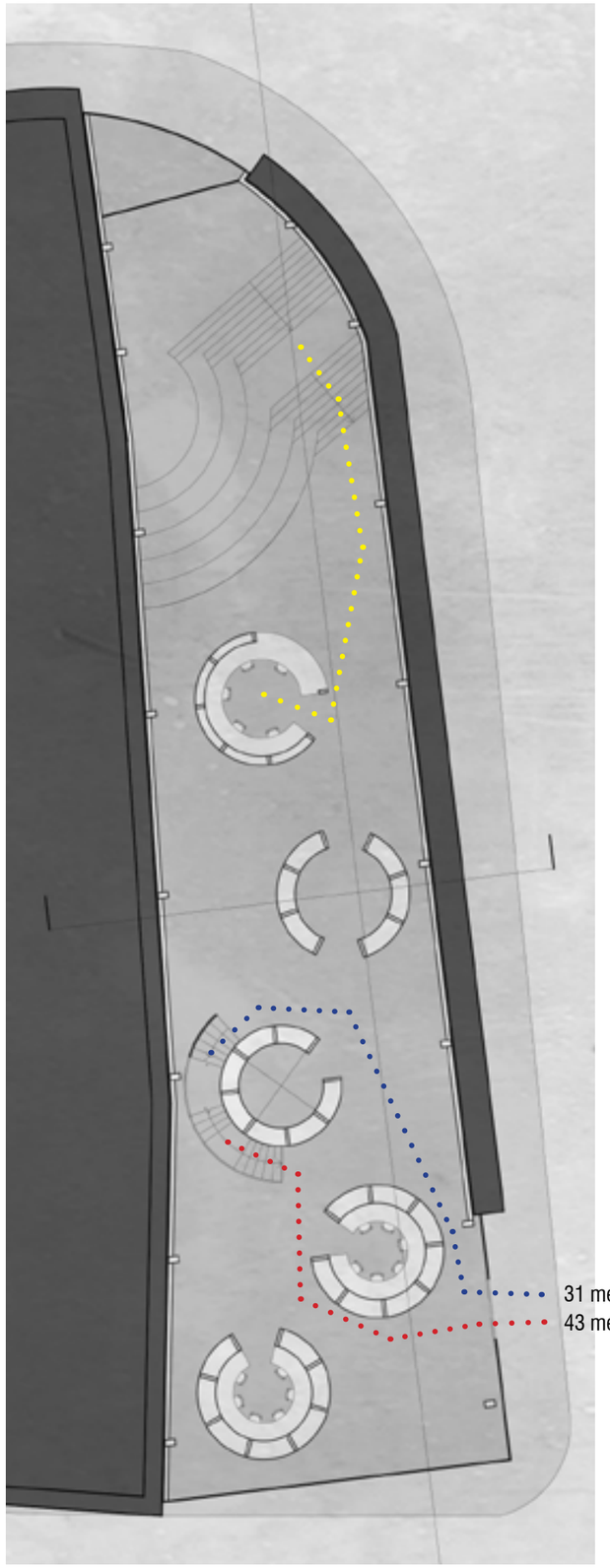
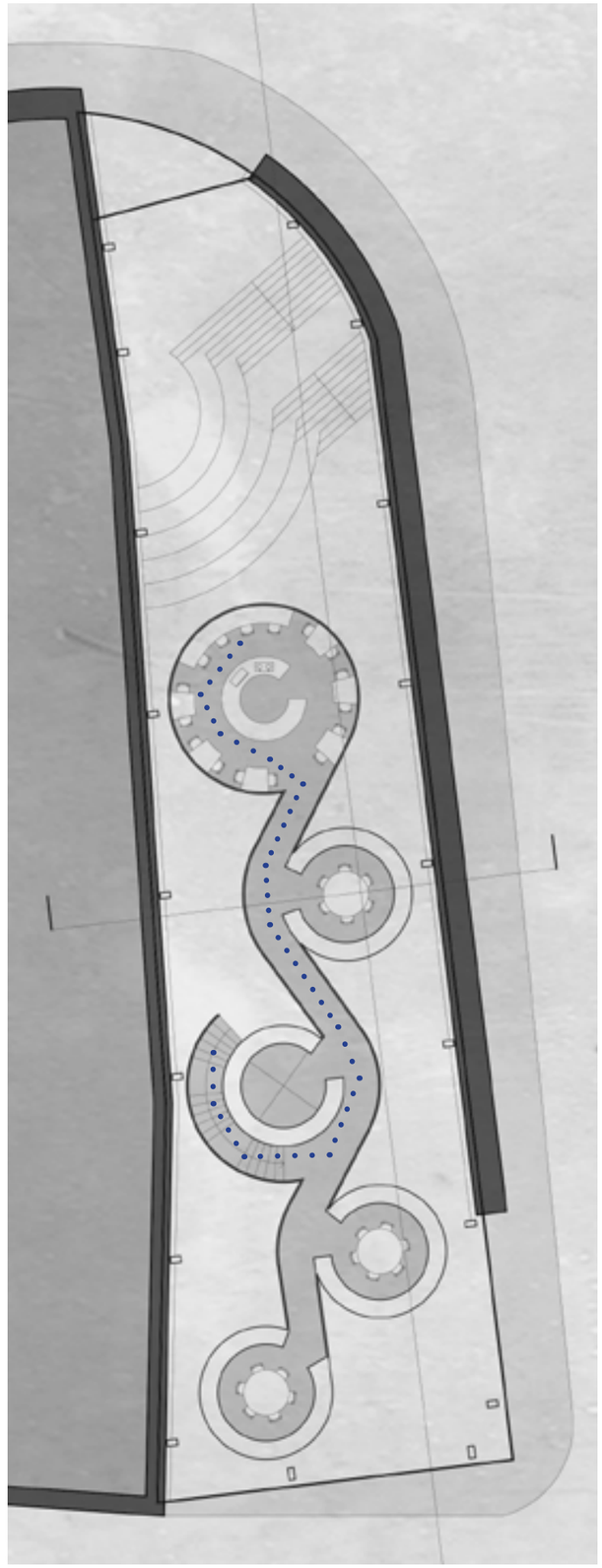


Figure 30
1st Floor Plan
Fire Escape Distances



Fire Strategy

Means of Warning

Section B1 of Approved Document B advises on means of warning and escape in the event of fire. All spaces within the Conversation Club will be fitted with fire alarms to manual raise alarm, as well as smoke detectors. A heat detector will be more appropriate for the coffee kiosk to reduce the risk of false alarm.

Approved Document B identifies that these systems although valuable are not entirely necessary as 'In most buildings fires are detected by people, either through observation or smell and therefore nothing more will be needed' (Approved Document B, 2013). It goes on to state that raising the alarm may also be simply a matter of 'a shouted warning "FIRE" by the person discovering the fire may be all that is needed' (Approved Document B, 2013). This is particularly true of the Conversation Club where the noise level is expected to be just a quiet conversational level and shouts could be easily communicated within the open spaces. However for the benefit of the hard of hearing and low sight an electronic alarm system is used which includes both audio and visual warnings.

Means of Escape

There are two available exits for use in emergencies, at opposite ends of the building to minimise travel distances. The maximum horizontal escape distances from the lower ground and first floors are shown in figures 28 to 30. The lower ground escape route is the longest at 43 m, and the first floor route is 31 m. All potential routes meet the maximum 45m regulation for assembly buildings as outlined in Approved Document B.

The Conversation Club meets the criteria for requiring only a single escape stair as the subterranean lower ground space (identified as a basement) has an occupancy level lower than 60, and there are no storeys above 11m.

The maximum capacity of the Conversation Club is 150 people (assuming a capacity of 5m sq per person, and a total floor area of 750m sq) therefore the minimum width for the escape stair outlined in Approved Document B is 1100mm.

All escape routes have adequate artificial lighting and emergency exits should display suitable signage 'of adequate size complying with the Health and Safety (Safety signs and signals) Regulations 1996' (Approved Document B, 2013)

Critical Evaluation

The designated escape stairs within the scheme are not enclosed and as such are not an appropriate means of escape. Unenclosed escape stairs would be acceptable 'if it does not connect more than two storeys and deliver into the ground storey not more than 3m from the final exit' (Approved Document B, 2013) however the stairs deliver 10m from the exit.

The stair fails in a second access, as the subterranean space is considered a basement it 'should be served by a separate stair' (Approved Document B, 2013).

Internal Fire Spread

Table A2 of Approved Document B states that basement of the should have a fire resistance of 60 minutes, and the ground and upper storeys 30 minutes if sprinklered, 60 minutes if not.

The stone crete is the, major internal surface material, has an incredibly high ignition temperature and should not be considered flammable. The ignition temperature of polycarbonate is around 450 ^{0}C and has a low inflammability (B1) fire resistance. As such it is considered difficult to ignite and often self extinguishing. The Junckers timber flooring has a similar low flammability classification of Cfl – S1, low flammability.

The critical consideration for spread of fire is the glulam frame and timber rotundas, however due to natural charring timber is naturally protected (figure 12). If this is deemed to be insufficient then a fire retardant coating – such as Osmose Firepro – can be applied to improve the material's fire retardance

According to Table 12 of Approved Document B the Conversation Club doesn't require compartmentalisation as the floor area is less than 2000 msq.

Figure 31
Conversation Space
Perspective

Figure 32
Rotunda Perspective

Metsa Wood Glulam

Rodeca Polycarbonate

Ancon Cross Bracing

Bespoke Ring Lights

Stone Crete

Saint Gobain Lite-Floor

Junckers Black Oak Timber Floor

Junckers Oak Timber Floor

Figure 33
Rotunda Perspective

Bespoke Ring Lights

Rodeca Polycarbonate

Saint Gobain Planilux Balustrade

Metsa Wood Glulam

Stone Crete

Junckers Oak Timber Floor

Internal Finishes

Metsä Wood Glulam

Metsä Wood glulam has mainly be chosen for its performance characteristics but additionally it has a high quality finish and attractive appearance suits the scheme. As a precedence the Bobingen Factory (figure 20 and refer to appendix) applies both glulam and polycarbonate in a fashion very similar to this scheme. The combination is low cost and sustainable.

Rodeca Polycarbonate

The Rodeca Polycarbonate envelope is lightweight, economical and has low U-values. It's easily cleaned, as per the manufacturer's documentation. The disadvantage of polycarbonate over glazing is the potential loud drumming to resonate through the building during heavy rainfall, however this is alleviated by the integration of a rain suppression mesh (figure 34).

Stone Crete

The scheme attempts to retain a significant surface area of the existing stone wall but in order to do so it must be waterproofed and insulated. The solution was to take moulds of the existing stonework and mimic the stone wall using Stone Crete, a cast in-place product by Increte Systems. By doing so a cavity is formed between the stone wall and the interior which is tanked and insulated (figure 16).

Junckers Solid Timber Floor

Junckers Nordic Oak solid hardwood flooring is used throughout the main spaces within the scheme with underfloor heating / cooling pipes integrated beneath (figures 35 & 36). The light oak colour contrasts with the Black Oak finish of the rotundas.

Junckers timber floors are well documented and have an eclectic list of case studies, demonstrating that they can be easily maintained.

Saint Gobain Lite-Floor

To further distinguish the rotundas and accentuate their extrusion through the floor deck each is surrounded by a glazed ring. Saint Gobain Lite-Floor is a laminated safety glass designed for floor panels. The material can be covered with an anti-slip top surface which will provide slip resistance when both wet and dry.

Saint Gobain Planilux Balustrade

To reduce the visual impact of the first floor rotunda bridge links the balustrades are glazed (figure 33). Saint Gobain Planilux is a multi-purpose clear float glass is suitable for use in glazed balustrades.

Figure 34
Rain Suppression Mesh

Figure 35
Junckers Floor Detail

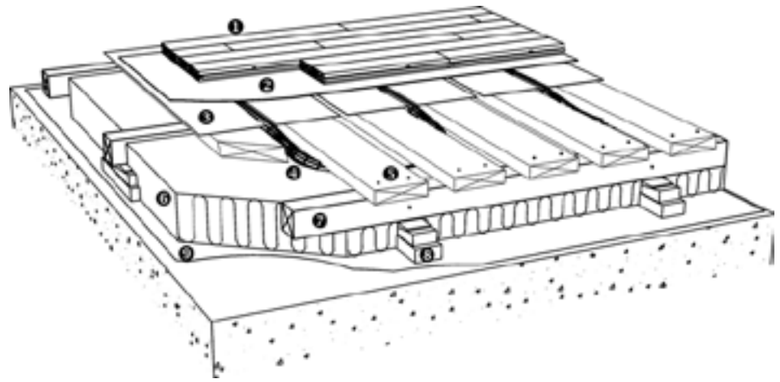
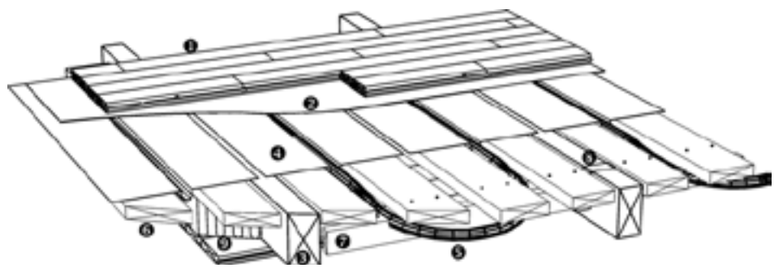
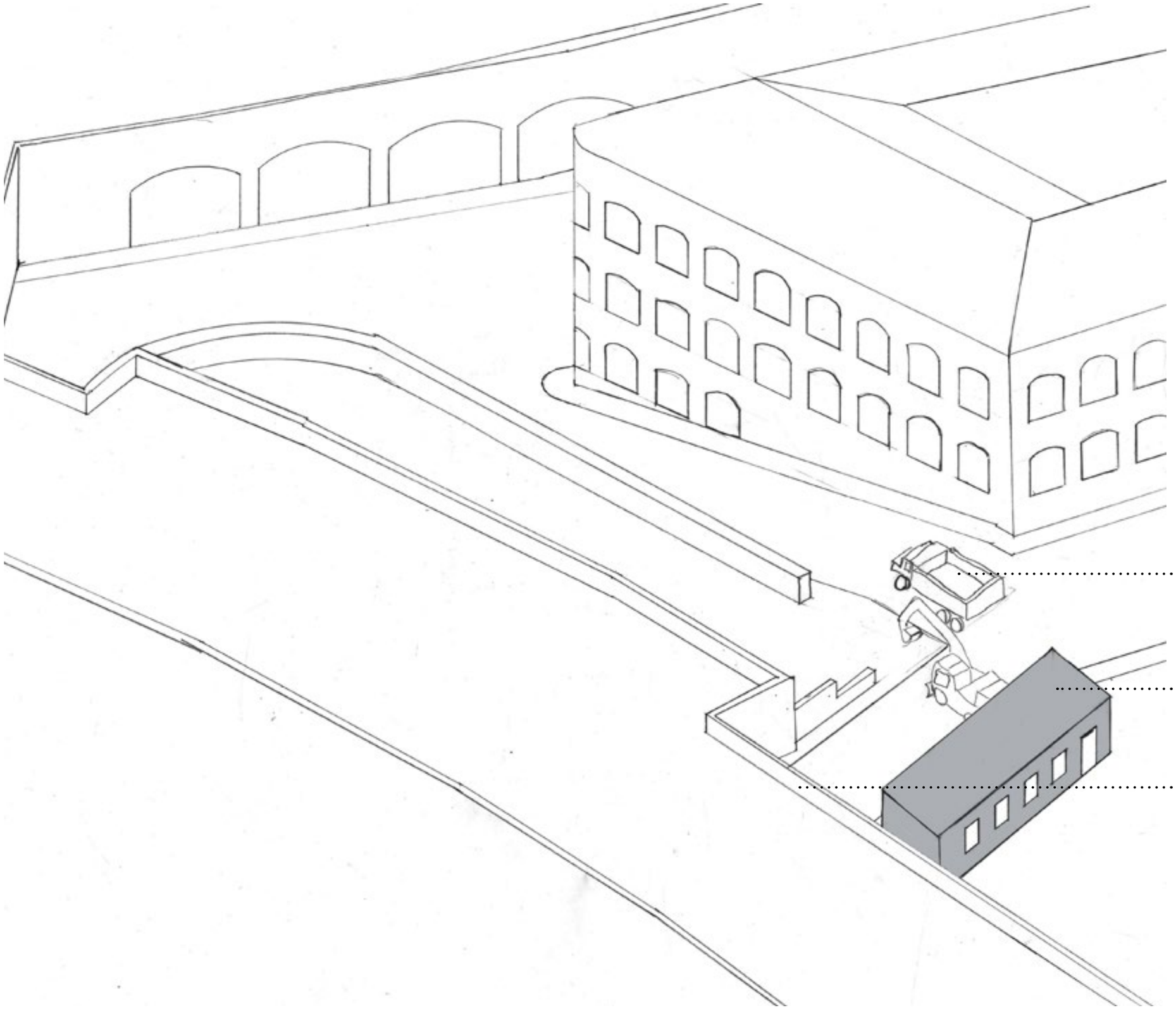


Figure 36
Junckers Floor Detail



Assembly Sequence

Figure 37
Assembly Sequence



Assembly Sequence 01

Site surveys commence, including borehole tests of ground quality and formation.

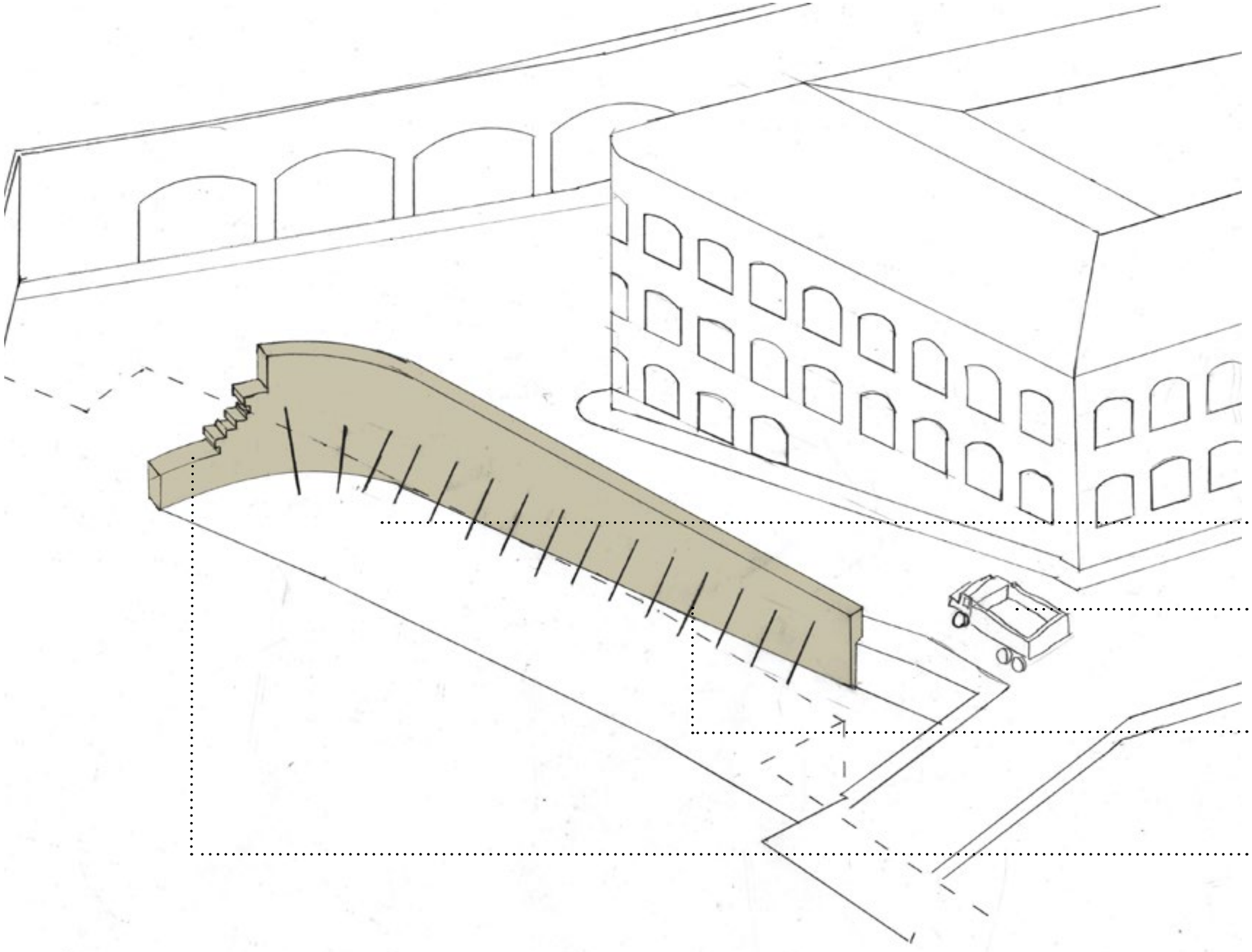
For health and safety the site is fenced off from public access. Access is restricted to construction workers wearing personal protective equipment.

Plant arrives and site is prepared for ground works.

Temporary site accomodation erected on site.

Fletcher Road tunnel closed, and traffic rerouted down High Level Road.

Figure 38
Assembly Sequence



Assembly Sequence 02

(For clarity the railway bridges and site accomodation are not shown in the following illustrations)

Tarmac, aggregate and soil are excavated from site.

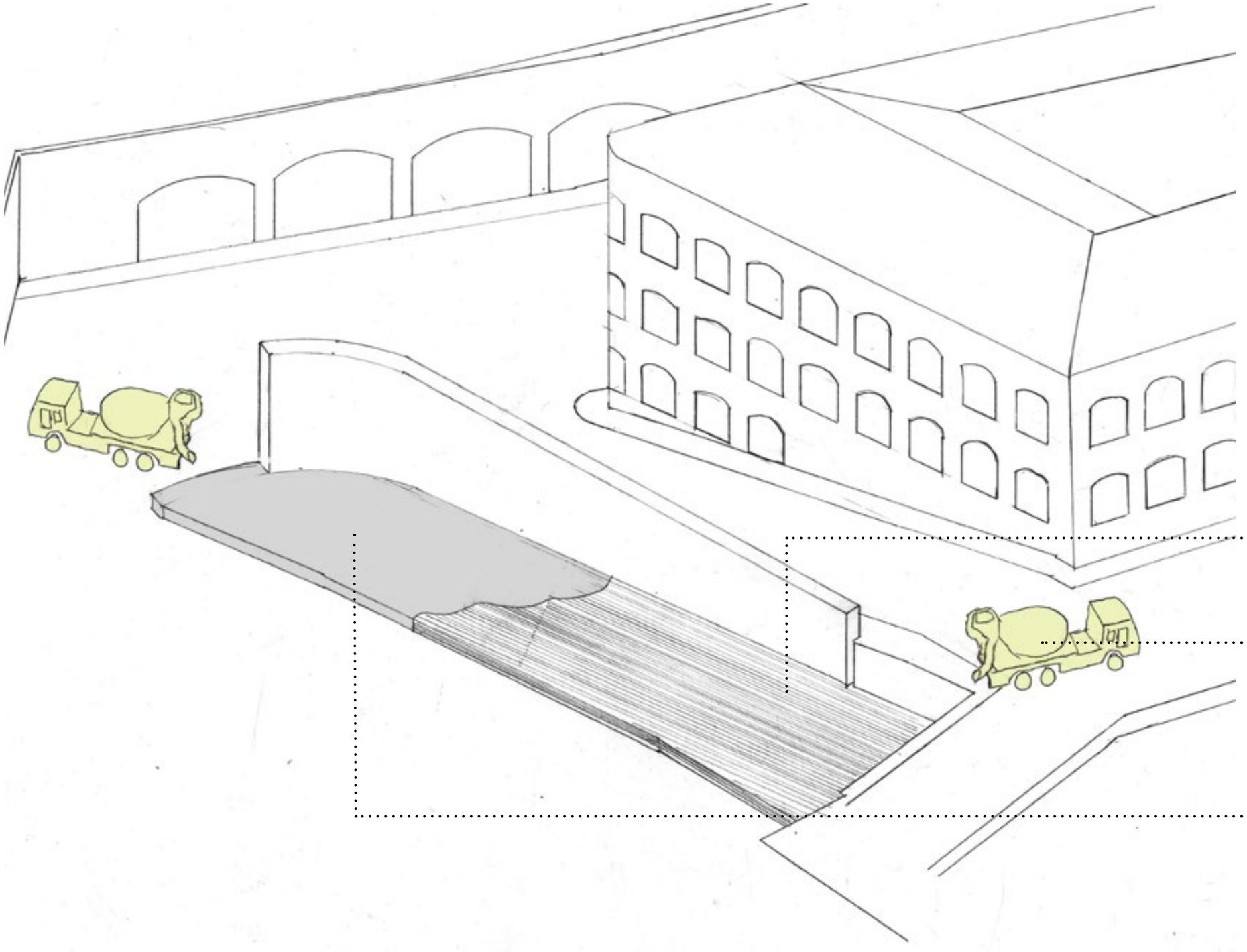
Extracted spoil is removed from site by road or rail depending on potential co-operation with National Rail.

Existing stone wall is temporarily reinforced with props.

Section of stone wall is deconstructed to form entrance to scheme.

The removed stone can be reused on site or recycled for use in other projects.

Figure 39
Assembly Sequence



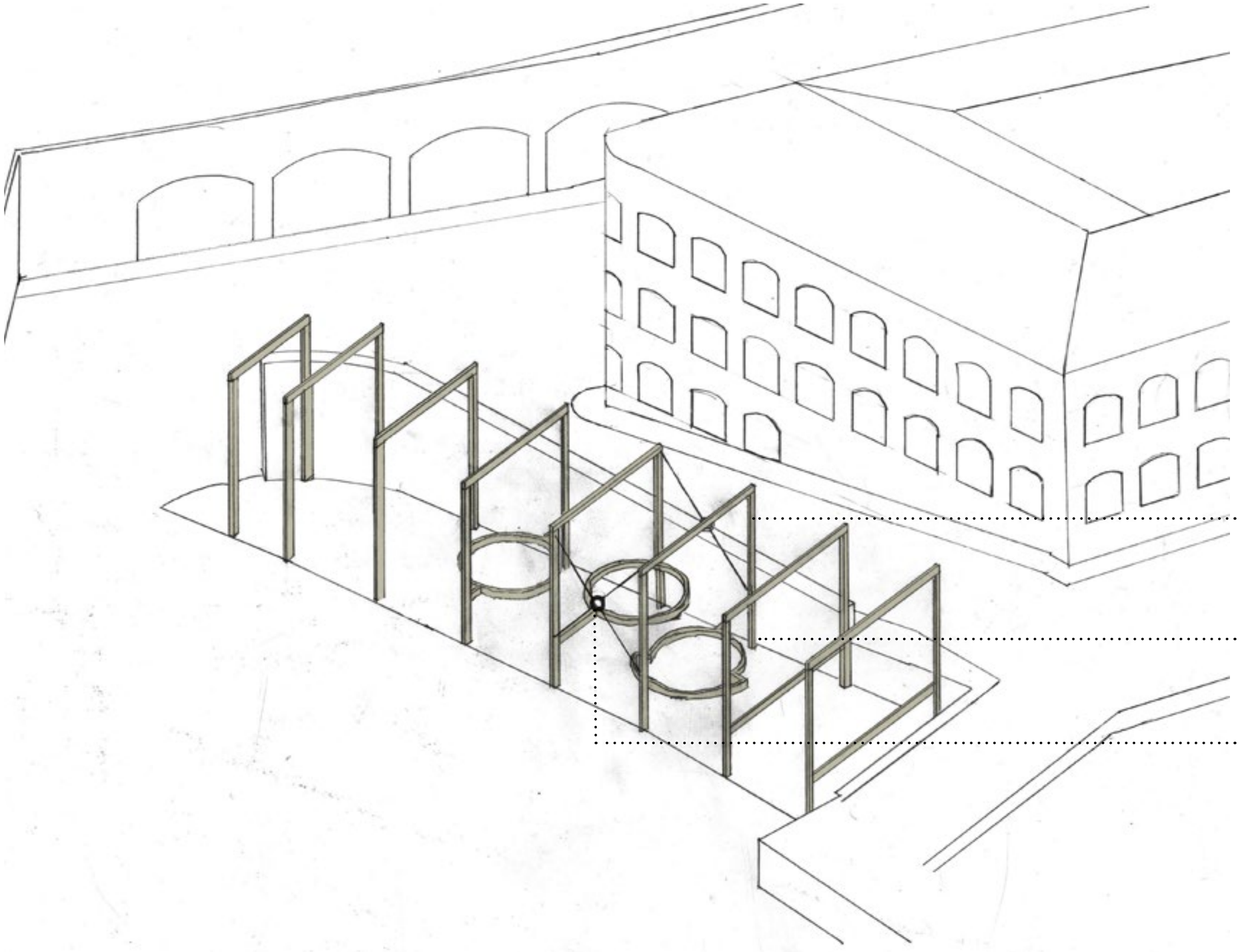
Assembly Sequence 03

Formwork and reinforcement mesh for raft foundation are lain.

Ready mixed concrete delivered to site.

Concrete is poured and tempered in sections. With test cubes made to test concrete strength later.

Figure 40
Assembly Sequence



Assembly Sequence 04

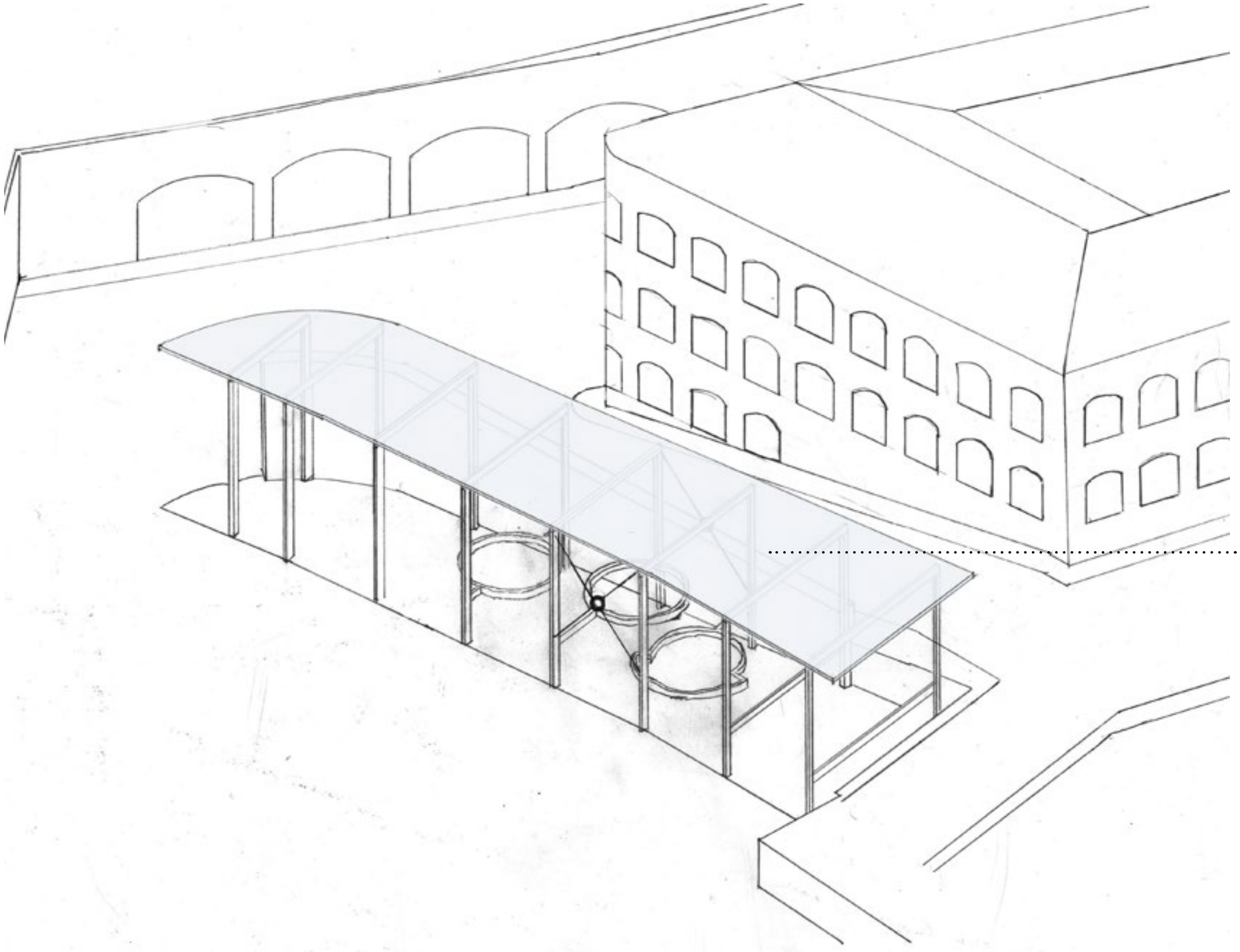
Following cube testing of concrete stength the primary structure is raised.

Metsä Wood glulam columns, beams and ring beams are joined by Strong Tie concealed beam hangers.

Steel rods drilled into stone tie the wall and primary structure together.

Stainless steel Ancon tension and compression system provides cross bracing for lateral rigidity within the frame.

Figure 41
Assembly Sequence

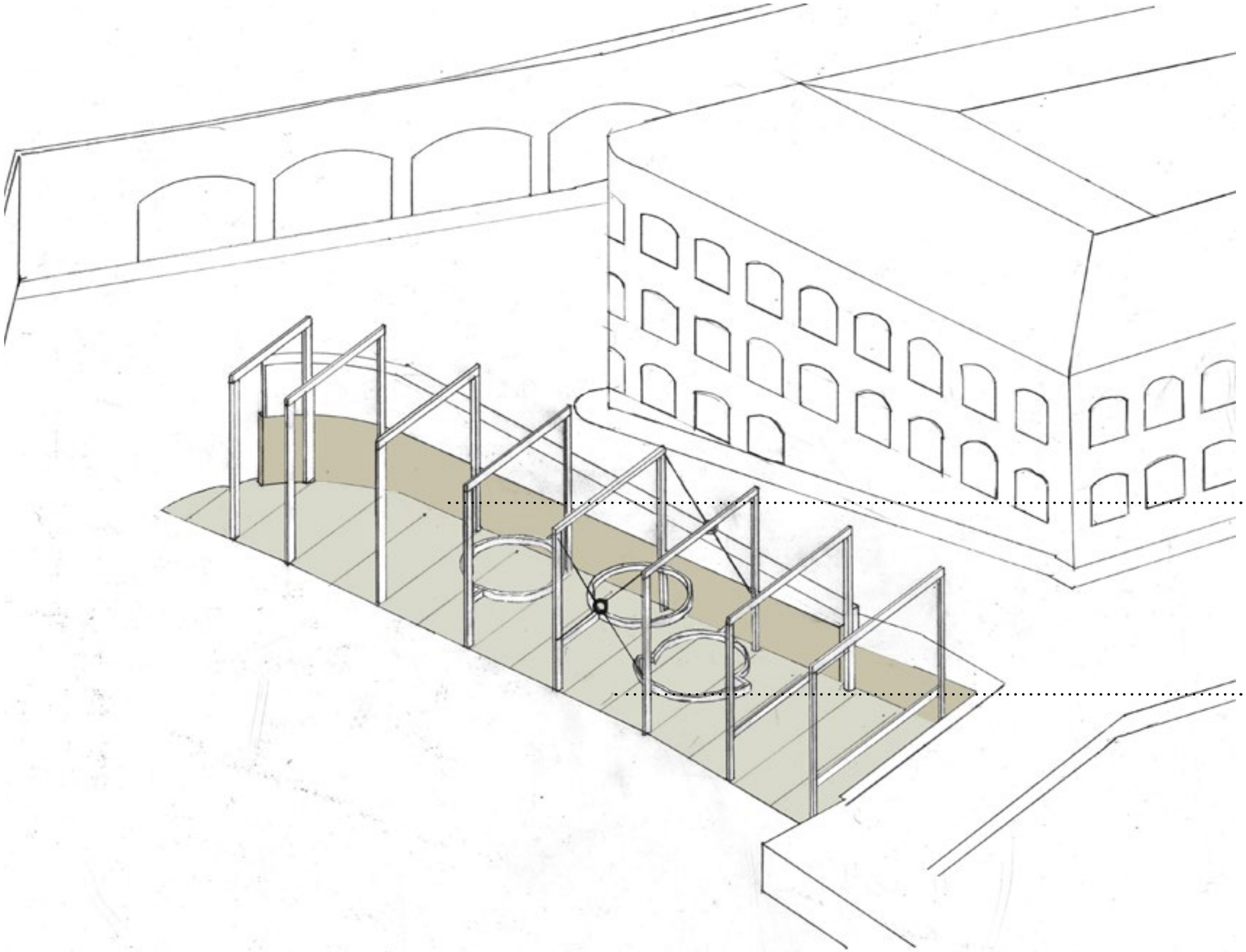


Assembly Sequence 05

Rodeca polycarbonate panels are attached to softwood rails on the glulam beams to form the roof and where practical the polycarbonate walls are constructed however some portions must be left open to allow large components and materials to be manoeuvred.

This will permit construction work to continue regardless of weather conditions.

Figure 42
Assembly Sequence



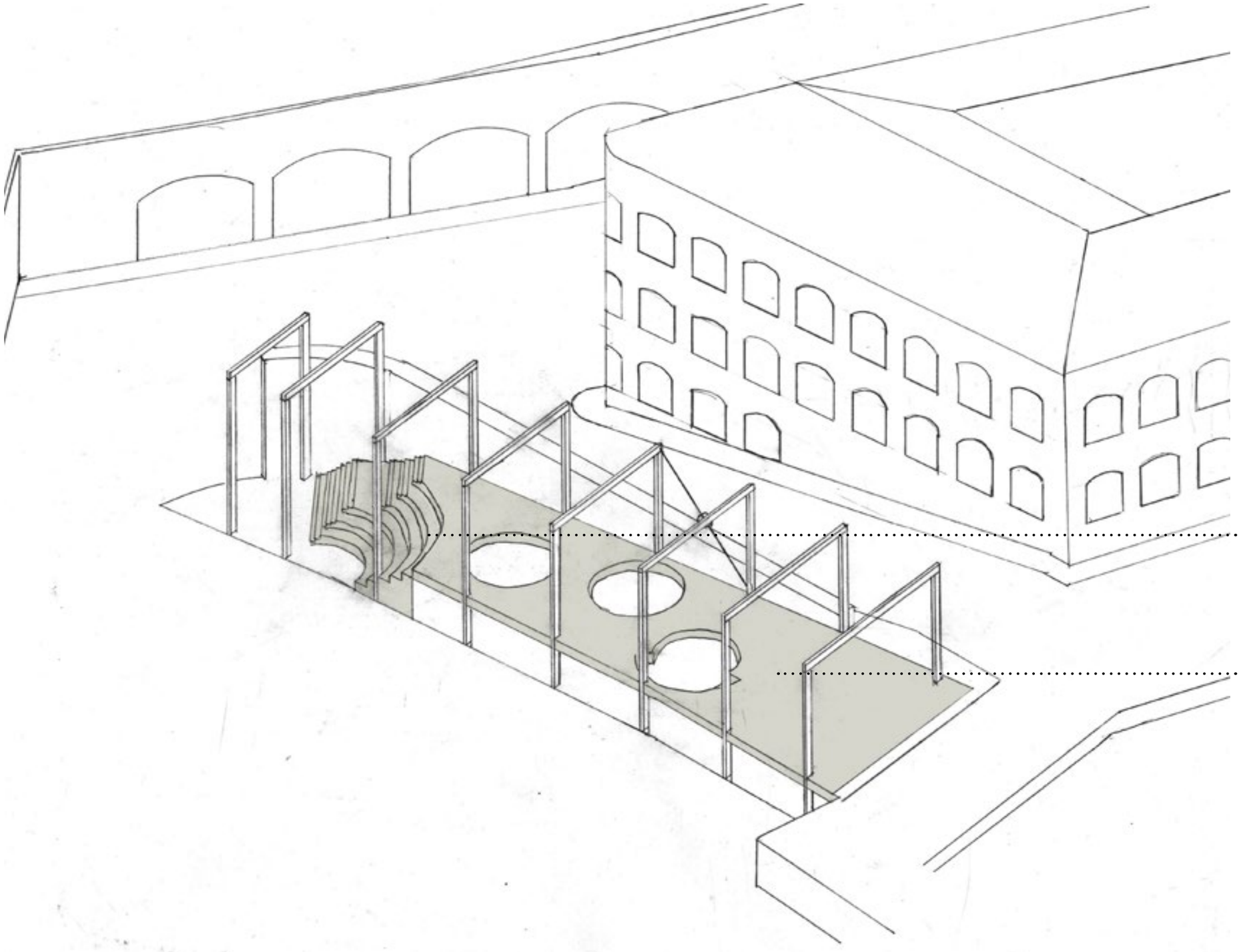
Assembly Sequence 06

(For clarity the installed polycarbonate envelope is not shown in the following illustrations)

Erection of the walls begins, and Stone Crete nterior finish is applied. Refer to detail axonometrics for layering.

Kingspan rigid floor insulation is placed.

Figure 43
Assembly Sequence



Assembly Sequence 07

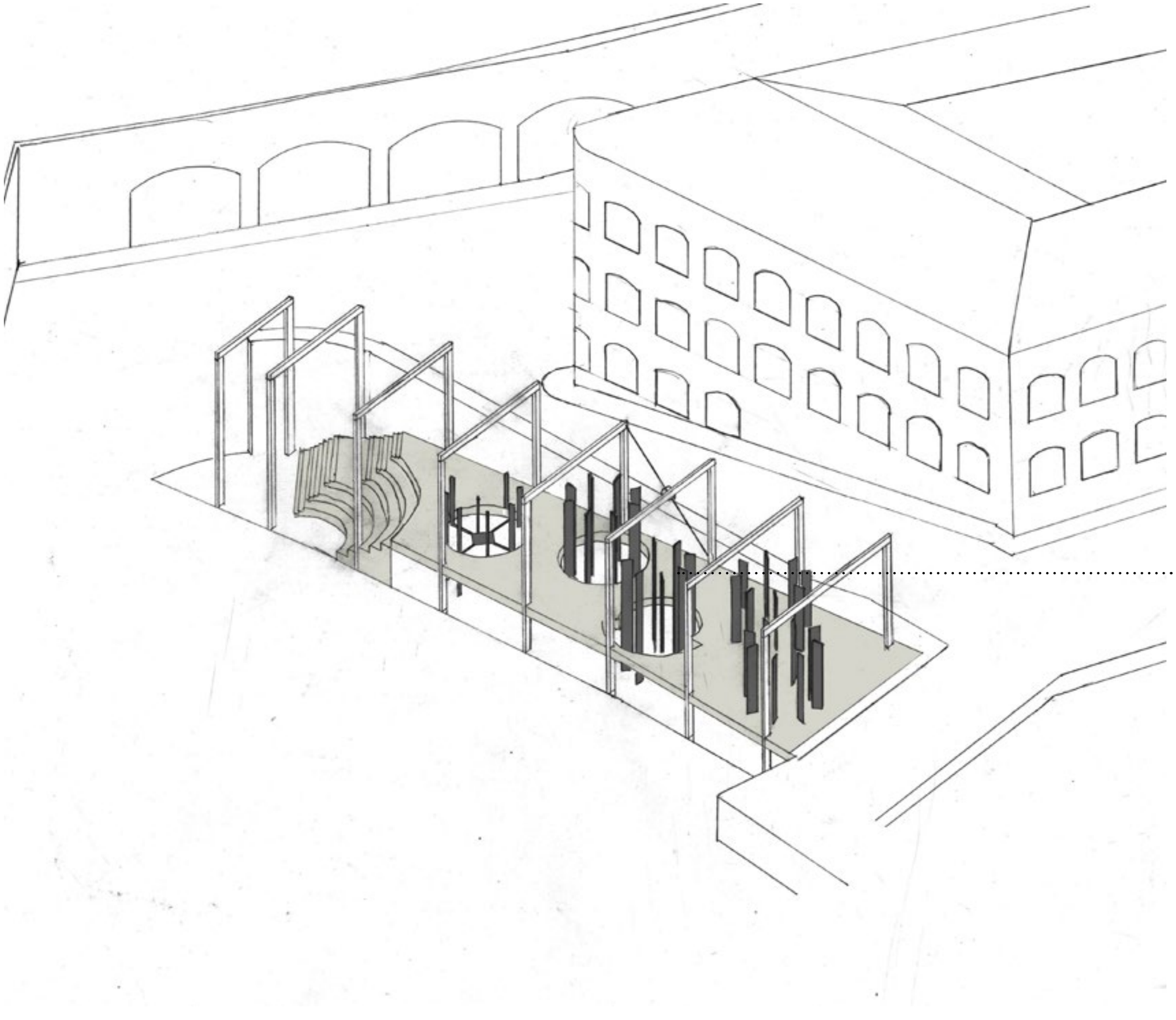
(For clarity the cross west cross bracing is not shown in the following illustrations)

Conversation space stairs are erected.

Early installation of stairs speeds up the rate of construction and reduces potential health and safety risks to workers.

Upper ground floor deck is constructed with spaces for the extrusion of the rotundas. Fencing around the holes will prevent fall hazards.

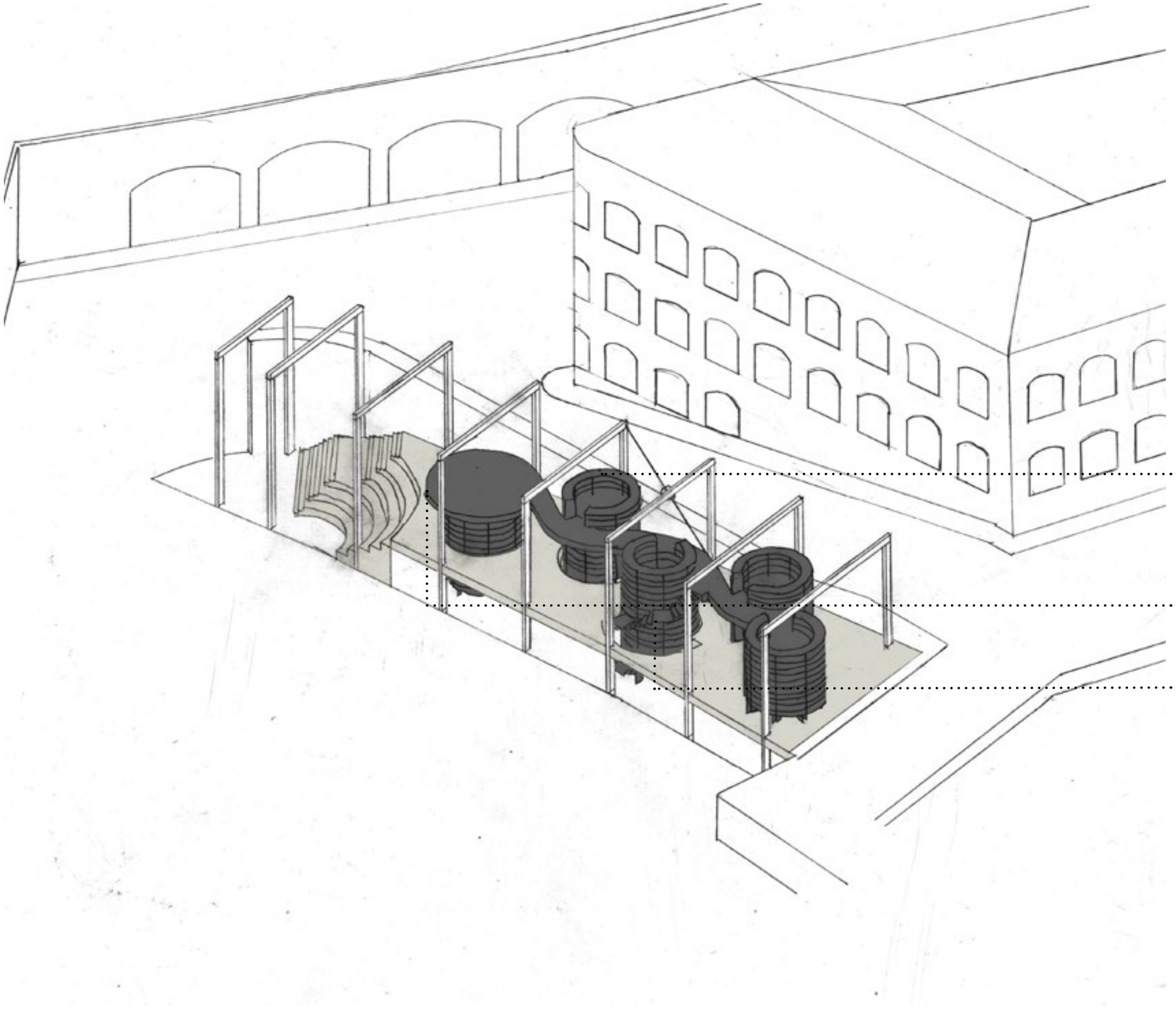
Figure 44
Assembly Sequence



Assembly Sequence 08

Rotunda columns and beams are raised. These are secured to the foundsation by anchor bolts.

Figure 45
Assembly Sequence



Assembly Sequence 09

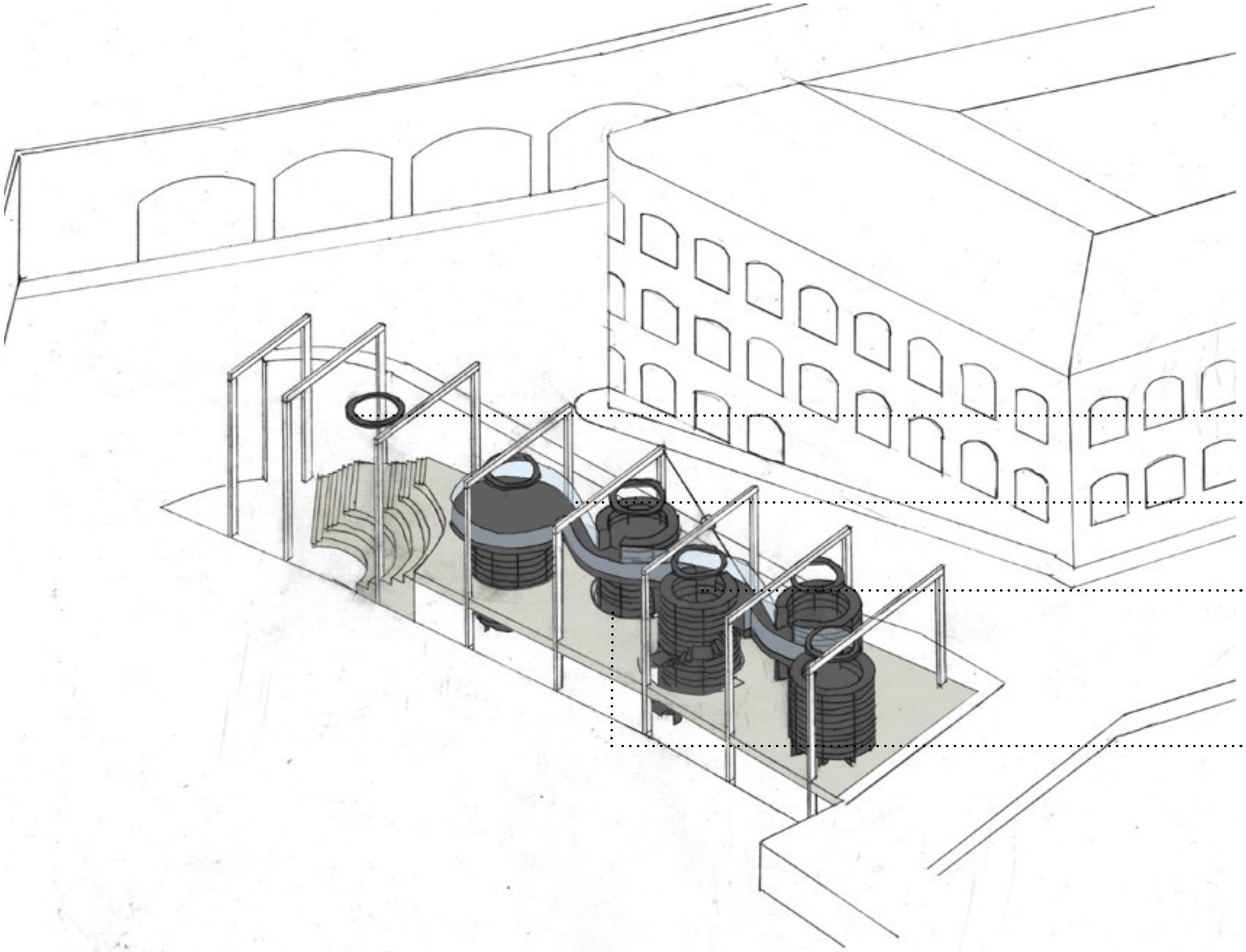
Rotunda shelves are installed which improve the lateral and torsional rigidity of the rotundas.

Any additional support is no longer necessary.

First floor deck, cantilever and linking bridges are constructed.

Rotunda stairs are inserted as soon as practical to increase construction speed and reduce health and safety risks.

Figure 46
Assembly Sequence



Assembly Sequence 10

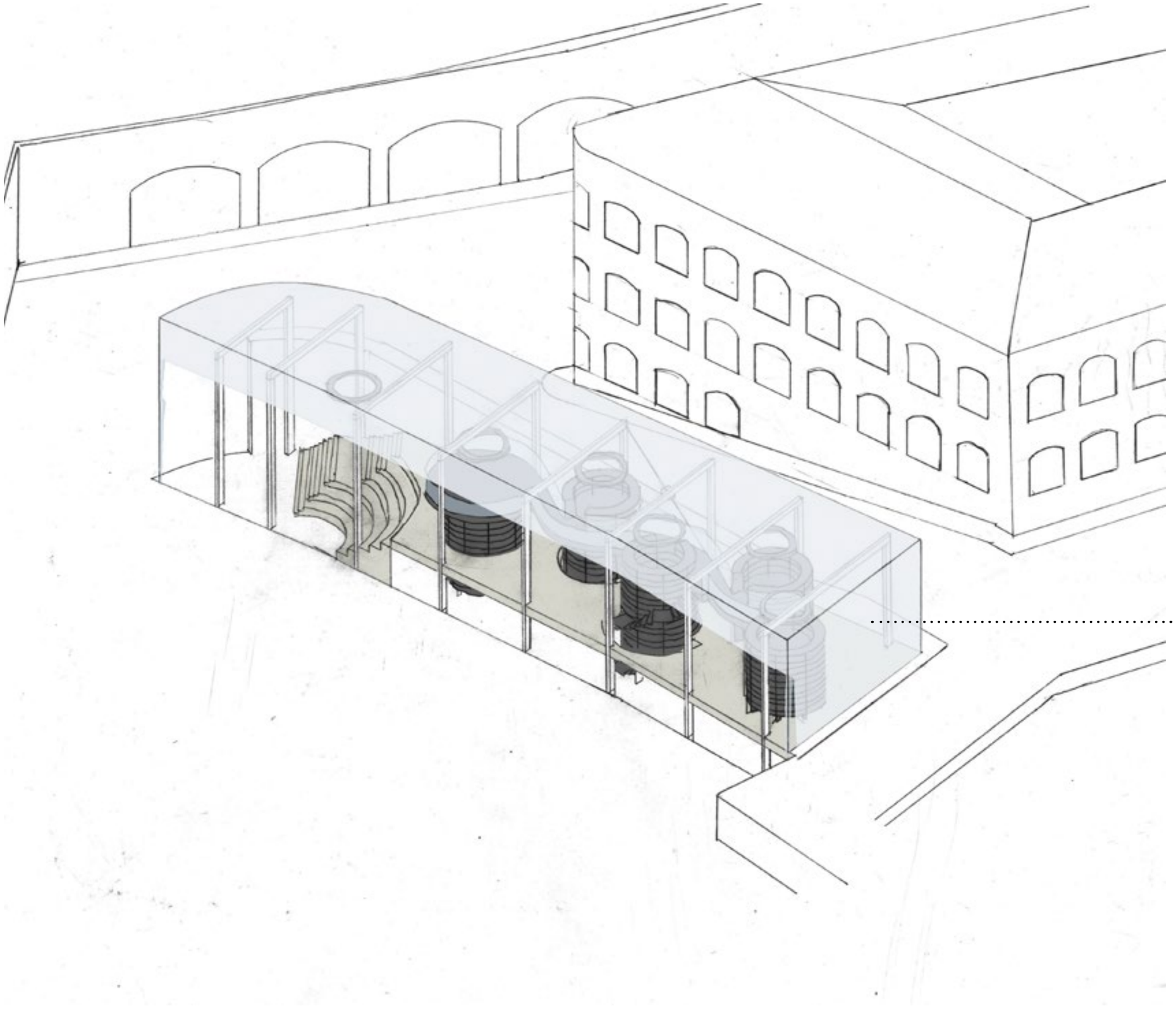
Ring lights are hung by tensioned wire between beams.

Saint Gobain planilux glazing inserted for balustrades to the links as soon as practical to reduce risks of falls.

Hydaulic lift installed within the vertical circulation rotunda.

Saint Gobain Lite-Floor glazing inserted around the extruded rotundas.

Figure 47
Assembly Sequence

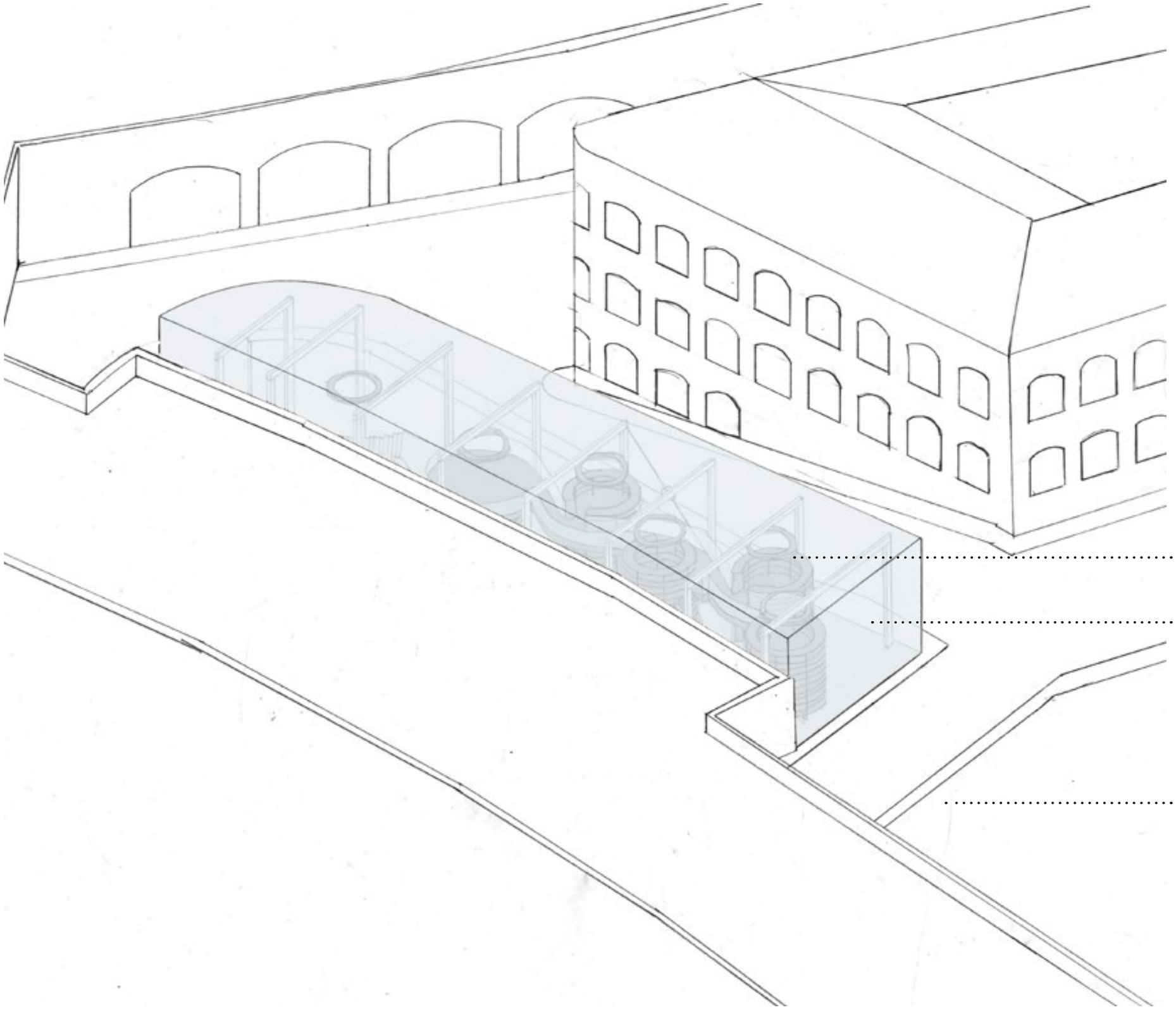


Assembly Sequence 11

The Rodeca polycarbonate envelope can now be completely sealed as all large components are contained within the scheme.

Now the scheme is fully sealed the internal fit out can be finalised.

Figure 48
Assembly Sequence



Assembly Sequence 12

Rain suppression mesh is applied to the polycarbonate roof.

Internal fit out continues.

All waste materials, temporary site accommodation and site fencing are removed from site.

Roads may now be reopened and returned to normal operation.

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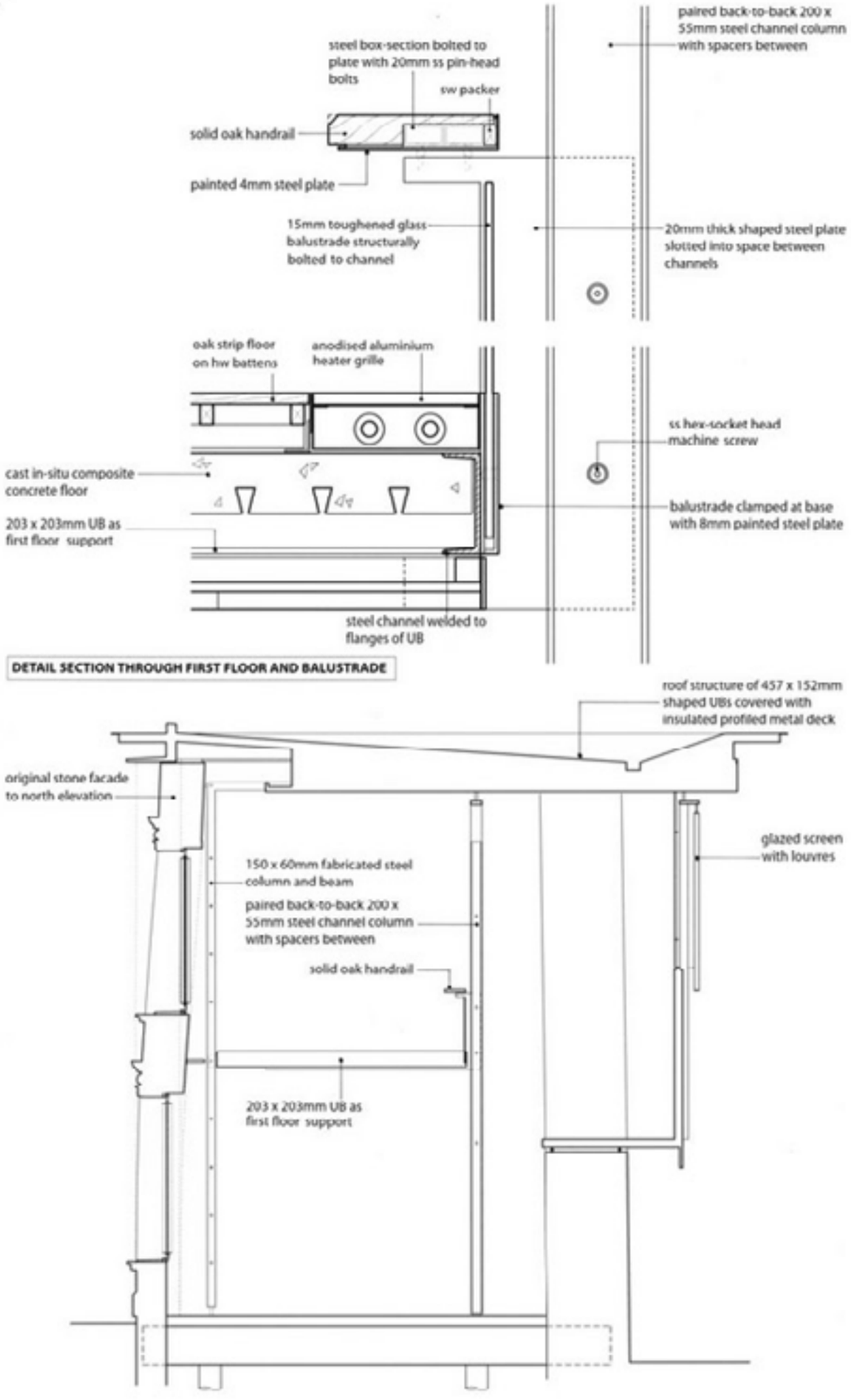
Appendix

Figure 49
Bobingen Factory,
Timber Construction
Manual



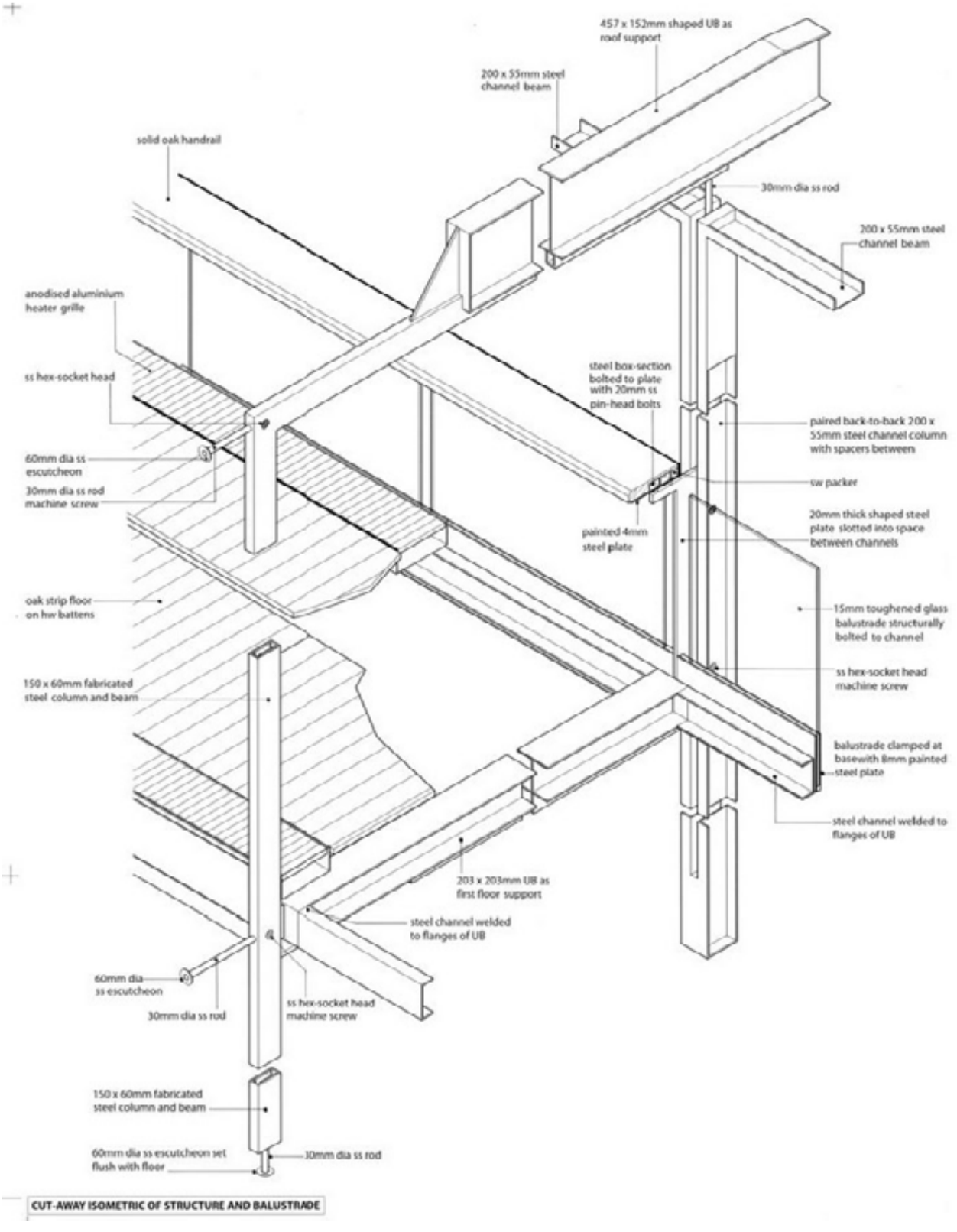


Figure 50
Bobingen Factory, Timber Construction Manual

14 · Factory building

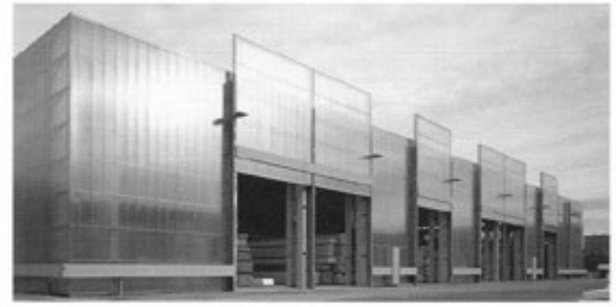
Bobingen, D; 1999

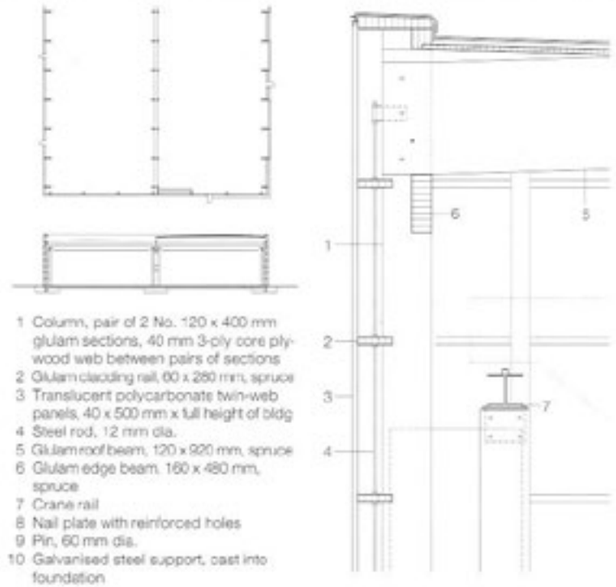
Architect: F. Nagler, Munich, D

Structural engineers: Merz Kaufmann und Partner, Dornbirn, A

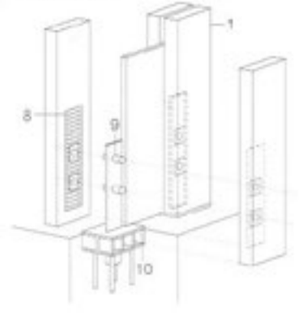
This two-bay production building with a travelling overhead crane in each bay measures 43 x 76 m on plan. The building derives its identity from its cladding of translucent polycarbonate twin-web panels. The four-part glued laminated timber columns at 6 m centres act like vertical Vierendeel girders. The comparatively large width of the columns and their restraint at the base via steel plates provides bracing in the transverse direction. The taller chords of the outer columns carry the roof construction, the lower inner chords the crane rails. Bracing in the longitudinal direction is provided by steel diagonals in the facades plus the crane rails, and roof decking made from 3-ply core plywood.

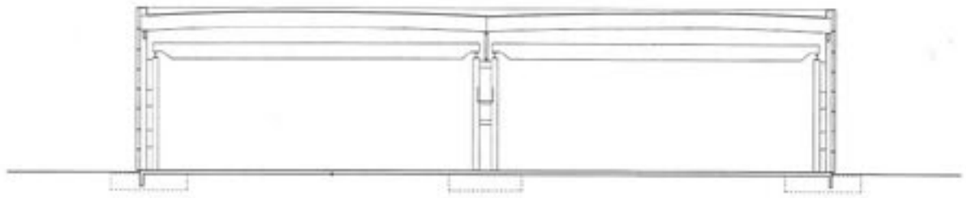
Detail 3/2001





1 Column, pair of 2 No. 120 x 400 mm glulam sections, 40 mm 3-ply core plywood web between pairs of sections
2 Glulam cladding rail, 60 x 280 mm, spruce
3 Translucent polycarbonate twin-web panels, 40 x 500 mm x full height of bldg
4 Steel rod, 12 mm dia.
5 Glulam roof beam, 120 x 920 mm, spruce
6 Glulam edge beam, 160 x 480 mm, spruce
7 Crane rail
8 Nail plate with reinforced holes
9 Pin, 60 mm dia.
10 Galvanised steel support, cast into foundation





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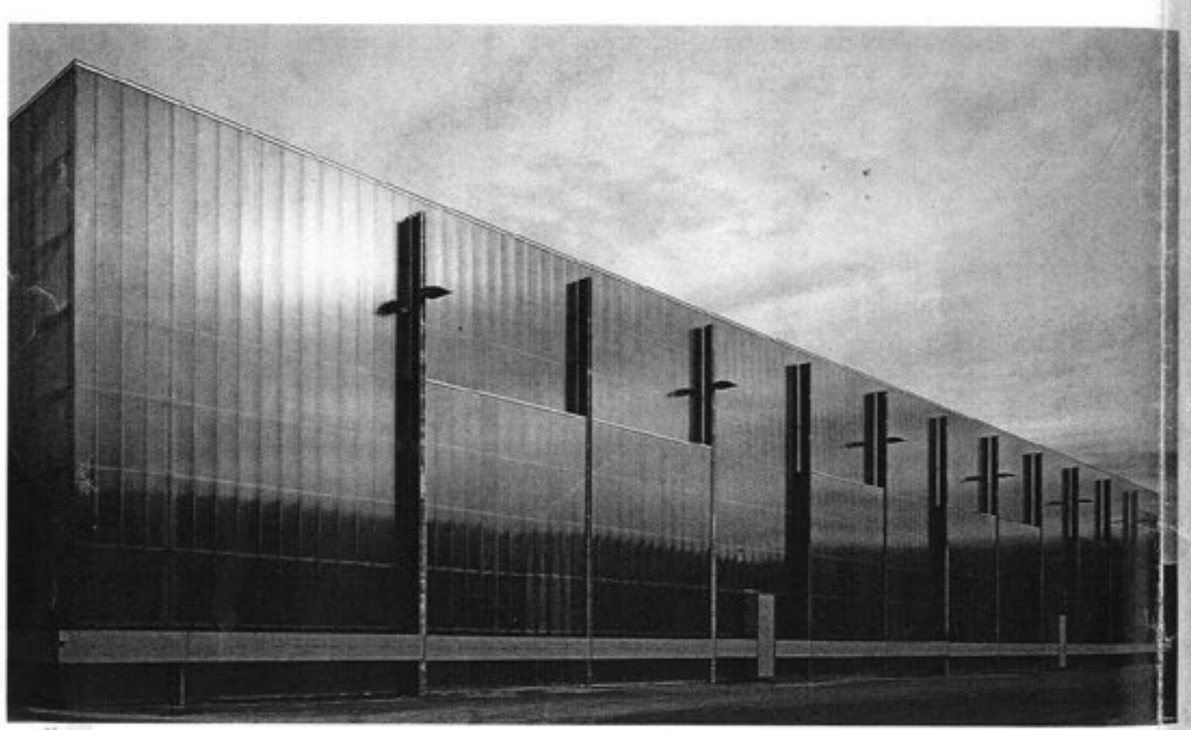
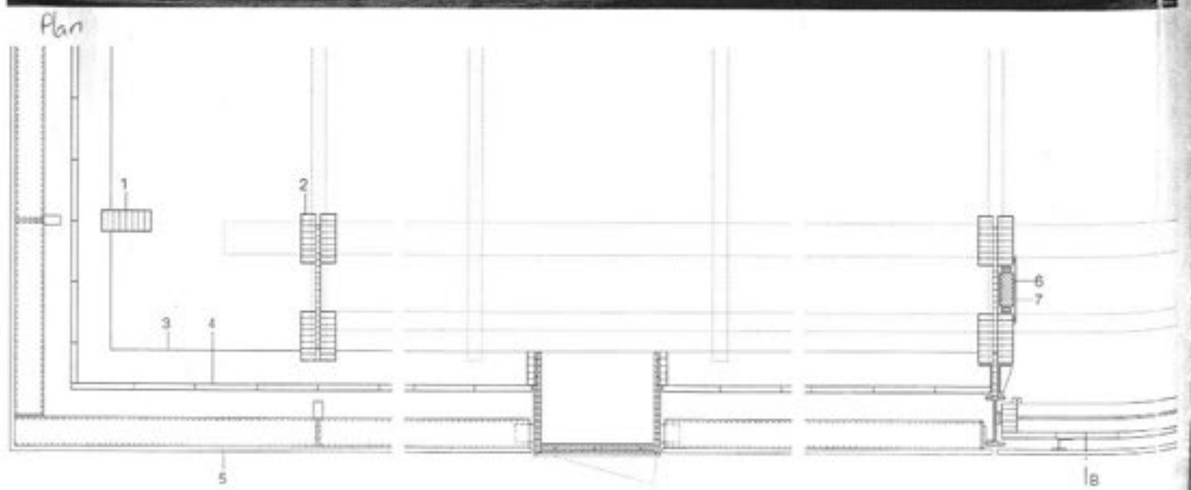


Querschnitt
Maßstab 1:400
Fassadenschnitte
horizontal und vertikal
Maßstab 1:50

1 Fassadenpfosten BSH 160/400 mm
2 Stütze BSH 2x 2x 120/400 mm
verbunden über Dreischichtplatten 40 mm
3 Riegel BSH Fichte 60/280 mm
4 Polycarbonat-Doppelstegplatten 40/500 mm,
gebäudehoch, U-Wert 1,65 W/m²K
5 Prallschutz Schaltafel
6 Gegengewicht
7 Polycarbonat-Massivplatte 8 mm
als Quetschschutz
8 Dachaufbau:
EPDM-Kautschukbahn 1,3 mm
Dämmung Mineralwolle 50 mm
Schalung Holzdielen 35 mm, in Teilbereichen
Dreischichtplatten 40 mm (Windverband)
9 Dachbinder BSH Fichte 120/920 mm
10 Längsträger BSH Fichte 160/480 mm
11 Stahlstab Ø 12 mm
12 Kranbahnschiene
13 Bodenplatte Stahlfaserbeton 200 mm, geglättet
14 Strahler
15 Motor Hubtor
16 Torwelle
17 Umlenkrolle

Plan



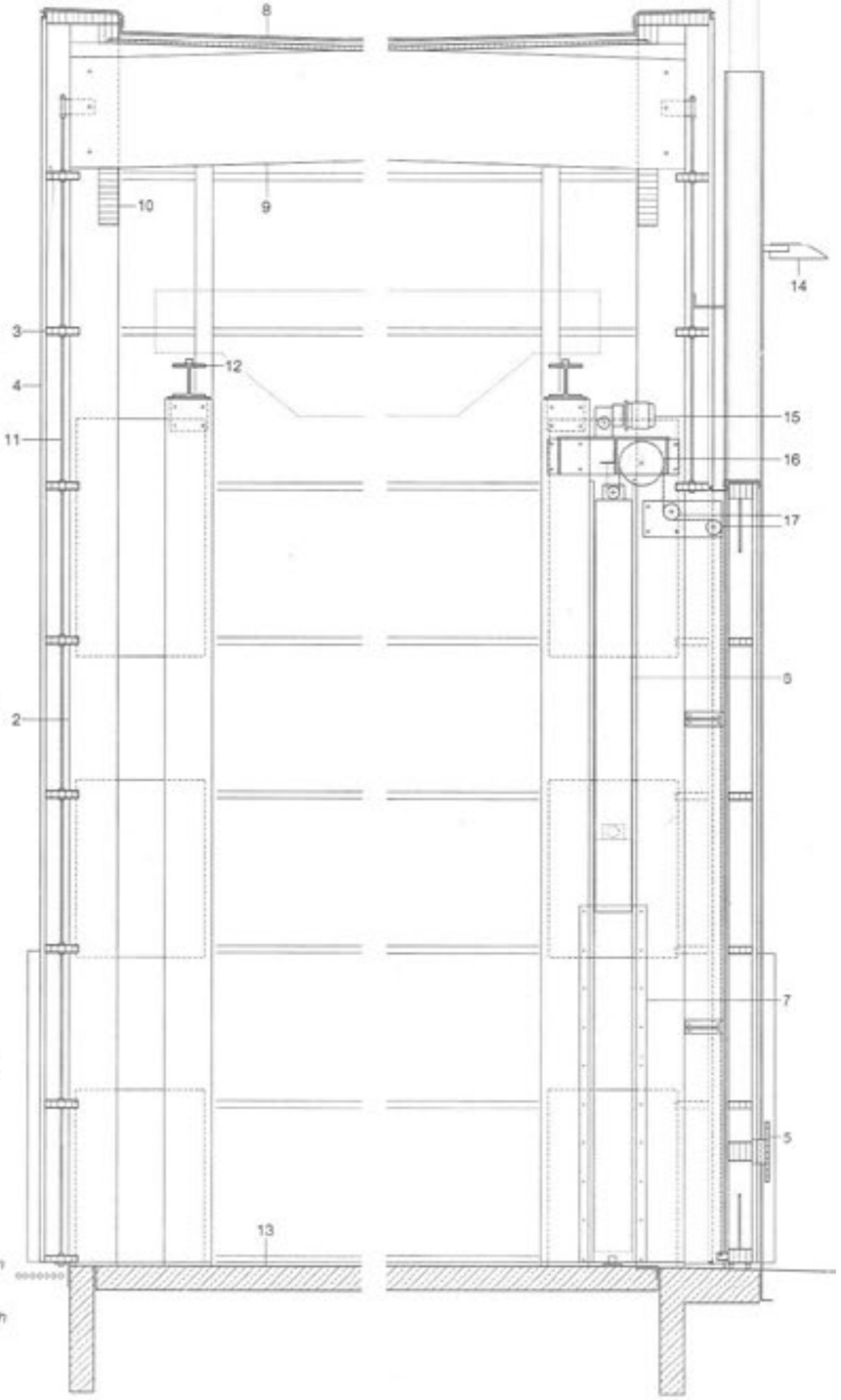
Cross-section
scale 1:400
Horizontal and vertical
sections through facade
scale 1:50

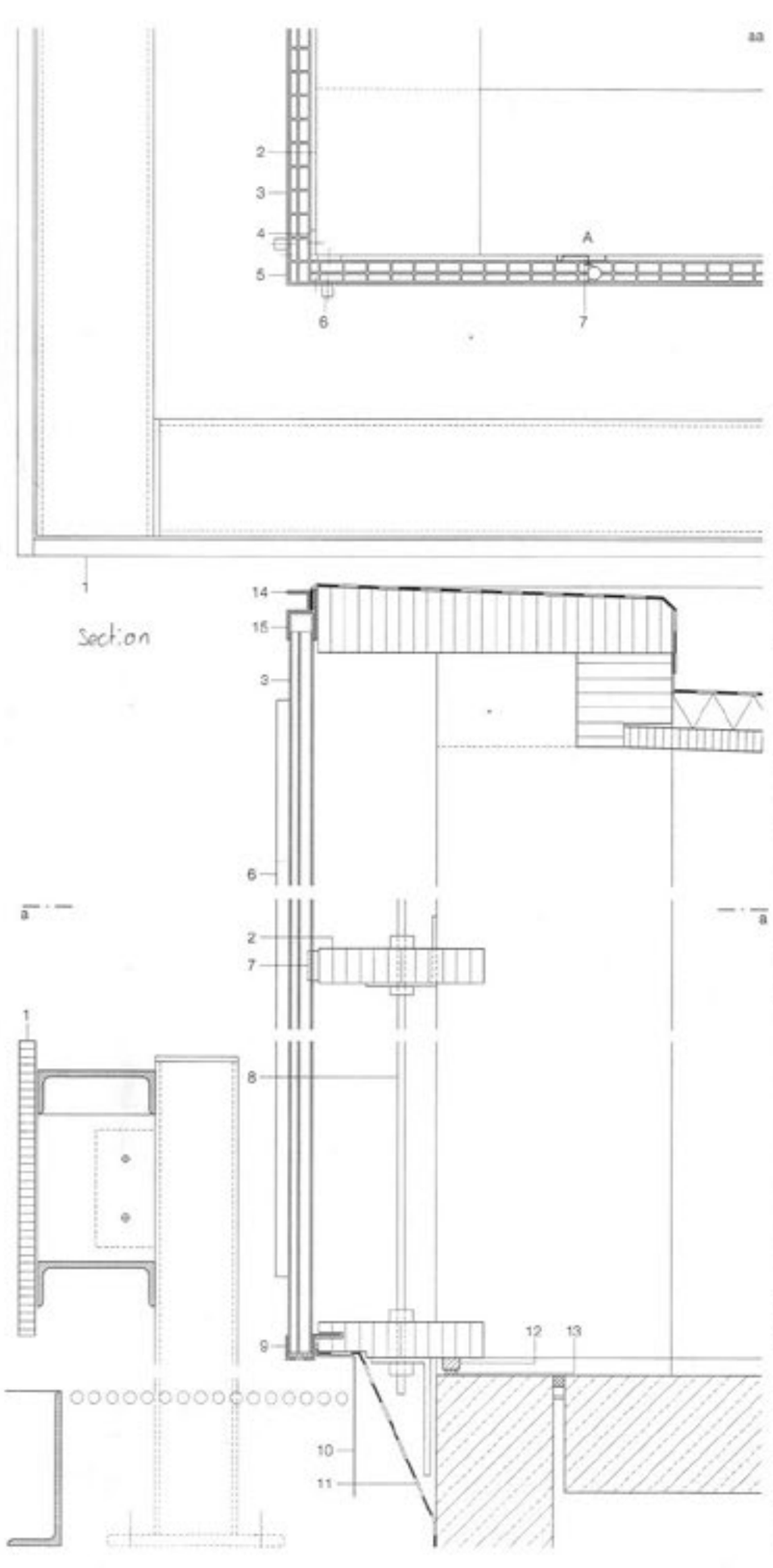
1 160/400 mm laminated timber facade post
2 trussed column: 2x 2x 120/400 mm lam. timber
members connected by 40 mm three-layer lam.
sheet
3 60/280 mm laminated softwood rail
4 40 mm polycarbonate cellular slabs 500 mm wide
(full height of building); U-value: 1.65 W/m²K
5 crash barrier: shuttering panel
6 counterweight
7 8 mm solid polycarbonate slab as safety shield
8 roof construction:
1.3 mm EPDM-rubber sheeting
50 mm mineral-wool insulation
35 mm timber boarding/40 mm three-layer
laminate as wind bracing in certain areas
9 120/920 mm laminated softwood roof beam
10 160/480 mm laminated softwood longitudinal beam
11 Ø 12 mm steel rod
12 gantry rail
13 200 mm steel-fibre-concrete slab with smooth finish
14 spotlight
15 motor for raising gate
16 gate hoisting shaft
17 pulley

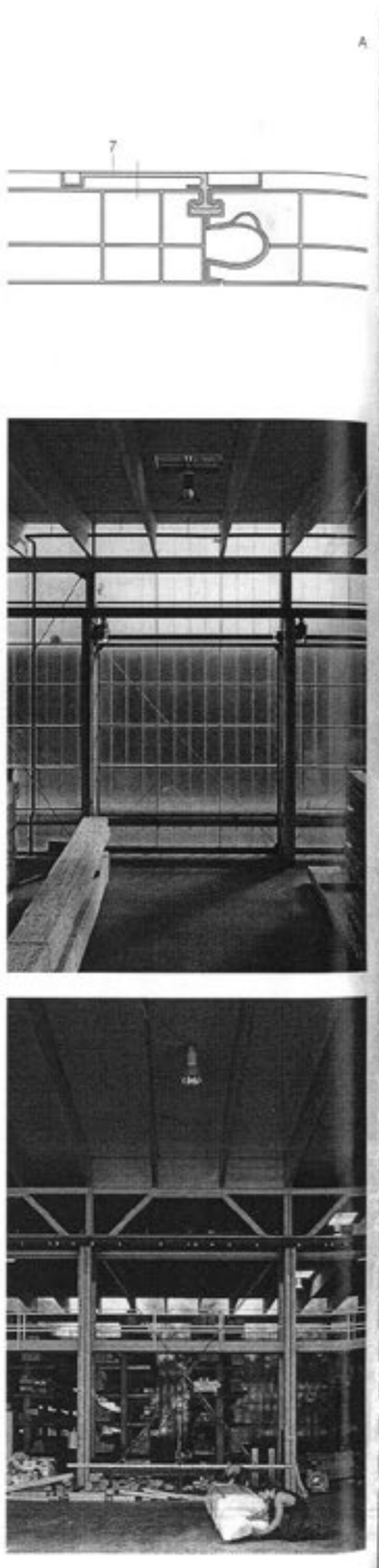
A

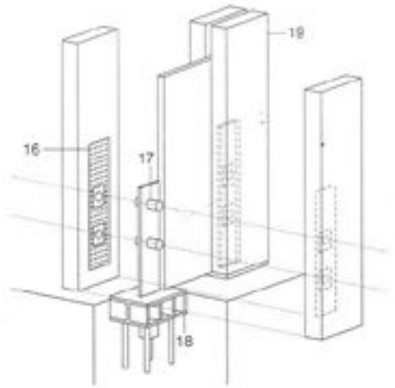
B

Section









Fassadendetails
Horizontal- und Vertikalschnitt Maßstab 1:10
Stoß der Polycarbonat-Elemente Maßstab 1:2,5
Isometrie Stützenfußpunkt

1 Prallschutz: Schaltafel an verzinkten Stahlprofilen befestigt
2 Riegel BSH Fichte 60/280 mm
3 Polycarbonat-Doppelstegplatten 40/500 mm, gebäudehoch, U-Wert 1,65 W/m²K
4 Beilagscheibe
5 Polycarbonat-Winkel 80/80 mm an 3 genietet
6 Polycarbonat-Massivprofil 18/18 mm, vernietet Stöße von 7 und 8 versetzt
7 Soganker Aluminium pressblank
8 Stahlstab Ø 12 mm
9 Sockelprofil Aluminium pressblank mit Bohrung und eingelegtem Fliegengitter
10 Sockelblech Aluminium gekantet 2 mm
11 Anschlussfolie an Bitumenschweißbahn
12 Abschlussleiste Lärche 20/30 mm, verschraubt
13 Kompriband
14 Aluminiumprofil L 30/50/5 mm
15 Aluminiumblech gekantet, pressblank 2 mm
16 Nagelplatte mit Lochverstärkung
17 Bolzen Ø 60 mm
18 Einbauteil im Fundament verankert
19 Stütze BSH 2x 2x 120/400 mm verbunden über Dreischichtplatten 40 mm

Facade details
Horizontal and vertical sections scale 1:10
Abutment of polycarbonate elements scale 1:2.5
Isometric of column foot

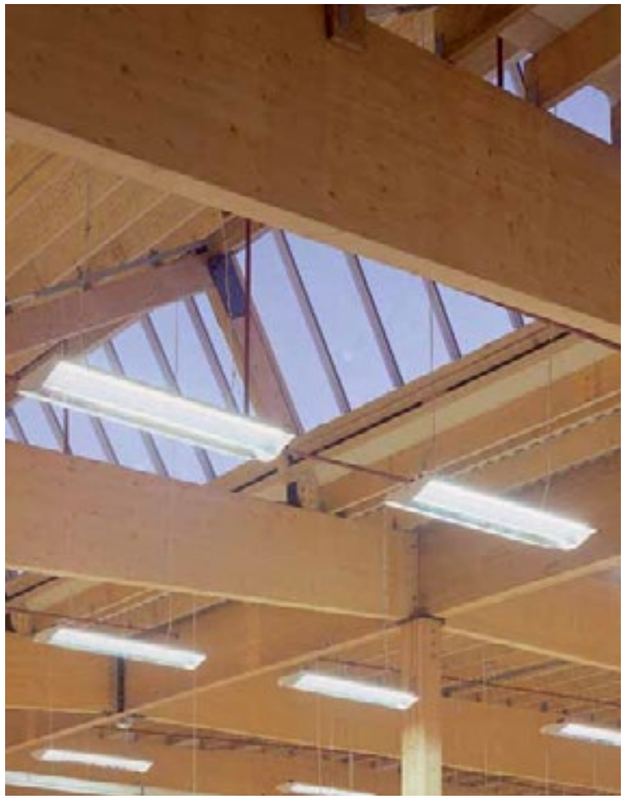
1 crash barrier: shuttering panel fixed to galvanized steel sections
2 60/280 mm laminated softwood rail
3 40 mm polycarbonate hollow cellular slab 500 mm wide and full height of building;
→ *U-Value: 1.65 W/m²K*
4 washer
5 80/80 mm polycarbonate angle riveted to 3
6 18/18 mm solid polycarbonate member, riveted on, with staggered abutments to 7 and 8
7 smooth-pressed aluminium fixing clip
8 Ø 12 mm steel rod
9 smooth-pressed aluminium bottom strip with boring and fly-screen insert
10 2 mm sheet aluminium plinth, bent to shape
11 waterproof sheet connection to bituminous sealing layer
12 20/30 mm larch closing strip, screw fixed
13 compressed rubber strip
14 30/50/5 mm aluminium angle
15 2 mm smooth-pressed aluminium sheet bent to shape
16 nailed connector plate with reinforced openings
17 Ø 60 mm bolt
18 anchor element cast into foundations
19 trussed column: 2x 2x 120/400 mm lam. timber members connected by 40 mm three-layer laminated sheet

METSÄ WOOD GLULAM INDIVIDUALLY DESIGNED WOOD SOLUTIONS

Metsä Wood glulam is made of sawn structural timber. The lamellas are cut along the grain, which are then finger-jointed and glued together to the desired size. Glulam is an ideal material for the load-bearing structures of wooden buildings where long spans are desired.

Metsä Wood glulam is made of Nordic premium timber. The slowly growing pine and spruce grow in the boreal forest zone where the soil and climate conditions mean that the forests grow slowly. The wood material becomes dense-fibred, small branched, solid and durable.

Metsä Wood glulam is a response to the builder's needs. Shape, dimensions and finishing can be freely chosen. The glue is weather-resistant.



Advantages for the builder

DESIGN FLEXIBILITY
- Large range of standard dimensions
- Manufactured to specific dimensions
- Cross sections and lengths can be optimized
- Beams can be straight, cambered or curved
- Easy to combine with other materials

STRONG AND FIRE RESISTANT
- Excellent strength properties based on dense-fibred Nordic premium timber
- Low weight compared to its strength
- R30 fire resistance class
- In cases of fire, glulam retains the structure's stability longer than other materials due to slow charring

VISUALLY ATTRACTIVE
- Visual and aesthetic demands concerning wood and surface treatment are easy to meet

EASY TO MACHINE AND ASSEMBLE
- All machining can be done at the factory
- Quick erection even in all weather conditions
- On-site machining can be done with normal hand tools

ECOLOGICALLY SUSTAINABLE
- Wood is the only 100% renewable raw material
- Wood supply and the manufacturing process have certified chains-of-custody according to the PEFC forest certification system
- Manufacturing wood products is less energy-consuming than for other building materials
- Bioenergy, produced by burning by-products such as woodchips and sawdust, is mainly used in the manufacturing process
- Wood acts as a CO_2 storage and over a longer time span does not emit any net CO_2

VISUALLY ATTRACTIVE STANDARD BEAMS

Nordic premium spruce is an excellent raw material due to favorable growing conditions in the dense-fibred Finnish forests. As a result, Metsä Wood glulam has excellent strength properties and outstanding visual appearance.

STOCK BEAMS: DIMENSIONS
90 x 225/270/315/360/405/450 mm
115 x 225/270/315/360/405/450 mm
140 x 225/270/315/360/405/450 mm
Lengths: 12/13.5 metres

DUOLAM AND TRIOLAM FOR ROOF STRUCTURES

Metsä Wood glulam can also be delivered as Duolam (two lamellas) or Triolam (three lamellas) for roof structures.

DUOLAM: DIMENSIONS
90 x 165/190/215 mm
115 x 215/240 mm
Lengths: 12/13.5 metres
TRIOLAM: DIMENSIONS
135 x 135/165/190/215/240 mm
180 x 180 mm
200 x 200 mm (4-ply)
Lengths: 12/13.5 metres

CUT-TO-SIZE SERVICE

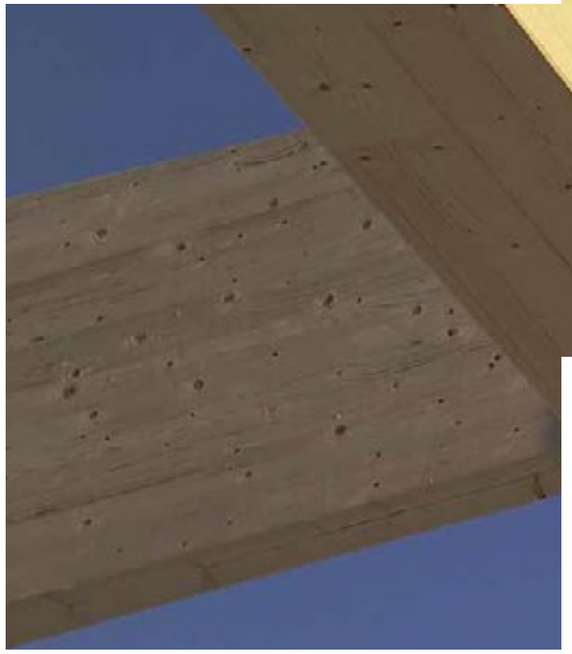
The mill's precision cut-to-size service makes on-site construction easier and quicker, and creates no on-site waste.

EFFICIENT LOGISTICS

Metsä Wood provides all its customers with the most suitable, precisely tailored and optimally cost-efficient delivery arrangement for their orders. Cooperation agreements between Metsä Wood and the best transport companies guarantee dependable and reliable services at all times.

GLULAM AT A GLANCE

Metsä Wood glulam is manufactured according to the demands of strength class GL 32c. The strength class of pine glulam is GL 28c. Other strength classes are available on request.



Dimensional tolerances at a moisture content of 12%

DIMENSIONS	RANGE	TOLERANCE
Width	All	±2 mm
Depth	h ≤ 400 mm h > 400 mm	+4 and -2 mm +1.0% and -0.5%
Length	l ≤ 2 m 2 < l ≤ 20 m l > 20 m	±2mm ±0.1% ±20 mm

Characteristic values to be used in design according to Eurocode 5

PROPERTY	STRENGTH CLASS				
	HOMOGENOUS			COMBINED	
	GL 24H	GL 28H	GL 32H	GL 28C	GL 32C
Bending strength (N/mm²)	24	28	32	28	32
Tension strength (N/mm²) - parallel to grain - perpendicular to grain	16.5 0.40	19.5 0.45	22.5 0.50	16.5 0.40	19.5 0.45
Compression strength (N/mm²) - parallel to grain - perpendicular to grain	24.0 2.7	26.5 3.0	29.0 3.3	24.0 2.7	26.5 3.0
Shear strength (N/mm²)	2.7	3.2	3.8	2.7	3.2
Modulus of elasticity (N/mm²) - parallel to grain (mean) - parallel to grain (5 % fractile) - perpendicular to grain (mean)	11600 9400 390	12600 10200 420	13700 11100 460	12600 10200 390	13700 11100 420
Shear modulus (N/mm²)	720	780	850	720	780
Density (kg/m³)	380	410	430	380	410

Source: VTT certificate No 167/02; revised 19 February, 2007

Your specialist for translucent building elements

rodeca® Translucent Building Elements

Product Range

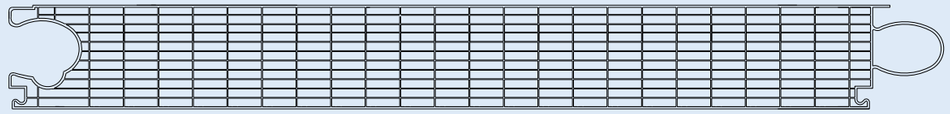
Translucent Building Elements

Standard and Vision-Line

Stand: 11/11

Standard – crystal and opal antiblind

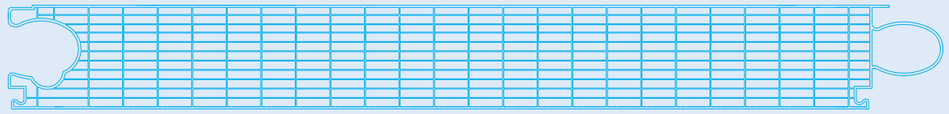
PC 2560-12 ISOCLEAR Up-Value from 0.71 to 0.77 W/m²K



Building width 500 mm + 1 /- 1 %

Design Series - COLOR

PC 2560-12 ISOCLEAR Up-Value from 0.71 to 0.77 W/m²K



Minimum order quantity of 300 m² necessary.

Building width 500 mm + 1 /- 1 %

Next to the fire certification according to DIN 4102, our products are certified according to European norm and other national norms. Additionally to the demands of building approvals and fire certificates our products fulfill the demands of joint tightness and are resistently tested for ball throwing, for hail and pucks according to RODECA warranty statements and supplementary certification reports.
We give a ten year product warranty.

Further technical information can be taken out of the single product data sheets.

Strong Tie Anchor Bolts & Beam Hangers

Glulam Connectors
Anchor Bolts & Concrete Resins

Superplus/Liebig Anchor/BOAX/AT-HP/LMAS

Shown below are the Heavy Duty Anchor Bolts and Concrete Resin products which are suitable for use in Glulam Timber applications:

Super Plus BLS
Zinc Coated Under-cut Anchor

Super Plus BLS
Stainless Steel Under-cut Anchor

AS Anchor
Stainless Steel Anchor with hex head screw and domed washer

AB Anchor
Stainless Steel Anchor with hex nut, domed washer and threaded stud.

BOAX
Throughbolt with hex nut and washer.

LMAS
Threaded Stud with hex nut and washer.

Chemical Anchors
A range of styrene free and pure epoxy resins.

Range	Material	Approval	Thread Size	Drill Hole Ø (mm)	Permissable Load Range	
					Tension	Shear
Superplus BLS	Grade 8.8 Carbon Steel Zinc Plated	ETA-01/0011 (Option 1)	M18	14	6.1 -10.8	6.1 - 23.7
			M12	20	17.2 - 28.4	34.4 - 40.0
			M16	25	44.1 - 53.0	67.4
	A4-80 Stainless Steel	ETA-05/0013 (Option 1)	M8	14	6..1 - 13.1	6.1 - 24.0
			M12	20	17.2 - 30.1	34.4 - 48.5
			M16	25	44.1 - 56.1	88.2 - 90.7
Liebig Anchor	Grade 8.8 Carbon Steel Zinc Plated	ETA-06/0123 (Option 1)	M10	15	9.5 - 14.8	22.3
			M12	20	17.1 - 26.6	34.3
			M16	25	24.0 - 37.2	48.0 - 54.9
	A4-80 Stainless Steel (Type AB) A4-70 Stainless Steel (Type AS)		M10	15	7.1 - 11.0	7.1 - 11.0
			M12	20	10.7 - 15.8	24.6 - 28.9
			M16	25	16.0 - 23.7	40.0 - 49.5
BOAX	Carbon Steel Zinc Plated	ETA-08/0276 (Option 1)	M10	10	6.3 - 8.1	8.7
			M12	12	7.9 - 10.1	11.0
			M16	16	16.7 - 21.4	21.0
	A4 Stainless Steel	ETA-08/0276 (Option 1)	M10	10	6.3 - 8.1	8.7
			M12	12	7.9 - 10.1	11.0
			M16	16	16.7 - 21.4	21.0
AT-HP/LMAS	Grade 5.8 Carbon Steel Zinc Plated	ETA-09/013 (Option 7)	M12	14	24.8 - 29.3	23.4
			M16	18	26.9 - 31.8	36.6
			M20	24	39.7 - 46.8	52.6
	A4-70 Stainless Steel	ETA Pending	M12	14	24.8	25.2
			M16	18	26.9	39.4
			M20	24	39.7	56.8

1. Loads are based on Non-Cracked concrete (C20/25 - C50/60).
2. For further information please refer to Simpson Strong-Tie® Liebig Technical Manual.
3. “Re-bar” drill bits are available on request.
4. Design calculations for all anchors are available on request.

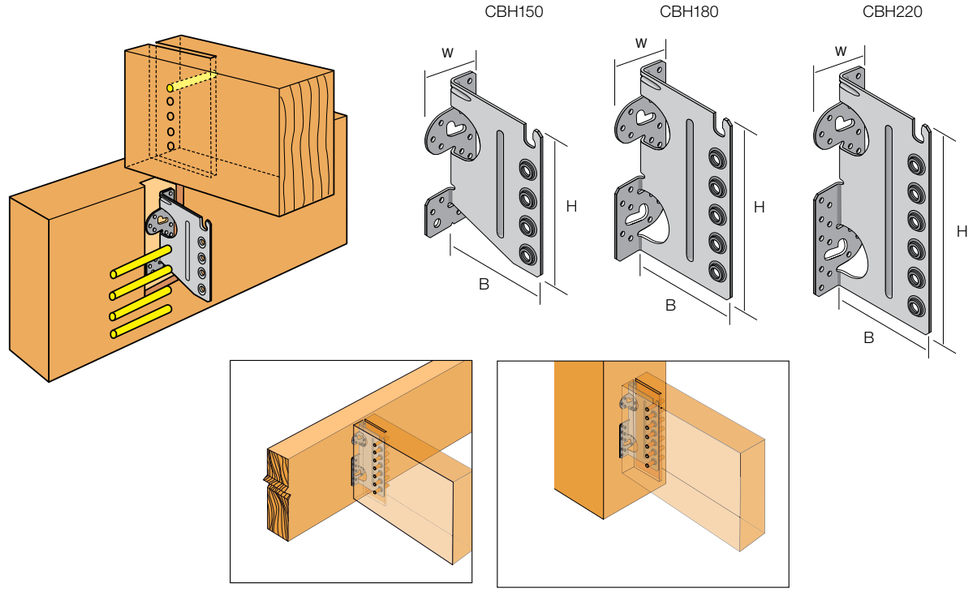
Glulam Connectors
Concealed Beam Connectors

CBH

The CBH hanger is a development of the TU range. It allows for concealed timber to timber connections and can be face fixed or pocketed on to the header timber.

Material: 2.5mm Pre-Galvanised Steel

Order nails and dowels separately.



Model No.	Minimum Joist Height	Connector Dimensions			Fasteners				Characteristic Capacity (kN)					
									Dowel Embedment Length (mm)					
		W	H	B	Header Nails		Joist Dowels		60	80	100	120	140	160
					Qty	Type	Qty	Ø						
Standard Installation (Slope = 0°)														
CBH150	190	60	150	113.5	14	4.0 X 60	5	10	17.96	18.63	20.65	22.40	24.00	24.00
CBH180	220	60	180	113.5	16	4.0 X 60	6	10	24.98	26.45	29.54	32.07	32.63	32.63
CBH220	250	60	220	113.5	22	4.0 X 60	7	10	32.61	34.24	37.90	41.11	42.83	42.83
Slope = 15°														
CBH150	190	60	150	113.5	14	4.0 X 60	5	10	17.31	17.86	19.63	21.22	22.90	23.26
CBH180	220	60	180	113.5	16	4.0 X 60	6	10	23.97	25.22	28.03	30.47	31.76	31.76
CBH220	250	60	220	113.5	22	4.0 X 60	7	10	31.36	32.71	35.95	38.91	41.58	41.58
Slope = 30°														
CBH150	190	60	150	113.5	14	4.0 X 60	5	10	16.73	17.16	18.68	20.08	21.59	22.49
CBH180	220	60	180	113.5	16	4.0 X 60	6	10	23.08	24.12	26.58	28.82	30.81	30.81
CBH220	250	60	220	113.5	22	4.0 X 60	7	10	30.38	31.49	34.30	36.96	39.72	40.37
Slope = 45°														
CBH150	190	60	510	113.5	14	4.0 X 60	5	10	16.35	16.71	18.03	19.28	20.64	21.91
CBH180	220	60	180	113.5	16	4.0 X 60	6	10	22.50	23.39	25.59	27.64	29.74	30.07
CBH220	250	60	22	113.5	22	4.0 X 60	7	10	29.84	30.80	33.32	35.73	38.28	39.52

1. 4.0 x 60 refers to CNA 4,0 x 60 Annular Ring Shank Nail

Glulam Connectors
Concealed Beam Connectors

SIMPSON Strong-Tie®

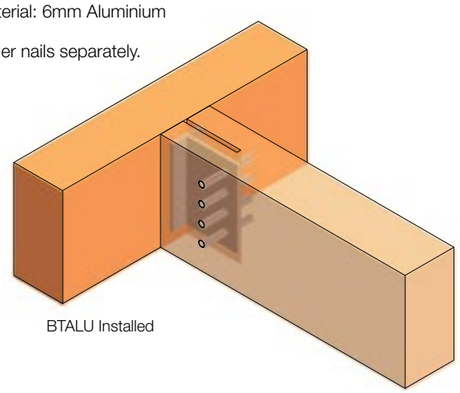
BTALU Concealed Beam Hanger

The BTALU concealed hanger is one solution to connecting timber members together without seeing the connector.

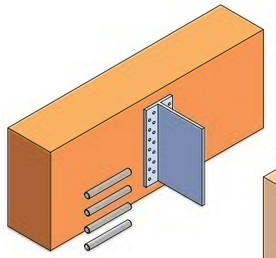
It is designed to be fixed to the header timber and then fully inserted into a slot in the in-coming beam, and held in place with dowels. Holes are drilled through the timber and fin of the BTALU, allowing accurate alignment. This method provides an aesthectically pleasing connection for feature beams.

Material: 6mm Aluminium

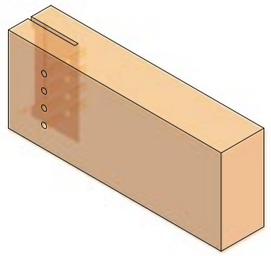
Order nails separately.

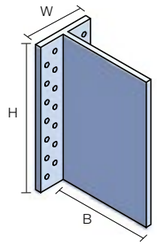


BTALU Installed



BTALU Installation





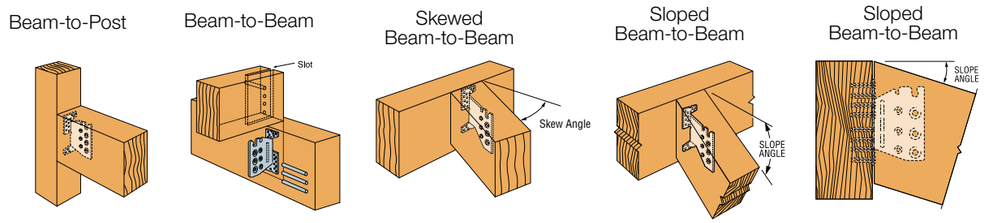
See opposite for dowel hole positions.

Model No.	Minimum Joist Height	Connector Dimensions			Fasteners				Characteristic Capacity (kN)					
									Dowel Embedment Length (mm)					
		W	H	B	Header Nail		Joist Dowels		60	80	100	120	140	160
					Qty	Type	Qty	Ø						
Standard Installation (Slope = 0° and Skew = 0°)														
BTALU90-B	142	62	86	103	16	4.0 x 60	4	8	10.30	11.30	12.4	13.20	13.20	13.20
BTALU120-B	172	62	116	103	24	4.0 x 60	3	12	18.10	18.70	19.80	21.20	22.70	24.30
BTALU160-B	212	62	156	103	32	4.0 x 60	4	12	29.80	30.70	23.30	34.40	36.80	39.30
BTALU200-B	252	62	196	103	40	4.0 x 60	5	12	42.70	43.80	46.00	48.90	52.20	55.60
BTALU240-B	292	62	236	103	48	4.0 x 60	6	12	56.00	57.30	60.20	63.90	68.20	72.60
Slope = 15°														
BTALU90-B	142	62	86	103	16	4.0 x 60	4	8	10.30	11.30	12.40	13.20	13.20	13.20
BTALU120-B	172	62	116	103	24	4.0 x 60	3	12	17.50	18.00	18.90	20.10	21.40	22.90
BTALU160-B	212	62	156	103	32	4.0 x 60	4	12	28.90	29.50	30.90	32.70	34.70	36.90
BTALU200-B	252	62	196	103	40	4.0 x 60	5	12	41.50	42.30	44.10	46.60	49.40	52.40
BTALU240-B	292	62	236	103	48	4.0 x 60	6	12	54.00	55.70	58.10	61.20	64.90	68.80
Slope = 30°														
BTALU90-B	142	62	86	103	16	4.0 x 60	4	8	10.30	11.30	12.40	13.20	13.20	13.20
BTALU120-B	172	62	116	103	24	4.0 x 60	3	12	17.00	17.30	18.10	19.10	20.30	21.50
BTALU160-B	212	62	156	103	32	4.0 x 60	4	12	28.00	28.70	29.90	31.40	33.20	35.10
BTALU200-B	252	62	196	103	40	4.0 x 60	5	12	40.30	41.50	43.10	45.20	47.60	50.30
BTALU240-B	292	62	236	103	48	4.0 x 60	6	12	53.40	55.20	57.20	60.00	63.20	66.60
Slope = 45°														
BTALU90-B	142	62	86	103	16	4.0 x 60	4	8	10.30	11.30	12.40	13.20	13.20	13.20
BTALU120-B	172	62	116	103	24	4.0 x 60	3	12	16.50	17.00	17.60	18.50	19.50	20.70
BTALU160-B	212	62	156	103	32	4.0 x 60	4	12	27.50	28.40	29.40	30.80	32.40	34.10
BTALU200-B	252	62	196	103	40	4.0 x 60	5	12	40.30	41.50	42.90	44.80	47.00	49.40
BTALU240-B	292	62	236	103	48	4.0 x 60	6	12	54.10	55.50	57.50	60.00	63.00	66.10

1. 4.0 x 60 refers to CNA 4,0 x 60 Annular Ring Shank Nail

Glulam Connectors
Concealed Beam Connectors (TU)

SIMPSON Strong-Tie®



INSTALLATION PROCEDURE FOR A TU CONCEALED CONNECTOR:

ATTACH CONNECTOR TO HEADER

- Position the connector at the pre determined height and screw the connector to the header or post.
- Fill all holes with screws supplied.

PREPARE THE BEAM

- Cut the beam to the length specified.
- Cut a slot into the end of the beam. Slot width for TU12 is 6mm and 9mm for all others.

- Cut the slot 3mm deeper than the TU and short of the beam height for concealed connector. This allows the connector to be hidden from below. Otherwise cut the slot 3mm deeper than the TU and through the entire beam height.
- **Fully Concealed Only:** Rout a pocket into the beam end. The pocket should be 6mm deep. Enough to hide the thickness of the TU and the screw heads. This eliminates the gap between the beam & header (see Pocket Installation Illustration).

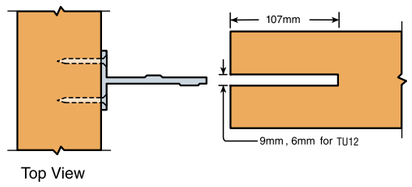
DRILL BEAM DOWEL HOLES

- Position drill guide to provide the proper dowel end distance & height. Clamp in place (Drill guide available from Simpson Strong-Tie).
- Drill the dowel holes to the required diameter. Dowel hole diameter for the TU12 is 8mm and 12mm for all others.

INSTALL BEAMS

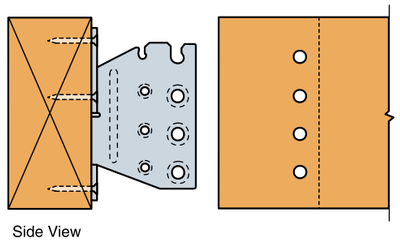
- Install top dowel into the carried beam first. Slip beam into place and install the remaining dowels working from the top downwards.
- Fully Concealed Only: To hide exposed dowel holes when the installation is complete, glue and plug the holes.

STANDARD INSTALLATION



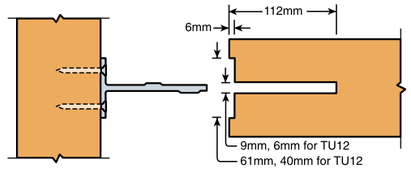
Top View

Cut a slot into the end of the beam



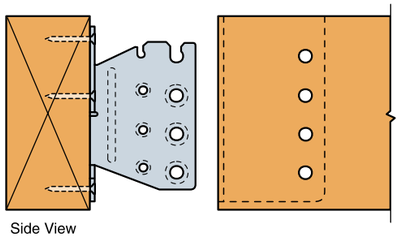
Side View

POCKET (CONCEALED)



Top View

Cut a slot and rout a pocket into the end of the beam



Side View

General information

on Translucent Building Elements of Polycarbonate

Stand: 11/11

The raw material
Polycarbonate (PC) is a crystal clear, high impact thermoplastic.

Advantages
- Temperature resistance between -40 to +115°C, temporarily up to +130 °C
- High impact resistance nearly unchanging within these temperatures
- Good long term performance through UV protection

UV co-extrusion
With this technique a high concentrated UV protection film is homogenously melted onto the basis material while production process.

This offers the following advantages:
- No adhesion problems of UV protection film
- Same temperature behaviour of base and UV material
- No impairment of high impact (like e.g. with coated or painted surfaces)
- Makes small cold bending radiuses possible. Better resistance against environmental influences and ageing

Outside Performance
Through the coextruded UV-protection film – which is always applied on the outer wall and if desired (surcharge). For some of the products is also available both-sided – our products offer best weather resistance and very good. Long term performance.

Warranty
Rodeca offers 10 years warranty (according to written warranty) to its uv-coextruded products regarding to yellowing **index – ageing – hail**

Light transmission
Customized on project demand RODECA can produce products with light transmission from almost 0% up to 80% light transmission (depending on material thickness and number of chambers).
Due to in-house compounding and raw material refineration special requests and colours can be realized.
Please inquiry the project demands which vary from our standards.

G-Value (Solar gain value)
The G-values are related to light transmission and U-value. G-values can differ from product specification to product Specification from 0.68 down to 0.25!

Up-values and Uf-values (heat transmission coefficient - Up=U-value panel; Uf =U-value frame)
Throughout the multi-walled design of our translucent building elements in connection with joint tightness, translucent.
Facades with thermally broken aluminium profiles can be designed according to the newest requirements on Heat Insulation Ordinance.

UV transmission
UV-radiation is stopped almost to 100% up to 380 Nm because of high UV-stabilization with coextruded UV-protection. The remaining transmission in the area of UV radiation is less than 1%. This can be very important for UV sensitive goods.

IR-radiation transmission
Our panels with HEATBLOC-surface let through day light and reflect and stop at the same time selectively the heating radiation. The effect is cooler rooms through lower solar gain values.

Reflection of radar radiation
In the near of radar-units (e.g. at airports) it is important to have none or minimized influence through building elements. It is proven per certificate that RODECA products do not have influence on reflection and do not affect radar-units.

Your specialist for translucent building elements

General information

on Translucent Building Elements of Polycarbonate

Stand: 11/11

Service temperature
Minus 40 °C up to plus 115 °C (temporarily up to 130 °C). Please take into consideration service temperature especially with curtain facades respectively the use of dark foils for deposition of translucent building elements. Adequate distances and sufficient ventilation need to be considered in planning. (Danger of heat accumulation and associated deformations.).

Thermal properties
The high deformation resistance from shortly up to 130 °C is one of the advantages which RODECA products with coextruded surface offer. RODECA products can be used in spaces where other thermoplastic cannot be used anymore. Interesting to know is that white surfaces on roof applications can heat up to +100°C.
(It is essential to respect thermal expansion/shrinking and to avoid heat accumulation.)

Colouring
The usual colours are:
- CLEAR with structure for panels for higher light transmission, light refraction. Additionally the surface is less sensitive to scratches.
- OPAL-ANTIBLEND with light refractive and light transmitting pigments for an optimized diffused and antiglare light.
- COLOR Serie - transparent or semitransparent COLOURS, similar to RAL from approx. 300 m^2 on request
- BICOLOR Serie - two coloured finish, inner wall coloured, similar to RAL from approx. 150 m^2 on request
- DUOCOLOR - two coloured finish of translucent building elements custom made in transparent or semitransparent COLOURS similar to RAL from approx. 300 m^2 on request
- DECOCOLOR - two coloured finish, outer wall coloured, similar to RAL from approx. 150 m^2 on request

Qualities
Depending on application area and demand RODECA produces different qualities.
- LONGLIFE quality for one sided UV protection (Northern Europe (northwards the Alps) (for UV radiation until max. 1400 Watt according to solar map)
- LONGLIFE PLUS quality for one sided UV protection (for UV radiation > 1400 Watt according to solar map)
- Please inquire separately nonstandard warranties (SUPERLIFE)

Impact resistance/fracture behaviour
RODECA products made of PC are due to the raw material practically indestructible through beat, impact, stone throwing etc. Polycarbonate is 200 times more impact resistant than glass.
Polycarbonate building elements do not splitter, do not crumble and prevent risk injury through splinters.
They comply with German regulations on workplaces (Arbeitsstättenverordnung).

Hail storm
Currently doesn‘t exist a DIN standard, so our RODECA elements were tested at EMPA (Swiss testing laboratory) with a simulated hail test with a shot radius of 20 mm and no holes occurred. According to the current testing results we achieve the highest class (class 5) of the Swiss hail test with factory-new goods.

Ball rebound safety
Even an ice hockey puck hurled against the element at 130 km/h could not cause damage.
Unlimited ball rebound safety thus applies according to DIN 18032 T 3.

Fire resistance
PC has a very high ignition temperature of approx. 450 °C and in case of fire the smoke development is very little.
Depending on element thickness and material composition RODECA products are according to DIN 4102
B 1 of low inflammability or B2 normally inflammable. Additionally the products are classified according to European fire test DIN EN 13501 and classified according to different national tests. Please inquire the test certificates in case of need.

Your specialist for translucent building elements

rodeca®
Translucent Building Elements

General information

on Translucent Building Elements of Polycarbonate

Stand: 11/11

Meltable area according to DIN 18234
In many cases RODECA elements are used as melt-surface because their softening point is below 300°C.

Sound insulation
Polycarbonate elements have despite the light weight a good sound insulation value up to 27 dB according to DIN EN ISO 140-3 in testing facility. With a double wall construction a value of up to 43 dB is achievable. This value means the value that the panel achieves, due to constructive conditions this value may differ.

Chemical resistance
PC elements possess a very high resistance to chemicals but can be affected through some chemical bounds. Particulars about chemical resistance of PC elements you can check on compatibility list. Please inquire this list if needed.

Painting
In case that the Polycarbonate Elements for advertising reasons or similar will be painted or screen printed the compatibility of the painting system needs necessarily be tested before use. The aluminium frame profiles can be powder coated according to the project needs. Additionally RODECA offers the possibility to deliver TPE gaskets in custom made colours.

Vinyl wrap
For advertising purposes large scale letters can be glued onto the panels' surface. It is important that the foil and the glue don't contain substances which harm and affect polycarbonate.
Please clarify before usage the compatibility with the vinyl wrap supplier or the advertising company.

Cleaning
Water with a small percentage of neutral cleaning agents. No use of glass cleaner, rubbing agents or sharp edged subjects. No alkaline or tensile agents to be used.

Storage/Transport
RODECA elements made of Polycarbonate have to be protected before sun and wet conditions before installation and must be stored on a plain underground. In case of non-observance stock damages may occur. The stacking height of translucent building elements shouldn't exceed 200 cm.

Packaging
The Translucent Building Elements are delivered with protective foil. The delivery is carried out - depending on length – from one to four pieces for hand unloading in a recyclable plastic wrapping or on pallet (for forklift unloading). Please unpack briefly before installation to avoid contamination in the hollow chambers.
The protective film can be removed after processing and installation.

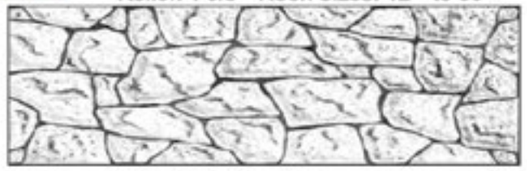
Processing
The Polycarbonate Elements can be smoothly cut with common tools, e.g. pad saw (saw blade with fine indentation) Incidental shavings are to be removed with oil free and water free compressed air. Drill holes (preferably steel-, twist drill or wedge angle drill) need to be at least 40 mm away from elements side and always minimum 50% larger than the screw radius (because of expansion and shrinking due to temperature).

Expansion/Shrinking
The expansion coefficient for Polycarbonate is 0.065 mm per °C and per m and hence three times as high as the expansion coefficient of aluminium.
Rule of thumb: 3 mm per m for 50 °C difference in temperature. Due to temperature differences the length and width of the panel change. The changes in length of the panel need to be considered constructional. RODECA has considered the lengths expansion in its system accessories.

Stone-Crete FORMLINERS

WSAN San Luis Obispo

Liner Size: 4' x 8' Liner Thickness: 2 3/8"
Relief: 1 3/8" Rock Sizes: 12" to 36"



WSED Sedona

Liner Size: 6' x 2' Liner Thickness: 2 3/8"
Relief: 2" Rock Sizes: 4" to 35"

San Luis Obispo

W12C Split Faced Granite 12" **W18C S.F.G. 18"** **W24C S.F.G. 24"**

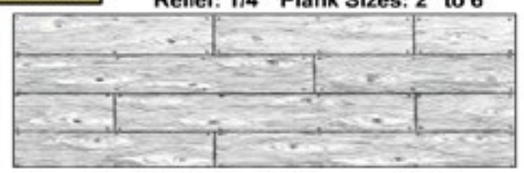
12" Liner Size: 6' x 2' Liner Thickness: 2 3/8"
Relief: 2" Rock Sizes: 14" to 30"

18" Liner Size: 8' x 1 1/2' Liner Thickness: 5"
Relief: 4" Rock Sizes: 24" to 48"

24" Liner Size: 2' x 2' 2' x 3' 2' x 4' 2' x 6' Liner Thickness: 4 1/4"
Relief: 4" Rock Sizes: 24" to 48"

WWOO 12" Rustic Wood Plank

Liner Size: 6' x 2' Liner Thickness: 1"
Relief: 1/4" Plank Sizes: 2' to 6'

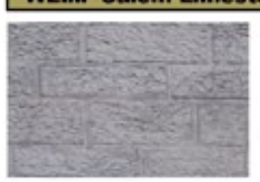


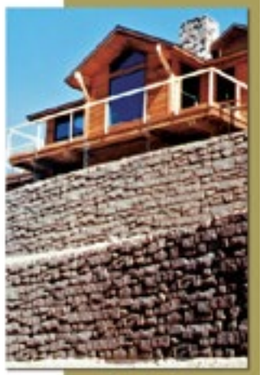
WHAW Hawaiian Coral

Liner Size: 6' x 2' Liner Thickness: 1 3/4"
Relief: 5/8" Rock Sizes: 3" to 10"

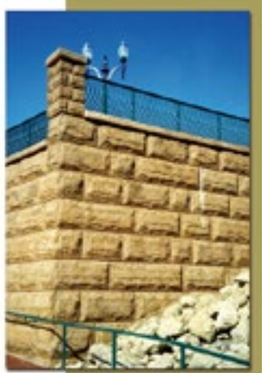
WLIM Salem Limestone

Liner Size: 6' x 2' Liner Thickness: 1 3/4"
Relief: 1/4" Rock Sizes: 13" to 23"





Sedona



Split Faced Granite 24"

HARDENER & RELEASES

Color Hardener

INCRETE SYSTEMS' *Color Hardener* is a ready-to-use dry-shake powder used to color and harden freshly placed concrete for stamping and other decorative surfaces.

Color Hardener is comprised of a pre-tested cement, hard, wear-resistant specially-graded silica quartz aggregate, finely ground alkali and light fast inorganic coloring pigments, and other propriety components which improve the finished concrete surface. Color Hardener builds in color and durability increasing the surface strength to over 8000 psi.

Color Hardener provides: a more uniform and intensely colored surface; an easy-to-clean surface that is resistant to grease, oil, and water penetration; greater resistance to weathering, freezing and thawing, and scaling from alkali salts.

Color Hardener may be used both indoors and out and is recommended for floor surfaces subject to medium to heavy duty use such as shopping centers, hotels/motels, garages, schools, sidewalks, driveways and parking lots.

- ✓ Uniform Color
- ✓ Decreases Maintenance
- ✓ UV & Alkali Resistant
- ✓ Increases Durability

For Complete Selection Of Standard Colors, See Page 42

Item #	Colors	Size
See Colors	30 Standard Colors	60 LB. (27.3 kg) Pail
Custom Colors/Color Matching. Available in bags upon request.		

Color Release

INCRETE SYSTEMS' *Color Release* is formulated to provide a barrier between stamping tools and wet concrete to prevent suction and facilitate the release of flexible stamping tools.

Applied directly to the wet concrete surface prior to stamping, *Color Release* contains integrated iron-oxide pigments to add color and depth to a stamped surface.

Available in Increte Systems' 30 standard colors, *Color Release is* also available in light and dark gray or brown, and clear. Special colors can be matched by request.

- ✓ Greater Stamping Efficiency
- ✓ Releases Stamping Tools
- ✓ Adds Color & Depth.
- ✓ Unlimited Design Options

For Complete Selection Of Standard Colors, See Pages 42

Item #	Colors	Size
See Colors-	30 Standard Colors	20 LB. (9.1kg) Pail

Antique Release

Antique Release, like *Color Release* is formulated to provide a barrier between stamping tools and wet concrete to prevent suction and facilitate the release of flexible stamping tools.

For Complete Selection Of Standard Colors, See Pages 42

Item #	Colors	Size
See Colors	10 Standard Colors	35 LB. (16kg) Pail

Junckers Oak

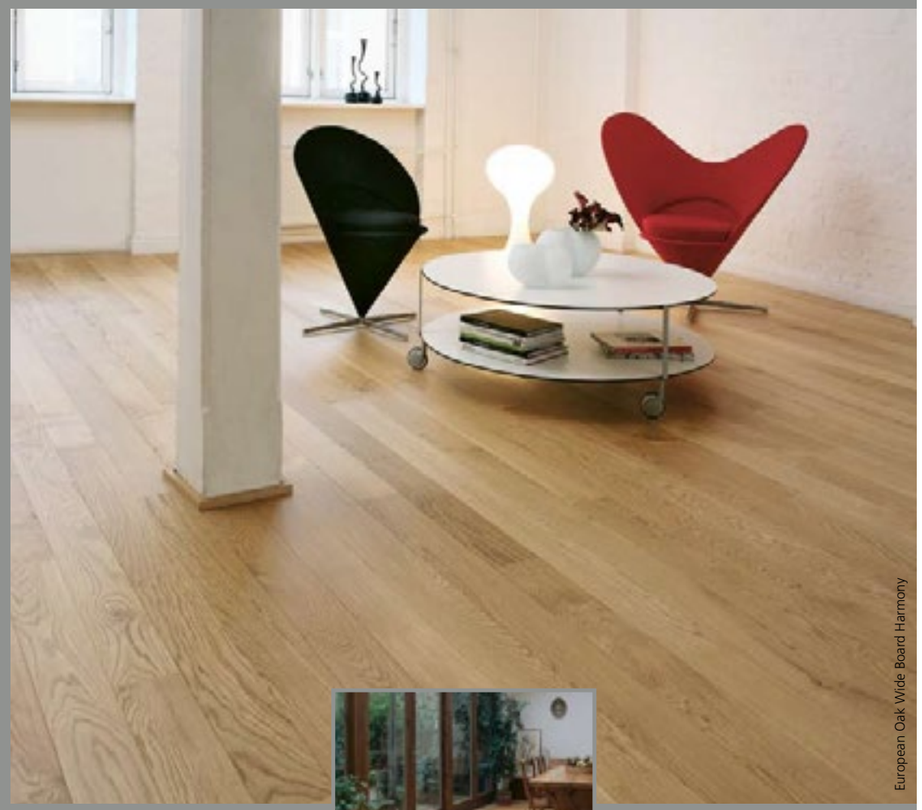
20.5 MM EUROPEAN OAK WIDE BOARD SOLID HARDWOOD FLOORING

STYLE CHART, B 5.15

RESIDENTIAL / COMMERCIAL

European oak (Quercus Robur L.) is one of the widespread European hardwood species which is characterised by being hard and hard-wearing and at the same time having a clear and interesting grain structure. The warm and robust wood has the colour of ripe wheat and is extremely suitable for flooring. Over time, the natural ageing gives the wood a golden glow.

Junckers solid hardwood flooring is produced and categorized according to Junckers factory standards and in accordance with EN 13226 and EN 14342. Junckers floors are made exclusively from solid hardwood, with all the characteristics typical of this natural material. Each style will display a unique range of grain and colour characteristics. The photographs are designed to show the average appearance of the style and species. It is normal to see a variance in appearance between individual boards and packs. Up to 5% of the boards may contain features of the next style. Floors laid at differing times may vary slightly because of this average grading. Hardwood floors may fade and change colour over time, especially when exposed directly to sunlight.



European Oak Wide Board Harmony

European Oak Wide Board Classic

JUNCKERS

Junckers Black Oak

20.5 MM

BLACK OAK PLANK

SOLID HARDWOOD FLOORING

STYLE CHART B 5.14

Black Oak is known from ancient times as one of nature's own materials, but it is not a wood species you can find in the forests. This makes it both interesting and exclusive - and also adds a touch of mystery. In brief, bog oak is formed when oak logs lie for hundreds of years in a bog. This starts a process which gives the wood a very special dark shade. Junckers recreates this process.

Junckers solid hardwood flooring is produced and categorized according to Junckers factory standards and in accordance with EN 13226 and EN 14342. Junckers floors are made exclusively from solid hardwood, with all the characteristics typical of this natural material. Each style will display a unique range of grain and colour characteristics. The photographs are designed to show the average appearance of the style and species. It is normal to see a variance in appearance between individual boards and packs. Up to 5% of the boards may contain features of the next style. Floors laid at differing times may vary slightly because of this average grading. Hardwood floors may fade and change colour over time, especially when exposed directly to sunlight.

JUNCKERS

JUNCKERS
A NATURAL FEELING
Technical Information

E 4.2
Solid Hardwood Flooring
Batten System Information
Underfloor Heating
Residential / Commercial

Underfloor Heating

E 4.0 General information

E 4.2 Batten System information

Introduction

These guidelines concern 22 mm solid boards and 20.5 mm solid wide boards nailed to battens, joists or a subfloor of bearers in which heating pipes are installed in heat-distribution plates.

Please note that full documentation of a floor system nailed to a wooden substructure with a built-in underfloor heating system comprises the data in E 4.0 and E 4.2.

Reference is also made to Junckers Batten System. → **C 1.2.**

General information on batten system with underfloor heating

Battens, joists and other wooden material included in substructures with underfloor heating systems should generally have a lower moisture content than normally specified because the wood will dry out more – in ideal conditions max. 10%. Veneer-laminated battens and joists supplied with a moisture content of 8-10% are therefore particularly suitable.

Insulation up to the underside of the heat-distribution plates and heating pipes will reduce the heat loss.

Nailing to bearers across batten and joist framework

Boards or wide boards can be nailed to a self-supporting underlay of bearers mounted on battens/joists. Heat-distribution plates, in which heating pipes are installed, are fixed on to the bearers.

The load bearing strength of the bearers must be suitable for the use of the floor. The bearers are supported by battens/joists. For residential and office/light industrial interiors a distance of 600 mm is suitable, while for industrial, i.e. public buildings/shops battens/joist should be at maximum 500 mm.
The bearers must be planed on one side so that the thickness does not vary more than ± 0.5 mm, and must also have a residual thickness which leaves enough room for the heat-distribution plates. The thickness is usually minimum 23 mm.

Please note that in this example the floorboards lie parallel to the bearing battens/joists.

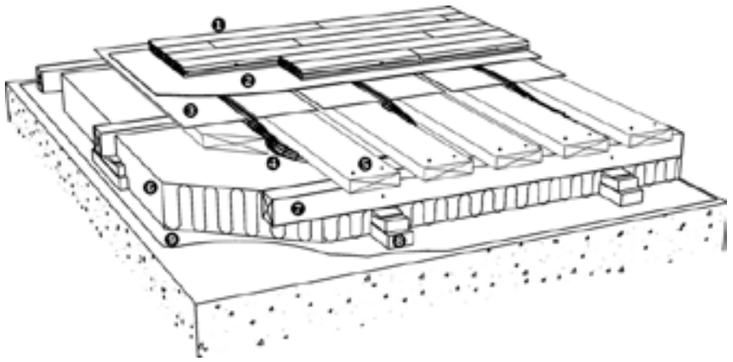


Fig. 3 - Floor heating on battens/joists (outline sketch)

Components in figure 3

1 - Boards
- 22 mm boards
- 22 mm ship's decking
- 20.5 mm wide boards
- 20.5 mm ship's decking

nailed to bearers with:

- 2.6 x 65 mm T-nails (machine nails) in every third board or 450 mm c/c.
  NB! Hand nails should not be used.

2 - Intermediate layer
- floor cardboard, 500 g/m²

3 - Heat-distribution plates

4 - Floor heating pipes

5 - Bearers
- 25 x 100 mm planed on one side, c/c distance: 150 mm

6 - Insulation

7 - Battens/Joists
- Maximum c/c distances:
  Residential: 600 mm
  Commercial: 500 mm

8 - Packing

9 - Moisture barrier
- 0.15 mm PE membrane.

Fig. 2

Components

1 - Boards/wide boards
- 22 mm boards
- 22 mm ship's decking
- 20.5 mm wide boards
- 20.5 mm ship's decking

nailed to battens/joists with:

- 2.6 x 65 mm T-nails (machine nails)
- 2.8 x 65 mm lost head wire nails* (hand nails)
  *) pre-drilling with 2-2.5 mm drill

2 - Intermediate layer
- Floor cardboard, 500g/m²

3 - Battens/joists
- c/c distance: max. 600 mm

4 - Heat-distribution plates

5 - Floor heating pipes

6 - Bearers
- 25 x 100 mm
- c/c distance: 150 mm

7 - Noggins

8 - Fittings for noggins

9 - Ceiling + insulation

Fig. 4

Nailing to batten and joist frames with underfloor heating

Both 22 mm solid boards and 20.5 mm solid wide boards can be nailed to battens/joists which have an underfloor heating system built in between.

The underfloor heating system comprises heat-distribution plates with heating pipes laid on a wooden underlay of bearers boards, supported by noggins attached to battens/joists.

To avoid creaking, floor cardboard, 500 g/m², is placed as an intermediate layer on the heat-distribution plates before the floorboards are installed.

To achieve the best possible temperature distribution the heat-distribution plates must be in close contact with the floor surface and the intermediate layer. This is done by mounting the upper side of the bearers level with the upper side of battens/joists.

The maximum 600 mm spacing of battens or joists makes this floor structure suitable for use in residential and office/light industrial interiors.

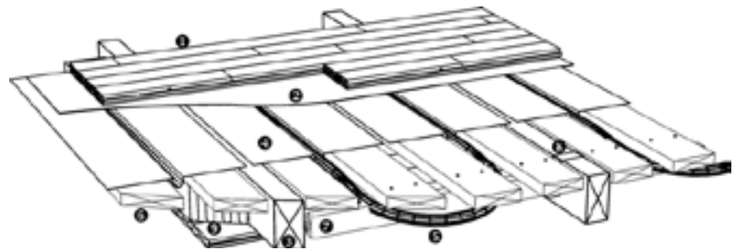


Fig. 5 - Floor heating built in between battens/joists (outline sketch)

Saint Gobain Lite-Floor

SAINT-GOBAIN GLASS SYSTEMS

SGG LITE-FLOOR®

Glass floor panels

Description

SGG LITE-FLOOR is a laminated safety glass which is designed especially for floor panels and stair treads.
SGG LITE-FLOOR comprises two or more sheets of glass bonded together with one or several Polyvinyl Butyral (PVB) interlayers. If the glass breaks, the fragments are held together by the PVB interlayer(s).
The number and/or thickness of each of the components can be varied to obtain laminated safety glass with different characteristics to satisfy all specifications.

Museo del Fiume - Rome, Italy
Architectes: Ferini - Fumo - Stella

Applications

Floor panels
SGG LITE-FLOOR is used as a floor element supported via a separate support structure.

Stair treads
SGG LITE-FLOOR can be used as a stair tread or floor panel.
SGG LITE-FLOOR is designed for internal applications. Special applications can be designed so that SGG LITE-FLOOR can be used in external applications.
SGG LITE-FLOOR should be designed to carry loads set out in BS 6399.

Advantages

Transparency
SGG LITE-FLOOR floor panels can be used to create a transparent floor cladding which allows light to enter the area below.

Stability in the event of breakage
If the glass breaks, the fragments are held together. The glass therefore provides residual safety until the glass is replaced.

Protection against injury
SGG LITE-FLOOR is a laminated safety glass. If the glass breaks, the fragments of glass remain bonded to the interlayer and avoid the risk of injury.

Slip-resistant
The floor should have an anti-slip top surface to provide slip resistance values when wet and dry. Please contact SAINT-GOBAIN GLASS for advice.

Range

Base products
SGG LITE-FLOOR glass can be made using the following substrates:
- SGG PLANILUX clear float glass
- SGG DIAMANT extra-clear glass
- SGG PLANIDUR heat-strengthened glass
- SGG PARSOL body-tinted glass
- SGG SATINOVO acid etched glass
- sandblasted (sandblasted on underside of the panel)
- SGG SERALIT screen-printed glass (one component only)
- SGG DECORGLASS or SGG MASTERGLASS textured glass (patterned face on upper side of panel)

Interlayers
The different types of interlayer that are available for SGG LITE-FLOOR are:
- standard transparent
- opaque
- coloured (SGG STADIP COLOR)
- printed with a digital image (SGG IMAGE);
- printed with a pattern: (SGG STADIP DESIGN).

Compositions
Details of glass from the SGG LITE-FLOOR range can be found below. The safety level required and therefore the type of glass that should be used depends on the number and type of supports, the length-width ratio (L/w) and the type of building in which the panel is to be installed.

As a general rule, the thickness required is determined on a case by case basis using the loads as per BS 6399.

SAINT-GOBAIN GLASS VISION

SGG PLANILUX®

Clear float glass

Description

SGG PLANILUX is a high quality, clear annealed glass from SAINT-GOBAIN GLASS. It is manufactured by the float process, which produces a glass with a perfectly flat, parallel surface.

Applications

SGG PLANILUX is available in an extensive range of thicknesses and is suitable for a wide variety of applications:
- External and internal glazing in buildings;
- Colourless, transparent furniture and glazing for all uses, ranging from indoor furniture to fully glazed structural facades.

SGG PLANILUX is a multi-purpose clear glass.

Range

SGG PLANILUX is available in a range of thicknesses, from 2 mm to 19 mm.

SGG PLANILUX : manufacturing sizes			
Thickness (mm)	Thickness tolerance (mm)	Standard dimensions (mm)	Average weight (kg/m²)
2	± 0,2	3210 x 2500	5
3	± 0,2	6000 x 3210	7,5
4	± 0,2	6000 x 3210	10
5	± 0,2	6000 x 3210	12,5
6	±0,2	6000 x 3210	15
8	± 0,3	6000 x 3210	20
10	± 0,3	6000 x 3210	25
12	± 0,3	6000 x 3210	30
15	± 0,5	6000 x 3210	37,5
19	± 1	6000 x 3210	47,5

Performances

- The spectrophotometric performance of SGG PLANILUX is given for:
- Single glazing, for all thicknesses;
- In SGG CLIMALIT double-glazed units and in SGG CLIMAPLUS enhanced thermal insulation double-glazed units, combined with an SGG PLANITHERM TOTAL low emissivity glass, for the most commonly used compositions.
- Acoustic performance
- The mechanical performance conforms to standard BS EN 572-2.

SGG PLANILUX												
Sinlge-glazing												
SGG PLANILUX												
Thickness	mm	2	3	4	5		6	8	10	12	15	19
Weight	kg/m²	5	7,5	10	12,5		15	20	25	30	37,5	47,5
Light factor												
LT	%	91	90	90	89		89	88	88	87	86	83
LRe	%	8	8	8	8		8	8	8	8	8	8
LRi	%	8	8	8	8		8	8	8	8	8	8
UV	%	69	64	59	56		53	48	50	47	44	36
Energy factor												
T	%	87	85	83	81		79	75	74	72	69	62
Re	%	8	8	7	7		7	7	7	7	7	6
Ri	%	8	8	8	7		7	7	7	7	7	6
A	%	5	8	10	12		14	18	17	21	24	32
Solar factor g		0,88	0,87	0,85	0,84		0,82	0,80	0,80	0,79	0,75	0,70
Shading Coefficient		1,01	1,00	0,98	0,96		0,95	0,92	0,92	0,89	0,87	0,81
U-value W/(m².K)		5,9	5,8	5,8	5,8		5,7	5,7	5,6	5,5	5,5	5,3
Sound reduction indices												
Rw	dB	ND (1)	29	30	30		31	32	33	34	36	37
C	dB	ND (1)	-2	-1	-1		-1	-1	-1	0	-1	-1
Cu	dB	ND (1)	-5	-3	-2		-2	-2	-2	-2	-3	-3
Ra	dB	ND (1)	27	29	29		30	31	32	34	35	36
RA,u	dB	ND (1)	24	27	28		29	30	31	32	33	34

(1) ND: non disponible.

Processed Product Variations

SGG PLANILUX is the substrate glass used for the manufacture of most other processed glass products: coated glass, mirrors, double-glazed units, laminated, toughened, screen-printed, decorated, acid-etched, sandblasted, lacquered, edgeworked etc.

Ancon Cross Bracing

Tension and Compression Systems

SYSTEM COMPONENTS

The wide range of components available can be used to create a variety of assemblies, from simple tie bars to complex bracing systems involving several bars joined at one point.

Fork Connectors & Locking Nuts

Ancon fork connectors are supplied with a locking nut which provides a neat transition from bar to fork. Forks and their locking nuts have left or right hand threads, and are supplied complete with a pin. They are stamped with the size and either the letter R or L to identify the hand of the thread.

The locking nuts firmly lock the bar to the fork and ensure that the connection remains secure. The internally threaded section of the locking nut is recessed to allow the threaded end of the bar to be hidden when the installation is complete.

Adjustments to the length of the system can still be made after installation without a turnbuckle, by loosening the locking nut and rotating the bar. The extent of this adjustment depends on the size of the bar, but will range from ±9mm for an Ancon 500/8 to ±45mm for an Ancon 360/56.

Carbon steel forks and locking nuts are zinc plated as standard. Stainless steel forks and locking nuts are electro-polished as standard and can also be supplied satin or hand polished.

Each stainless steel fork is supplied with two clear, self-adhesive, PET (polyester) washers to isolate the system from a connecting plate of a dissimilar metal.

Pins

The pins are a two-part construction and once installed are flush with the fork. The installation requires a twin-pin driver. Two driver bits of the appropriate size are supplied with each Ancon system. This type of fixing, known as 'Snake Eyes'*, allows a high torque to be achieved without damage to the pin.

The female section of the pin is located through the fork connector and temporarily held in position. A second driver is then used to wind the male section into position creating a secure connection.

Stainless steel pins are supplied with a PTFE coating around the barrel, as illustrated, to isolate the system from a connecting plate of a dissimilar metal.

Anchor Discs

Anchor discs allow up to eight bars to be connected together. They can be used at the centre of conventional cross bracing, or where several bars need to be connected at one point. Anchor discs are machined from plate and can be supplied polished or coated to match the surface finish of the tie bars. Ancon can design and manufacture plates in special shapes to replace standard anchor discs and suit the aesthetic requirements of an application.

*'Snake Eyes' is the registered trademark of Tamperproof Screw Company Inc.

Tension and Compression Systems

PERFORMANCE AND DIMENSIONS

The yield loads indicated below are based on rigorous tests. The design capacities include a material factor (γ_m) of 1.25 against failure. An appropriate partial safety factor (γ_f) will need to be applied to the characteristic dead, imposed and wind loads.

Forks must be correctly aligned, and positioned in the same plane to ensure that bending is not introduced into the tension system.

Design Example

Characteristic dead load = 30.0kN γ_f = 1.4

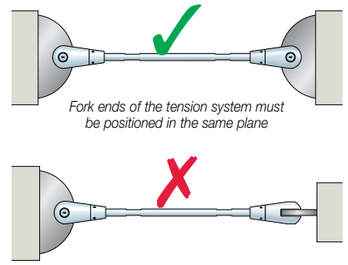
Characteristic imposed load = 22.6kN γ_f = 1.6

Design load = (30.0 x 1.4) + (22.6 x 1.6) = 78.2kN

Use Ancon 500/16

Design capacity = 81kN > 78.2kN

Ancon Tension Systems are not suitable for dynamic loads.



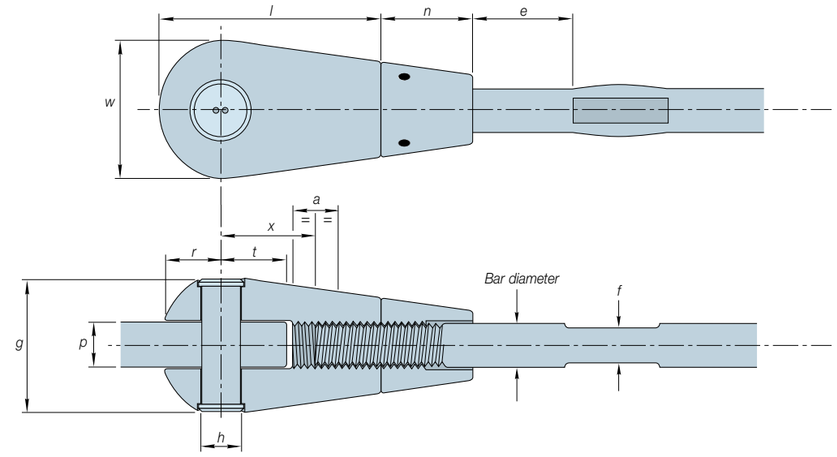
Fork ends of the tension system must be positioned in the same plane

Ancon 500 & 360 Carbon Steel Tension System

	500 System									360 System	
Thread Size	**8**	**10**	**12**	**16**	**20**	**24**	**30**	**36**	**42**	**48**	**56**
Failure Loads (kN)	22.5	37.5	54.5	102	159	229	364	531	728	760	1055
Yield Loads (kN)	17	29	42	71	110	156	247	408	551	510	710
Design Capacities (kN)	18	30	43	81	127	183	291	424	582	608	844

Ancon 500 Stainless Steel Tension System

Thread Size	**8**	**10**	**12**	**16**	**20**	**24**	**30**	**36**	**42**
Failure Loads (kN)	22.5	37.5	54.5	102	159	229	364	531	728
Yield Loads (kN)	17	29	42	71	110	156	247	408	551
Design Capacities (kN)	18	30	43	81	127	183	291	424	582

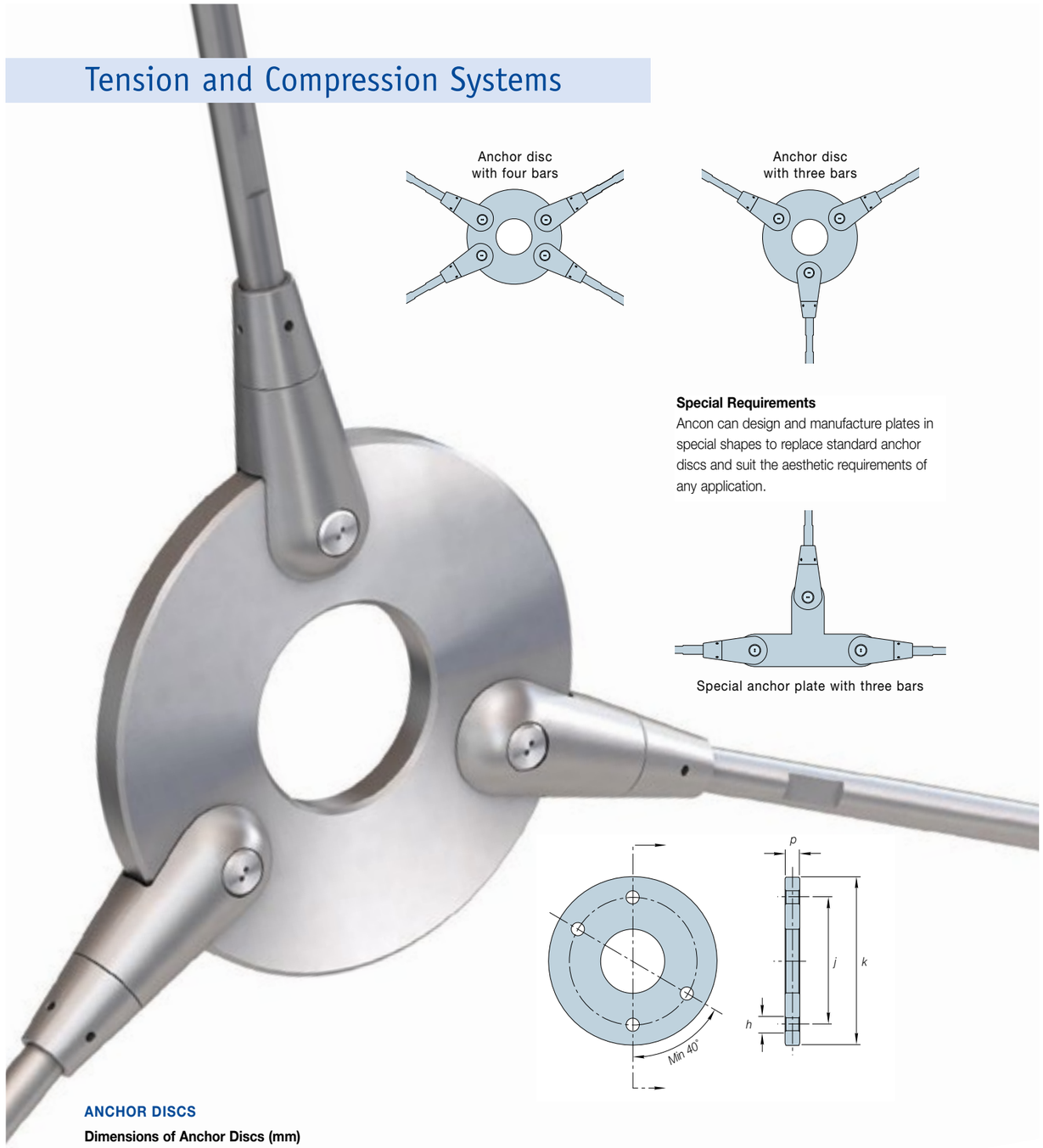


Dimensions of Fork Connectors (mm)

		500 System									360 System	
Thread Size		**8**	**10**	**12**	**16**	**20**	**24**	**30**	**36**	**42**	**48**	**56**
Bar Diameter		8	10	12	16	20	24/25	30	35	42/40	45	55
Fork Length	*l*	40	49	60	78	94	115	140	169	196	224	261
Fork Diameter	*w*	23.5	29	35	48	60	70	89	106	123	140	164
Plate Thickness	*p*	8	10	12	16	20	22	30	30	35	40	50
Pin to End	*r*	10.5	13.5	16	22	28	33	41	50	58	66	77
Pin to Plate Edge	*t*	12	15	18	23	29	36	43	54	63	74	83
Hole Diameter for Pin	*h*	7.5	9.5	11.5	14.5	18.5	21.5	26.5	30.5	35.5	42.5	50.5
Pin Length	*g*	23	28.5	34	46	58	68	86	103	118	135	156
Adjustment	*a*	9	10	13	15	16	22	25	28	30	35	45
Thickness of Flat	*f*	6	8	10	14	18	21	27	32	36	41	50
Position of Flat	*e*	17	20	25	38	43	58	69	84	99	116	139
Pin to Bar End	*x*	19	23	27	35.5	42	52	62.5	76	89	102.5	116.5
Length of Locking Nut	*n*	18	22	27	33	38	49	60	71	84	93	108

Notes: *The bar diameter of Ancon 500/24 is 24mm in Stainless Steel and 25mm in Carbon Steel. The bar diameter of Ancon 500/42 is 42mm in Stainless Steel and 40mm in Carbon Steel. Ancon 360 Systems are only available in Carbon Steel.*

Tension and Compression Systems



Special Requirements
Ancon can design and manufacture plates in special shapes to replace standard anchor discs and suit the aesthetic requirements of any application.

Special anchor plate with three bars

ANCHOR DISCS

Dimensions of Anchor Discs (mm)

		500 System									360 System	
Thread Size		**8**	**10**	**12**	**16**	**20**	**24**	**30**	**36**	**42**	**48**	**56**
Disc Thickness	*p*	8	10	12	16	20	22	30	30	35	40	50
Overall Diameter	*k*	100	123	148	196	242	282	355	425.5	493.5	563	654
Effective Diameter	*j*	76	93	112	150	184	212	269	318	367	416	488
Hole Diameter for Pin	*h*	7.5	9.5	11.5	14.5	18.5	21.5	26.5	30.5	35.5	42.5	50.5

Note: *Ancon 360 Systems are only available in Carbon Steel.*

Kingspan K12 Framing Board

Typical Constructions and U-values

Assumptions

The U–values in the tables that follow have been calculated, under a management system certified to the BBA Scheme for Assessing the Competency of Persons to Undertake U-value and Condensation Risk Calculations, using the method detailed in BS / I.S. EN ISO 6946: 2007 (Building components and building elements. Thermal resistance and thermal transmittance. Calculation method), and using the conventions set out in BR443 (Conventions for U–value calculations). They are valid for the constructions shown in the details immediately above each table.

Unless otherwise stated both the timber and steel frame U–values quoted are based on an internal construction comprising a 3 mm plaster skim on 15 mm plasterboard. The external finishes are as specified in the examples themselves.

NB When calculating U–values to BS / I.S. EN ISO 6946: 2007, the type of mechanical fixing used may change the thickness of insulation required. The effect of fixings for Kingspan **Kool**therm® K18 Insulated Plasterboard *has been ignored in these calculations, as the insulation layer penetrated is not the main insulation layer. For the purposes of timber frame calculations which feature insulating sheathing, the use of stainless steel fasteners of cross sectional area 7.45 mm² has been assumed at a density of 4.4 per m². For steel frame calculations featuring insulating sheathing, the use of carbon steel fasteners of cross sectional area 14.8 mm² has been assumed at a density of 4.5 per m².*

NB For calculations which feature insulation between timber frame studs / timber battens, a 15% bridging factor has been assumed. The thermal conductivity of the timber has been assumed to be 0.12 W/m·K.

NB Calculations assume that a foil faced breathable membrane yields an airspace thermal resistance of 0.54 m²·K/W. Calculations assume that a 4 mm foil faced bubble breathable membrane yields a combined product and airspace thermal resistance of 0.79 m²·K/W.

NB For the purposes of these calculations the standard of workmanship has been assumed good, and therefore the correction factor for air gaps has been ignored.

NB The figures quoted are for guidance only. A detailed U–value calculation and a condensation risk analysis should be completed for each project.

NB If your construction is different from those specified, and / or to gain a comprehensive U–value calculation along with a condensation risk analysis of your project, please consult the Kingspan Insulation Technical Service Department for assistance (see rear cover).

U-value Table Key

Where an ✗ symbol is shown, the U–value is higher than the worst of the maximum new build area weighted average / refurbishment (as applicable) U–values allowed by the 2010 Editions of Approved Documents L to the Building Regulations (England & Wales), the 2010 Editions of Technical Handbooks Section 6 (Scotland), the 2006 Editions of Technical Booklets F (Northern Ireland), or the 2008 Editions of Technical Guidance Documents L* (Republic of Ireland).

** Excluding Change of Use and Material Alterations.*

Where an 💧 is shown, the combination of insulation products may result in an interstitial condensation risk and so the calculations have been excluded.

Refurbishment – Internal Dry Lining

Insulation Between, and Insulated Plasterboard Fixed to, Timber Framework on Solid Brick Wall

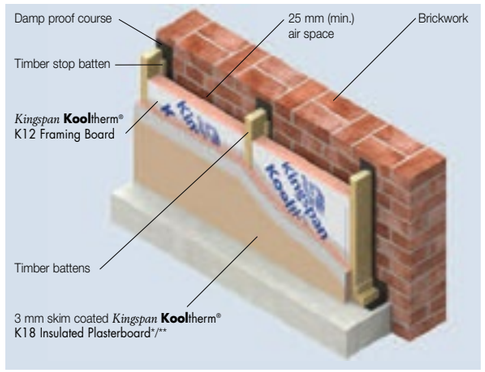


Figure 1

U–values (W/m²·K) for Various Thicknesses of Insulation, Timber Depths, and Brickwork Thicknesses

Thickness of *Kingspan* **Kool**therm® K12 Framing Board Between Timbers (mm)	Product Thickness of *Kingspan* **Kool**therm® K18 Insulated Plasterboard*** Fixed to Timbers (mm)	Brickwork Thickness (mm) 102.5	215
75 mm Deep Timbers			
50	0*	✗	✗
50	32.5	0.29	0.28
50	37.5	0.27	0.26
50	42.5	0.25	0.24
50	52.5	0.22	0.21
50	62.5	0.20	0.19
50	67.5	💧	💧
100 mm Deep Timbers			
70	0*	✗	✗
75	0*	✗	0.30
75	32.5	0.24	0.23
75	37.5	0.22	0.21
75	42.5	0.21	0.20
75	52.5	0.19	0.18
75	62.5	0.17	0.16
75	72.5	0.15	0.15
75	77.5	💧	💧

* *Calculations which feature insulation between studwork only, assume the use of 15 mm plasterboard and a polythene sheet vapour control layer in order to minimise the risk of condensation (see 'Design Considerations – Water Vapour Control').*

** *Kingspan* **Kool**therm® K18 Insulated Plasterboard *contains an integral vapour control layer in order to minimise the risk of condensation (see 'Design Considerations – Water Vapour Control').*

*** *Product thicknesses = insulant thickness + 12.5 mm plasterboard.*

Product Details

The Facings

Kingspan **Kool**therm® K12 Framing Board is faced on both sides with a low emissivity composite foil, autohesively bonded to the insulation core during manufacture. This reflective, low emissivity surface improves the thermal resistance of any unventilated cavity adjacent to the board.

The Core

The core of *Kingspan* **Kool**therm® K12 Framing Board is a premium performance rigid thermoset modified resin insulant manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

zero O.D.P

Standards and Approvals

Kingspan **Kool**therm® K12 Framing Board is manufactured to the highest standards under a management system certified to BS / I.S. EN ISO 9001: 2008 (Quality management systems. Requirements), BS / I.S. EN ISO 14001: 2004 (Environmental Management Systems. Requirements) and BS / I.S OHSAS 18001: 2007 (Health and Safety Management Systems. Requirements).

The use of *Kingspan* **Kool**therm® K12 Framing Board, produced at Kingspan Insulation's Pembridge manufacturing facility, is covered by BBA Certificate 08/4615, and that produced at Kingspan Insulation's Castleblayney manufacturing facility by NSAI Agrément Certificate 09/0329.

Standard Dimensions

Kingspan **Kool**therm® K12 Framing Board is available in the following standard size(s):

Nominal Dimension		Availability
Length	(m)	2.4
Width	(m)	1.2
Insulant Thickness	(mm)	Refer to local distributor or Kingspan Insulation price list for current stock and non–stock sizes.

* *Kingspan* **Kool**therm® K12 Framing Board *is available in other widths subject to quantity. Extended lead times and price premiums will apply.*

Compressive Strength

The compressive strength of *Kingspan* **Kool**therm® K12 Framing Board typically exceeds 100 kPa at 10% compression, when tested to BS /I.S. EN 826: 1996 (Thermal insulating products for building applications. Determination of compression behaviour).

Water Vapour Resistance

Adjusted for the effect of board joints, the product typically achieves a resistance far greater than 100 MN·s/g, when tested in accordance with BS EN 12086: 1997 / I.S. EN 12086: 1998 (Thermal insulating products for building applications. Determination of water vapour transmission properties).

Durability

If correctly installed, *Kingspan* **Kool**therm® K12 Framing Board can have an indefinite life. Its durability depends on the supporting structure and the conditions of its use.

Resistance to Solvents, Fungi & Rodents

The insulation core is resistant to short–term contact with petrol and with most dilute acids, alkalis and mineral oils. However, it is recommended that any spills be cleaned off fully before the boards are installed. Ensure that safe methods of cleaning are used, as recommended by the suppliers of the spilt liquid. The insulation core is not resistant to some solvent–based adhesive systems, particularly those containing methyl ethyl ketone. Adhesives containing such solvents should not be used in association with this product. Damaged boards or boards that have been in contact with harsh solvents or acids should not be used.

The insulation core and facings used in the manufacture of *Kingspan* **Kool**therm® K12 Framing Board resist attack by mould and microbial growth, and do not provide any food value to vermin.

Product Details

Fire Performance

Kingspan **Kool**therm® K12 Framing Board is Class 1, as defined by BS 476–7: 1997 (Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products).

The rigid thermoset insulation core of *Kingspan* **Kool**therm® K12 Framing Board is Class 0, as defined by the Building Regulations.

The rigid thermoset insulation core of *Kingspan* **Kool**therm® K12 Framing Board, when subjected to the British Standard fire test specified in the table below, has achieved the result shown.

Test	Result
BS 5111–1: 1974 (Smoke Obscuration)	< 5% (Negligible smoke obscuration)

Kingspan **Kool**therm® K12 Framing Board in the construction specified in the table below, when subjected to British Standard fire test BS 476–21: 1987 (Fire tests on building materials and structures. Methods for determination of the fire resistance of loadbearing elements of construction), has achieved the result shown.

Construction	Result
12.5 mm plasterboard, 75 mm *Kingspan* **Kool**therm® K12 Framing Board, 100 x 50 mm timber studs @ 600 mm centres with 9 mm OSB sheathing.	51 minutes integrity and load bearing capacity; 50 minutes insulation.

BRE Global has determined that *Kingspan* **Kool**therm® K12 Framing Board, in the constructions specified in the table below, when assessed against the performance requirements of British Standard fire test BS 476–21: 1987 (Fire tests on building materials and structures. Methods for determination of the fire resistance of loadbearing elements of construction), will achieve the results shown.

Construction	Result
15 mm fire resistant plasterboard, 75 mm *Kingspan* **Kool**therm® K12 Framing Board, 100 x 50 mm timber studs @ 600 mm centres with 9 mm OSB sheathing	60 minutes integrity, insulation and load bearing capacity.
2 x 12.5 mm plasterboard, 75 mm *Kingspan* **Kool**therm® K12 Framing Board, 100 x 50 mm timber studs @ 600 mm centres with 9 mm OSB sheathing.	60 minutes integrity, insulation and load bearing capacity.

Further details on the fire performance of Kingspan Insulation products may be obtained from the Kingspan Insulation Technical Service Department (see rear cover).

Thermal Properties

The λ–values and R–values detailed below are quoted in accordance with BS / I.S. EN 13166: 2008 (Thermal insulation products for buildings – Factory made products of phenolic foam (PF) – Specification).

Thermal Conductivity

The boards achieve a thermal conductivity (λ–value) of:
0.023 W/m·K (insulant thickness 15–24 mm);
0.021 W/m·K (insulant thickness 25–44 mm); and
0.020 W/m·K (insulant thickness ≥ 45 mm).

Thermal Resistance

Thermal resistance (R–value) varies with thickness and is calculated by dividing the thickness of the board (expressed in metres) by its thermal conductivity. The resulting number is rounded down to the nearest 0.05 (m^2·K/W).

Insulant Thickness (mm)	Thermal Resistance (m^2·K/W)
20	0.85
25	1.15
30	1.40
35	1.65
40	1.90
45	2.25
50	2.50
55	2.75
60	3.00
65	3.25
70	3.50
75	3.75
80	4.00
90	4.50
100	5.00
110	5.50
120	6.00

NB Refer to local distributor or Kingspan Insulation price list for current stock and non–stock sizes.

Kingspan Thermafloor TF70

Typical Constructions and U–values

Heat Loss and Linear Thermal Bridging

For buildings with relatively small ground floor areas (primarily domestic properties), if the ground floor is left uninsulated, the thermal performance will be poor. To enhance the thermal performance, complete insulation of the ground floor should be adopted (Figures 1 & 3).

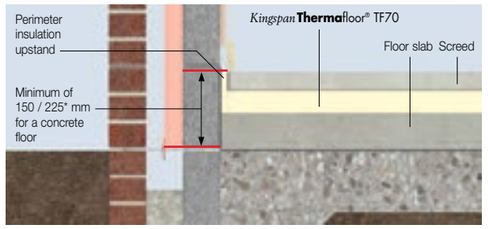


Figure 1 – Complete Masonry Floor Insulation

For buildings with large ground floor areas (primarily non–domestic properties), complete insulation of the ground floor may be unnecessary. Insulating the perimeter in a 1.2 metre wide strip may provide adequate thermal performance (Figure 2).

Calculations in the tables that follow assume complete insulation of the floor area, please contact the Kingspan Insulation Technical Service Department for calculations with perimeter strip insulation only.

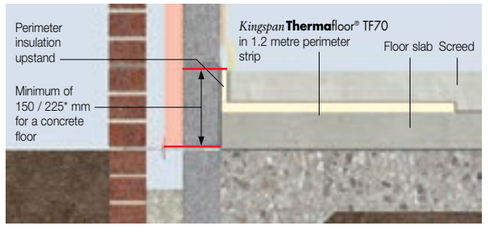


Figure 2 – Perimeter Strip Masonry Floor Insulation

In order to minimise cold bridging at the edge of the floor, the distance between the top of the floor insulation surface, or perimeter insulation upstand, and the bottom of the wall insulation must be 150 / 225* mm min. for a concrete floor (Figures 1 & 2) and 200 mm min. for a suspended timber floor (Figure 3).

** 150 mm applies to the UK and 225 mm to the Republic of Ireland.*

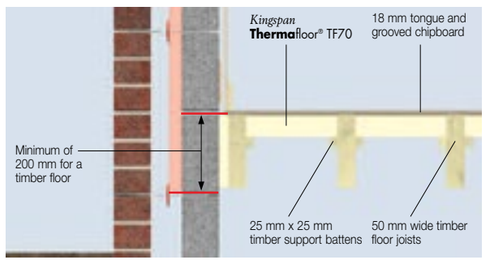


Figure 3 – Complete Timber Floor Insulation

Assumptions

The U–values in the tables that follow have been calculated, under a management system certified to the BBA Scheme for Assessing the Competency of Persons to Undertake U–value and Condensation Risk Calculations, using the method detailed in BS / I.S. EN ISO 13370: 2007 (Thermal performance of buildings. Heat transfer via the ground. Calculation methods) and using the conventions set out in BR443 (Conventions for U–value calculations). They are valid for the constructions shown in the details immediately above each table.

Unlike roofs, walls and intermediate floors, U–value calculations for ground floors cannot be calculated with reference to the construction detail alone. Heat loss from ground floors depends upon the ratio of the exposed floor perimeter to the total floor area, the thickness of any basement wall and the depth of any basement.

Floor dimensions should be measured between the finished internal surfaces of the external walls. Non–usable heated space such as ducts and stairwells should be included when determining the area of the floor. Unheated spaces outside of the insulated fabric, such as attached garages or porches, should be excluded when determining the area of the floor, but the length of the wall between the heated building and the unheated space should be included when determining the perimeter. The floor dimensions of semi–detached, terraced or other joined premises / dwellings can be taken either as those of the premises / dwelling itself or those of the whole building. Where extensions to existing buildings are under consideration, the floor dimensions should be taken as those of the extension.

If the P/A ratio lies between two of the numbers shown in the tables that follow, for a safe estimate please use the P/A ratio shown that is the next highest i.e. for 0.57 use 0.6.

NB The figures quoted are for guidance only. A detailed U–value calculation should be completed for each individual project.

NB For the purposes of these calculations, using the method as detailed in BS / I.S. EN ISO 13370: 2007, the soil has been assumed to be sand or gravel, the wall insulation is assumed to overlap the floor insulation by minimum 150 / 225 mm for a concrete floor and 200 mm for a timber floor, and the standard of workmanship has been assumed good and therefore the correction factor for air gaps has been ignored.*

NB If your construction is different from those specified and / or to gain a comprehensive U–value calculation for your project please consult the Kingspan Insulation Technical Service Department for assistance (see rear cover).

U-value Table Key

Where an ✗ is shown, the U–value is higher than the worst of the maximum new build area weighted average U–values allowed by the 2010 Editions of Approved Documents L to the Building Regulations (England & Wales), the 2010 Editions of Technical Handbooks Section 6 (Scotland), the 2006 Editions of Technical Booklets F (Northern Ireland), or the 2008 Editions of Technical Guidance Documents L* (Republic of Ireland).

** Excluding Change of Use and Material Alterations.*

Underfloor Heating Systems

The constructions shown in the Typical Constructions and U–values section can be readily converted to accommodate underfloor heating systems.

For a solid concrete floor, the position of the insulation is important in either exposing the thermal mass of the concrete floor to the heat provided by the system, or isolating the thermal mass from it.

For a 24 hour heating cycle, allowing the heat from the underfloor heating system to penetrate the concrete slab will provide a more even heating regime over a 24 hour period (Figure 10).

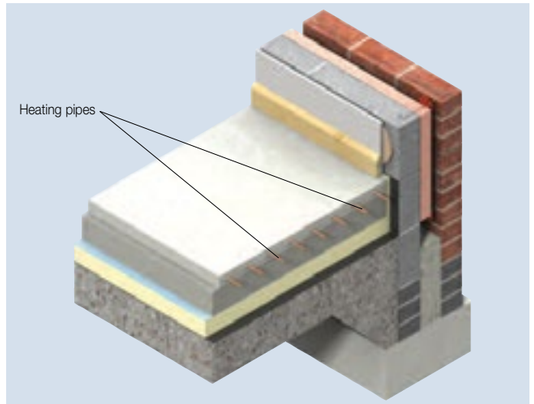


Figure 10 – 24 Hour Heating Applications – Below the Floor Slab

For intermittent heating applications, where a fast response time is required, it is beneficial to have less thermal mass available to take up heat from the system and so placing the insulation layer below the screed (Figure 11) or timber floor (Figure 12) but above the concrete slab or beam and block floor (Figure 13) is the best solution.

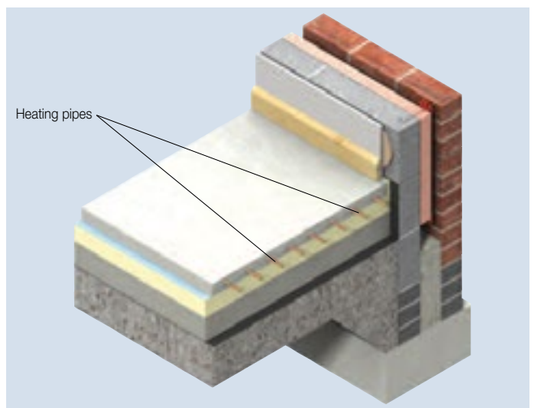


Figure 11 – Intermittent Heating Applications – Below the Floor Screed

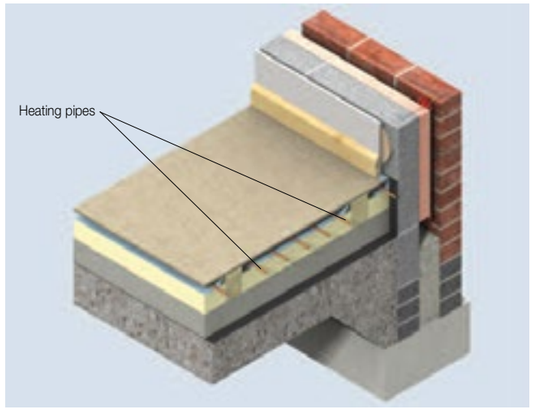


Figure 12 – Intermittent Heating Applications – Timber Floor on Battens

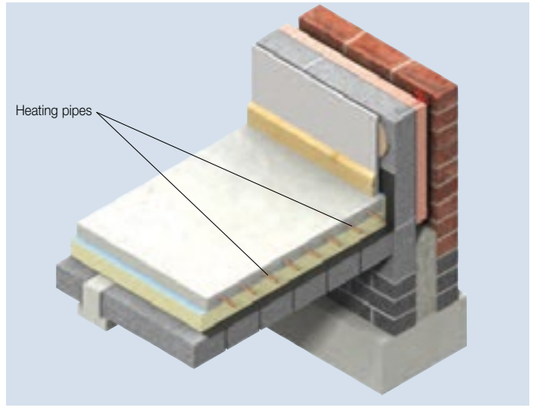


Figure 13 – Intermittent Heating Applications – Beam and Block Floor

Underfloor heating systems can also be accommodated in suspended timber floors. This arrangement has low thermal mass and so is more suited to intermittent heating cycle applications (Figure 14).

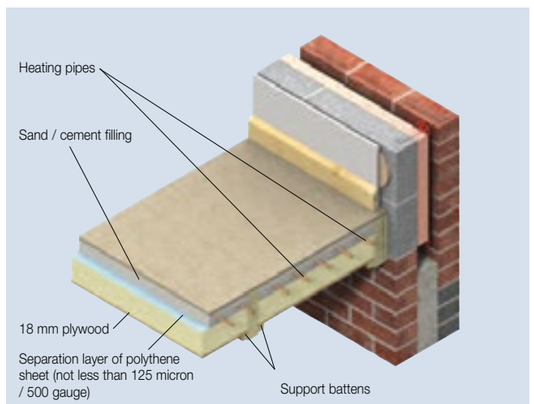


Figure 14 – Intermittent Heating Applications – Suspended Timber Floor

Product Details

The Facings

Kingspan **Therma**floor® TF70 is faced on both sides with a low emissivity composite foil, autohesively bonded to the insulation core during manufacture.

The Core

The core of *Kingspan* **Therma**floor® TF70 is manufactured with **Nil*flam*®** technology, a high performance rigid thermoset polyisocyanurate (PIR) insulant manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

Standards and Approvals

Kingspan **Therma**floor® TF70 is manufactured to the highest standards in accordance with BS 4841–6 (Rigid Polyurethane (PUR) and Polyisocyanurate (PIR) products for building end–use applications. Specification for laminated insulation boards for floors).

Kingspan **Therma**floor® TF70 is also manufactured under a management system certified to BS / I.S. EN ISO 9001: 2008 (Quality Management Systems. Requirements), BS / I.S EN ISO 14001: 2004 (Environmental Management Systems. Requirements) and BS / I.S OHSAS 18001: 2007 (Health and Safety Management Systems. Requirements).

The use of *Kingspan* **Therma**floor® TF70 produced at Kingspan Insulation's Pembridge and Selby manfacturing facilities is covered by BBA Certificate 07/4450, and that produced at Kingspan Insulation's Castleblayney manufacturing facility by IAB Certificate 03/0196.

Standard Dimensions

Kingspan **Therma**floor® TF70 is available in the following standard size:

Nominal Dimension		Availability
Length	(m)	2.4
Width	(m)	1.2
Insulant Thickness	(mm)	Refer to local distributor or Kingspan Insulation price list for current stock and non–stock sizes.

Compressive Strength

The compressive strength of *Kingspan* **Therma**floor® TF70 typically exceeds 140 kPa at 10% compression, when tested to BS / I.S. EN 826: 1996 (Thermal insulating products for building applications. Determination of compression behaviour).

Water Vapour Resistance

Adjusted for the effect of board joints, the product achieves a resistance far greater than 100 MN·s/g, when tested in accordance with BS EN 12086: 1997 / I.S. EN 12086: 1998 (Thermal insulating products for building applications. Determination of water vapour transmission properties).

Durability

If correctly installed, *Kingspan* **Therma**floor® TF70 can have an indefinite life. Its durability depends on the supporting structure and the conditions of its use.

Resistance to Solvents, Fungi & Rodents

The insulation core is resistant to short–term contact with petrol and with most dilute acids, alkalis and mineral oils. However, it is recommended that any spills be cleaned off fully before the boards are installed. Ensure that safe methods of cleaning are used, as recommended by the suppliers of the spilt liquid. The insulation core is not resistant to some solvent–based adhesive systems, particularly those containing methyl ethyl ketone. Adhesives containing such solvents should not be used in association with this product. Damaged boards or boards that have been in contact with harsh solvents or acids should not be used.

The insulation core and facings used in the manufacture of *Kingspan* **Therma**floor® TF70 resist attack by mould and microbial growth, and do not provide any food value to vermin.

Fire Performance

Kingspan **Therma**floor® TF70 is Class 1, as defined by BS 476–7: 1997 (Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products).

Further details on the fire performance of Kingspan Insulation products may be obtained from the Kingspan Insulation Technical Service Department (see rear cover).

Thermal Properties

The λ–values and R–values detailed below are quoted in accordance with BS / I.S. EN 13165: 2008 (Thermal insulation products for buildings – Factory made rigid polyurethane foam (PUR) products – Specification).

Thermal Conductivity

The boards achieve a thermal conductivity (λ–value) of 0.022 W/m·K.

Thermal Resistance

Thermal resistance (R–value) varies with thickness and is calculated by dividing the thickness of the board (expressed in metres) by its thermal conductivity. The resulting number is rounded down to the nearest 0.05 (m^2·K/W).

Insulant Thickness (mm)	Thermal Resistance (m^2·K/W)
20	0.90
25	1.10
30	1.35
40	1.80
50	2.25
60	2.70
70	3.15
75	3.40
80	3.60
90	4.05
100	4.50
110	5.00
120	5.45
125	5.65
130	5.90
140	6.35
150	6.80

** NB Refer to local distributor or Kingspan Insulation price list for current stock and non–stock sizes.*