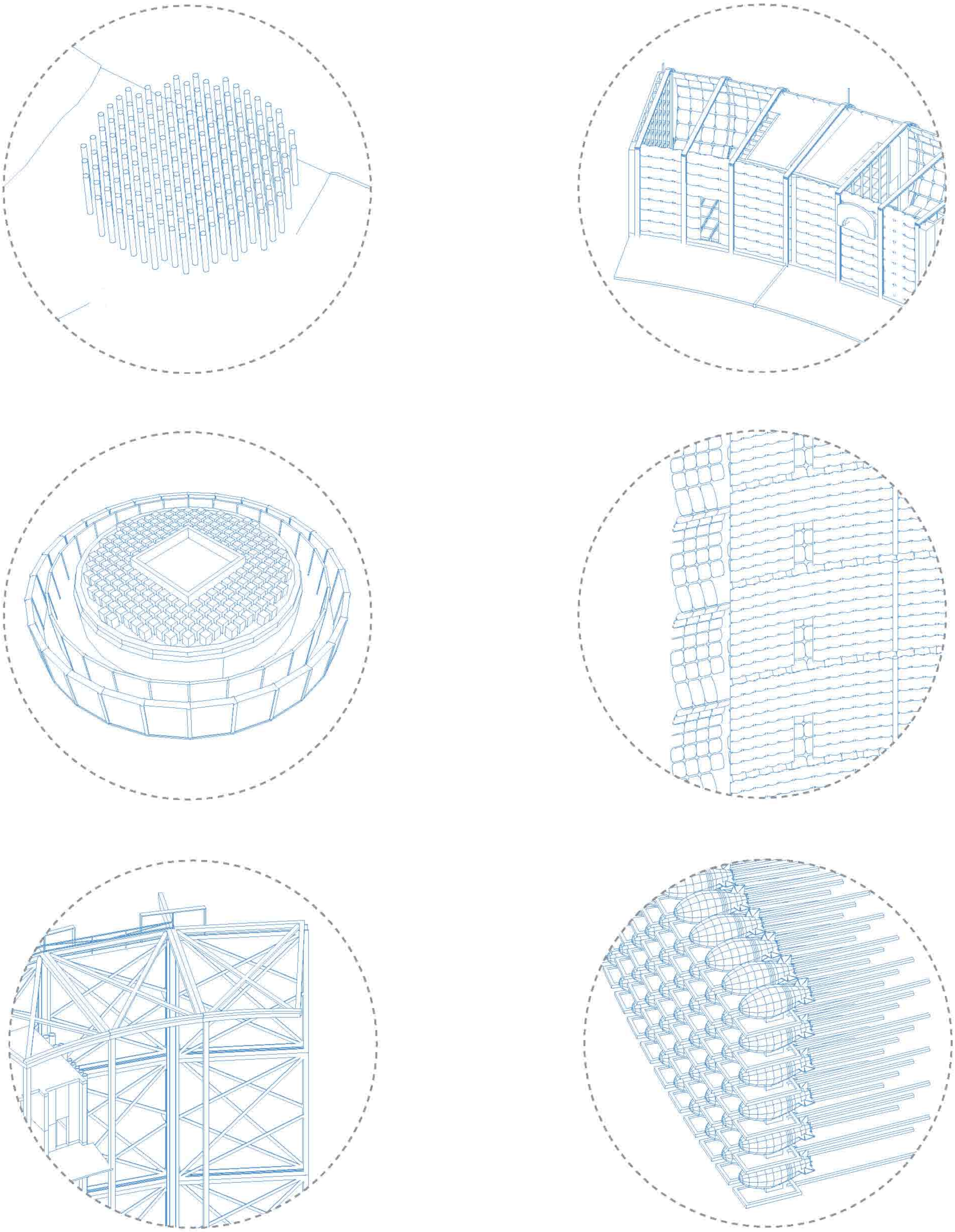
04_

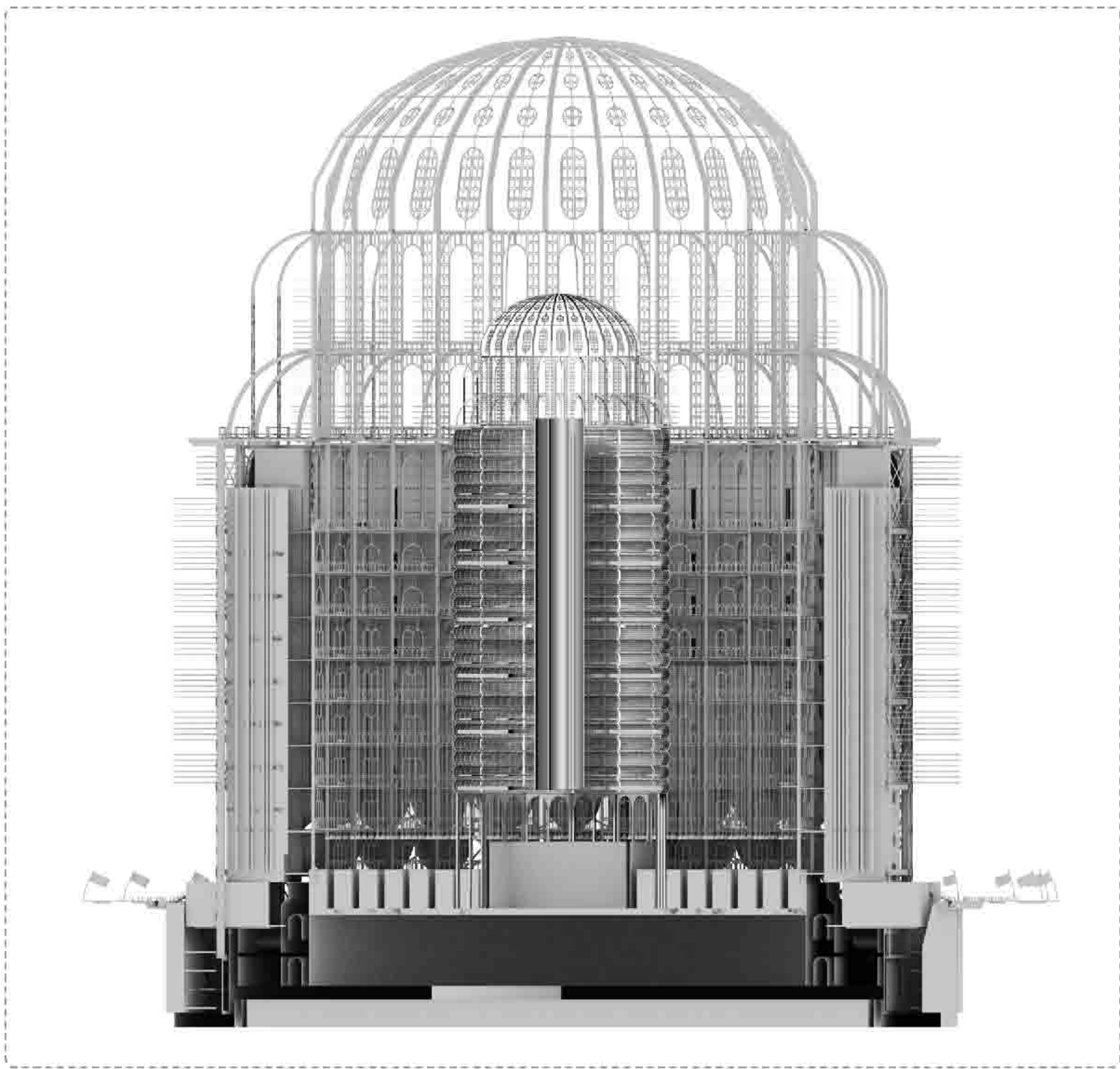
BUILDING CONSTRUCTION

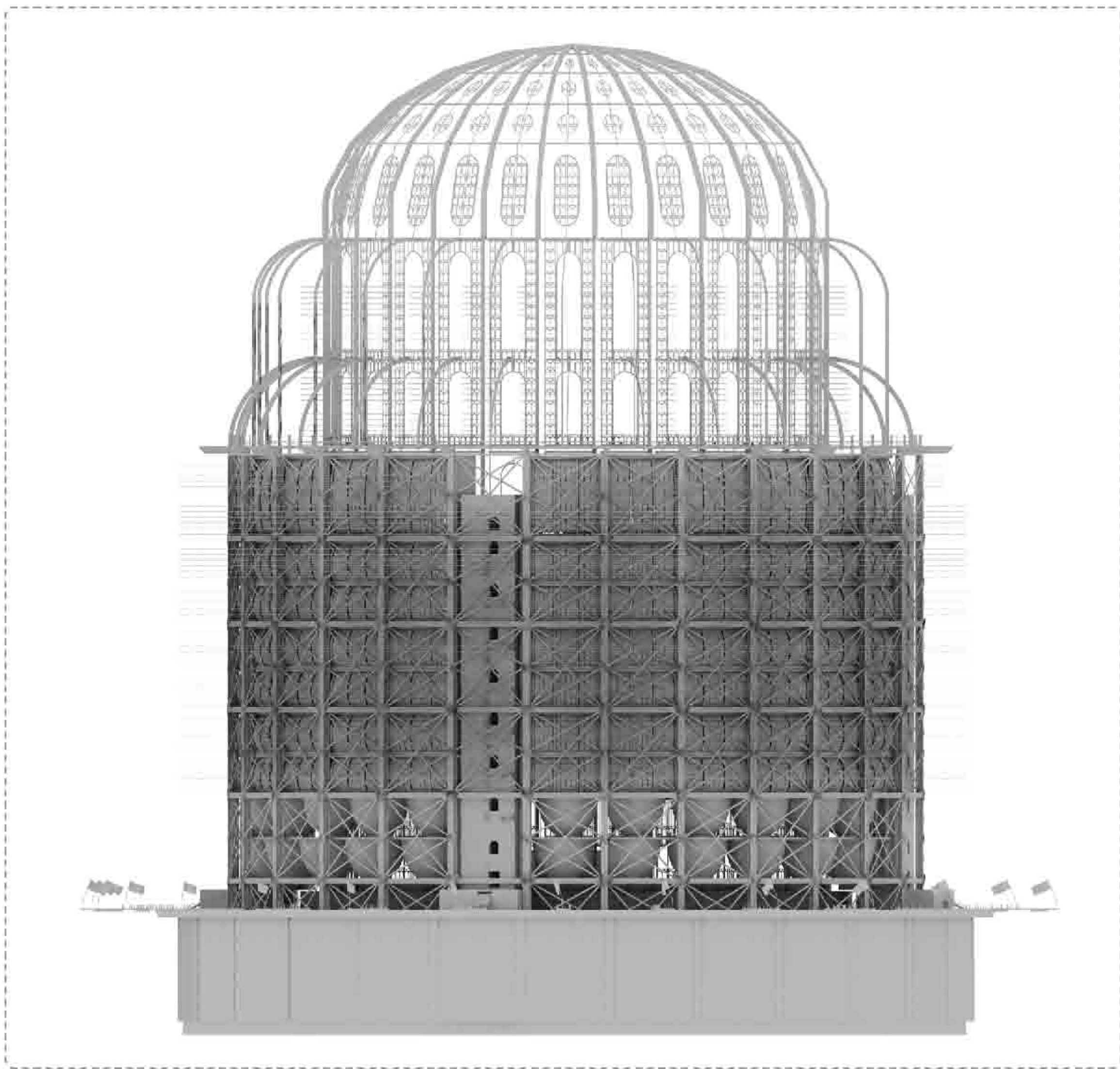


4.1 __STRUCTURE

Construction challenges

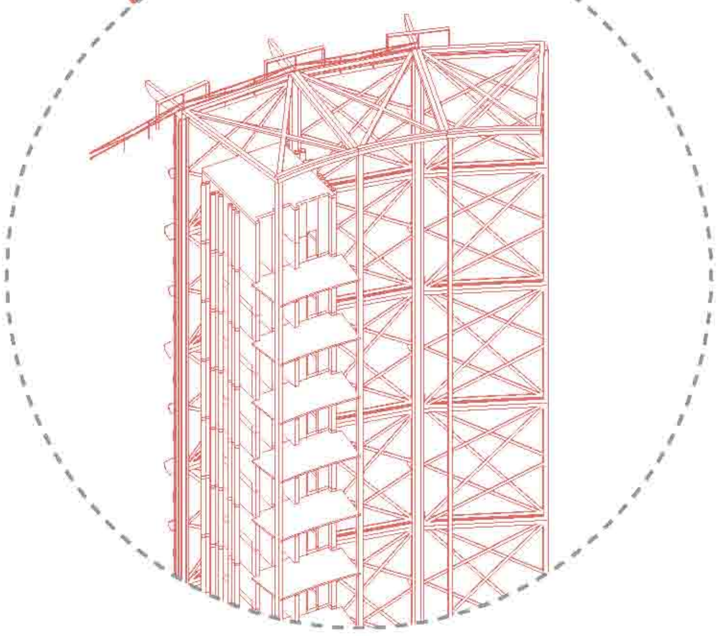
Radial pile foundation
Concrete raft
Primary steel frame
Gasometer refurbishment
Prefabricated modules
ETFE envelope
Drone facade





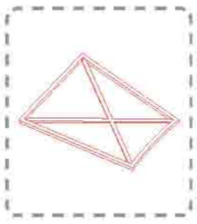
Above: The ambition of the scheme
Top: Building sectional view
Bottom: Building elevation

Primary

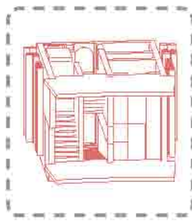


Steel
[Black painted]

Concrete
[Dark Earth Mix]



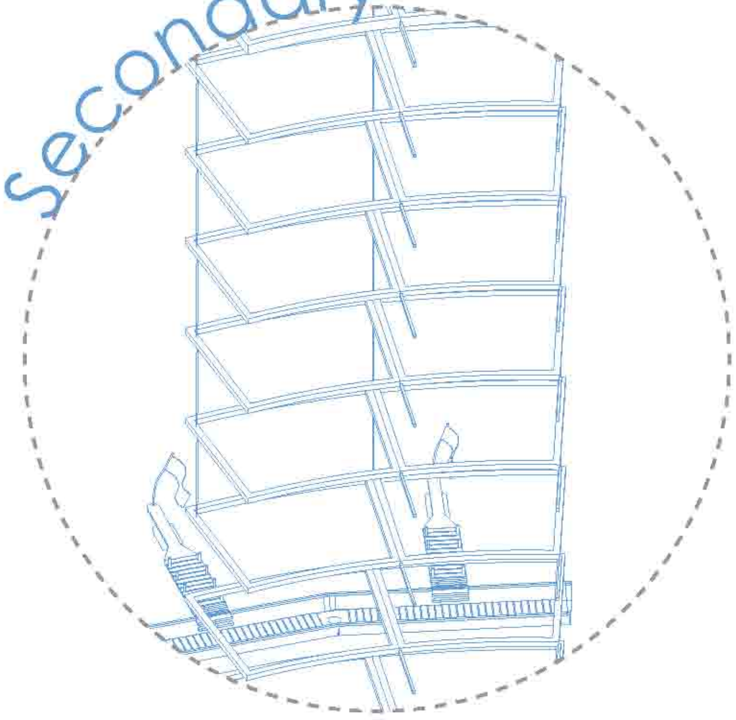
Frame



Core

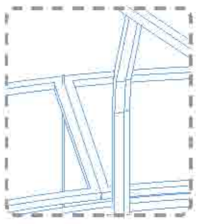
A primary steel frame combined with a concrete raft foundation and concrete cores work together to form the primary structure

Secondary

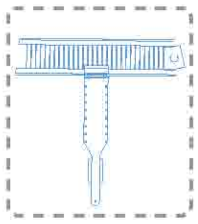


Steel
[Stainless Steel]

Timber
[Charred Larch Wood]



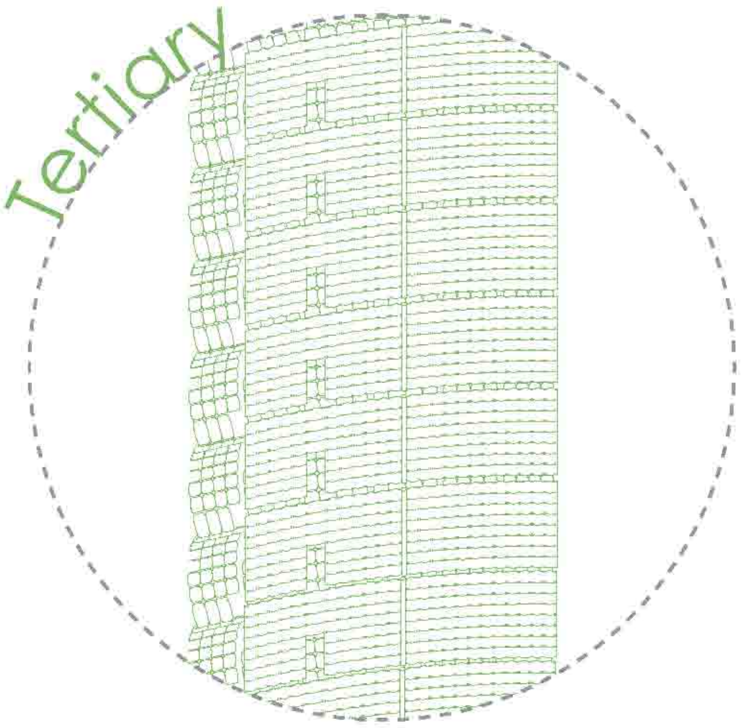
Frame



Jetty

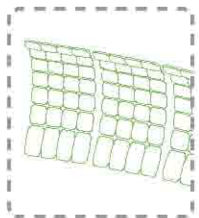
A secondary steel frame combined with a wooden perimeter jetty work together to form the secondary structure which supports the prefabricated modules and provides access to the building

Tertiary

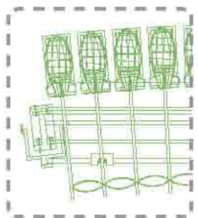


ETFE
[Translucent]

Latex
[Yellow]



Envelope



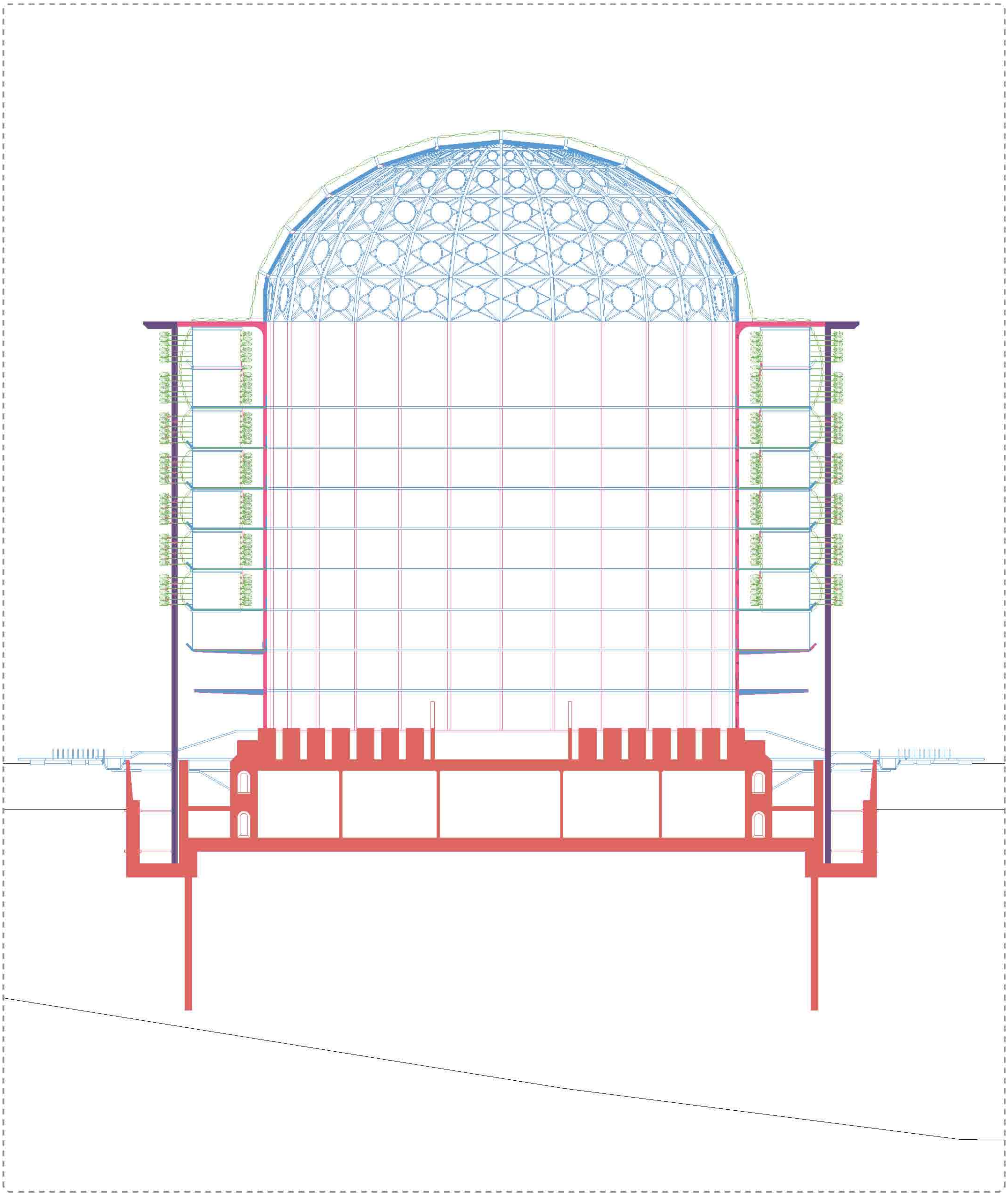
Drone Facade System

An ETFE envelope combined with a lightweight aluminium frame and drone facade system structure work together to form the tertiary structure that provides a weather resistant barrier from the outside

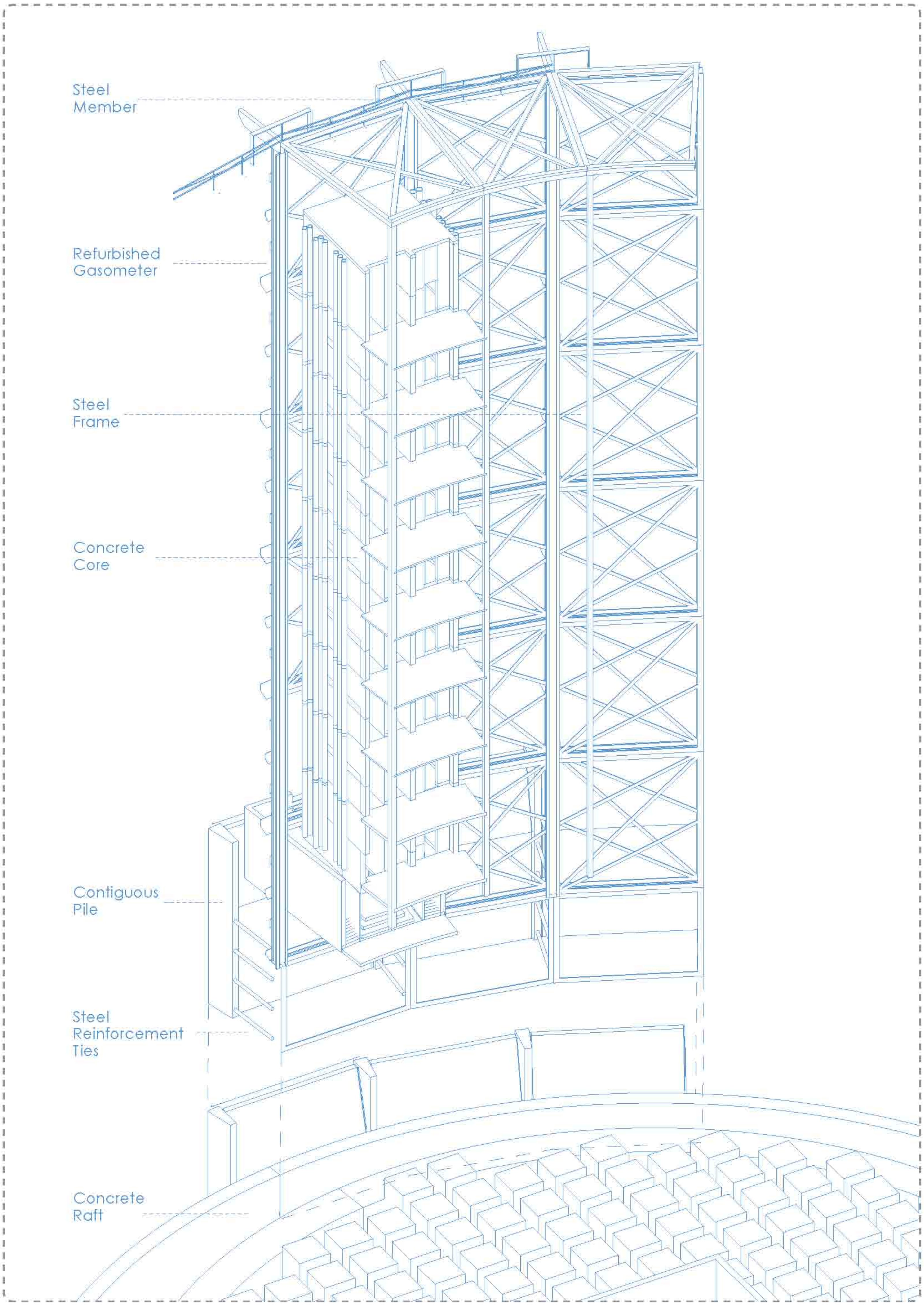
4.1 1__STRUCTURE

A brake down summary of the structure, its role and material details

Structural Hierarchy



Primary Structure
Secondary Structure
Tertiary Structure

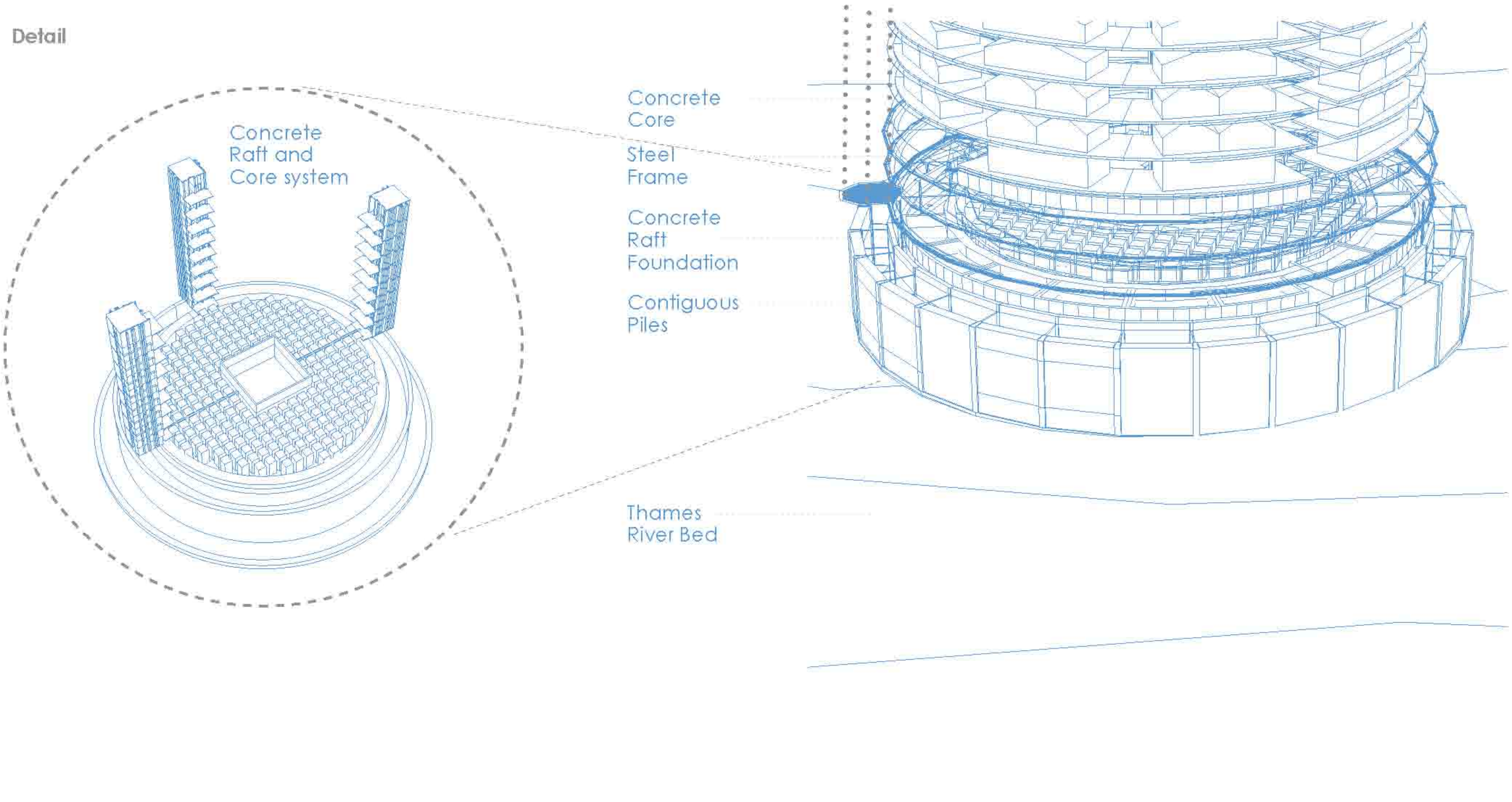


4.1 2__STRUCTURE

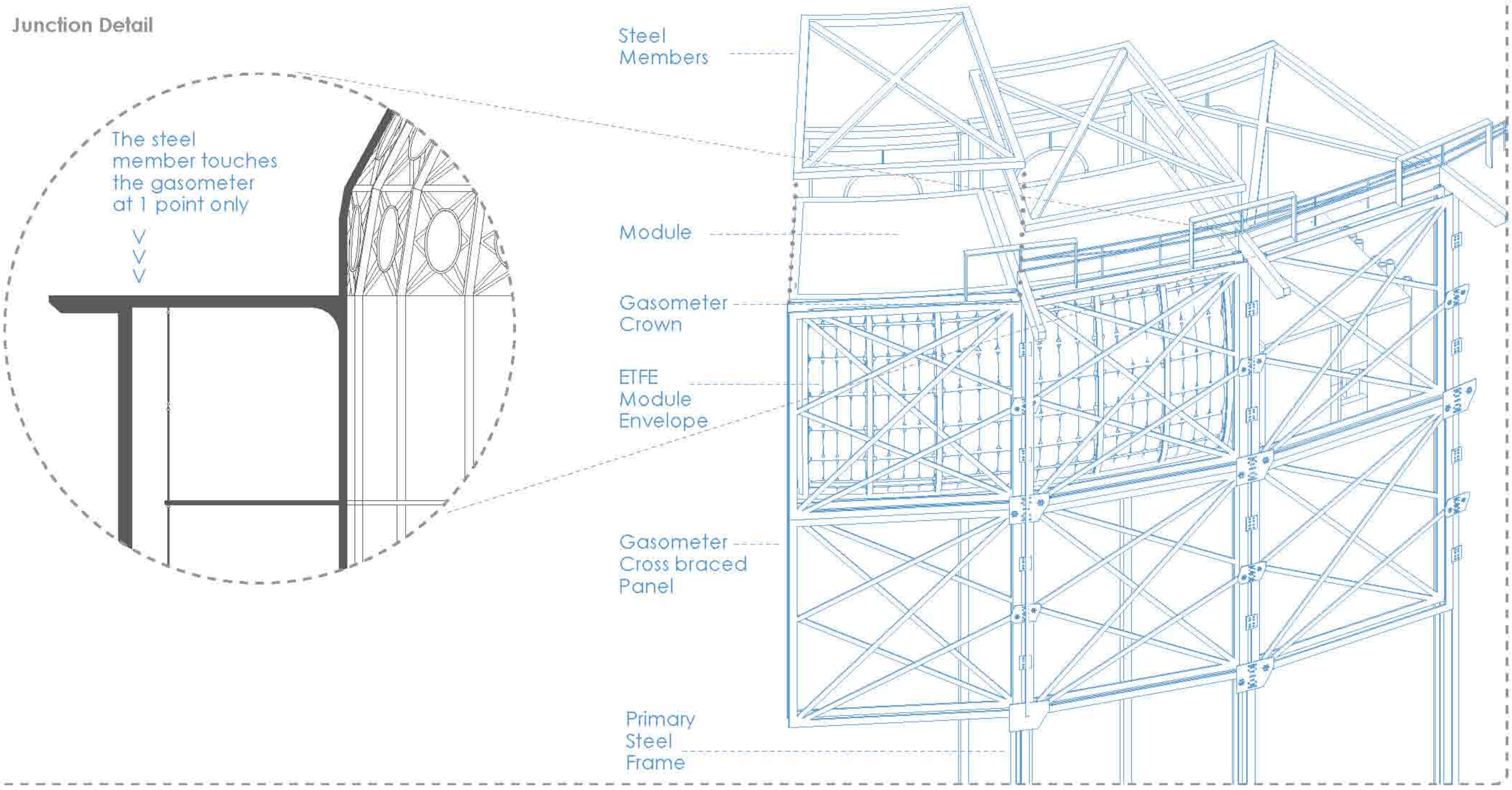
Primary Structure

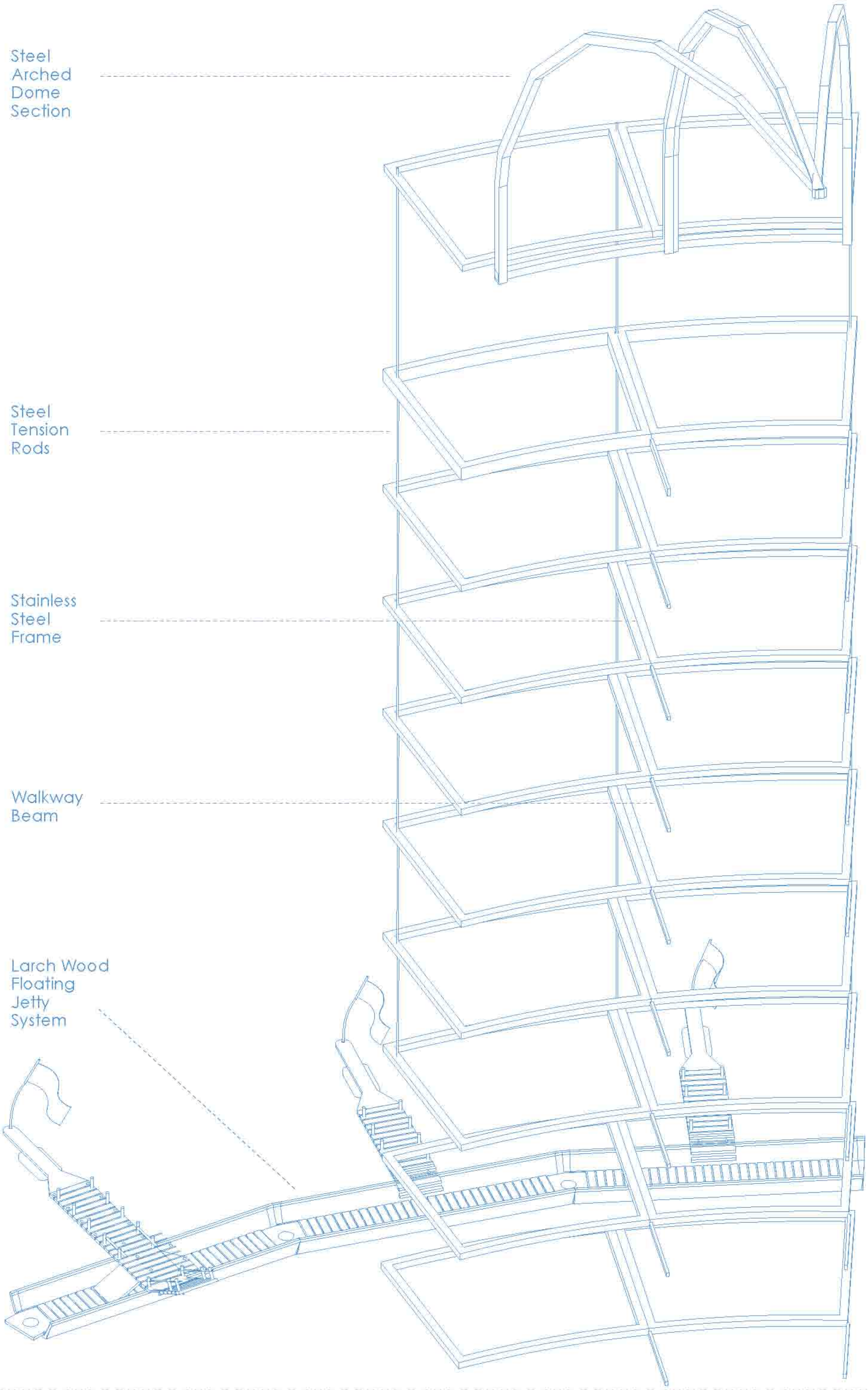
A primary steel frame combind with a concrete raft foundation and concrete cores work together to form the primary structure

Detail



Junction Detail



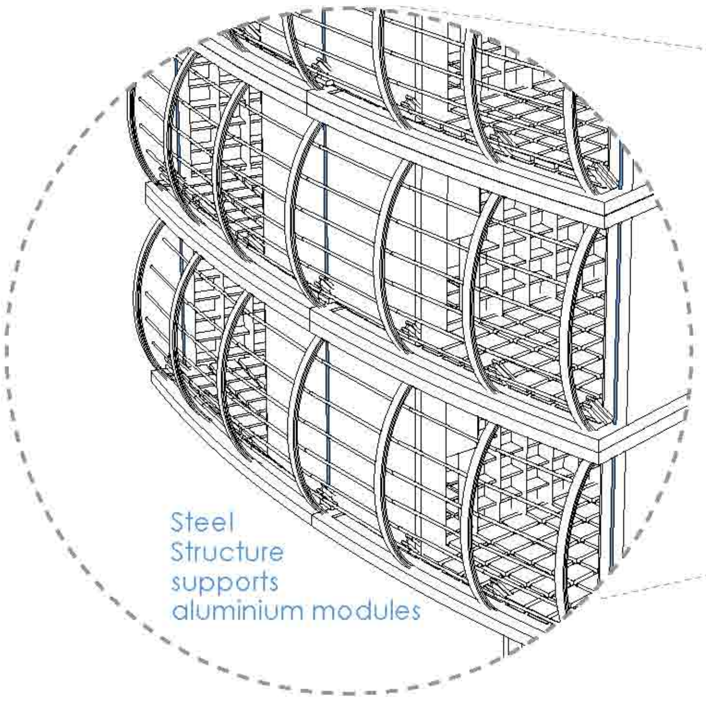


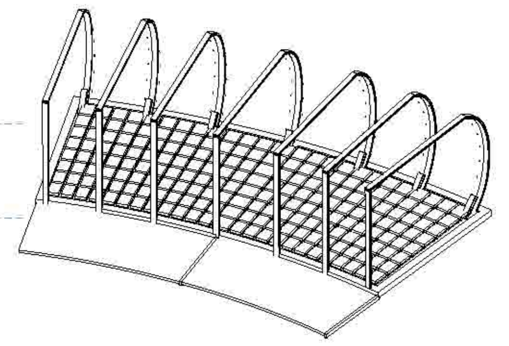
4.1 [3] __STRUCTURE

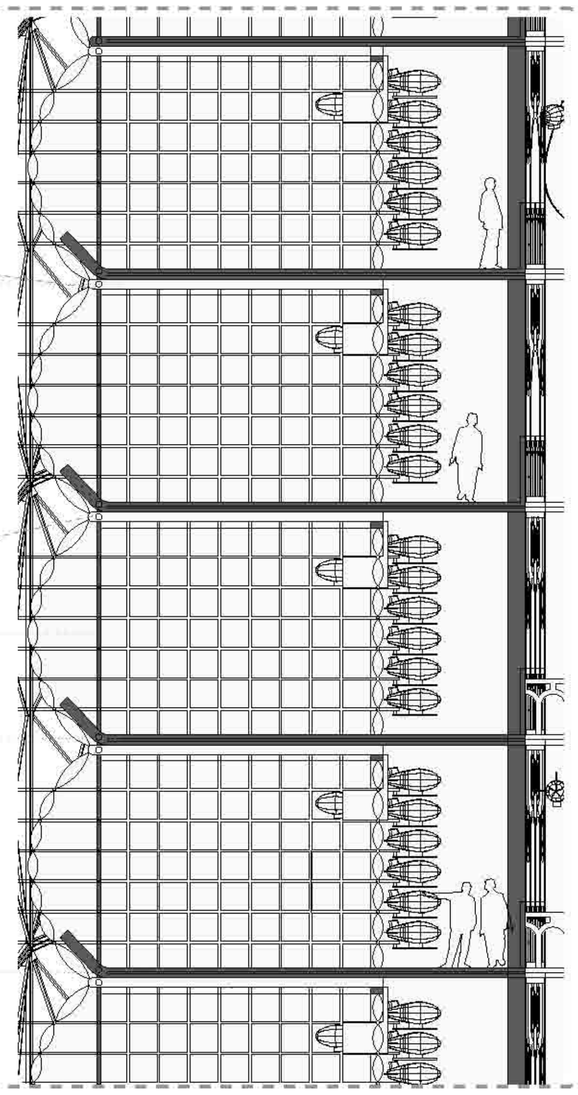
Secondary Structure

A secondary steel frame combined with a wooden perimeter jetty work together to form the secondary structure which supports the prefabricated modules and provides access to the building

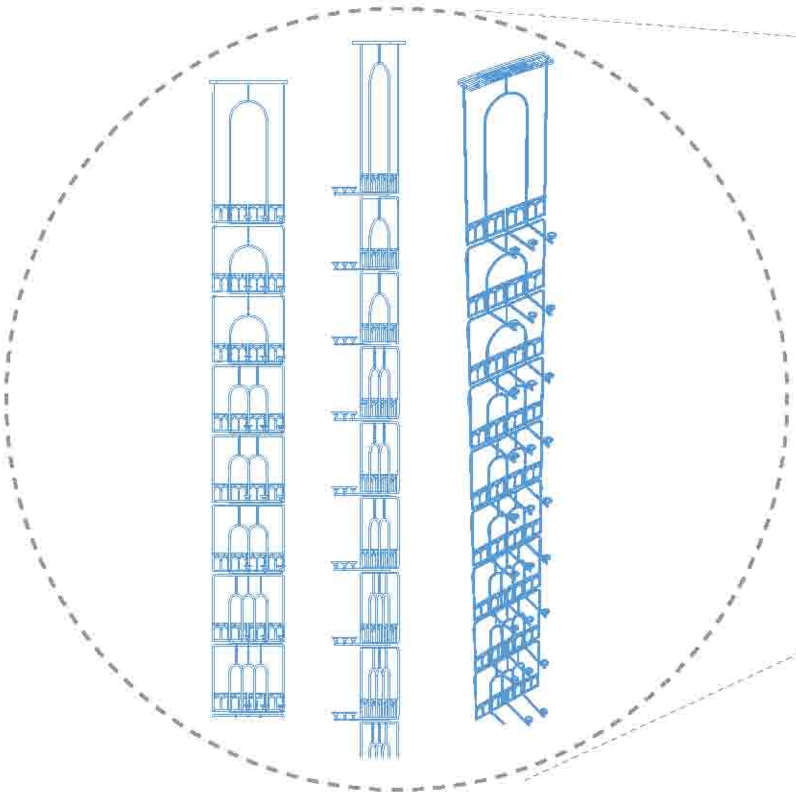
Detail

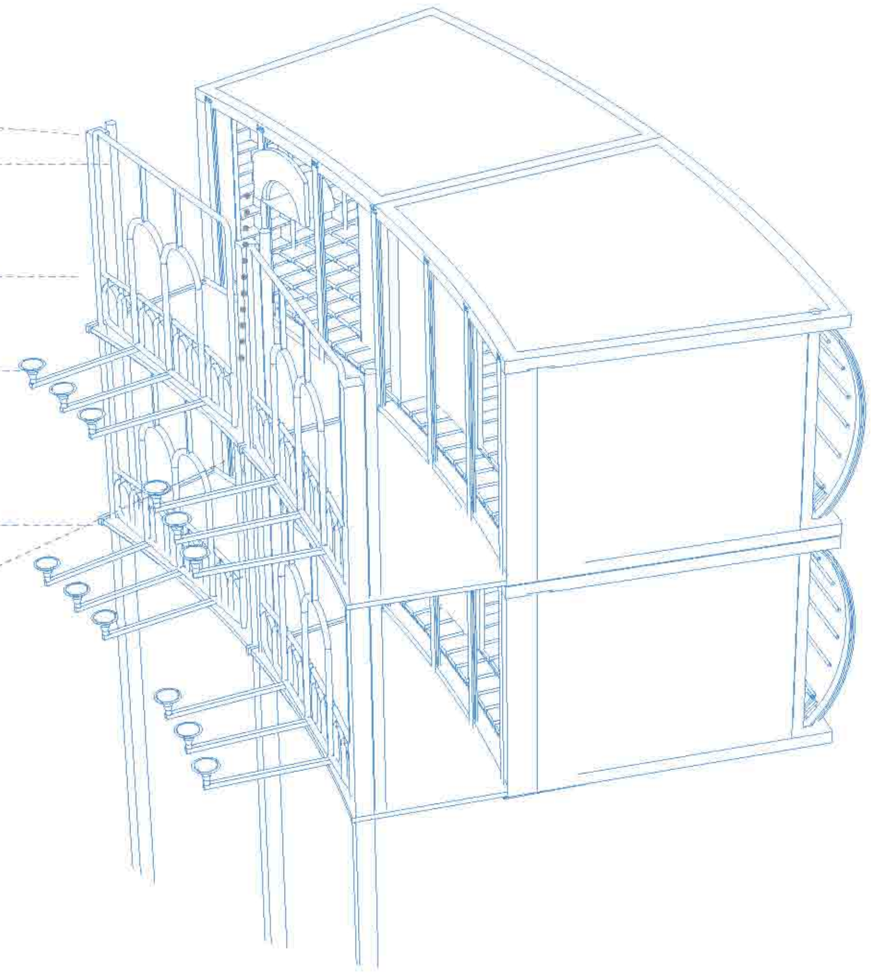


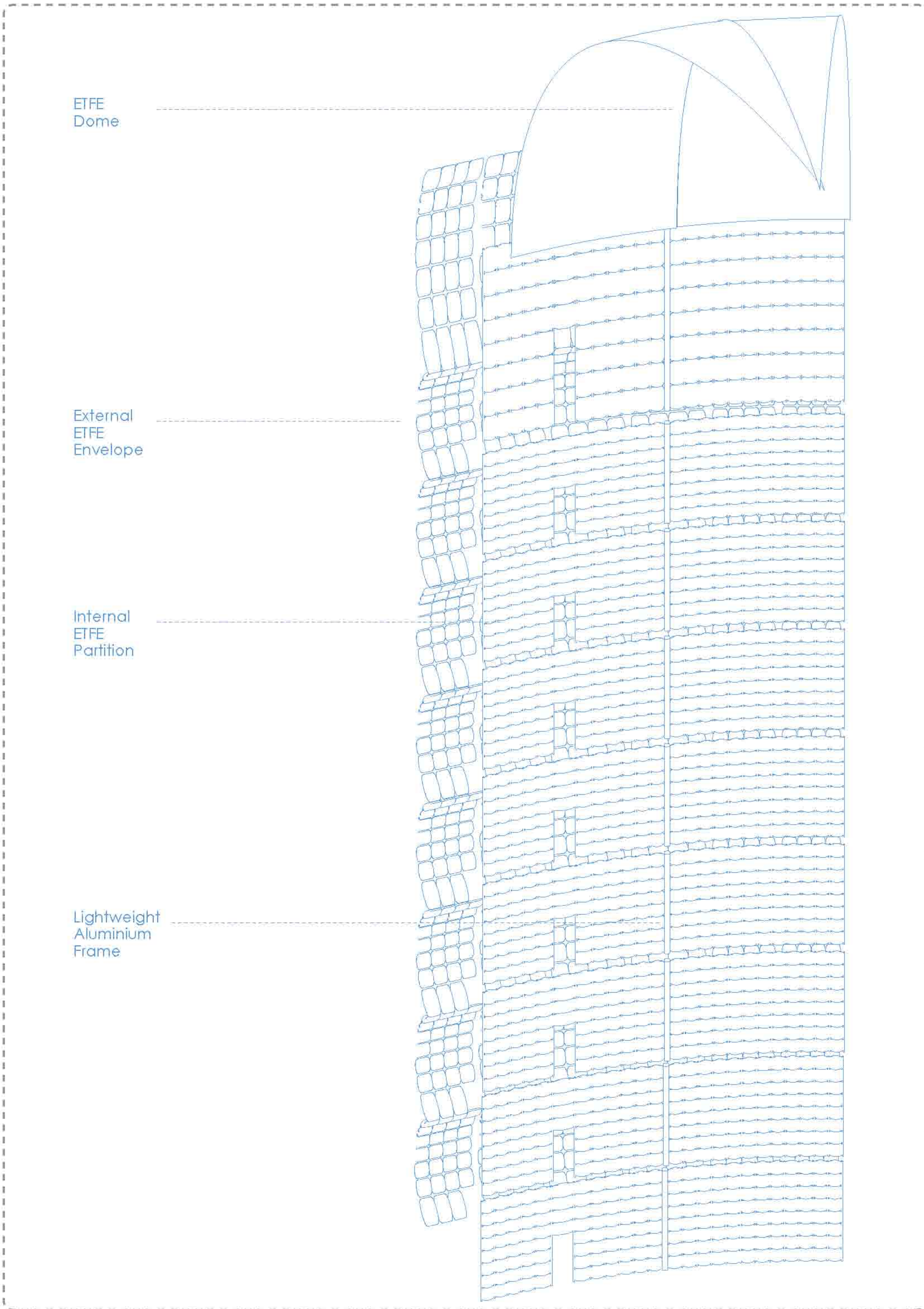




Junction Detail







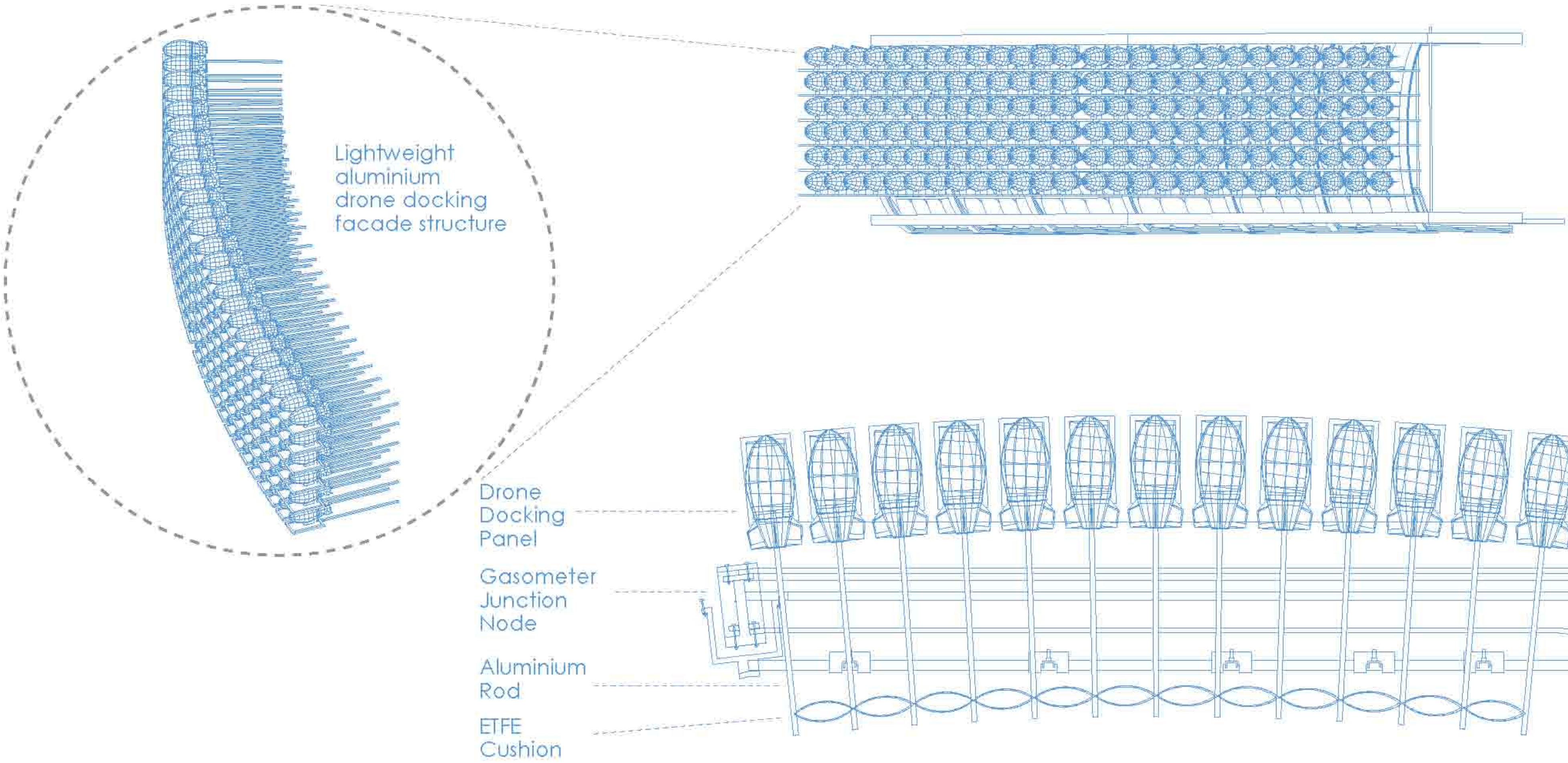
4.1

Tertiary Structure

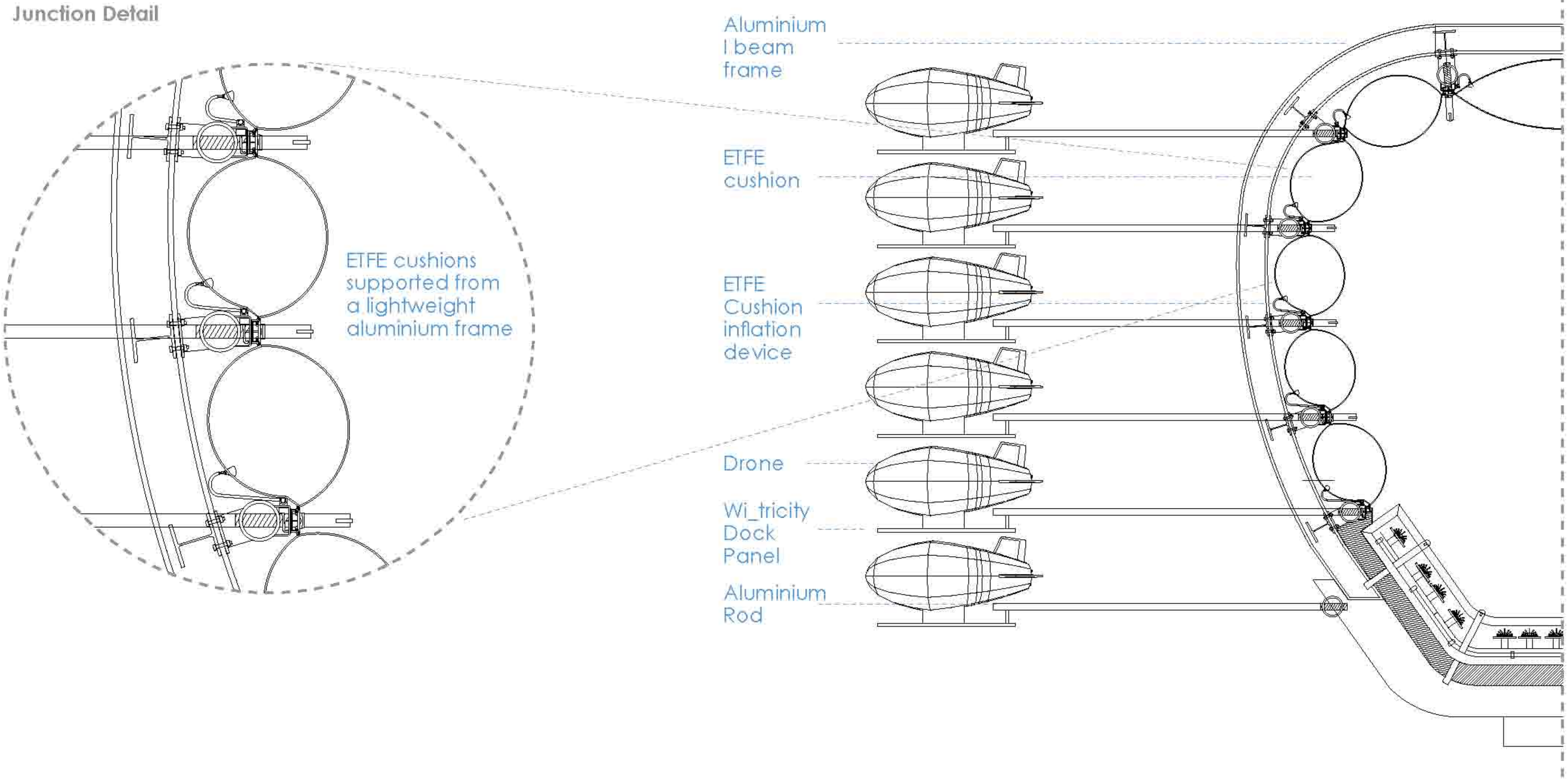
4 __STRUCTURE

An ETFE envelope combined with a lightweight aluminium frame and drone facade system structure work together to form the tertiary structure that provides a weather resistant barrier from the outside

Detail: Drone facade system



Junction Detail



Prefabricated Construction

The benefits of prefabricated construction will suit many parts of this project. The modular design and 'kit of parts' approach will lend itself to a quality driven, tailor-made mass production process.

The production process is not driven by quantity but by semi-automated prefabricated and pre-assembly of components that results in a quality standard that could never be achieved through manual, predominately on-site, assembly. This is imperative to the carefully crafted atmospheric tuning that has gone into each modules design, created by a combination of high technologies that could not be installed by anyone else other than a professional with experience in the field, off site under factory conditions.

The terms 'tailor-made' and 'mass production' appear irreconcilably incompatible. However, the components emerge from a state-of-the-art production line, that are assembled to create an individually architectured module, with every part being manufactured to the highest quality standards.

No "standard blueprint" plans are used, but instead each module is captured in a bespoke design that takes into account the location and context of the site. Team work begins at the outset with the consultation and planning phase and continues through production planning, manufacturing, assembly and fit-out. A team of specialists will work together with the architect through each of these phases in order to deliver the very best

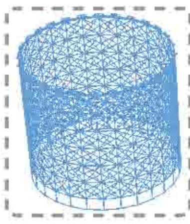
Factory Produced

By 2030, 'HUF HAUS' have begun to branch out from timber post and beam prefabricated architecture and are able to produce the bespoke modules designed for the R_evolution Lab.

The company takes sustainability as a matter of principle, meaning the choice of materials and energy used is governed by ecological and environmental compatibility and sustainability. Craftsmanship is to the highest standard, meaning finish and air tightness are also achieved in order to reach a BREEAM Outstanding score.

breeam The Code for Sustainable Buildings

OUTSTANDING ★★★★★

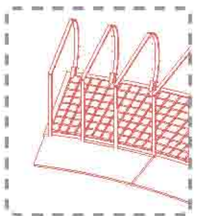


Structure

HARE CONSTRUCTION COMMERCIAL & RESIDENTIAL builder of all ideas

General Contractor

Refurbished in a **factory** in **Yorkshire**



Module

HUF HAUS

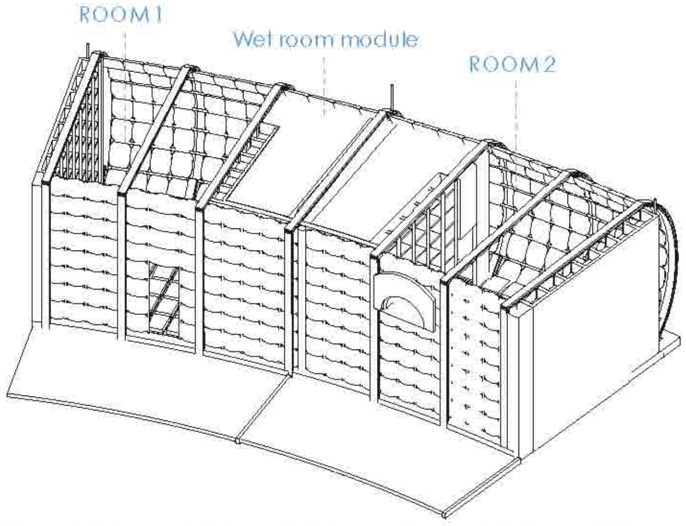
Prefabrication Contractor

Manufactured in a **factory** in **Germany**

Modular Design

All modules are designed around this fundamental module design

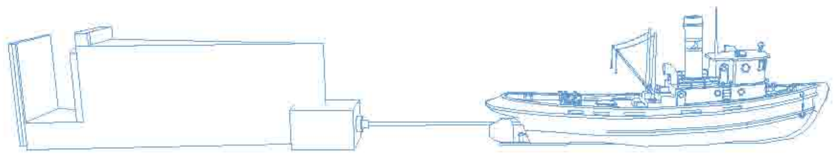
It is constructed from a kit of parts that are repeated and re configured around the building in order to construct each bespoke module iteration



Transport to site

All prefabricated modules and construction materials are transported to site on barges down the River Thames.

Some prefabricated components such as the concrete foundation can be floated on to site segment by segment

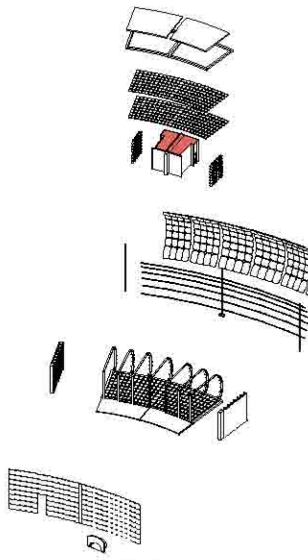


4.2_PREFABRICATION

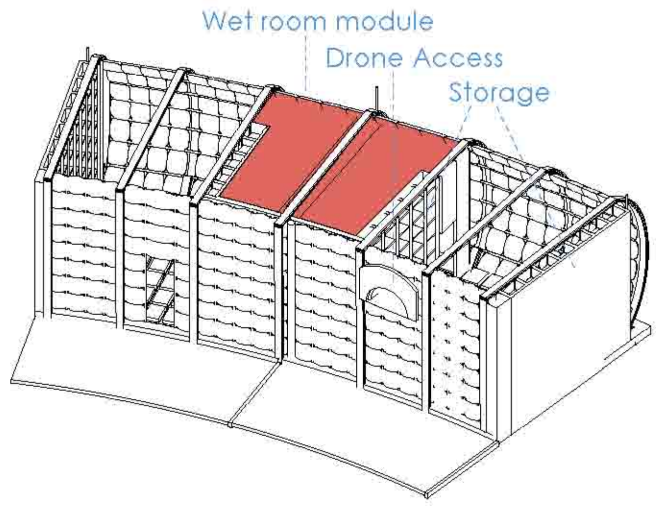
Prefabricated Modules

The modular design and kit of parts architecture approach used for the design of the R_evolution lab lends itself to a prefabricated construction process.

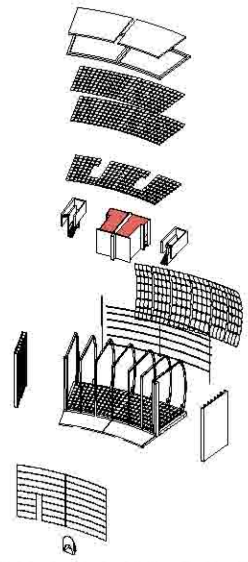
The quality of construction and finish required in each of the bespoke accommodation, laboratory and kitchen modules can only be achieved under factory conditions, and it is the responsibility of the architect to take an active role alongside the prefabrication contractor to deliver each module to the desired standard of the design.



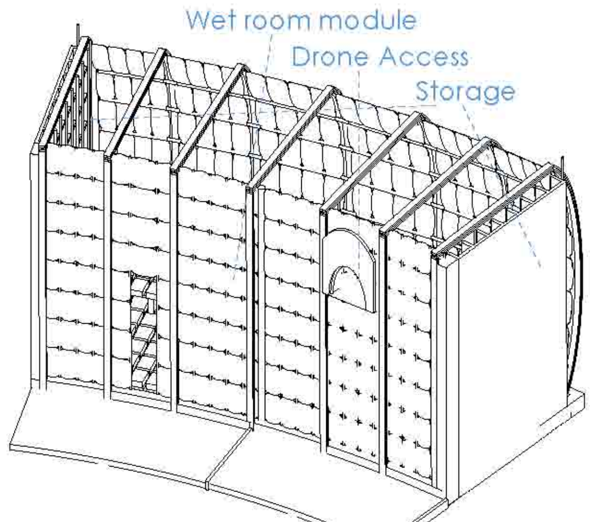
Accommodation
Kit of parts



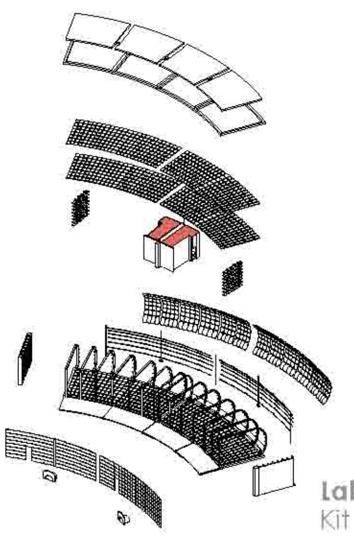
Module 1



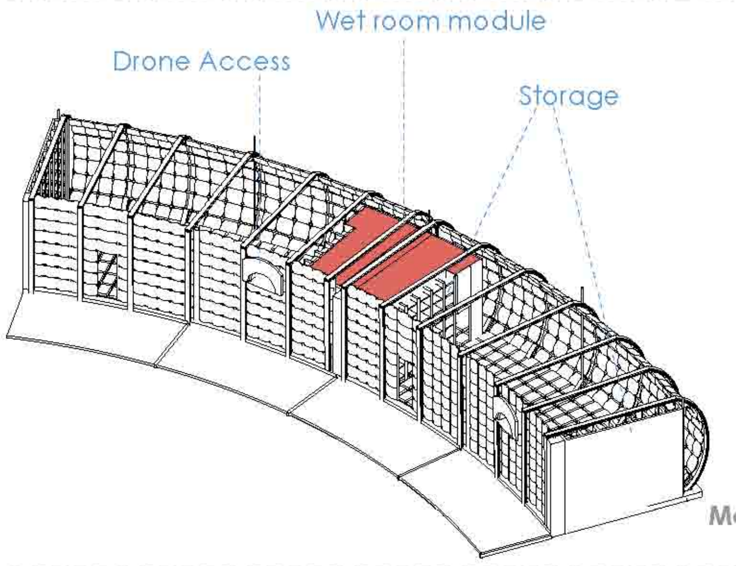
VIP Accommodation
Kit of parts



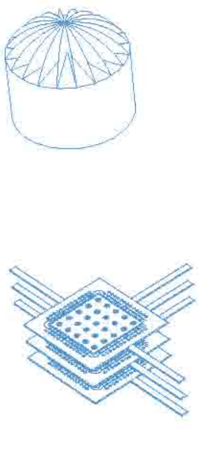
Module 2



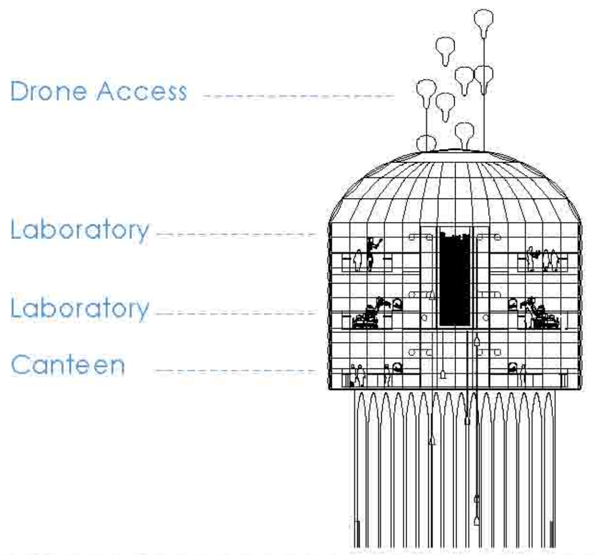
Lab / Kitchen
Kit of parts



Module 3



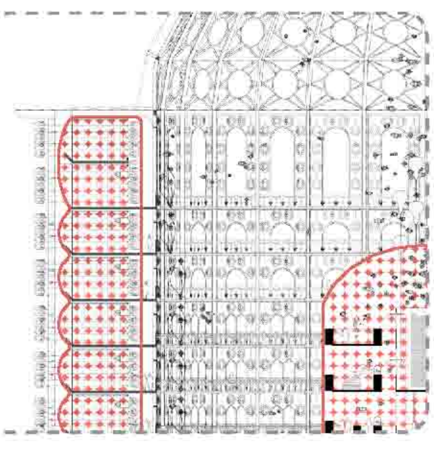
Eel Lab / Canteen
Kit of parts



Module 4
1 off
bespoke

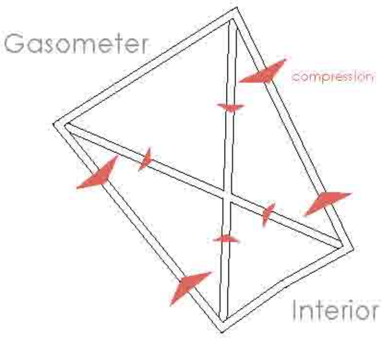
Kit of parts architecture

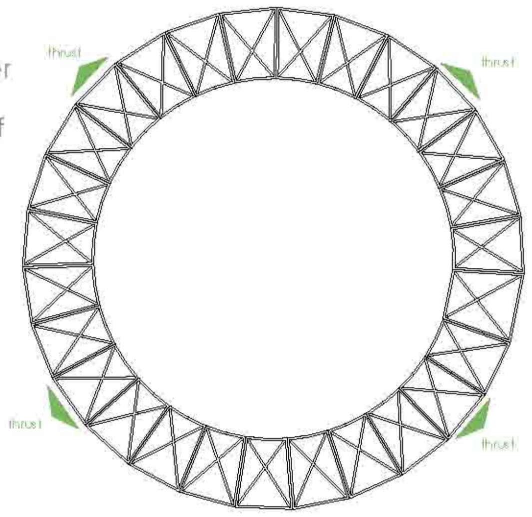
The R_evolution lab is constructed from a kit of parts that are repeated and re configured around the building in order to construct each bespoke module iteration

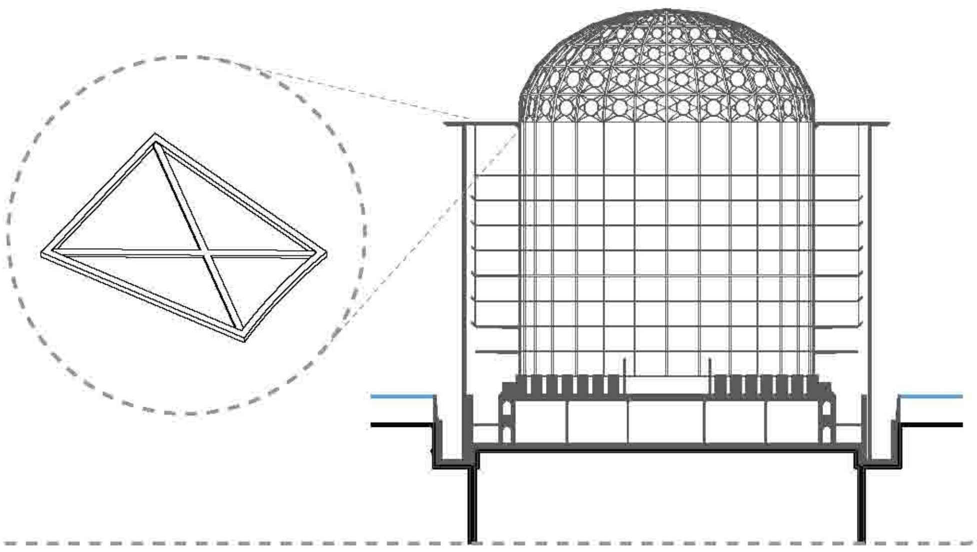


4. Steel Member:

Acting under compression, it is the role of the steel members to transfer the lateral thrust forces caused by the arched compression of the roof to the gasometer structure

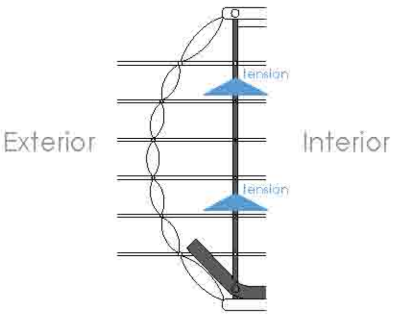


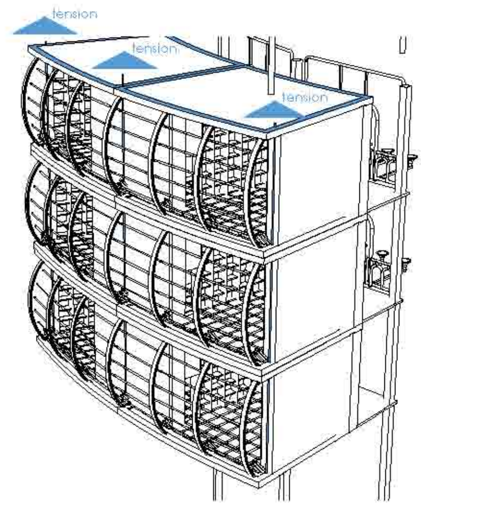


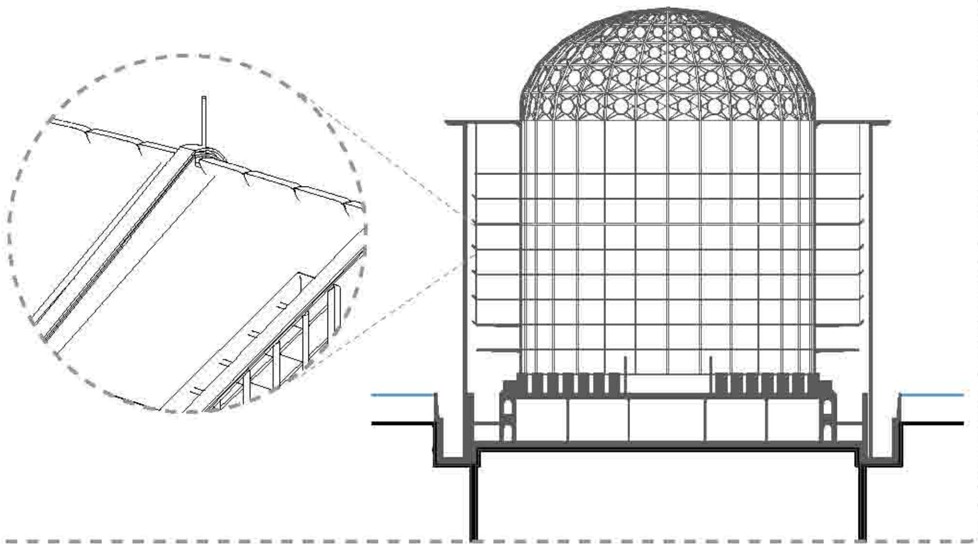


6. Steel Rod:

Acting under tension, it is the role of the steel rods to hang the 10 meter long steel beams [spanned too far to cantilever] that support the modules from the steel members.



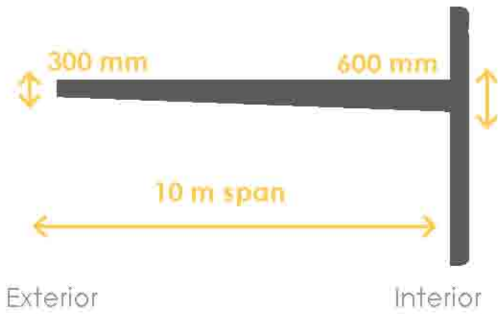


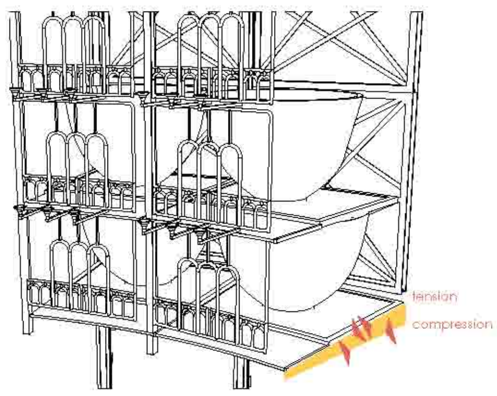


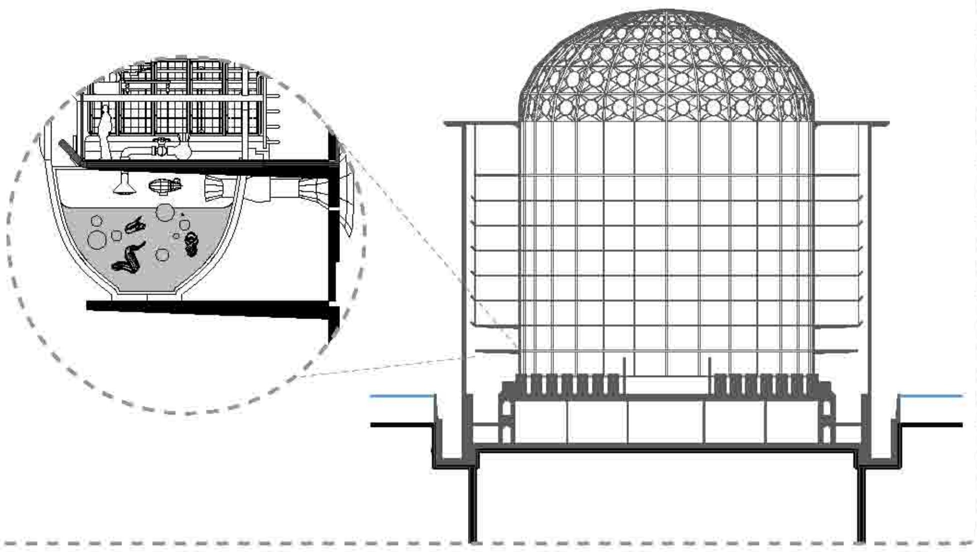
7. Profile Beam:

Cantilevered beams take the weight of the Eel soup tanks

The structural hierarchy dictates the heaviest modules are at the bottom







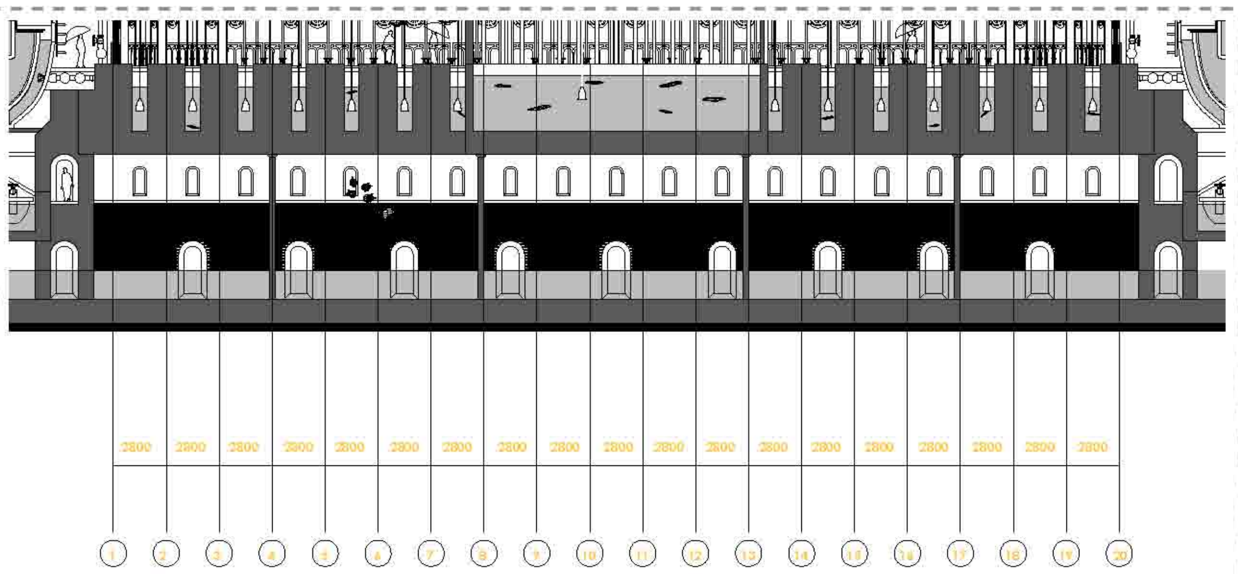
Structural Grid: [scale 1:400]

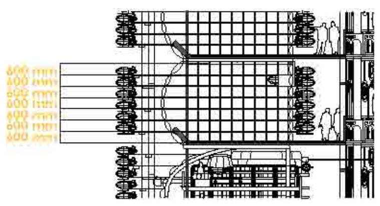
The building is designed on a strict vertical and horizontal structural grid for structural and organisational purposes. The buildings modular design will ensure structural stiffness and stability

Horizontal Grid 1:400

2800 x 2800

Dictated by: Landscape column centres





Vertical Grid 1:400

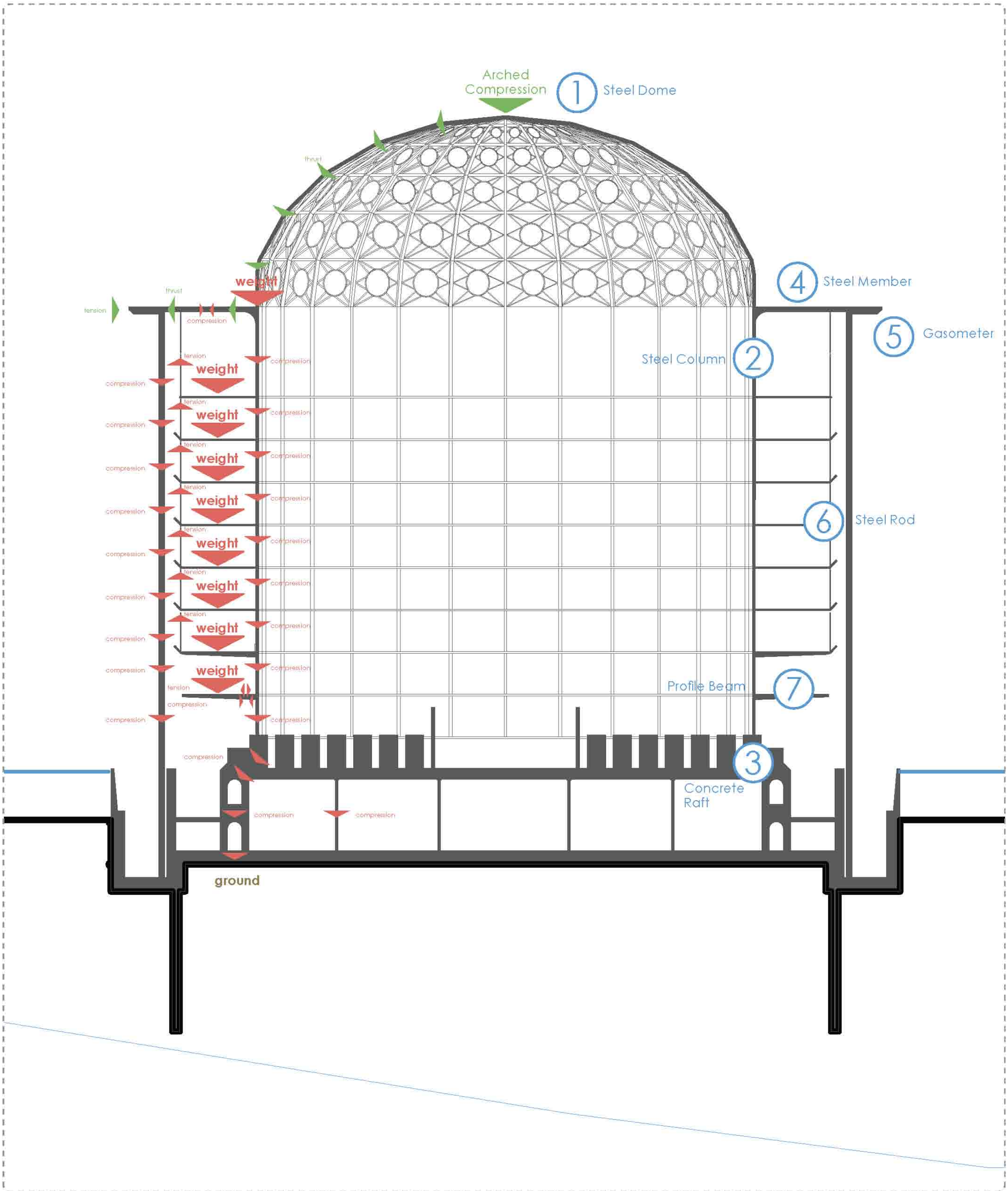
600 x 600

Dictated by: VR panel dimensions

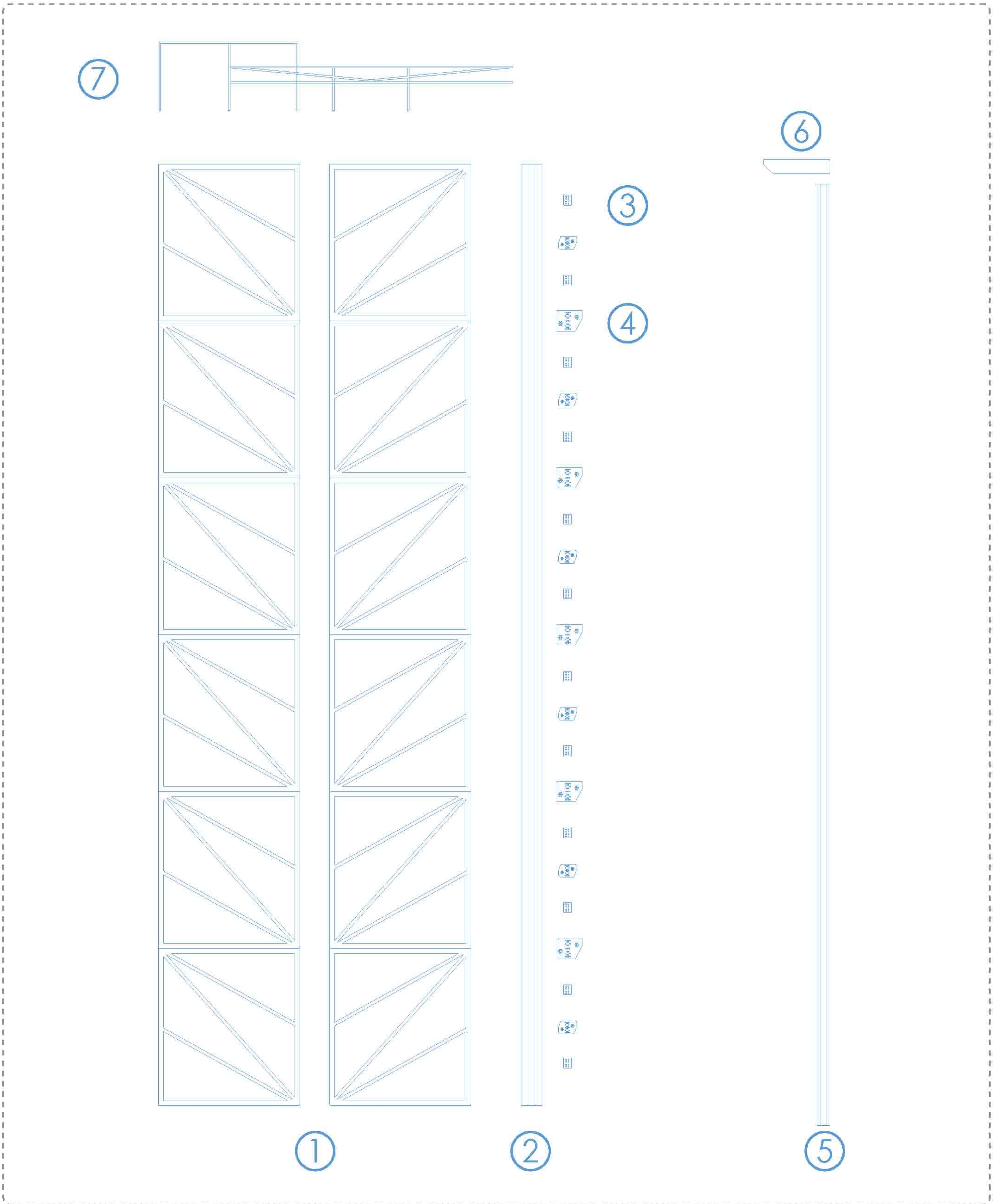
4.3_PRINCIPLES

Structural Principles

A summary of forces acting upon the structure and its constituent parts as well as a summary of the structural principles applied to deal with them. The building's modular design and strict structural grids ensure structural integrity throughout the scheme



1. Steel Dome: in 'arched compression' at the top, will exert a 'thrust force' outwards at the bottom. Due to it's mass under gravity, a vertical force caused by the weight of the structure will also act equally about each radial steel column
2. Steel Column: Acting under compression as a constituent part of the primary steel frame structure, its role is to take the vertical forces caused by the weight of the prefabricated modules and roof to the foundation
3. Concrete Raft Foundation: The vertical loading of the structure will then be taken to ground by a series of concrete columns acting under compression.
4. Steel Member: Acting under compression, it is the role of the steel members to transfer the lateral thrust forces caused by the arched compression of the roof to the gasometer structure
5. Gasometer: The newly refurbished gasometer structure will continue to be utilised in the structural role in which it was initially designed for. Due to its vast array of cast iron bracing, the structure remains incredibly 'stiff' and acting under tension is able to pick up the lateral thrust forces as well as the shared weight of the modules.
6. Steel Rod: Acting under tension, it is the role of the steel rods to hang the 10 meter long steel beams [spanned too far to cantilever] that support the modules from the steel members.
7. Profile Beam: Cantilevered beams take the weight of the Eel soup tanks.

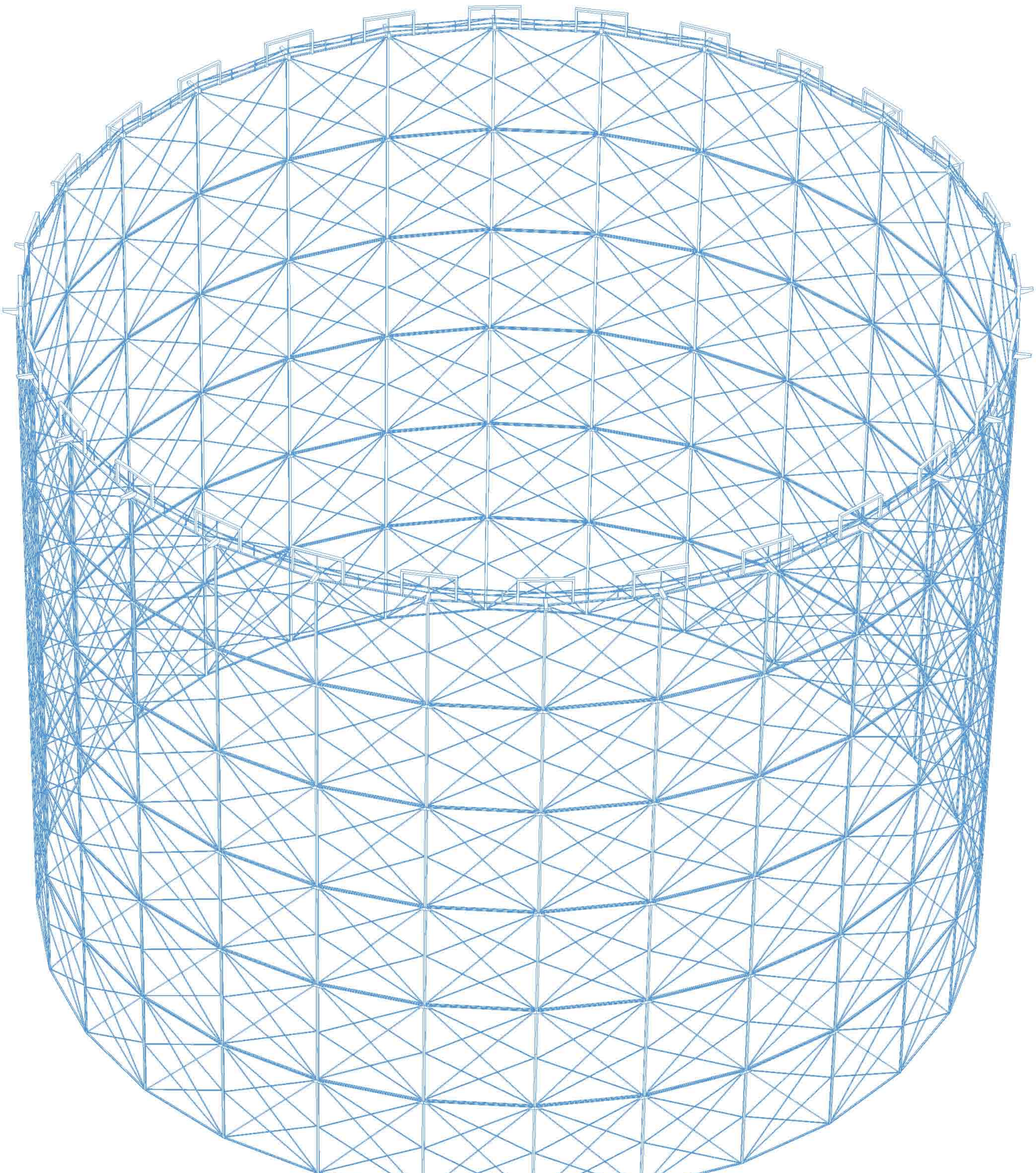


4.4__GASOMETER

Refurbishing the Gasometer

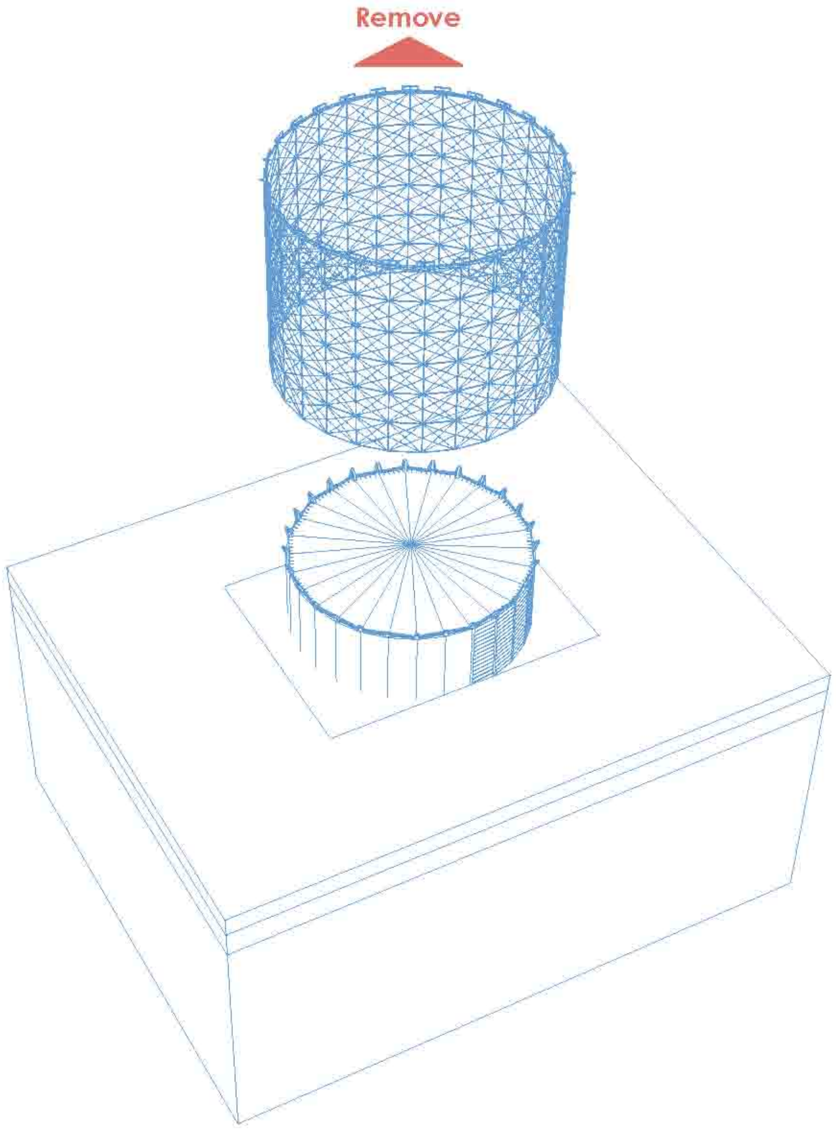
Analysis of the modular design of the gasometer and its kit of parts:

1. [Double layer] Super imposed cross bracing panel - cast iron [x 28 faces = x56 panels]
2. Cast iron column [I section] x 28
3. Iron rivet detail fixings x 336
4. Riveted facing panels x 336
5. Gasometer mechanism [vertical runner] x 28
6. Gasometer crown sections x 28
7. Walkway sections x 28



The refurbished gasometer returns to site where it will be reconstructed and capable to perform a structural role as well as a striking aesthetic role

Phase 1

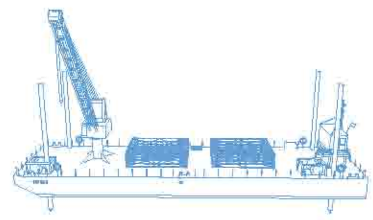


Phase Summary

Remove gasometer

HARE CONSTRUCTION
COMMERCIAL & RESIDENTIAL

Transported by sea and refurbished in a specialist **factory** in **Yorkshire**



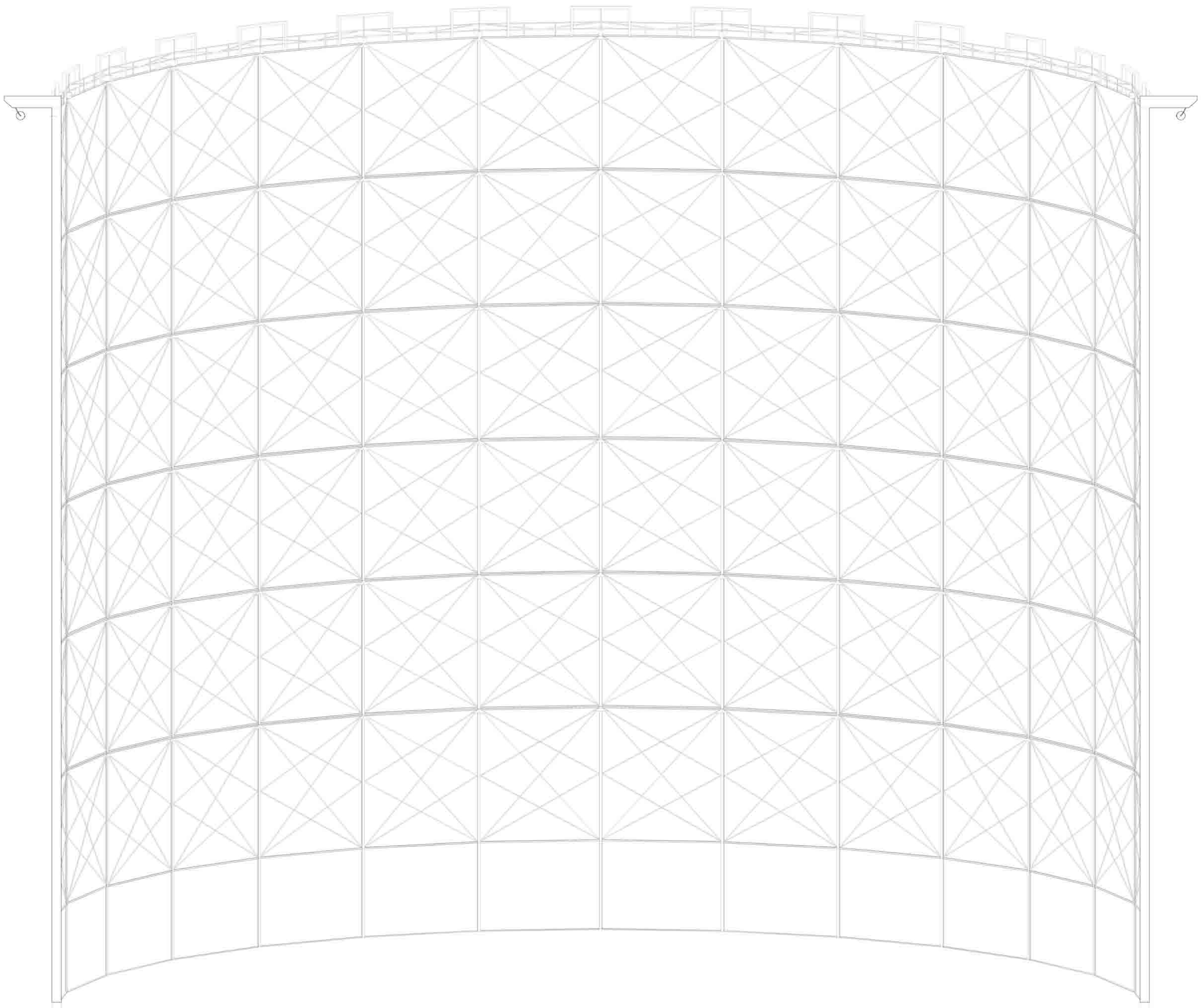
4.5__SEQUENCE

Construction Sequence

1. Gasometer Dismantled:

Specialist demolition contractors begin work on the ex gasworks site, carefully de constructing the existing gasometer ready for refurbishment

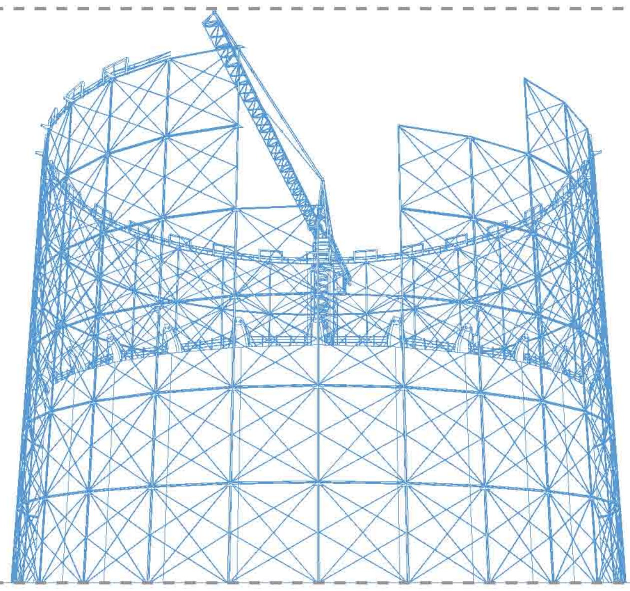
Build Status



Building Site Status

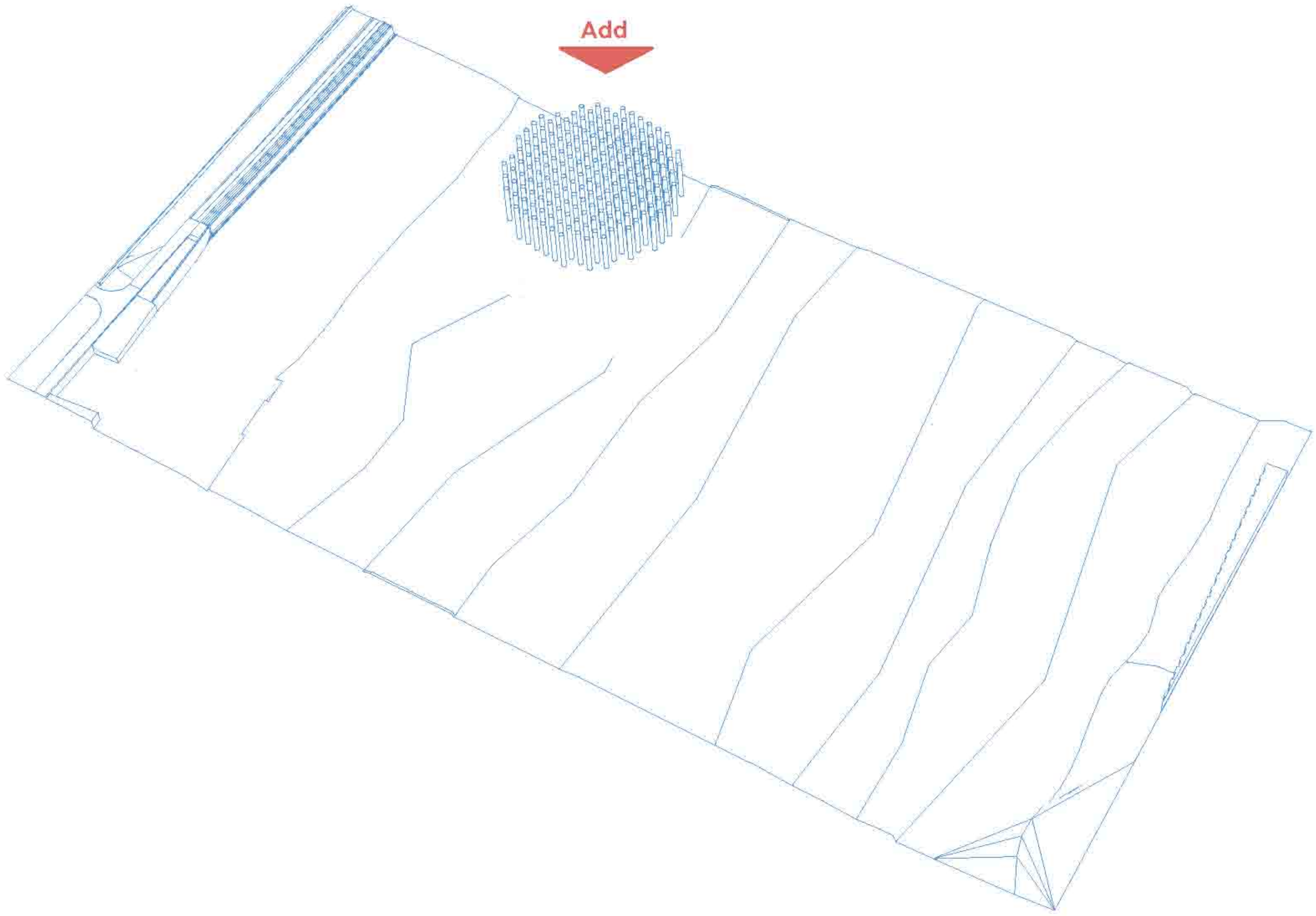
A team of around 15 men use two cranes. One crane dangles a basket carrying a masked worker, know as a "burner", who uses a plasma cutter to sever huge sections of the metal guiders.

The second crane holds the sections as they are worked on, ready to lower them down to the ground once sheared off.

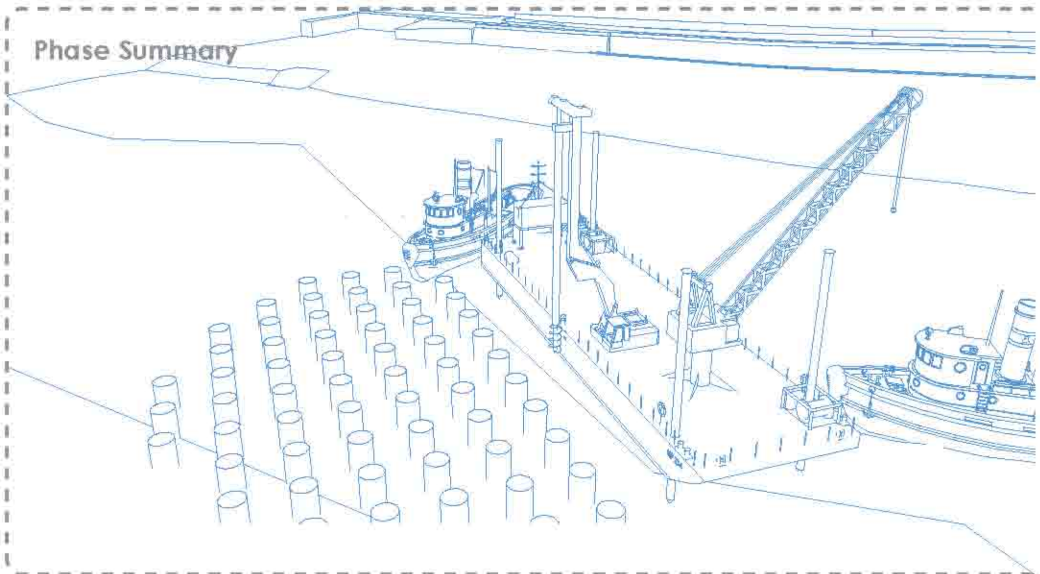


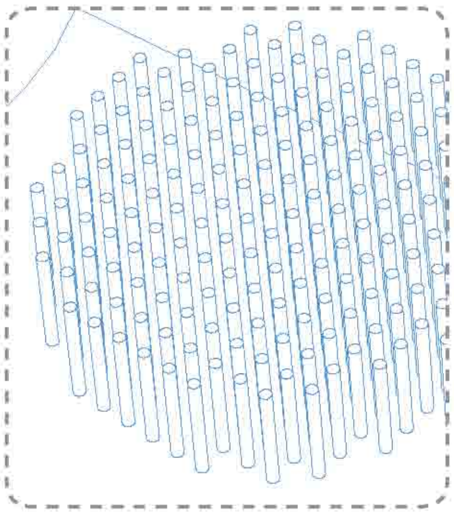
The process is done with methodical accuracy over a 5 month period. Each section of the gasometer is meticulously labelled and documented in preparation for its reconstruction on the Thames site

Phase 2



Phase Summary





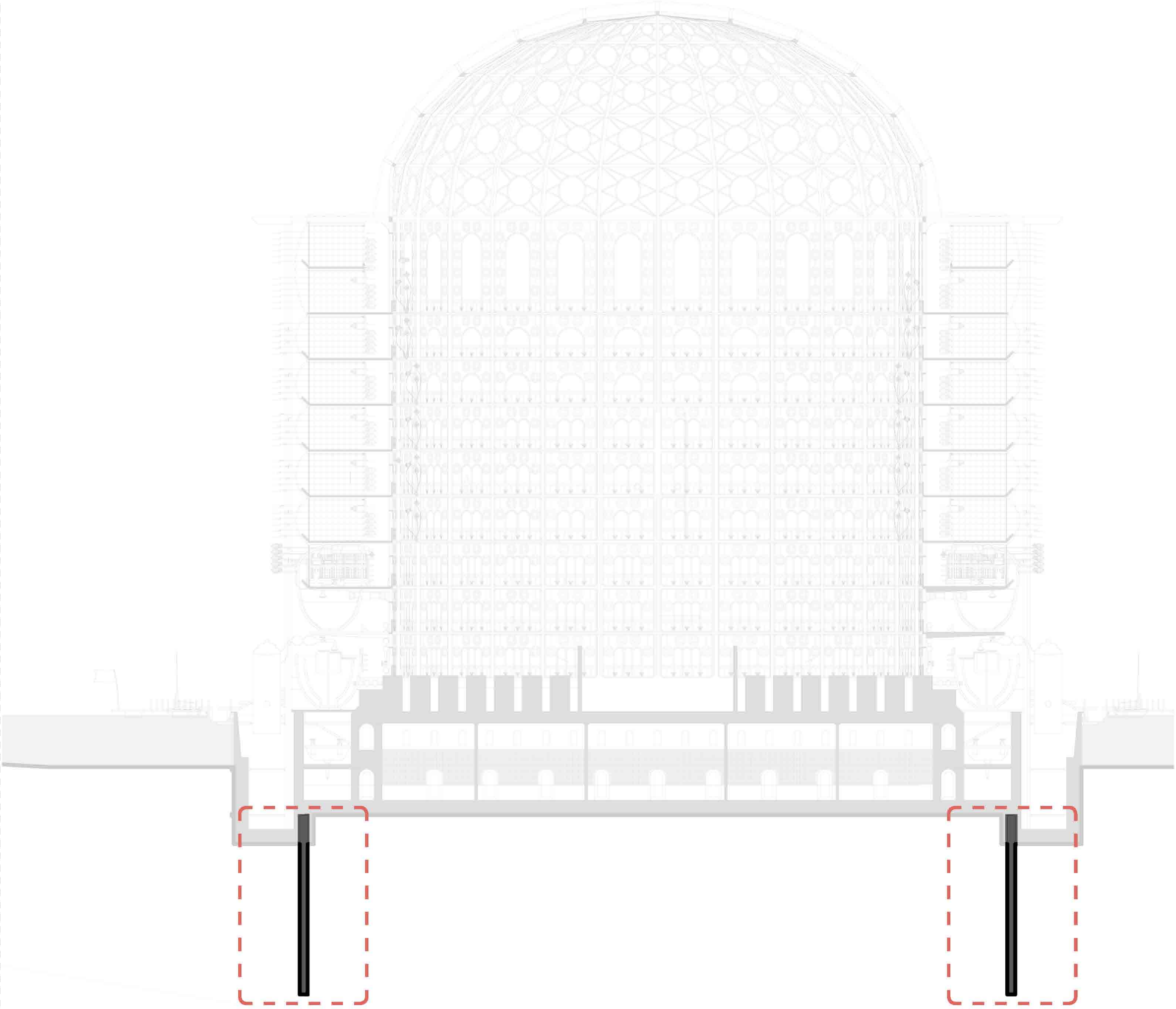
4.5[1]__SEQUENCE

Construction Sequence

2. Drive Pile Foundations:

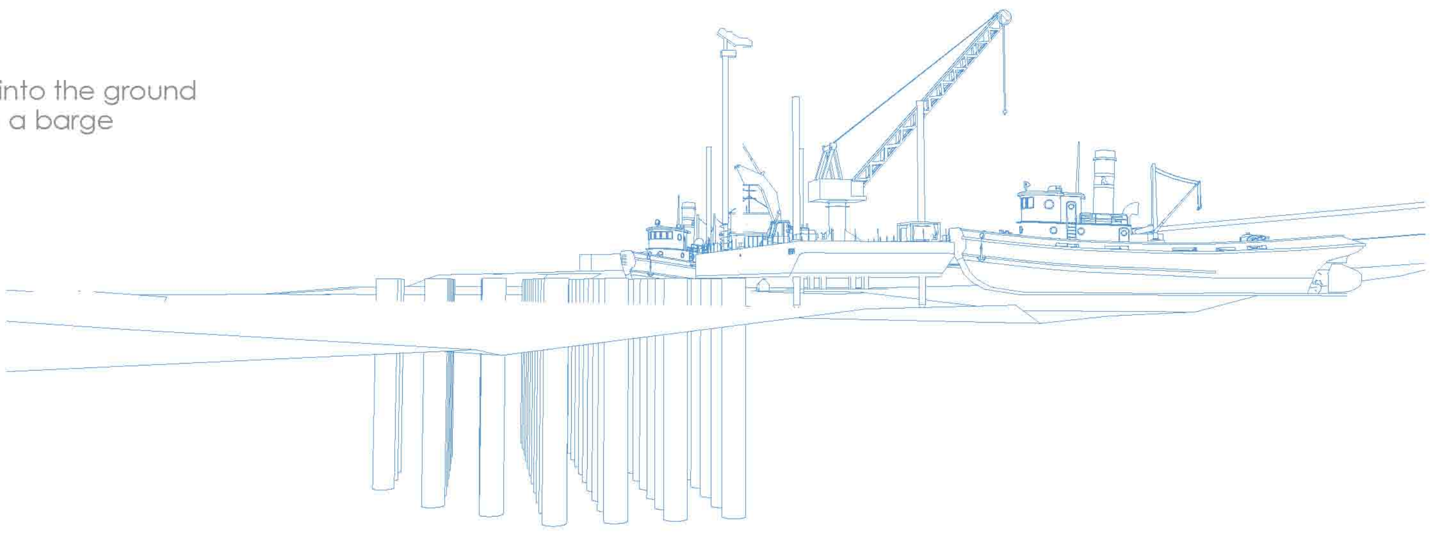
A steel pipe pile system will provide a solid base for the concrete raft which will account for any site movement once the building is complete. Soil lab analysis of the bore shafts specify a depth for the piles to be driven to

Build Status



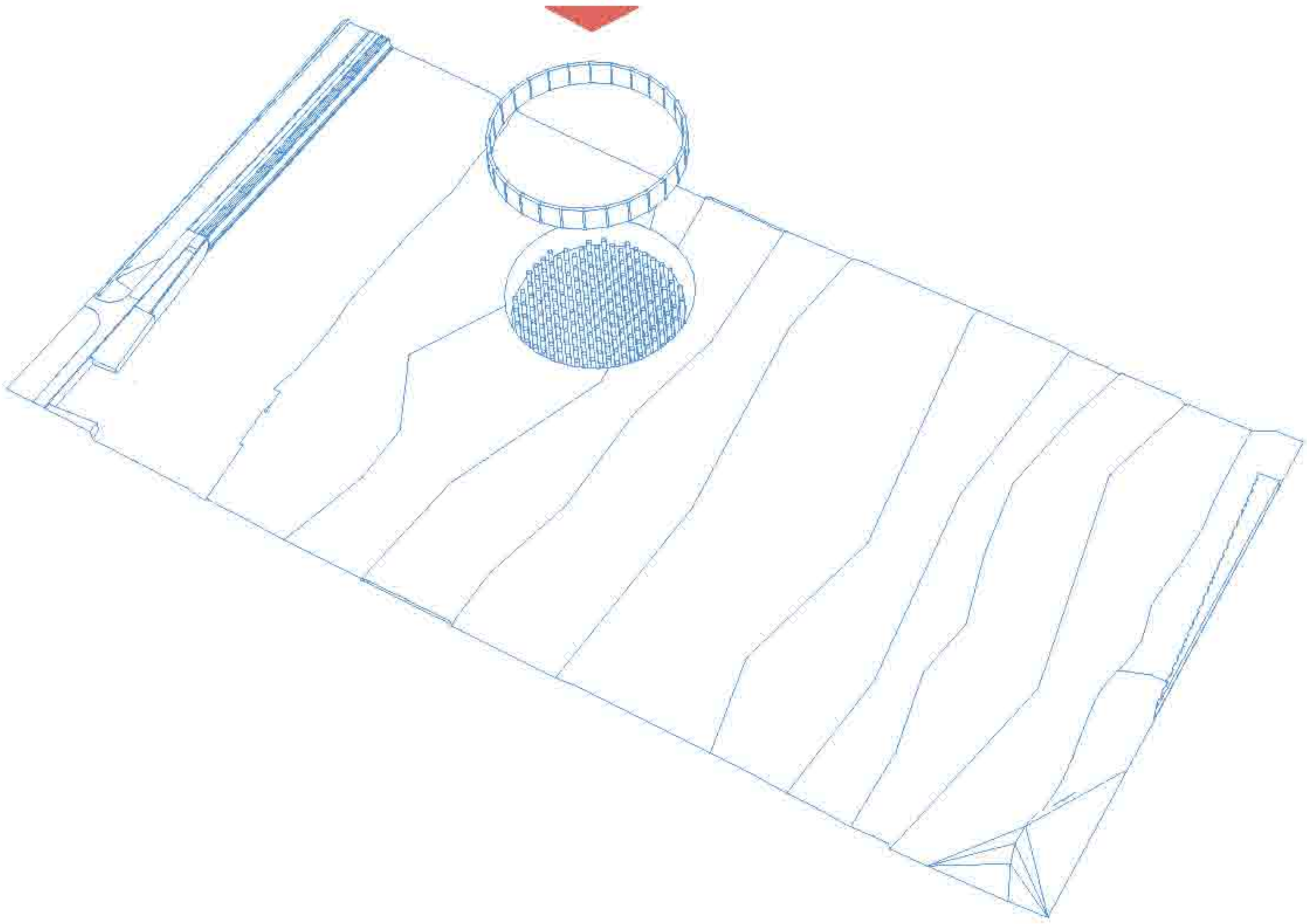
Building Site Status

Prefabricated piles are driven into the ground using a pile driver mounted on a barge

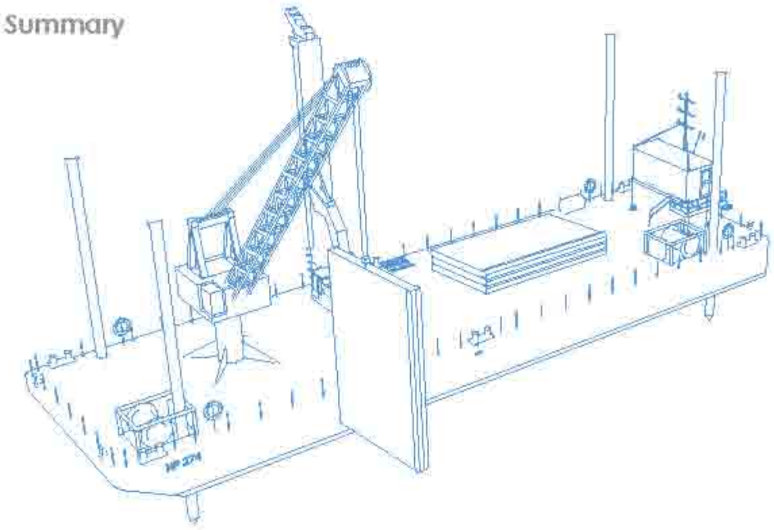


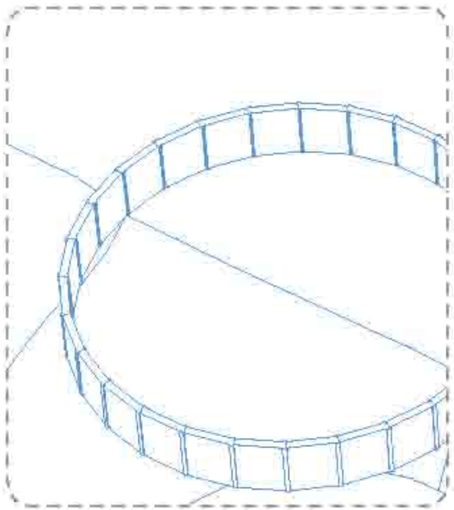
Steel pipe piles are driven as opposed to drilling shafts, is advantageous because the soil displaced by driving the piles compresses the surrounding soil, causing greater friction against the sides of the piles, thus increasing their load-bearing capacity. Driven piles are also considered to be "tested" for weight-bearing ability because of their method of installation

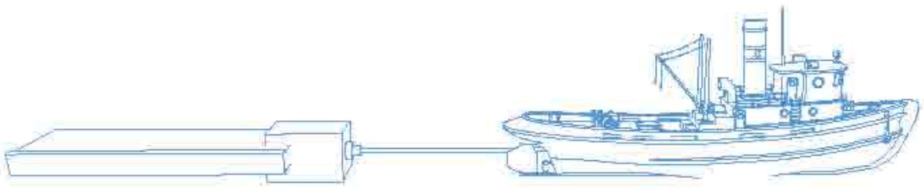
Phase 3



Phase Summary







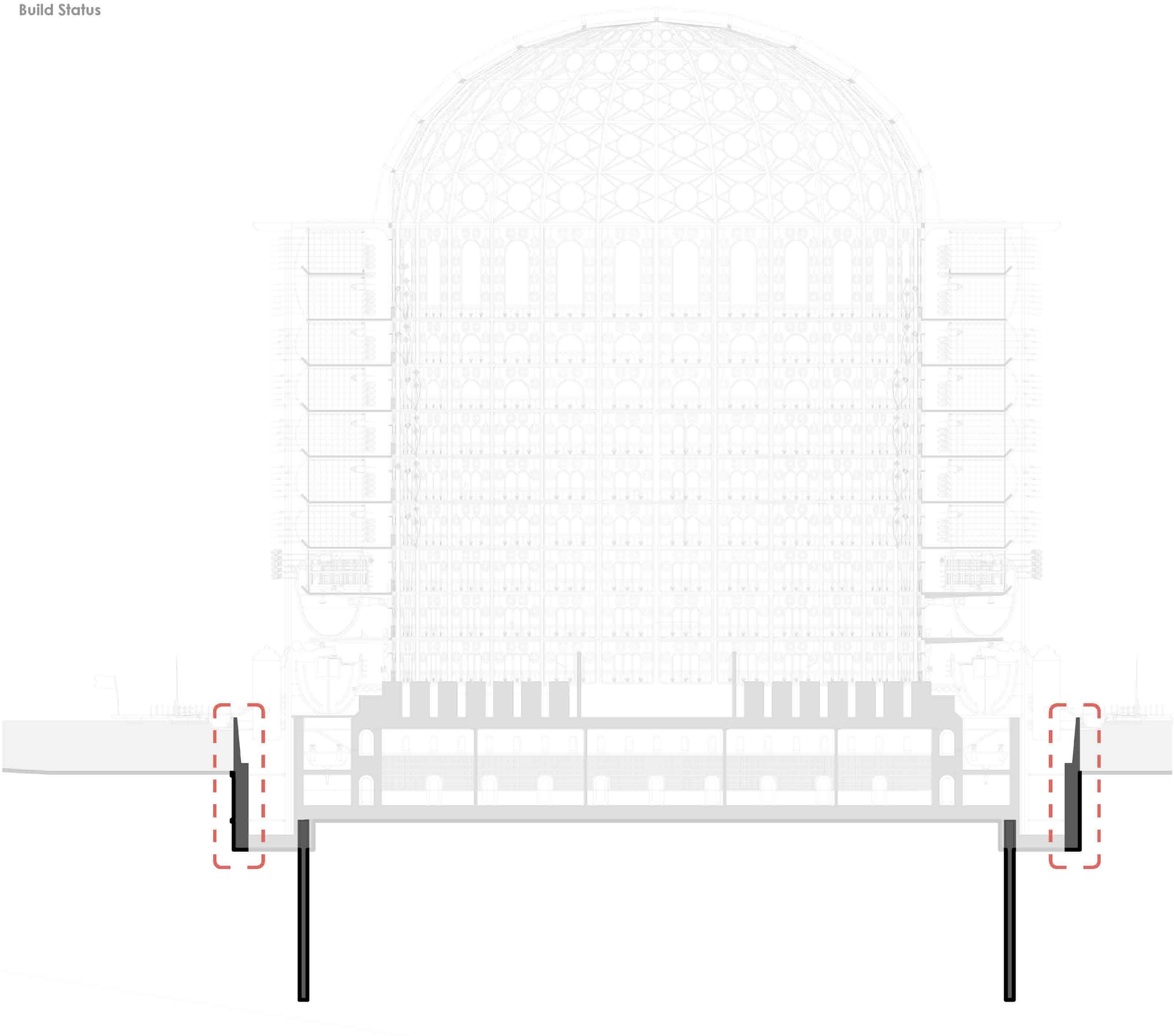
4.5[2] __SEQUENCE

Construction Sequence

3. Install Contiguous Piles:

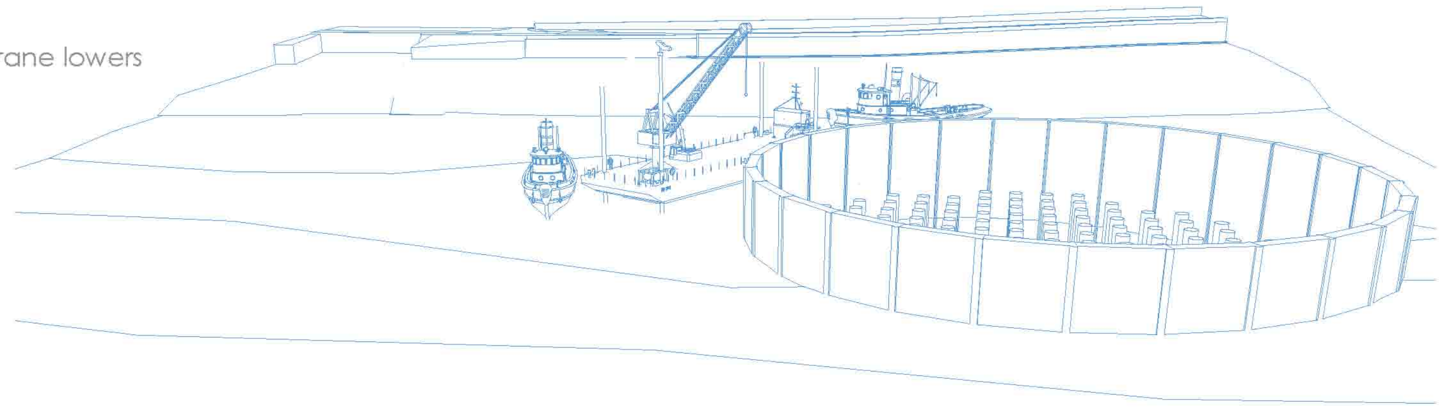
Contiguous piles are driven around the sites perimeter in order to create a retaining wall before excavations begin. The piles are given a 'shotcrete' finish in order to ensure the boundary remains water tight and strong before the river water is pumped out.

Build Status



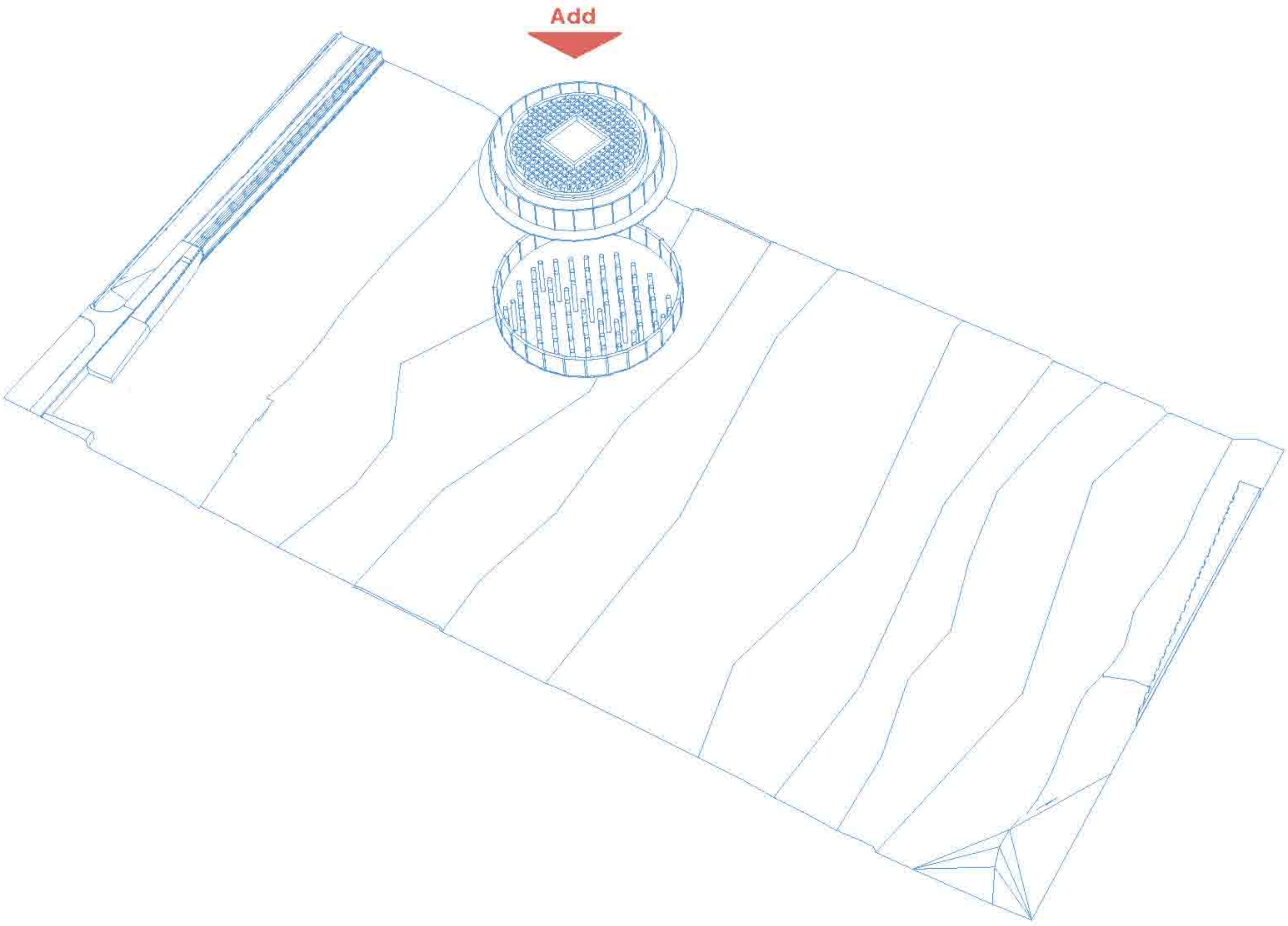
Building Site Status

A barge mounted crane lowers the prefabricated contiguous piles into place

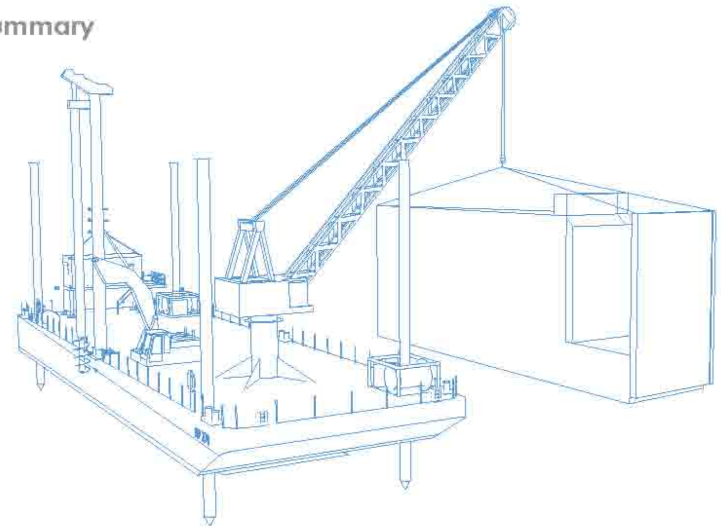


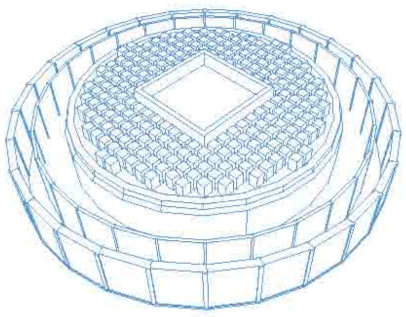
Prefabricated concrete contiguous piles can be floated onto site and installed by cranes mounted on barges

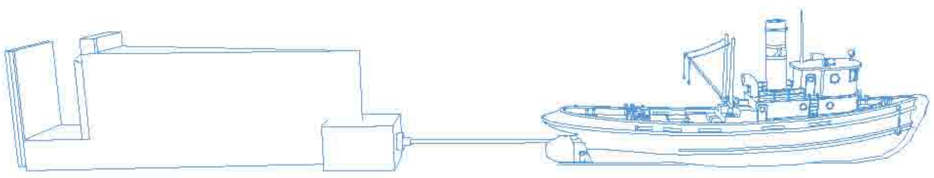
Phase 4



Phase Summary







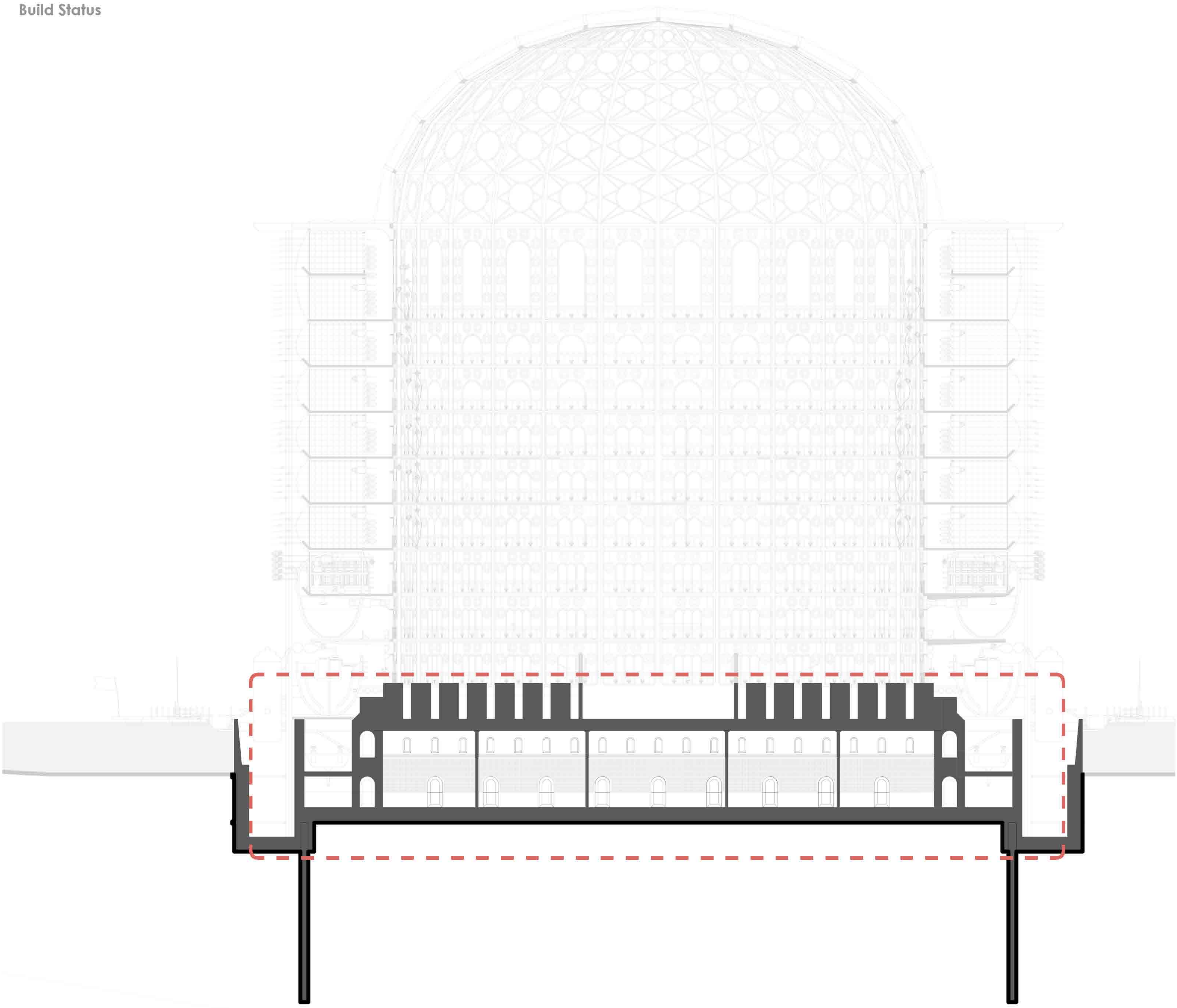
4.5[3] __SEQUENCE

Construction Sequence

4. Install Concrete Raft:

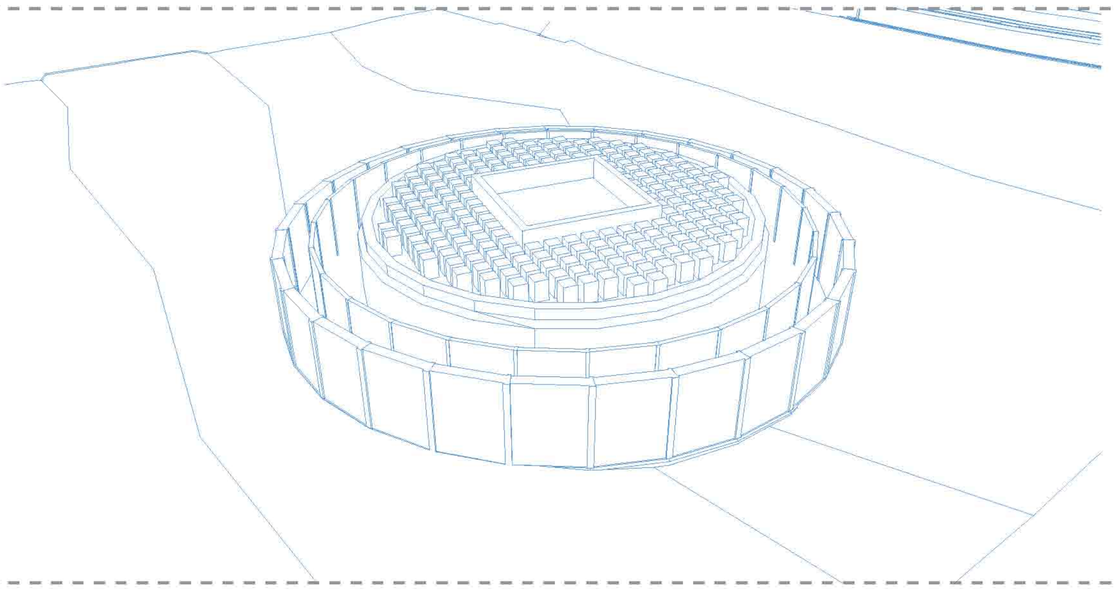
The Pile cap is cast on a bed of steel reinforcement bars. Prefabricated segments of the concrete landscape are then floated in from factories and assembled on site from barge mounted cranes

Build Status



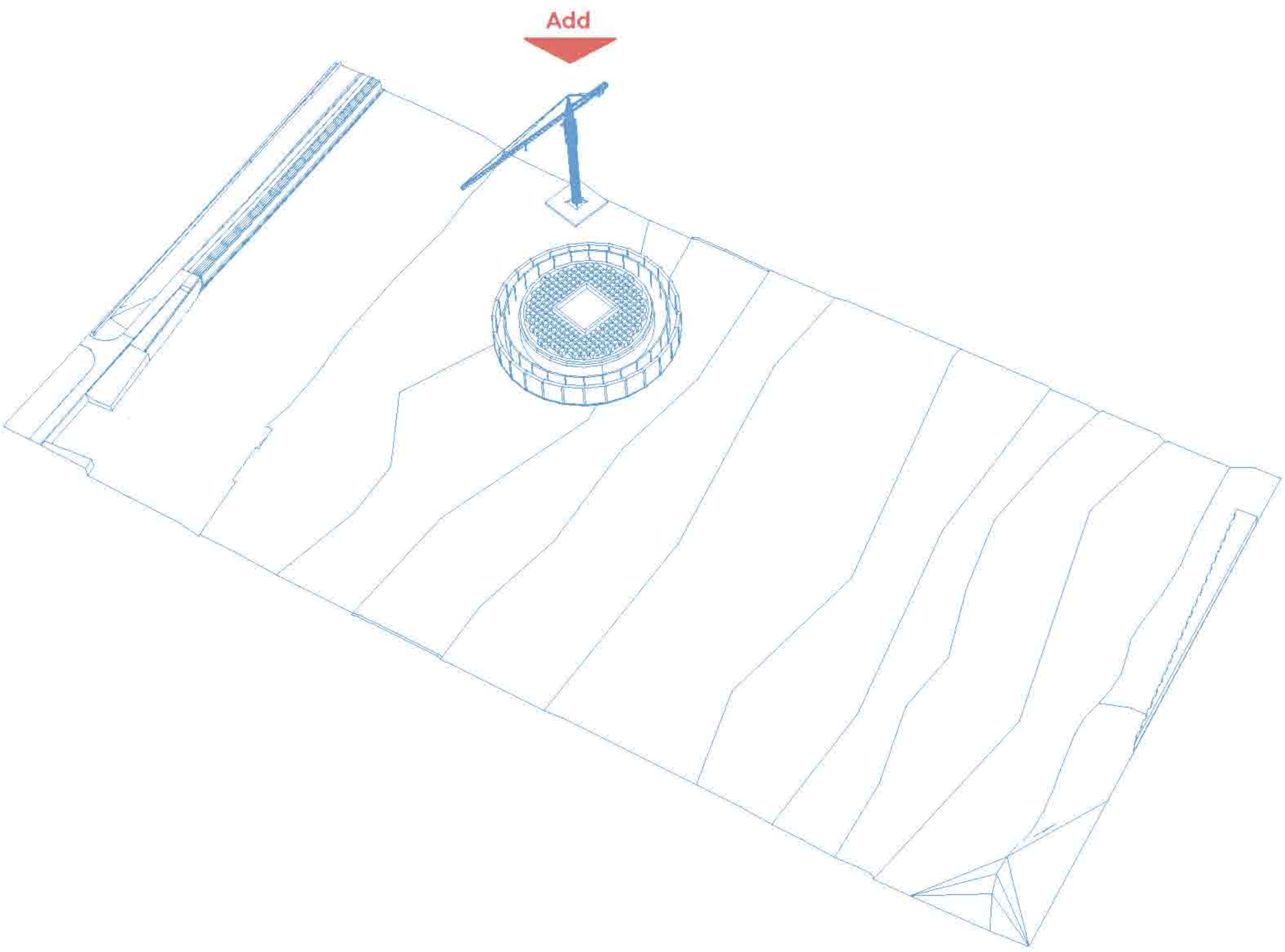
Building Site Status

A team of riggers work alongside the barge mounted cranes to guide the prefabricated concrete segments in to place before securing them

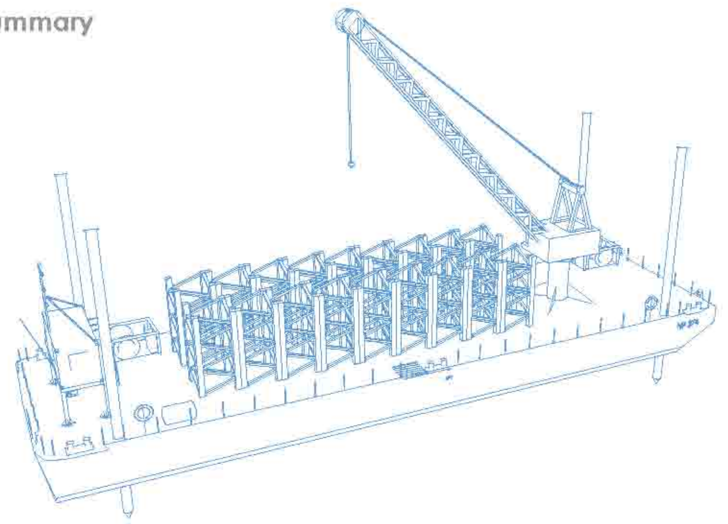


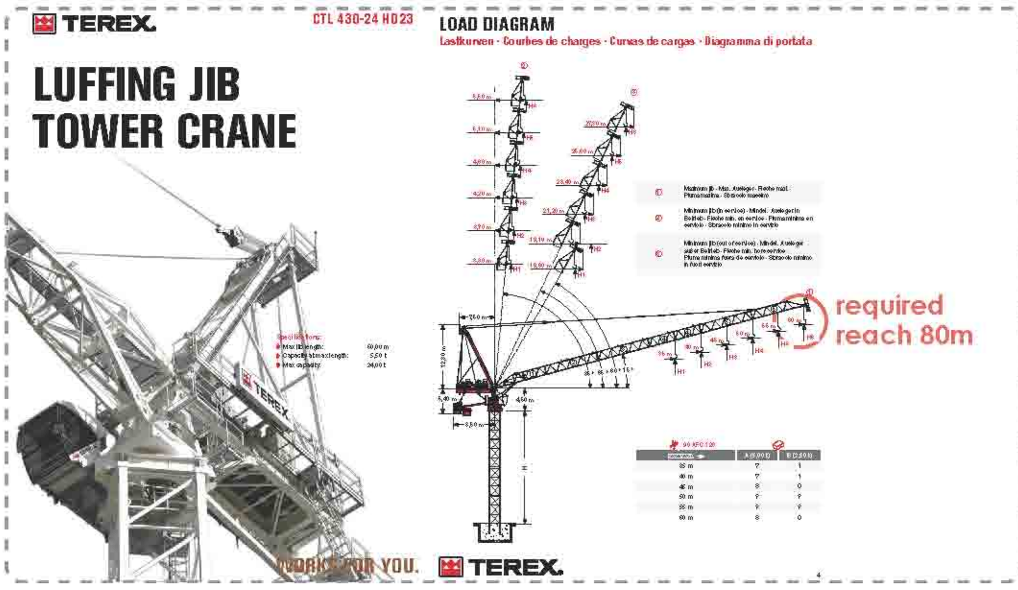
The concrete raft will now provide a solid foundation for the building to be constructed on

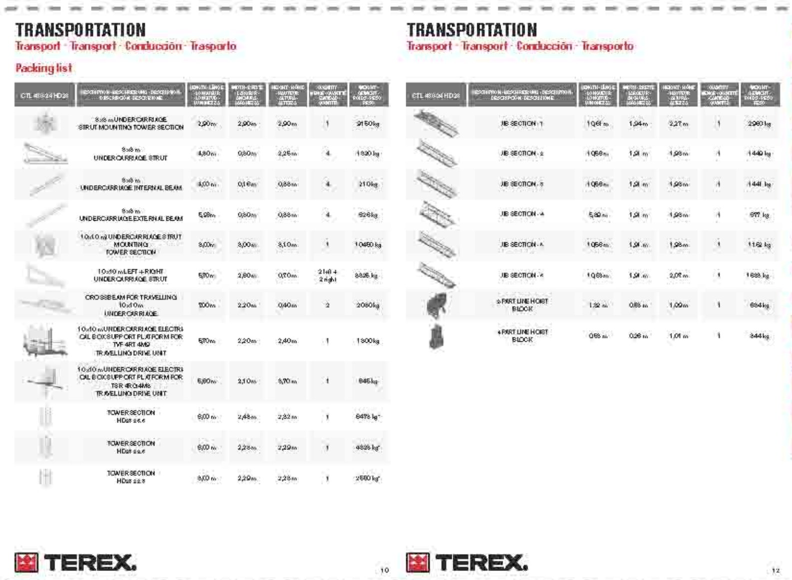
Phase 5



Phase Summary







Crane is designed for assembly on site, meaning all parts can be transported to site on the back of a barge and assembled on the concrete raft to provide lifting services throughout the project

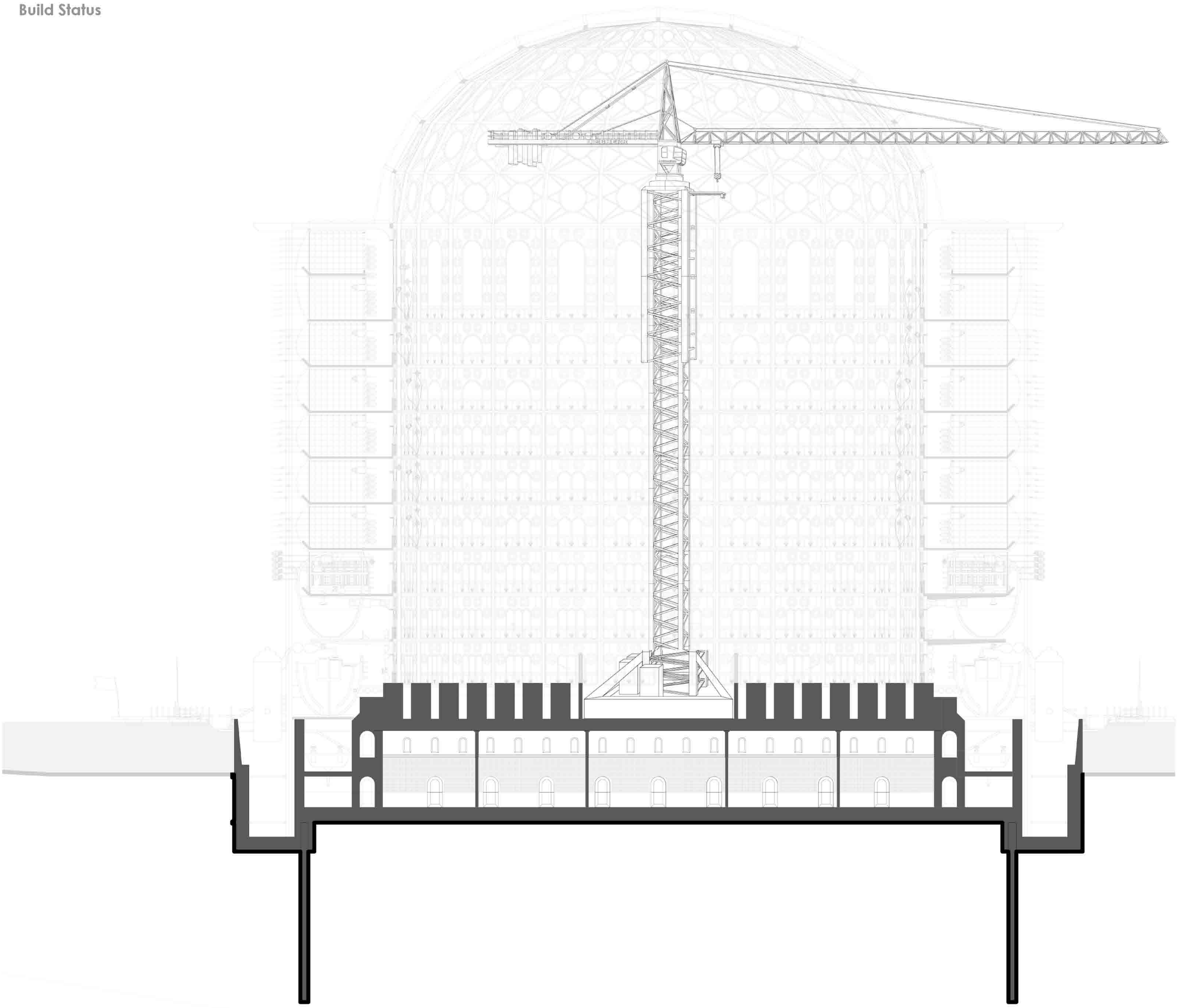
4.5 4__SEQUENCE

Construction Sequence

5. Construct Tower Crane:

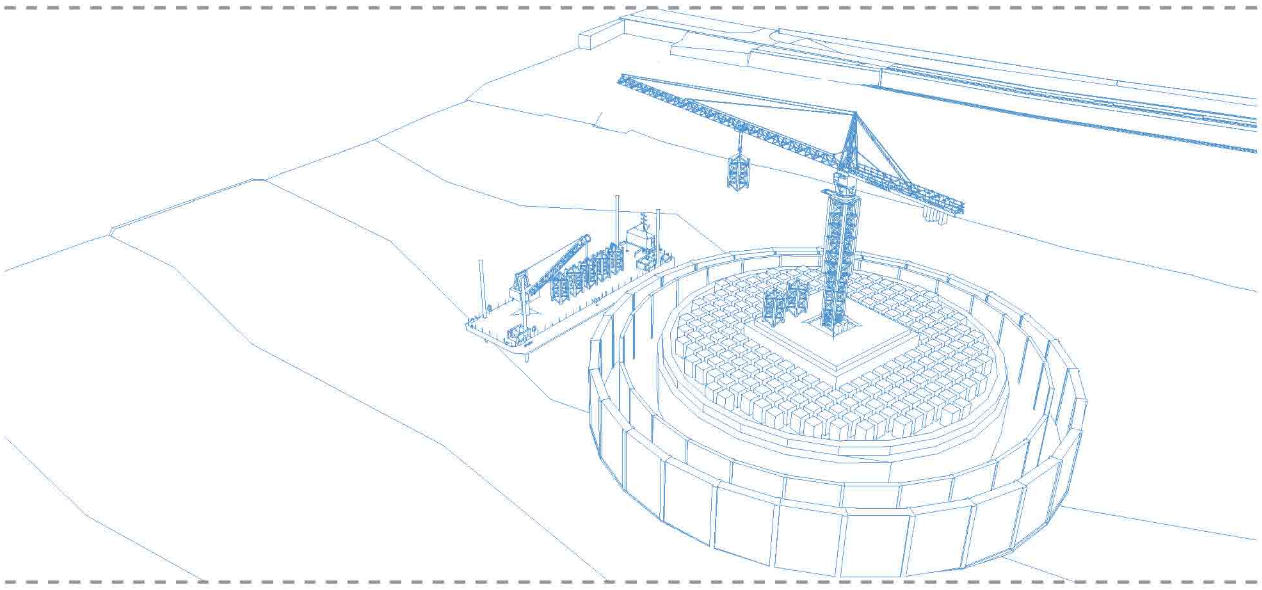
assemble tower crane on raft
assemble crane on raft
barge crane assembly
crane deployed - [size - 90m limit - city airport]

Build Status



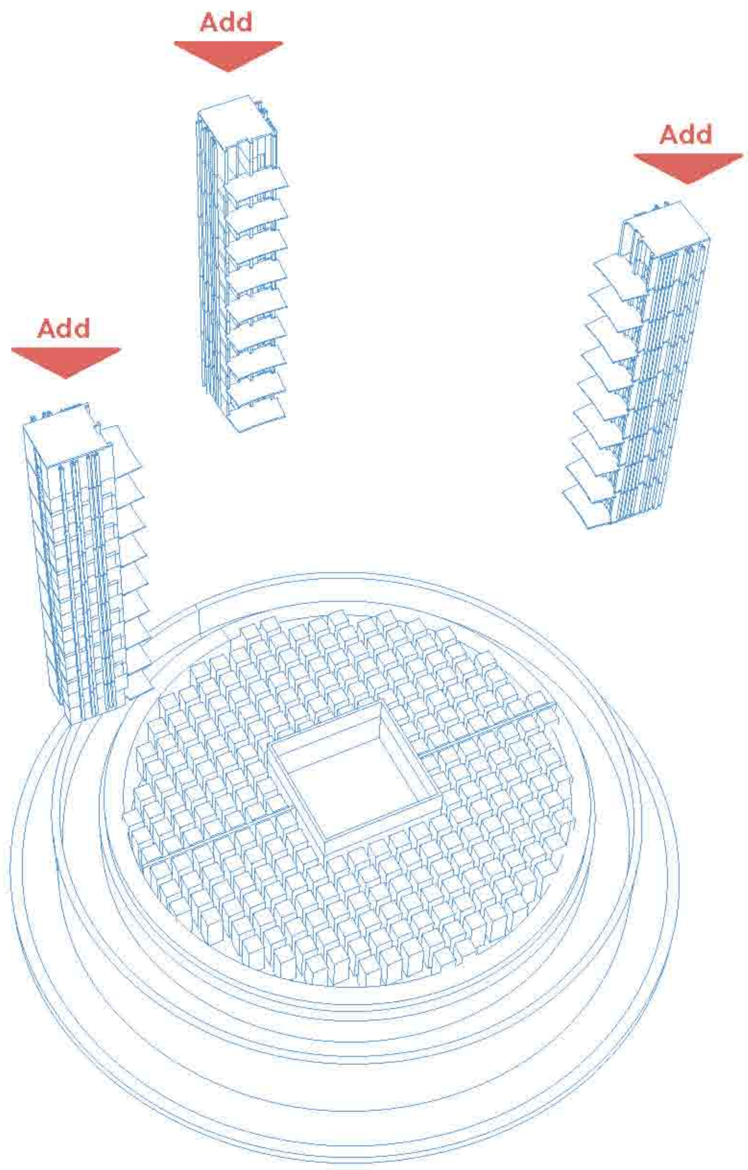
Building Site Status

Each component of the crane detailed opposite is delivered to site by barge. The crane is then assembled by a crew on the concrete raft. The crane will remain in situ for several phases of the build.

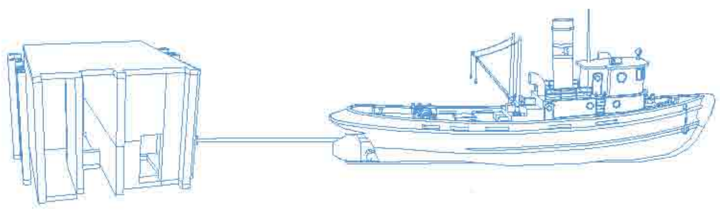


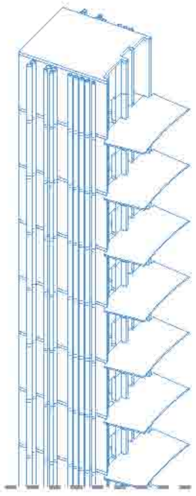
A 'luffing jib tower crane' is most suited to the construction of the R_evolution lab, providing a 360 degree field of operation with a maximum span of 80 meters.
The height of the crane should be monitored in order to stay clear of the 90m height restriction sanctioned by city airport

Phase 6



Phase Summary





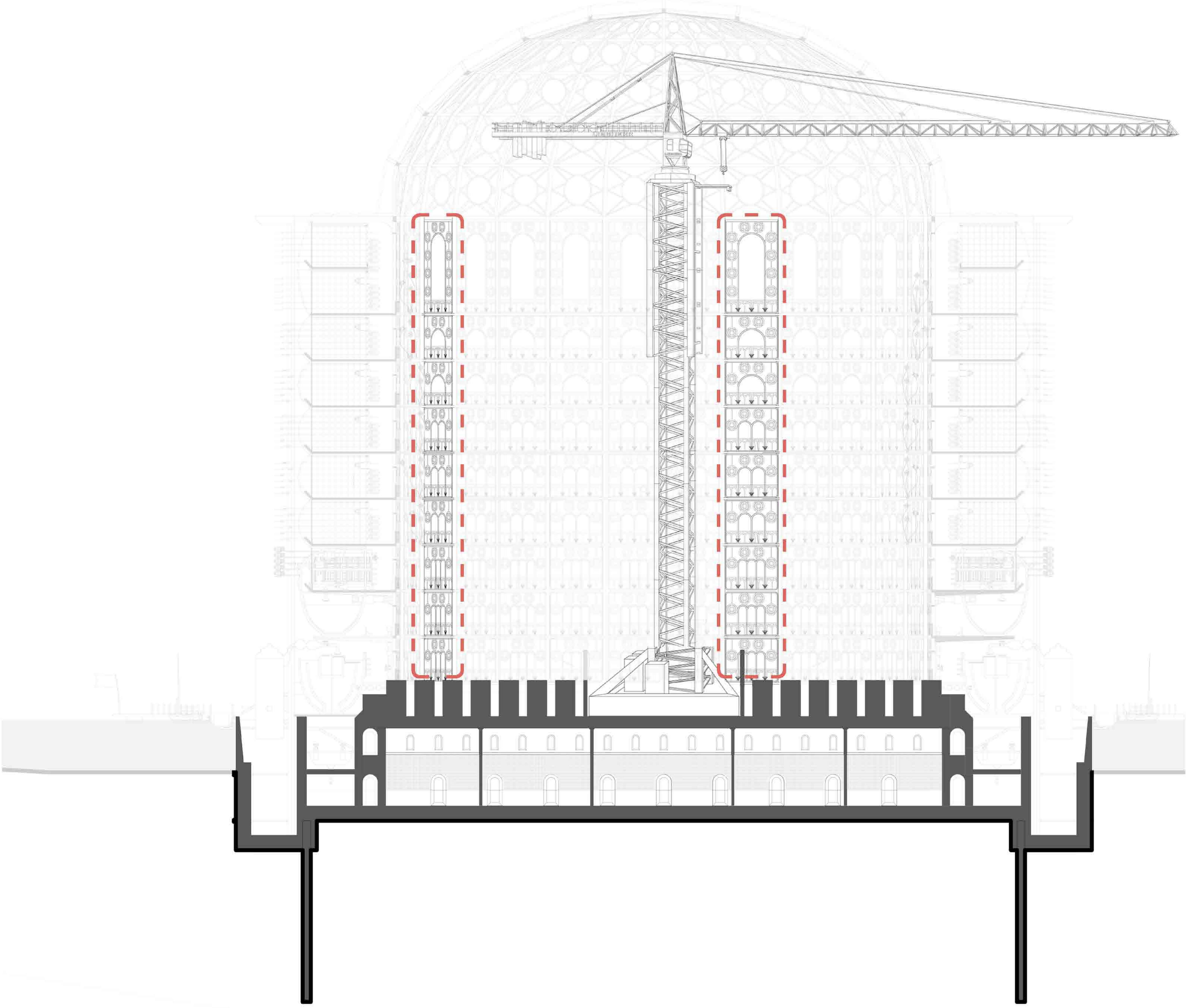
4.5[5]__SEQUENCE

Construction Sequence

6. Assemble Concrete Cores:

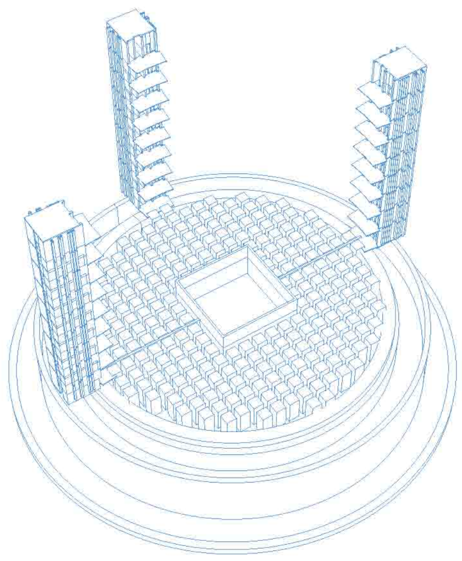
Prefabricated segments of the concrete cores are stacked in place on top of the concrete raft foundation

Build Status



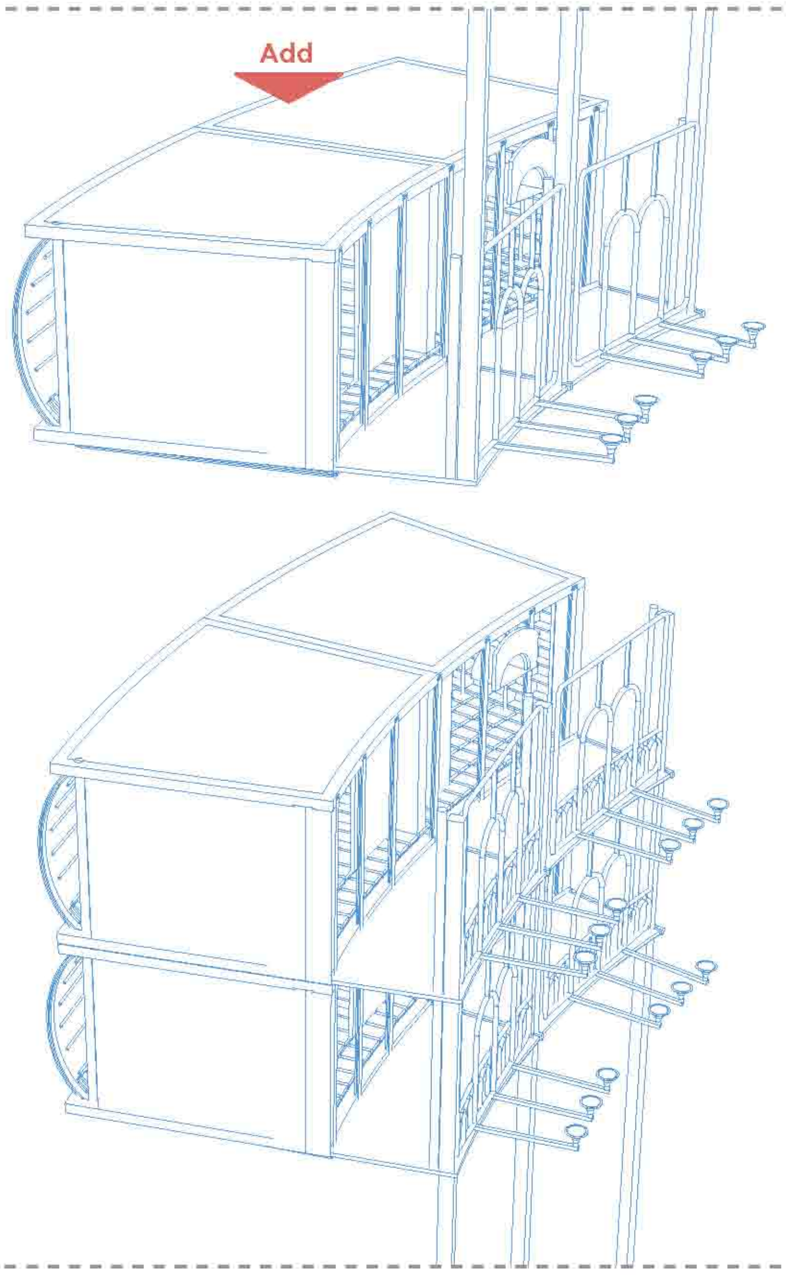
Building Site Status

The tower crane lifts each individual section of the concrete cores into place before a rigging team secure them.
Each section of the cores are floated to site and delivered using tug boats

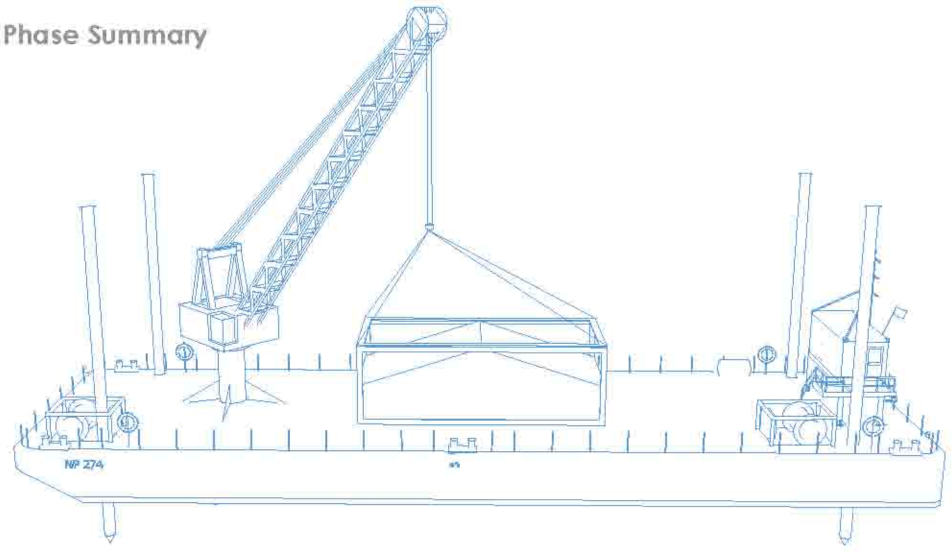


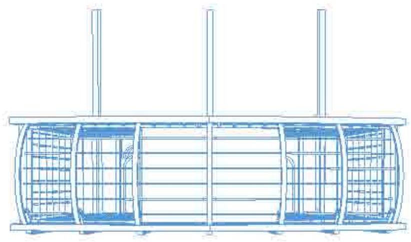
The concrete cores will provide a structurally stiff anchor for the remaining structures to fix to, becoming an intrinsic part of the primary structure

Phase 7



Phase Summary





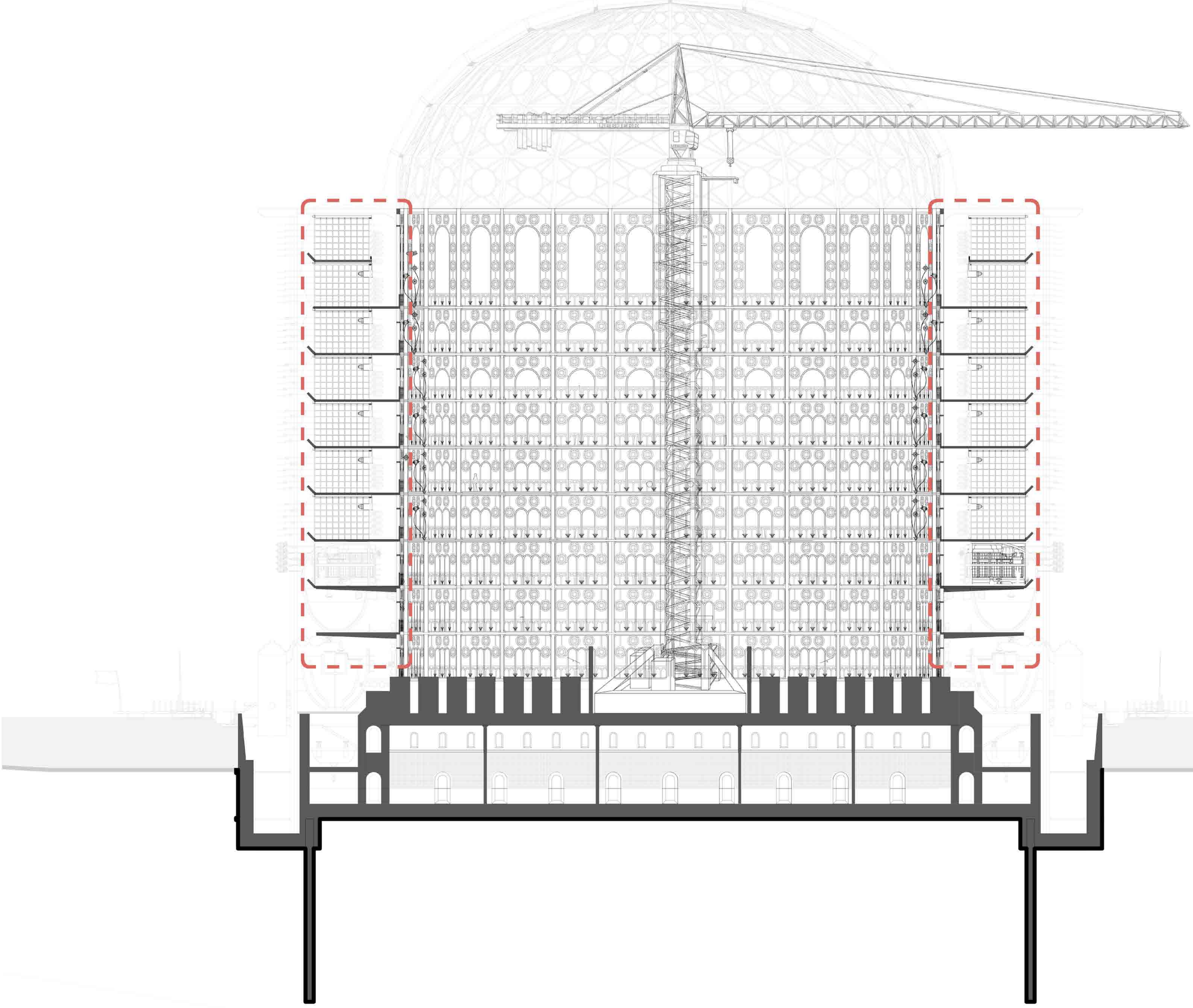
4.5 [6] __SEQUENCE

Construction Sequence

7. Sequential construction of Primary Structure:

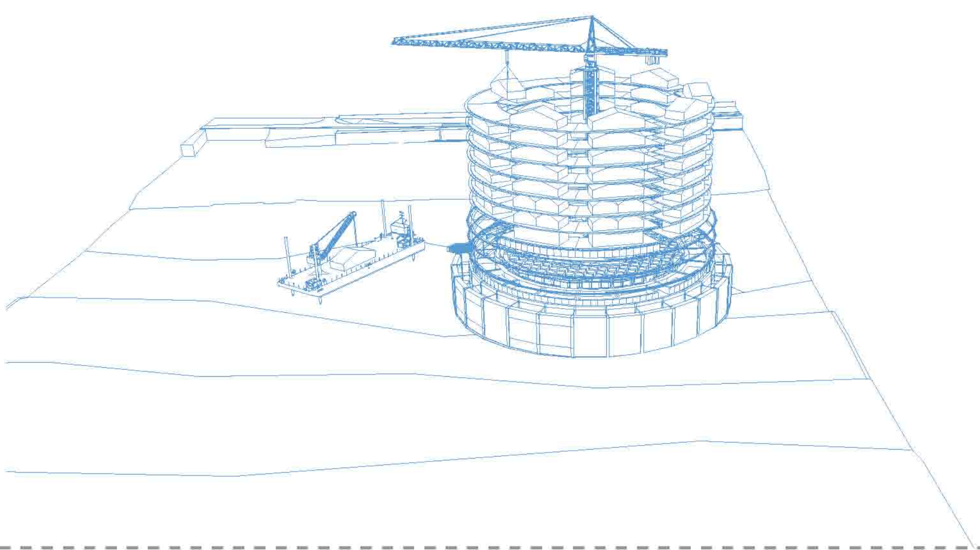
The primary steel frame is then constructed using the concrete cores as an anchor. The prefabricated modules are then lowered in sequentially in radial arrangements.

Build Status



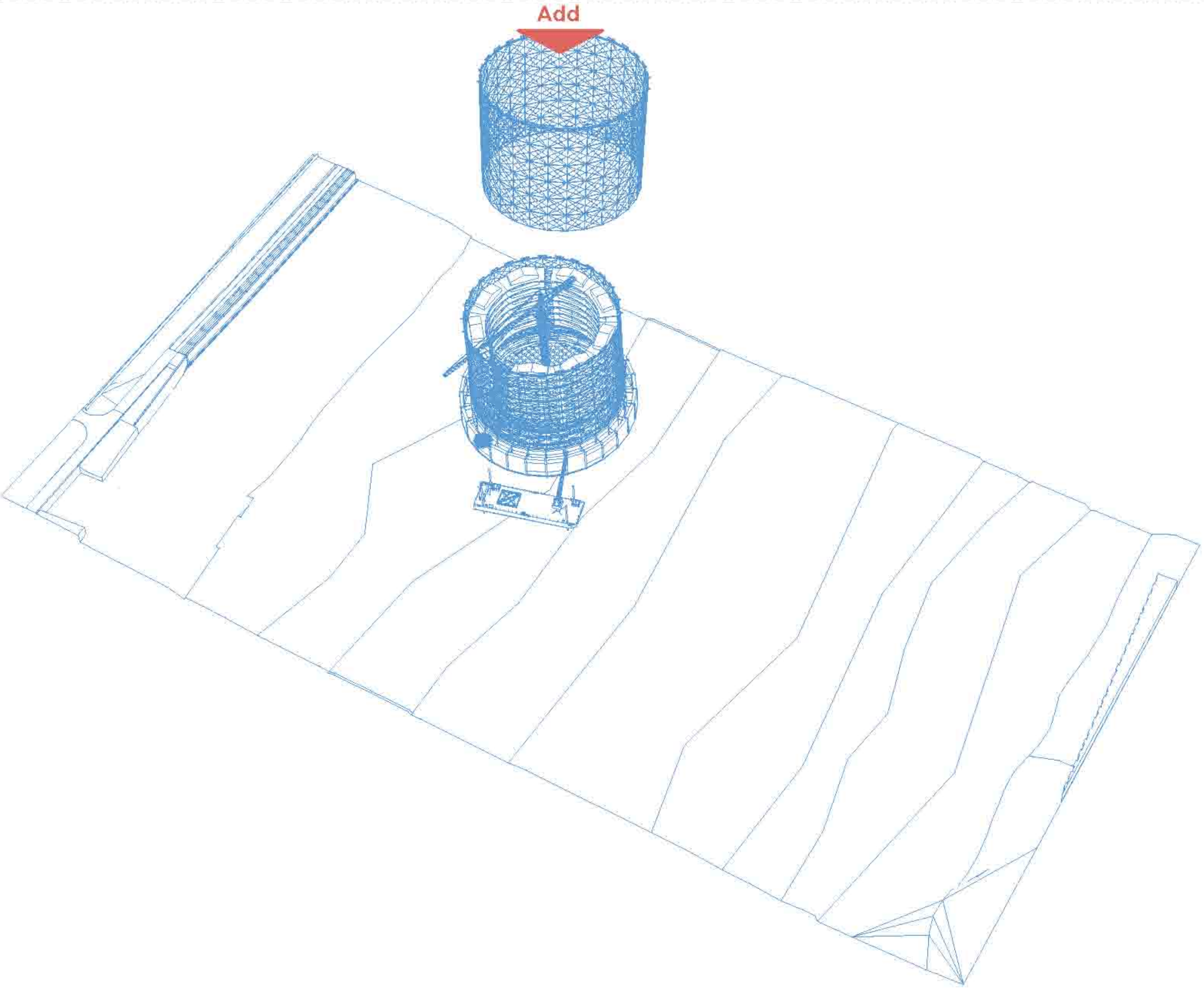
Building Site Status

Both the primary steel frame and prefabricated modules are delivered to site by barges, before being lowered into place by the tower crane. A rigging team then guides the components into place and secures them

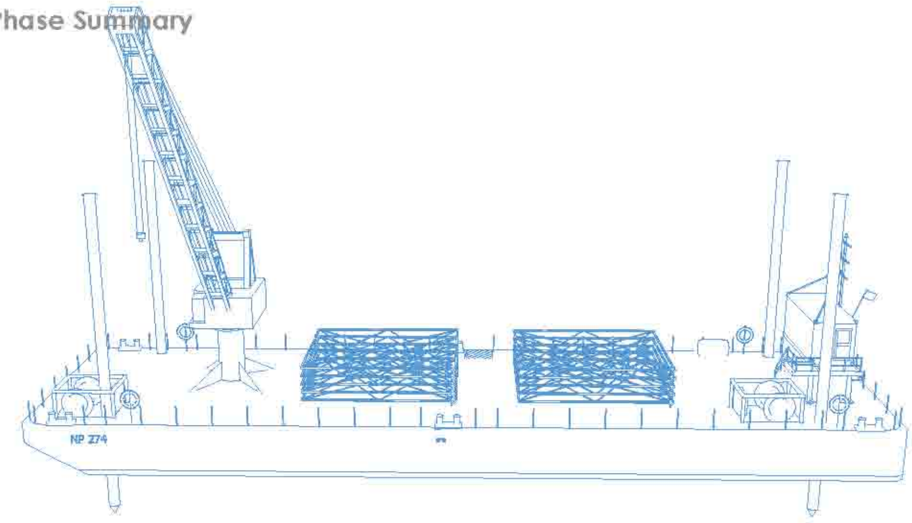


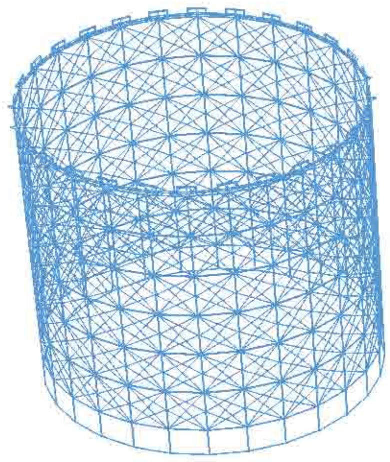
Each prefabricated module is delivered to site from the factory in Germany encased in a temporary scaffold structure consisting of vertical steel supports that will take the weight of the structure during construction. These temporary steel components are located at each lifting point of the module, and must be secured and checked before loading of other modules takes place

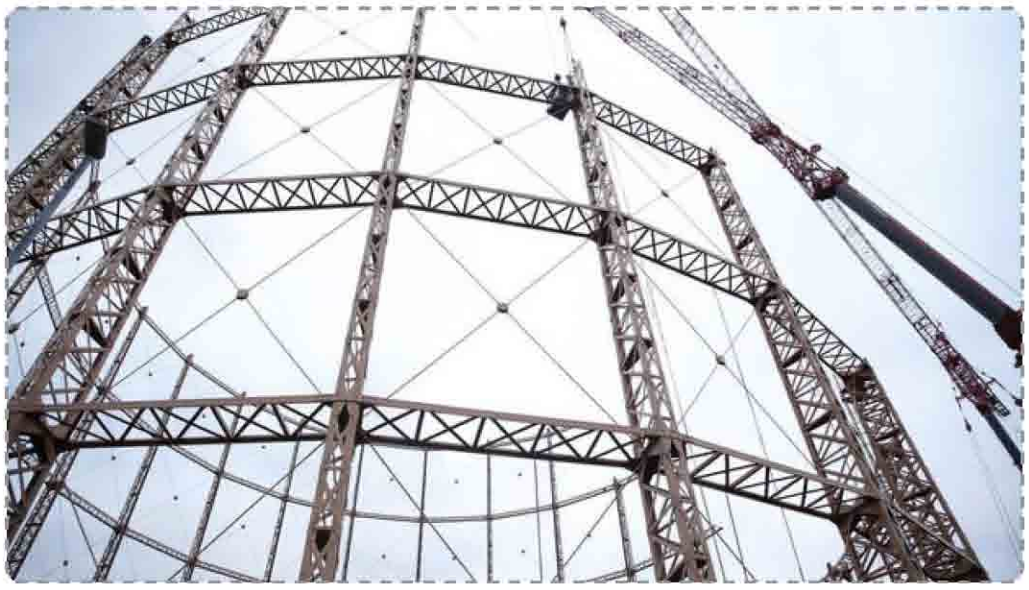
Phase 8



Phase Summary







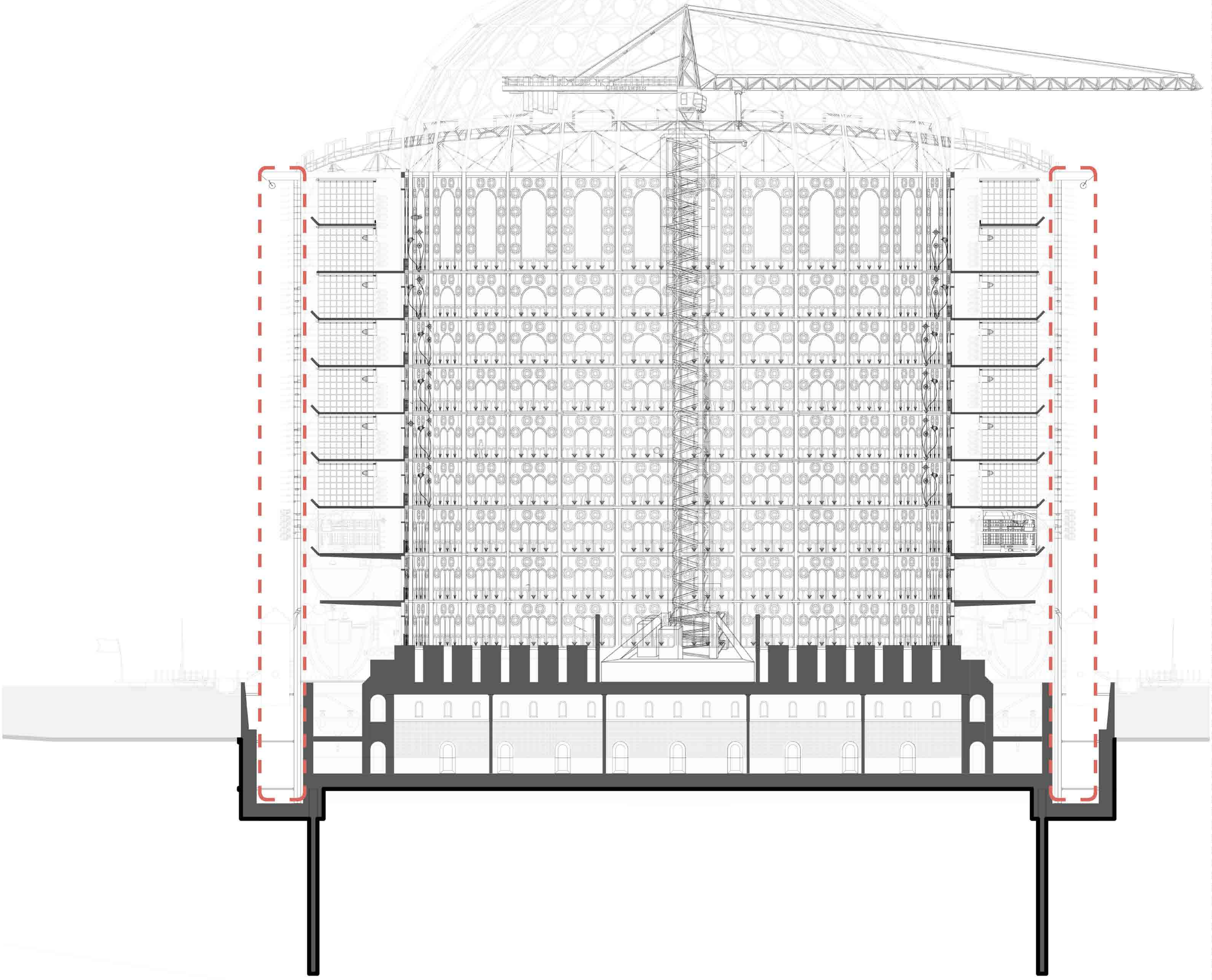
4.5 7__SEQUENCE

Construction Sequence

8. Reconstruction of Gasometer:

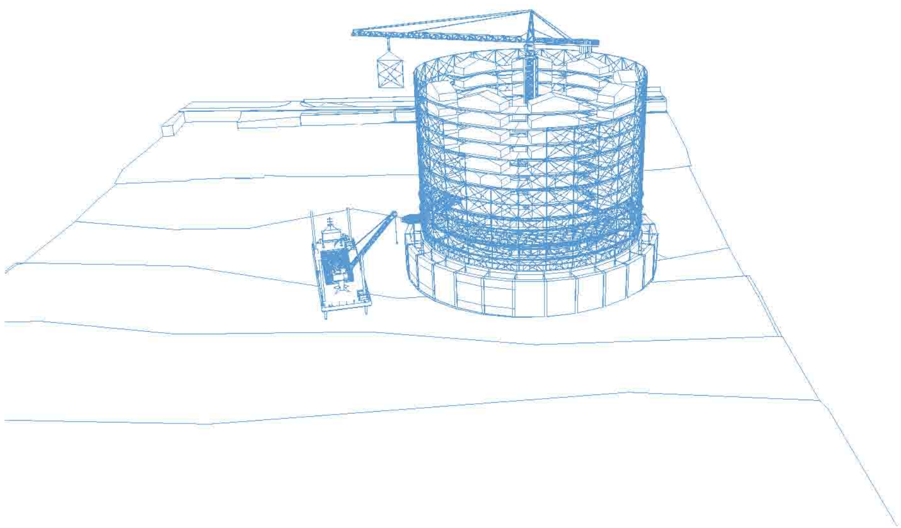
The refurbished gasometer sections return to site from the factory in Yorkshire. The intricate documentation of the deconstruction process is then utilised to reconstruct the structure on the Thames site

Build Status



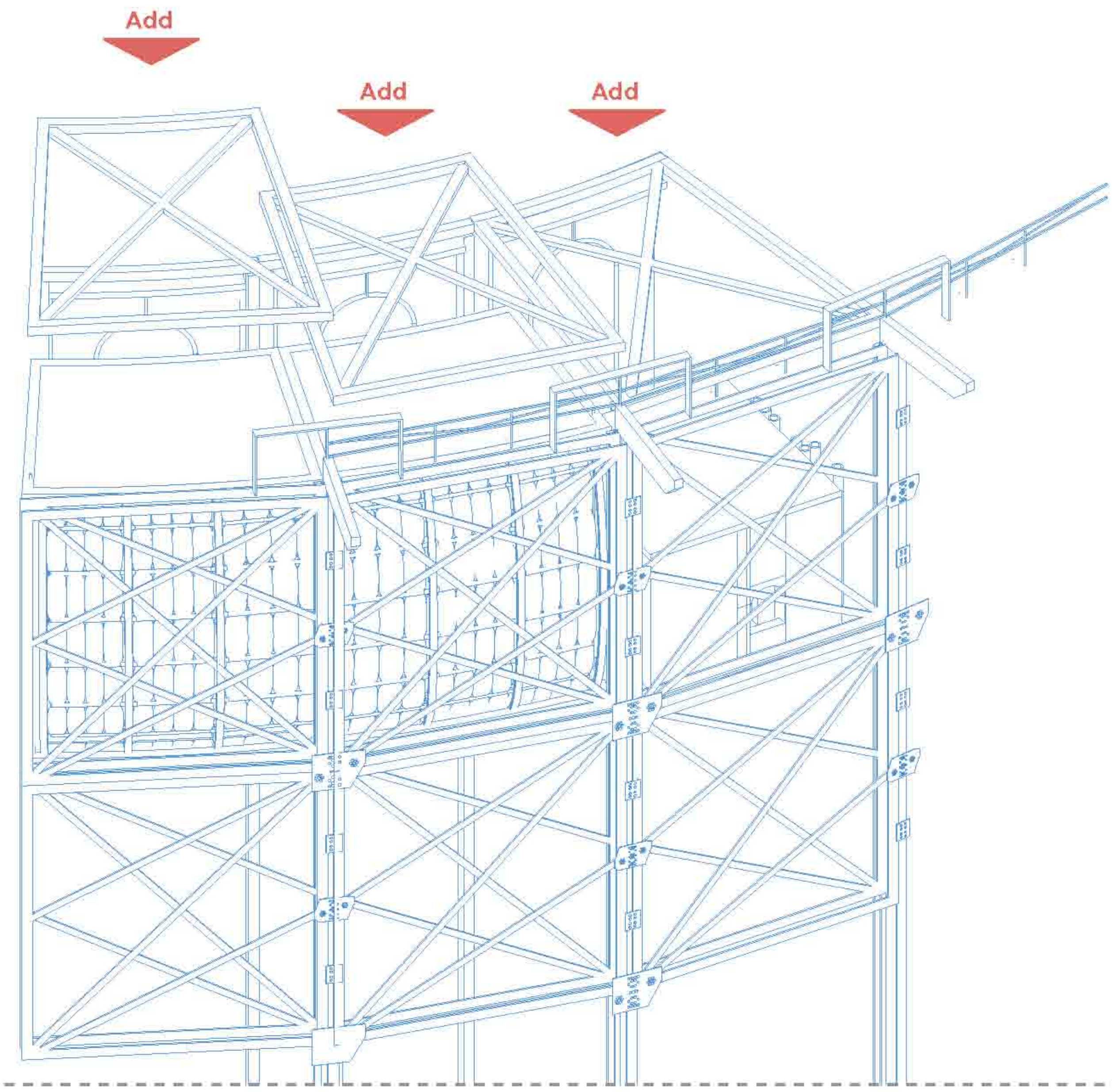
Building Site Status

Refurbished gasometer sections are loaded on barges from the factory located in Yorkshire. An intricate delivery schedule will then be followed in order to deliver each section to site to ensure the river does not become congested.
Cranes are used to lift components into place and specialist contractors work alongside experienced rigging teams in order to reconstruct the gasometer structure on the concrete raft.

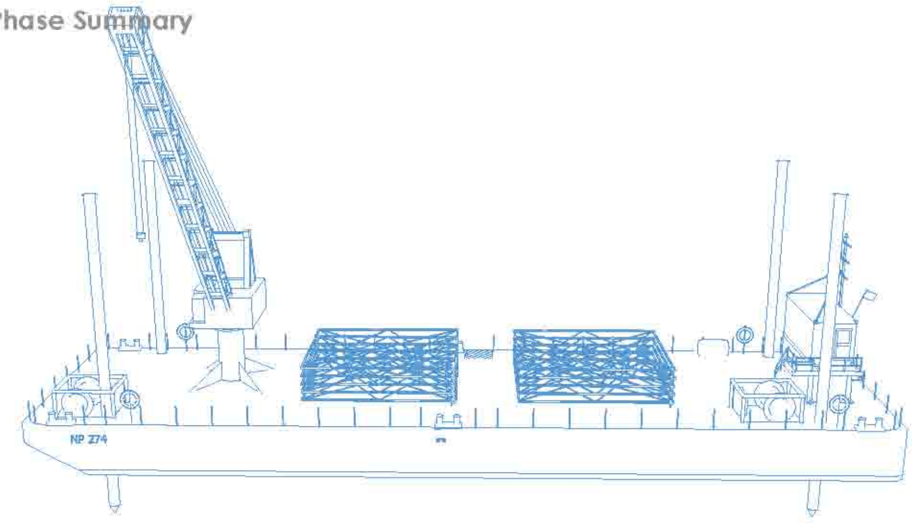


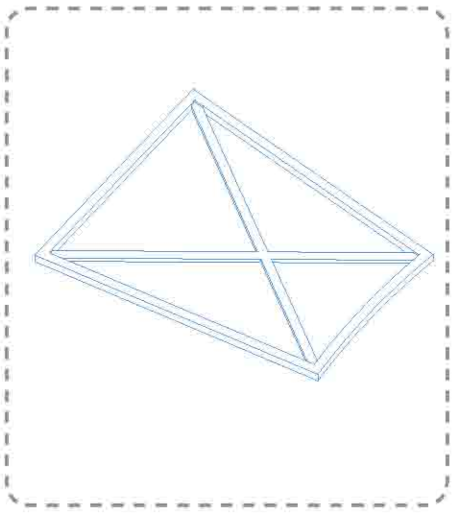
Each barge is loaded with components corresponding to the deconstruction notes. This will ensure that sections arrive on site in the correct order for re-construction to ensure components do not have to be stored awaiting assembly due to the lack of space on site.

Phase 9



Phase Summary





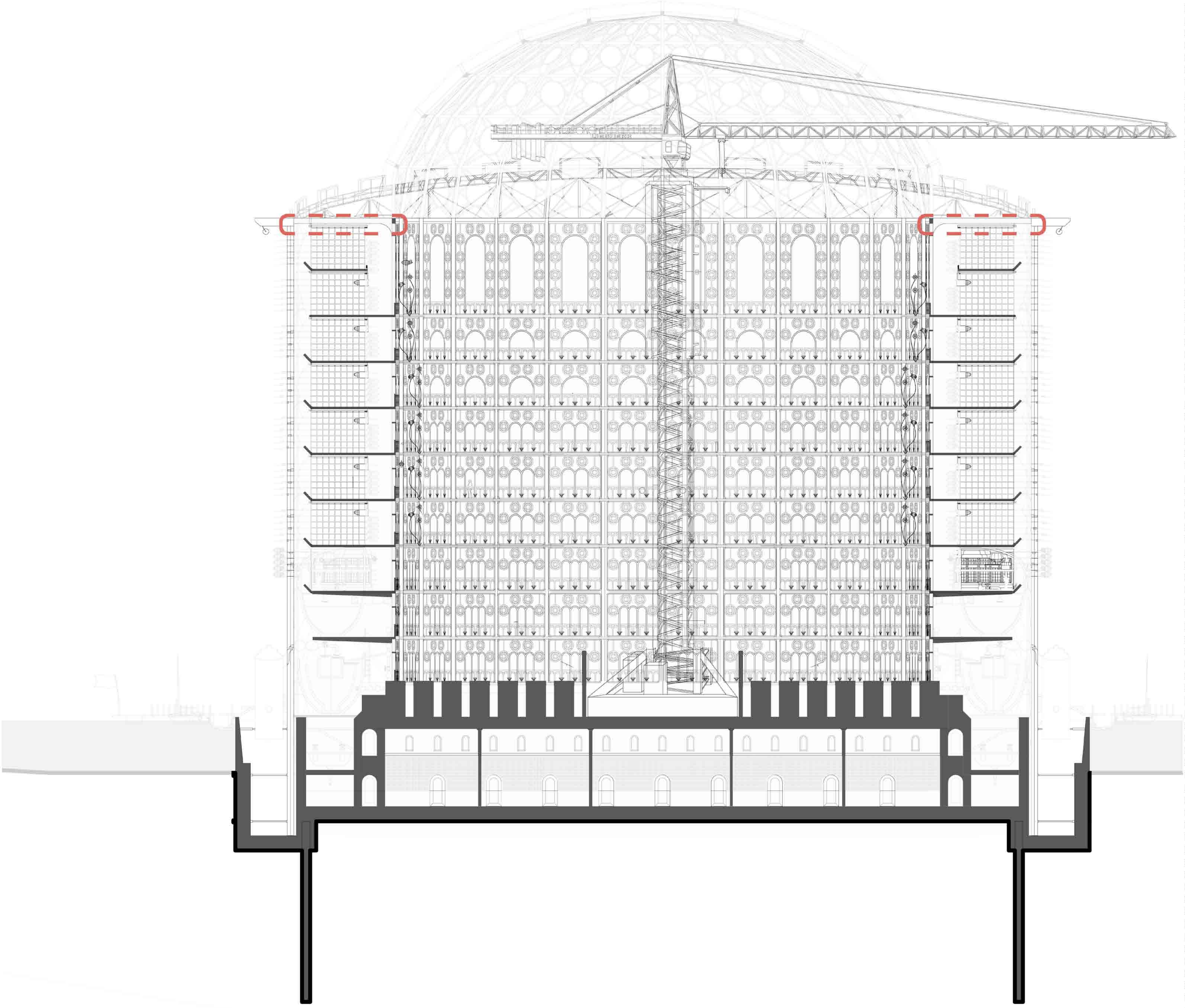
4.5[8]__SEQUENCE

Construction Sequence

9. Insert Steel Members:

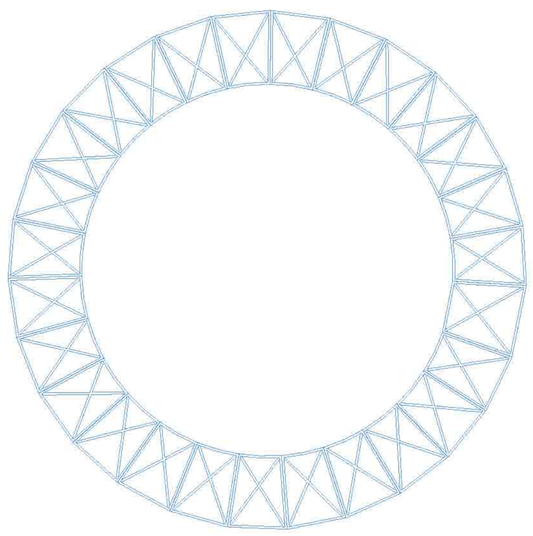
Key steel members are then lowered into place connecting the primary steel structure and gasometer

Build Status



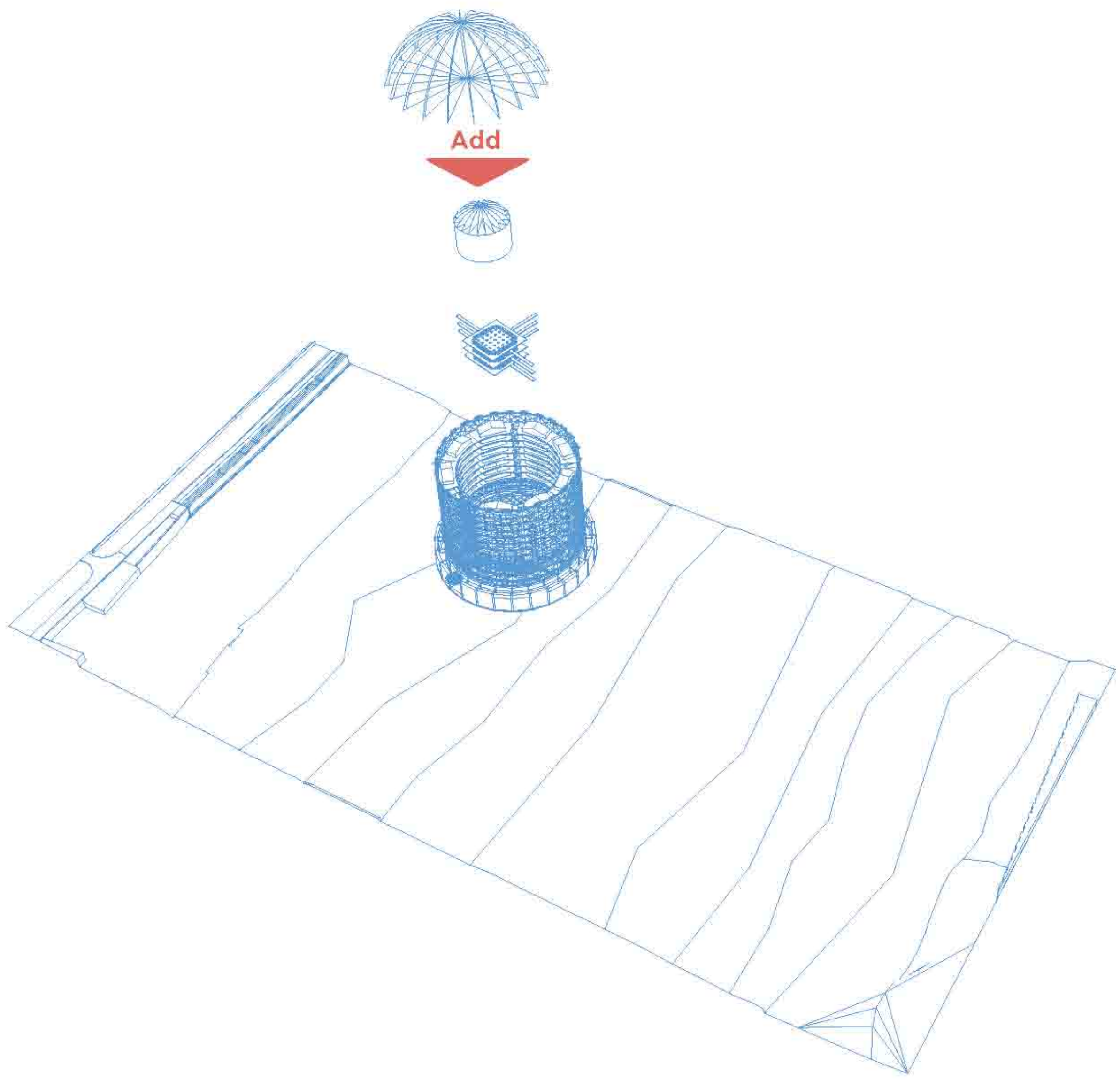
Building Site Status

Steel members are delivered to site on barges before being lifted into place at the top of the structure. Specialist contractors await each member to be manoeuvred into place by rigging teams before securing them accordingly.

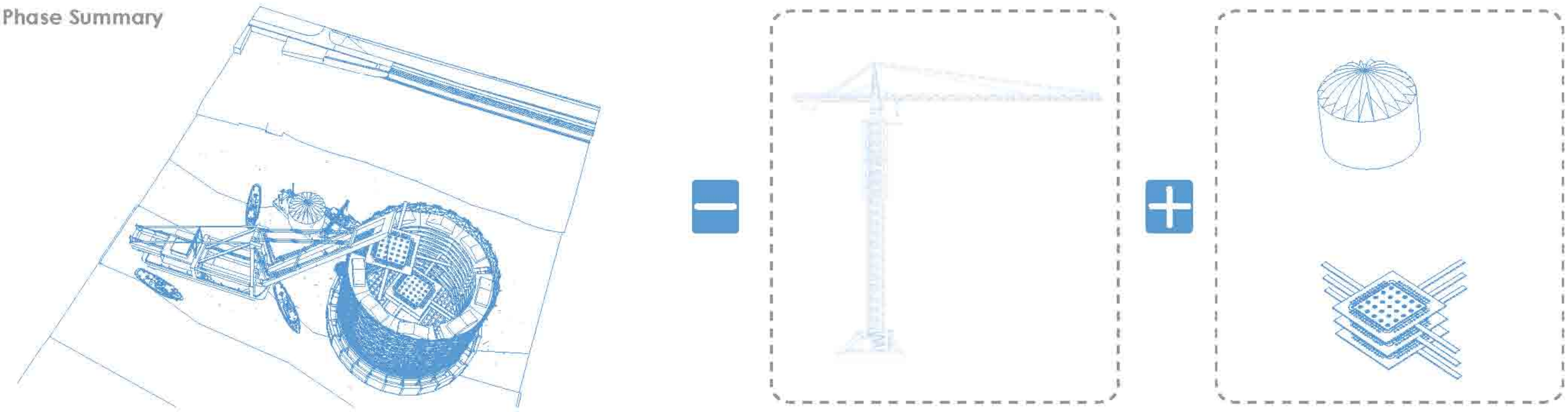


Due to the importance of this key piece of structure, specialist contractors will over see its assembly and conduct tests where necessary.

Phase 10



Phase Summary



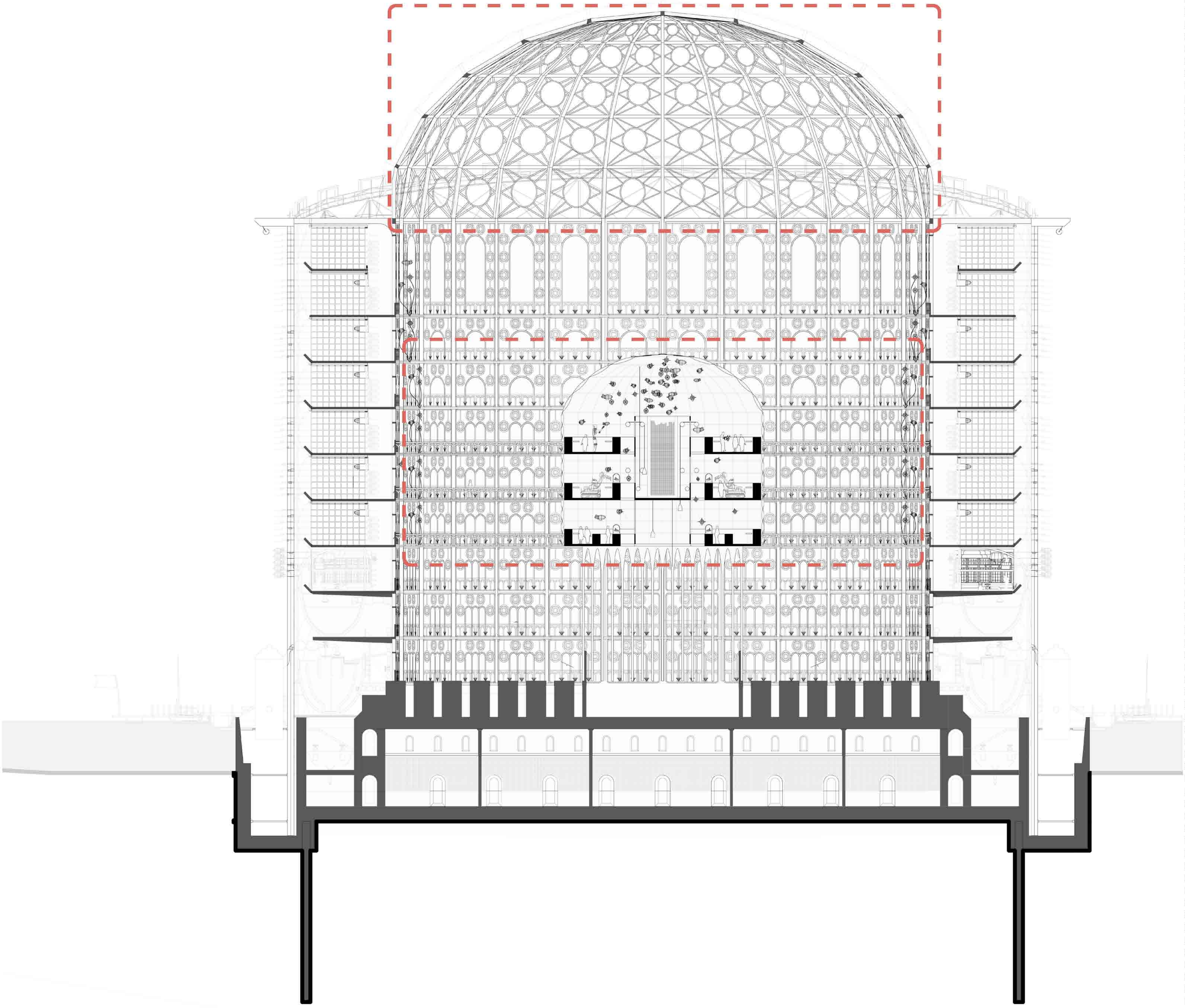
4.5[9]__SEQUENCE

Construction Sequence

10. Install prefabricated Eel laboratory and Canteen module:

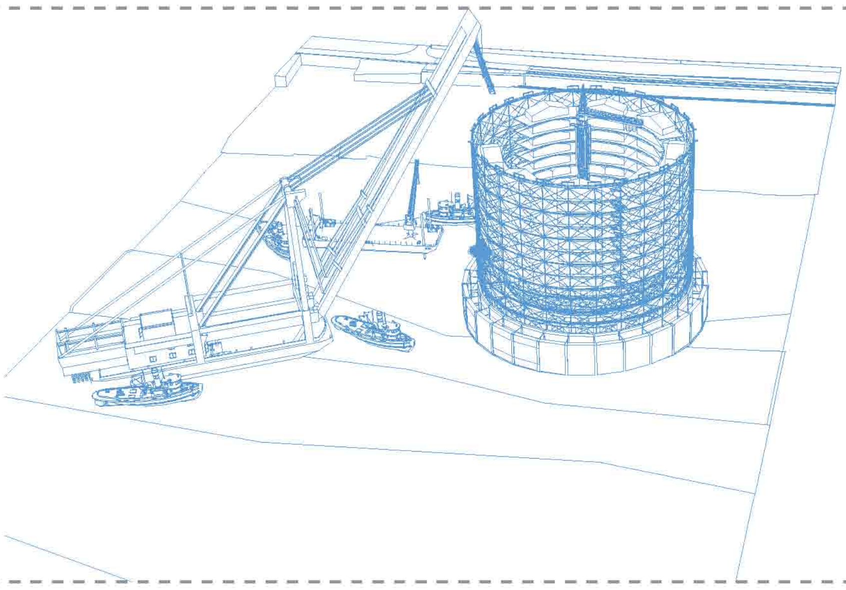
The single bespoke prefabricated module arrives on site from Germany by sea and is lowered into place using a crane vessel. The roof is then constructed once the module is secured.

Build Status



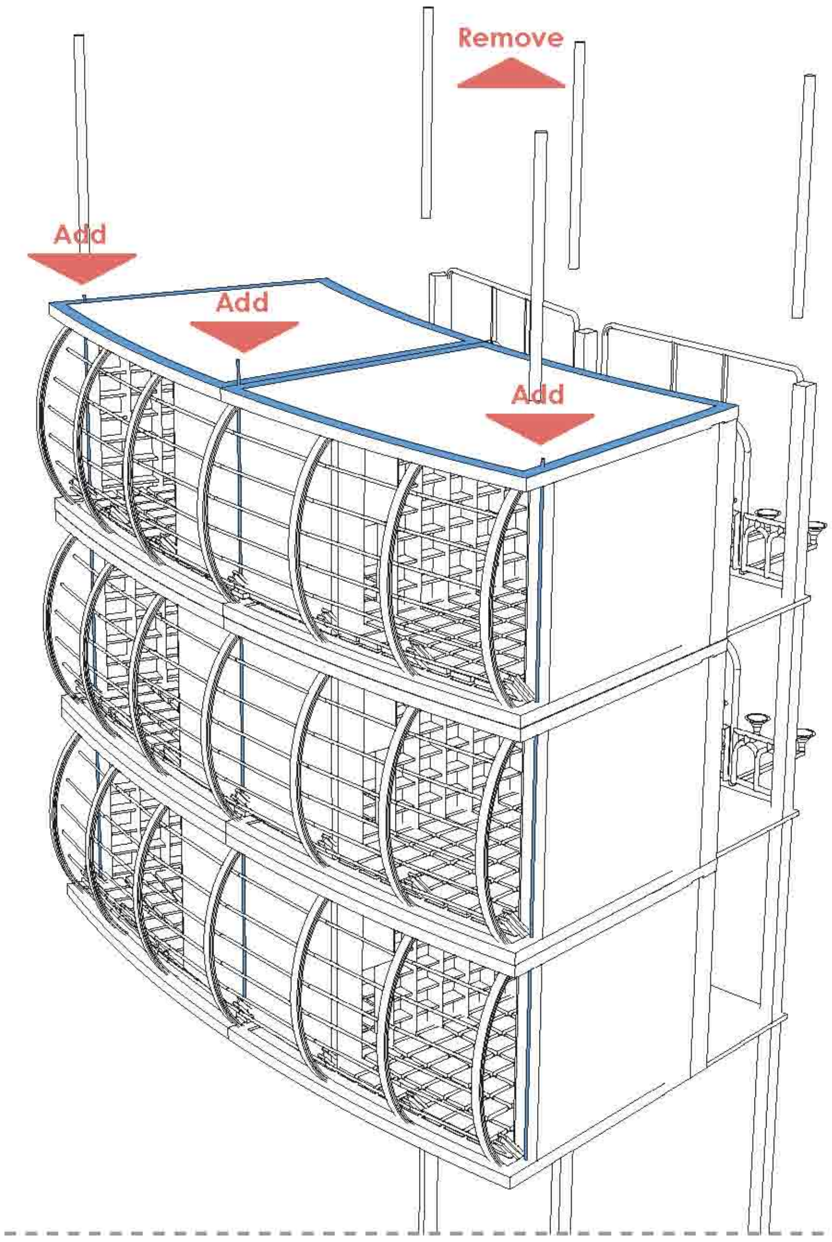
Building Site Status

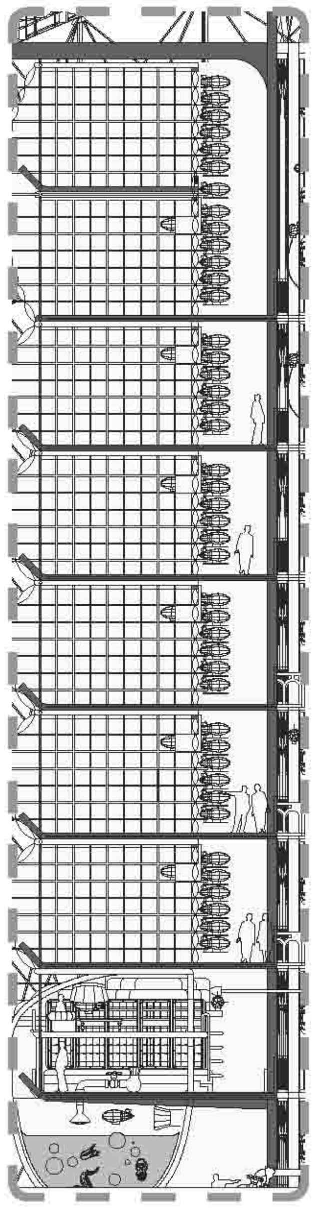
- The tower crane is now de constructed and removed from site. Barge cranes and a crane vessel will now occupy the site for the remainder of the project to perform the role.



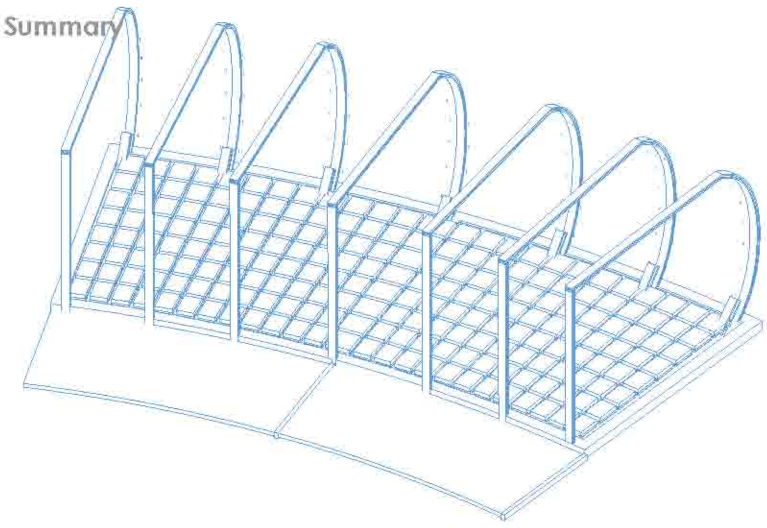
Deconstruction of the tower crane is necessary to provide space for the Eel laboratory and canteen. This prefabricated module will arrive from the factory in Germany by sea where a team of contractors await its arrival for installation

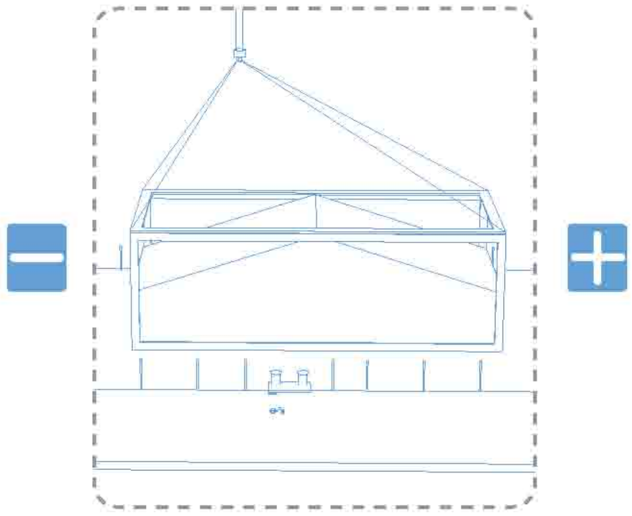
Phase 11

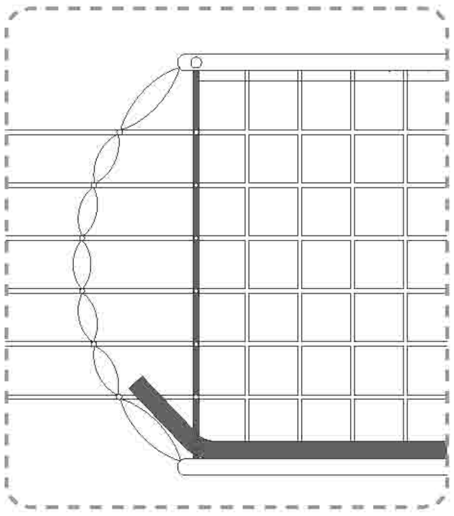




Phase Summary







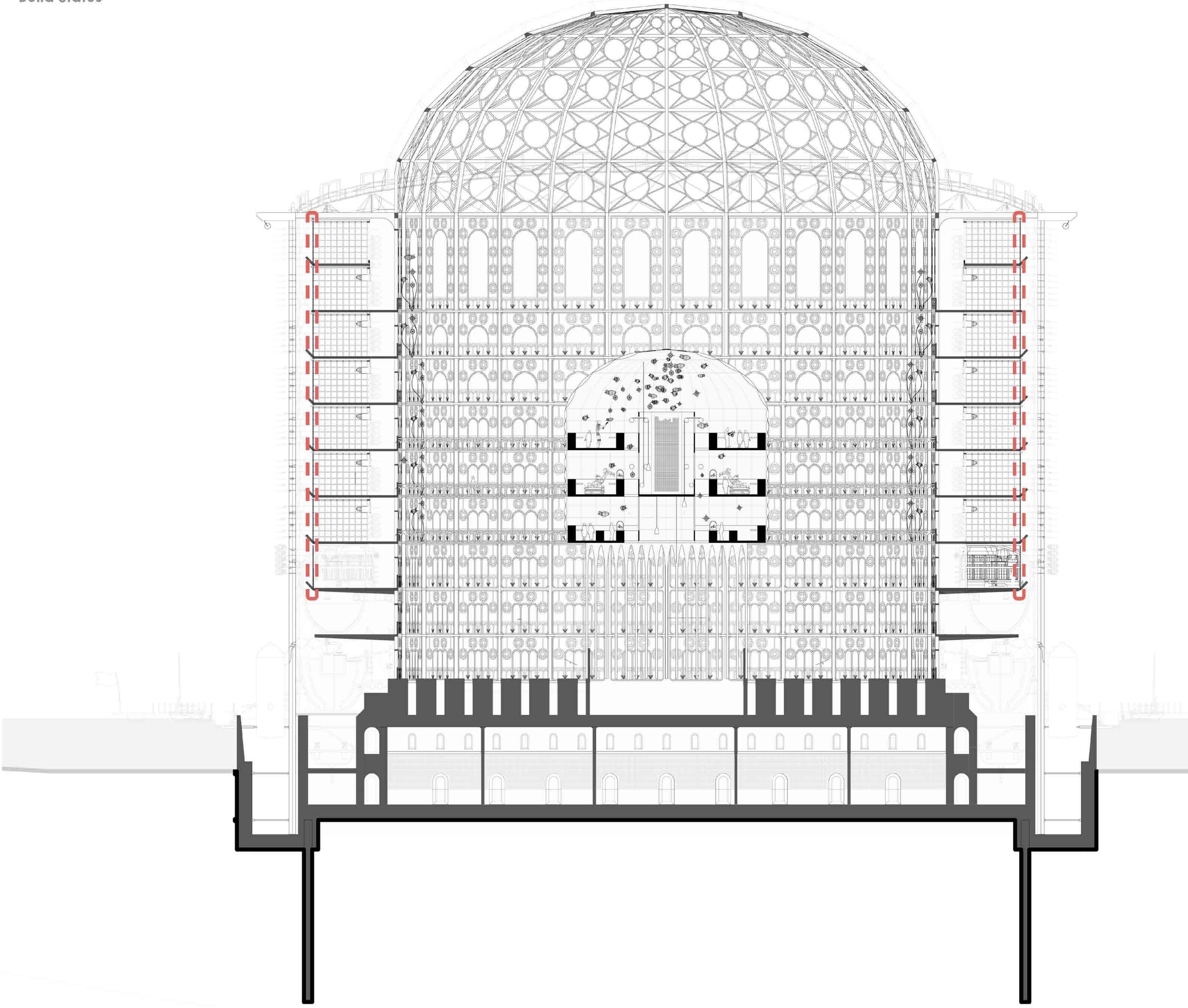
4.5 [10] __SEQUENCE

Construction Sequence

11. Insert Steel Tension Rods:

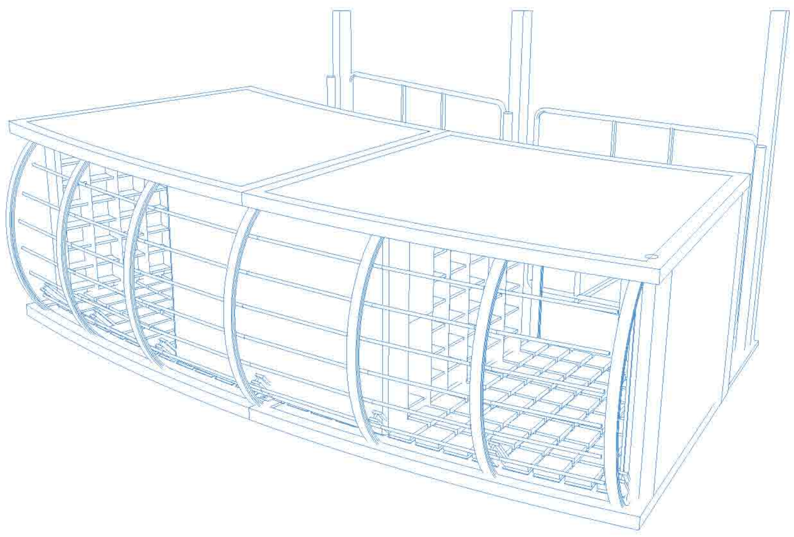
Steel tension rods are then hung from the steel members and secured in place in each prefabricated module

Build Status



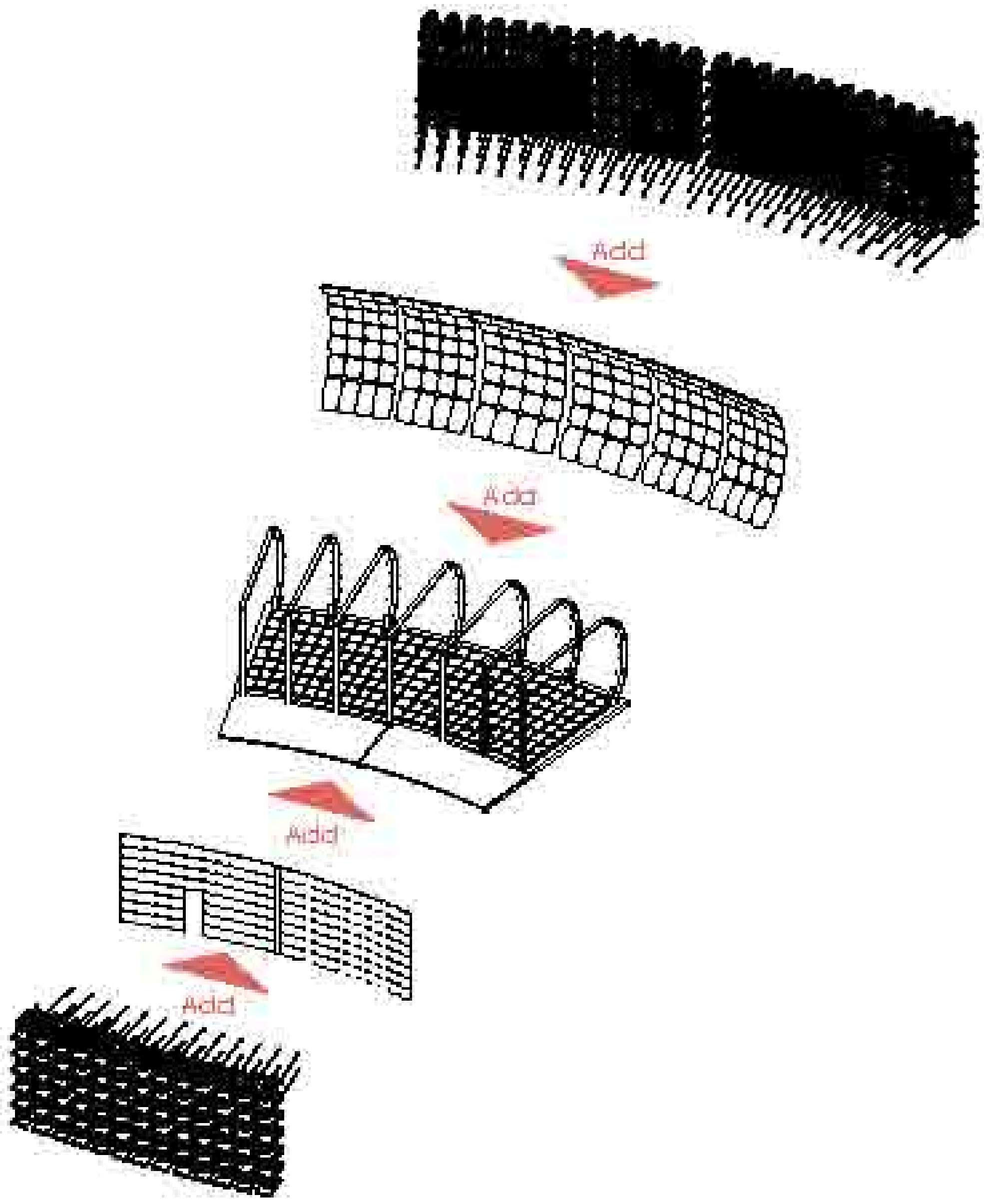
Building Site Status

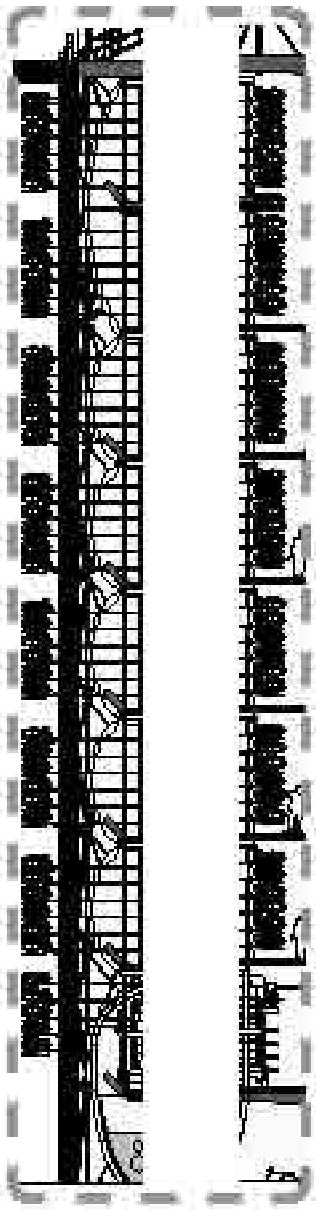
Contracting teams now move in to the modules in order to prep them for the final structural stage



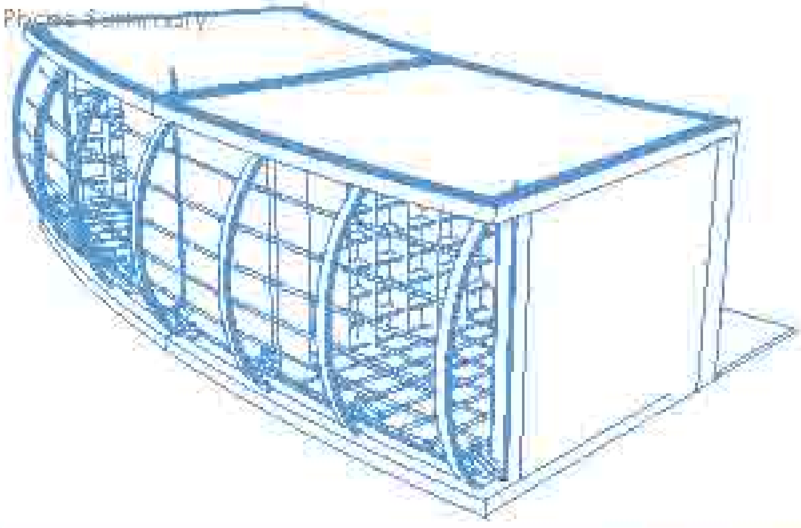
Each steel rod is then calibrated and tensioned in sequence in order to prepare it to take the structural loading of each module. Once tests have been conducted, the temporary scaffold structure originally installed with each module is removed from top to bottom, allowing each module to be semi suspended from the steel members and hang from the structure above

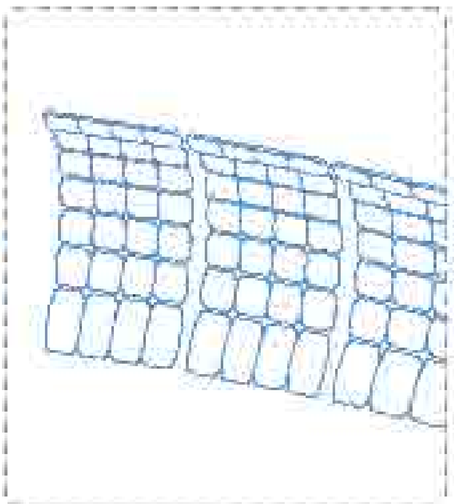
Phase 12

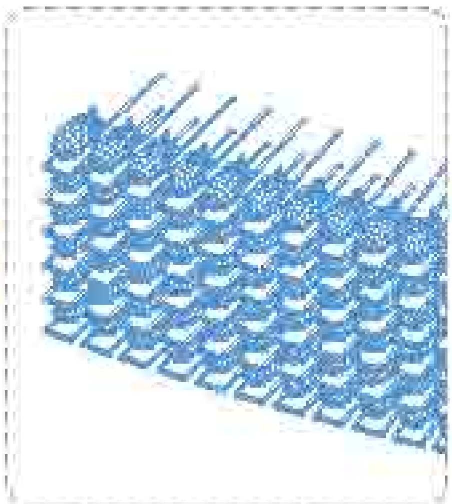




Phase Summary







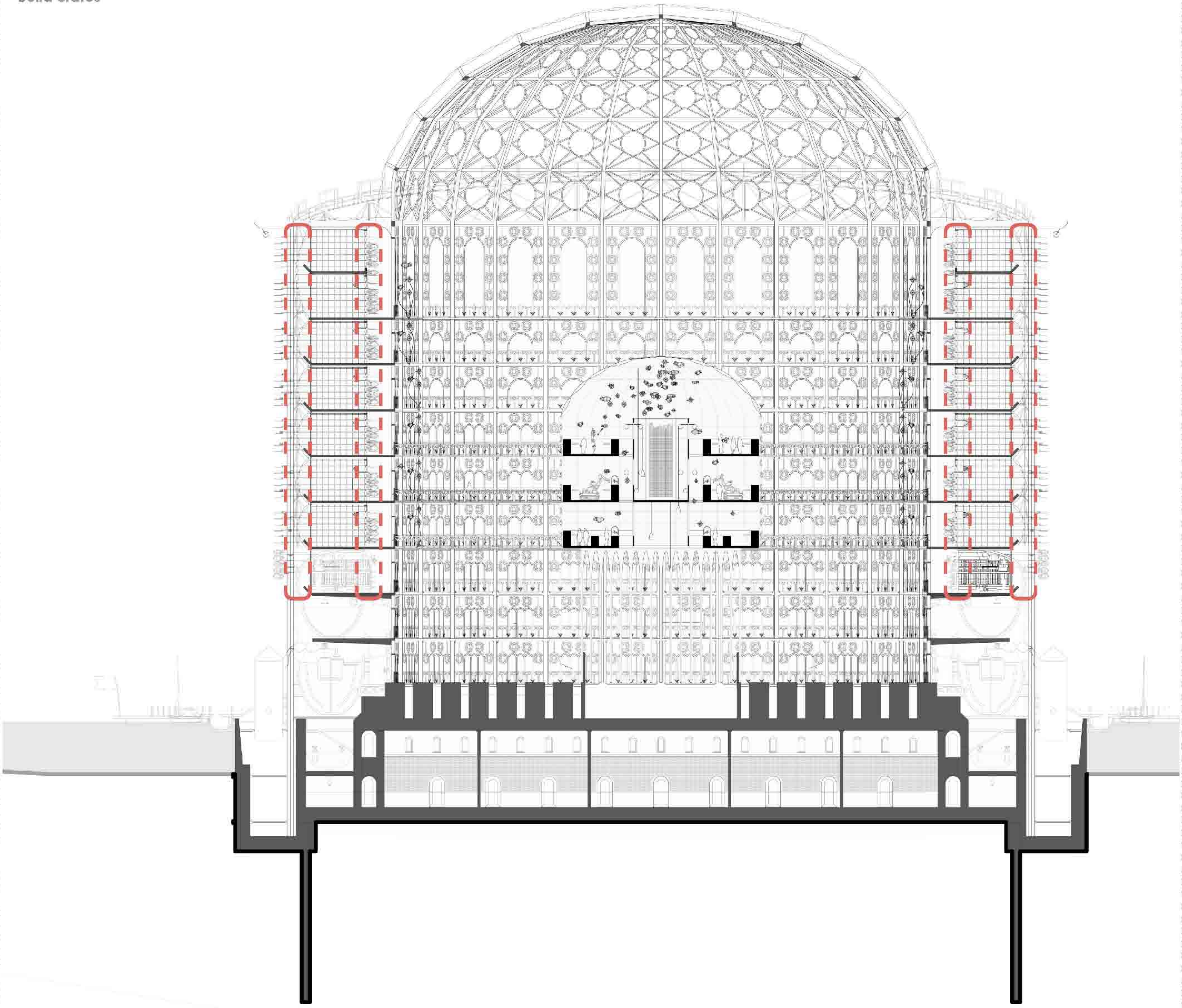
4.5 11 _SEQUENCE

Construction Sequence

12. Construct ETFE envelope:

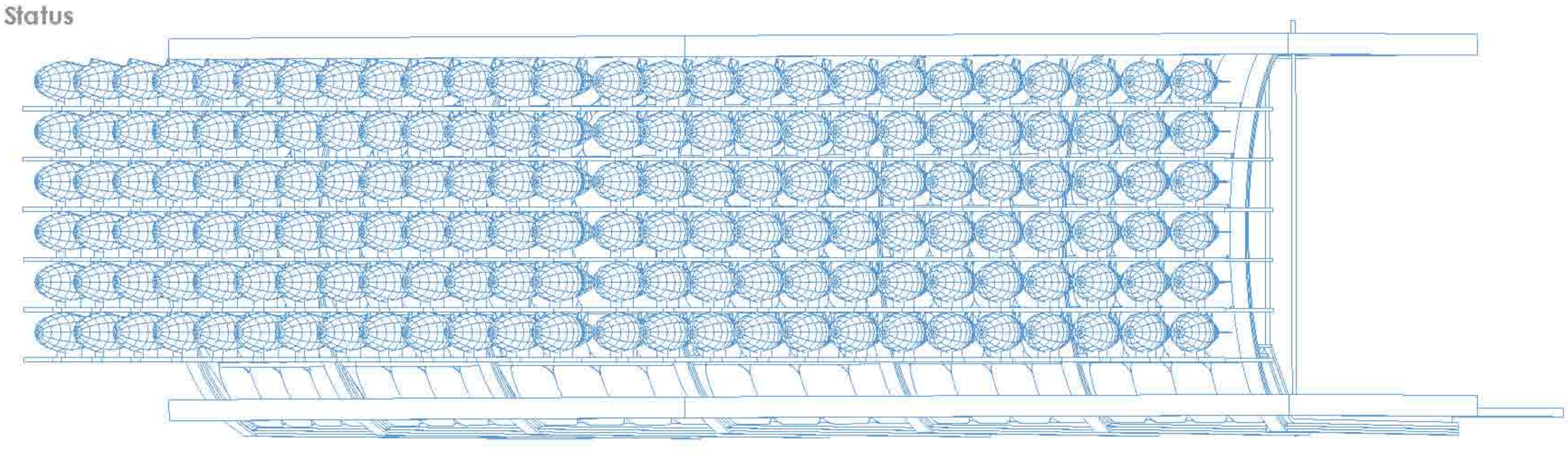
The building is then wrapped in an ETFE envelope. The drone facade system is then installed and deployed

Build Status



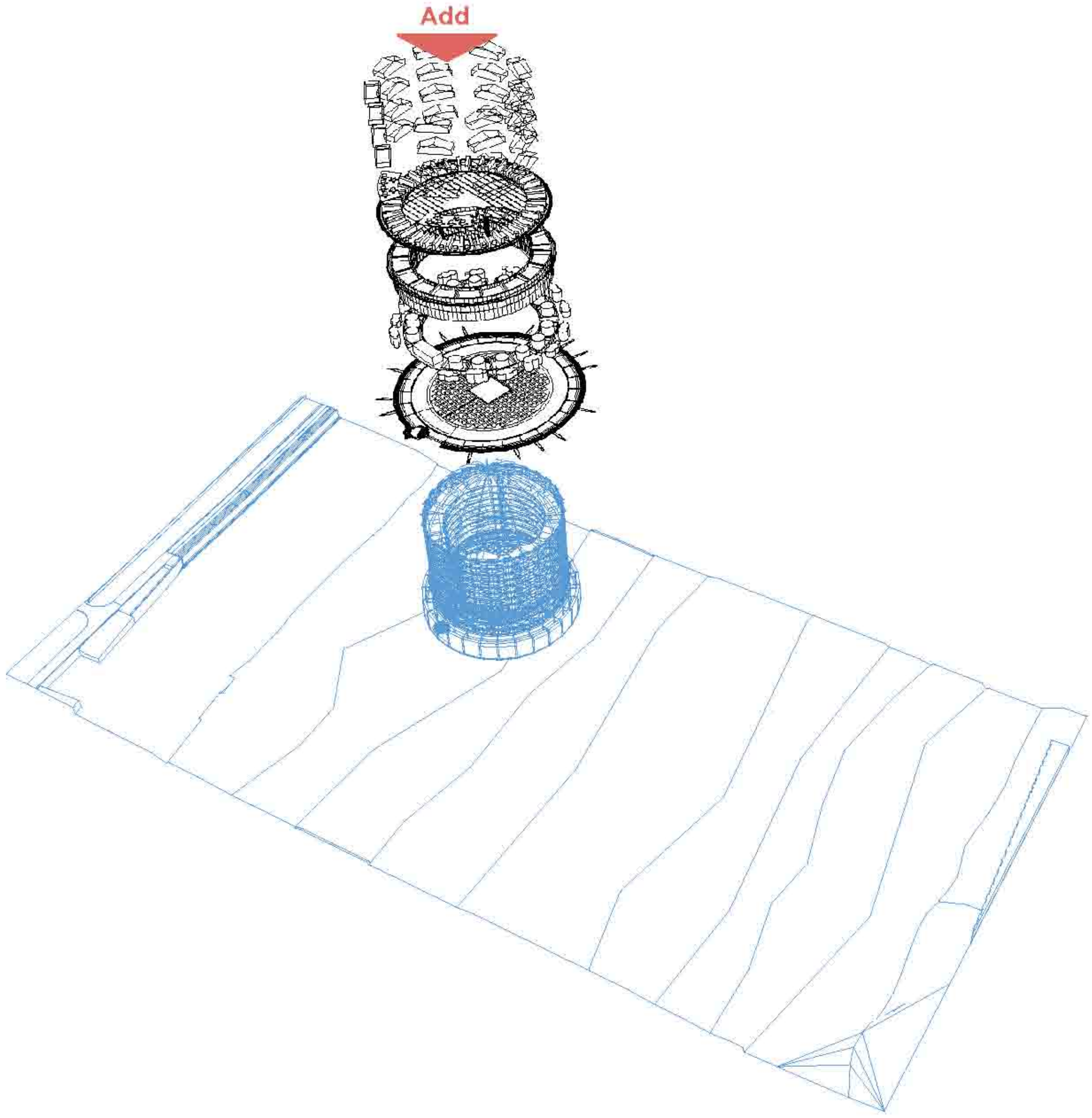
Building Site Status

specialist contractors use abseiling apparatus to install the ETFE envelope

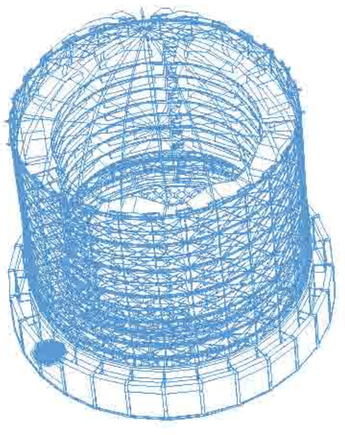


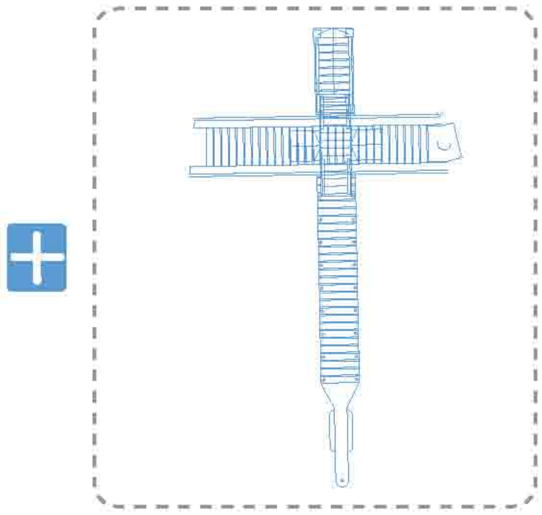
The building is now weather proof and water tight. At this point in the construction, each of the modules is now inhabitable

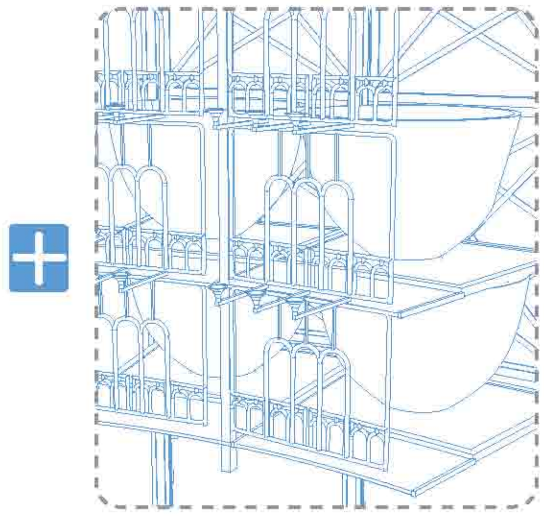
Phase 13

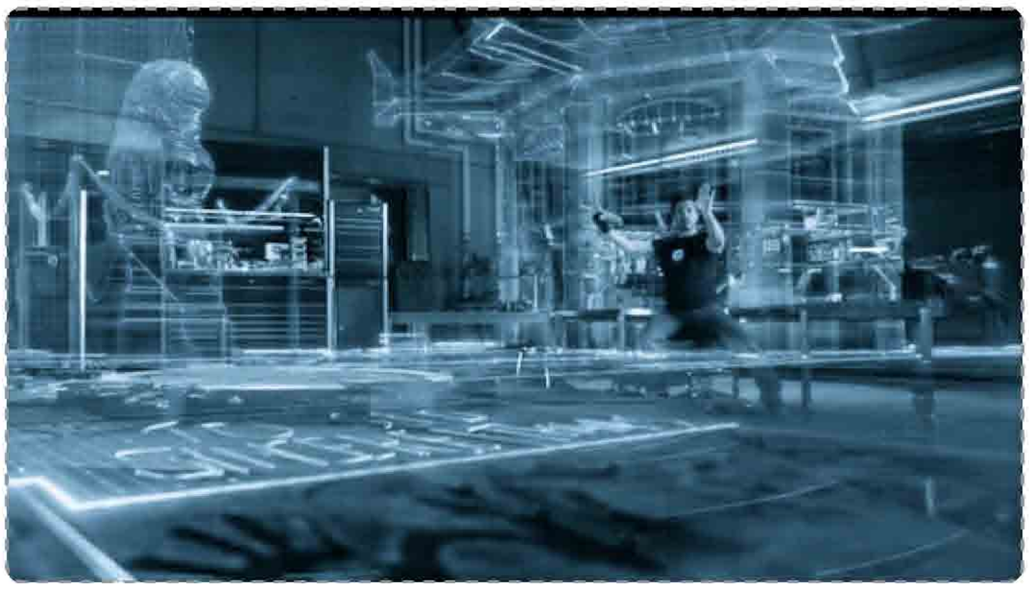


Phase Summary









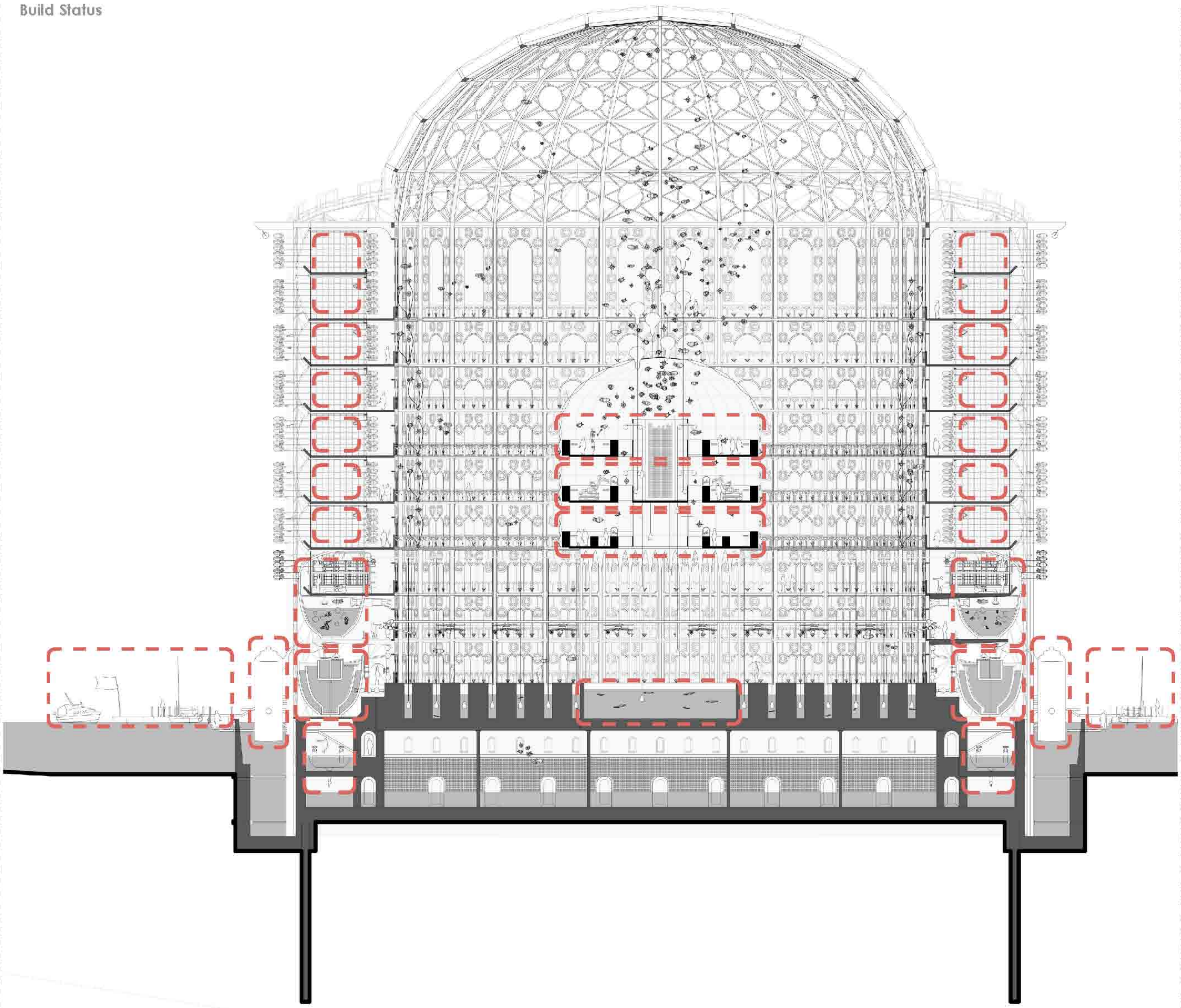
4.5 12 __SEQUENCE

Construction Sequence

13. Fit Out:

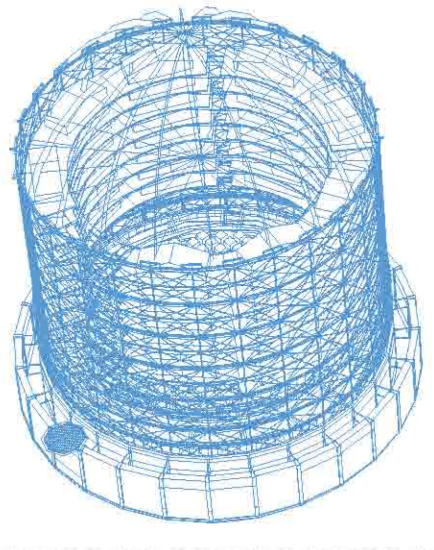
Specialist contractors now move in to provide the internal finish and installation of technology ready for hand over to the client

Build Status

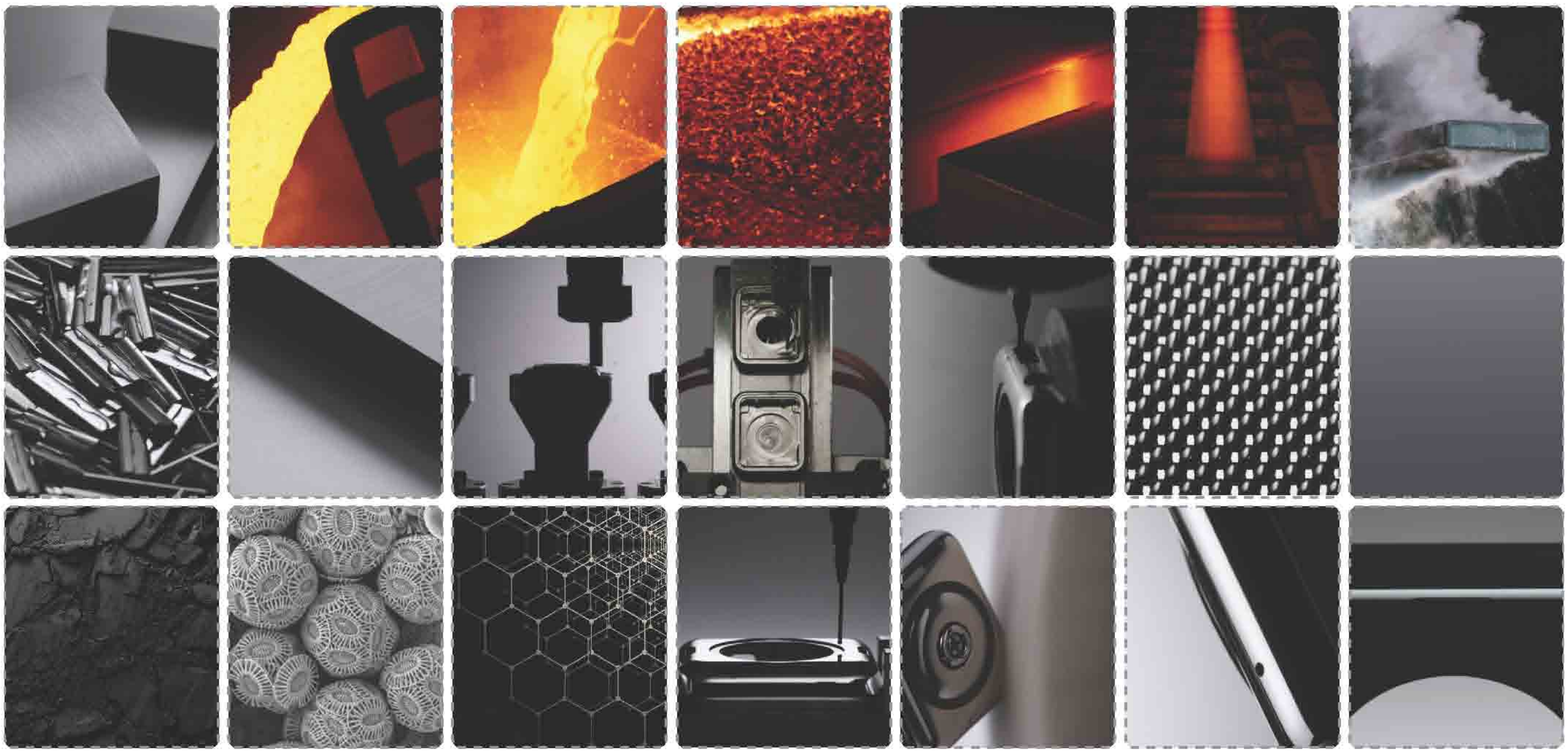


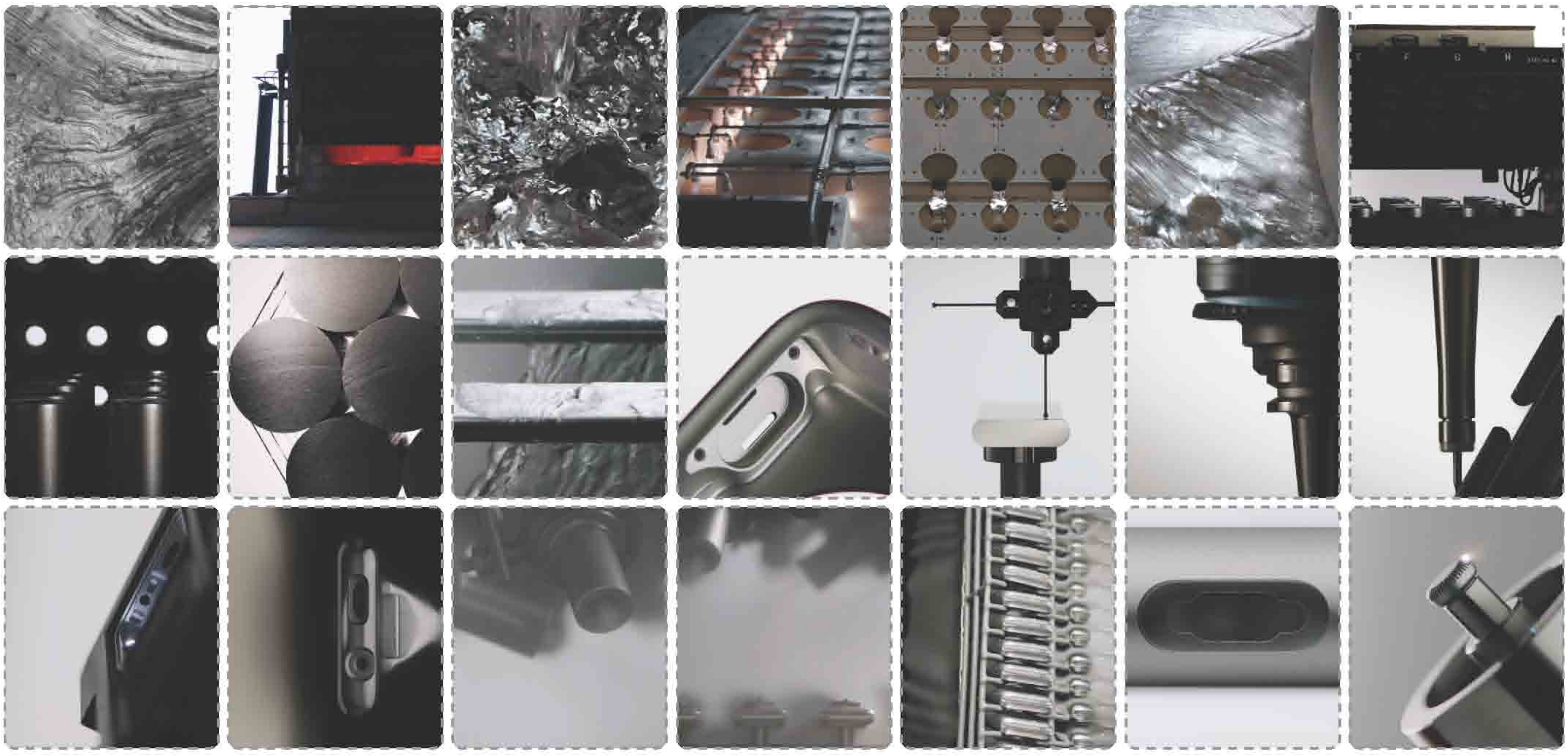
Building Site Status

Structurally the building is complete. The interior of the building now becomes a hive of action with specialist contractors working on internal finishes and detailing.
All deliveries are made to the newly constructed North Pier of the floating jetty network.



This is the final stage of the construction process and the final opportunity to fulfil the clients vision of an extremely high quality building that utilises high technology as a fundamental part of its design.
All technologies are installed and tested extensively in order to ensure they function correctly by the hand over date.





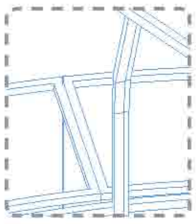
4.6 __MATERIAL

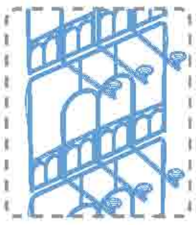
Internal Material

Internal material details and desired finish information.

Internal walkways and hand rails are constructed from stainless steel with a ‘space black finish’.

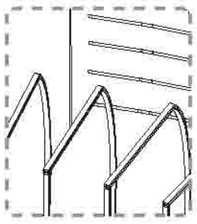
All ‘kit of parts’ furniture and visible structures inside the prefabricated modules is made from aluminium with a ‘Zirconia finish’

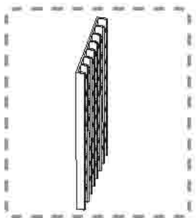




Stainless steel
> **Strong** and **beautiful**
> **Alloy** used chosen for **strength and corrosion resistance**
> **Alloying** and processing steps to make it even **stronger**
> Tightly **controlled moulten state** temp to **minimize impurities** and **ensure hardness**
> **Cold forging** process makes **metal 80 percent harder** and less susceptible to nicks and scratches
> **'Forgings'** then machined by 12 station **multi- access milling machine**
> **Polished** to **pristine mirror finish**

'Space Black' **[Finish]**
> Additional **diamond like carbon layer** added
> **Durable and beautiful appearance**
> **Traditional material** with **new expression**





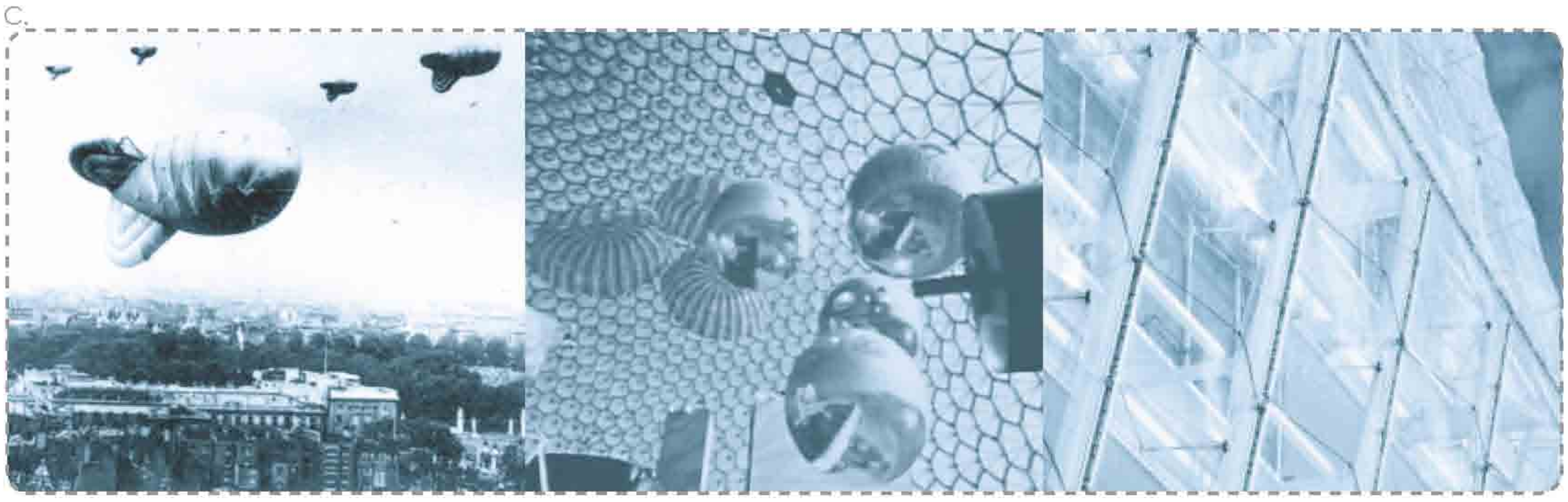
Aluminium alloy:
> Poured
> Jet cooled
> Cast
> High temp treatment epitomizes consistency in the billets
> Ensures grain structure
> Finely tuned extrusion process free of defects
> Each Piece of prefabricated module is machined and buffed

'Zirconia' [Finish]
> Textured with microscopic zirconia beads
> Achieves consistent satin finish
> Anodising creates a hard, clear outer layer to protect from scratches

A.

B.

C.

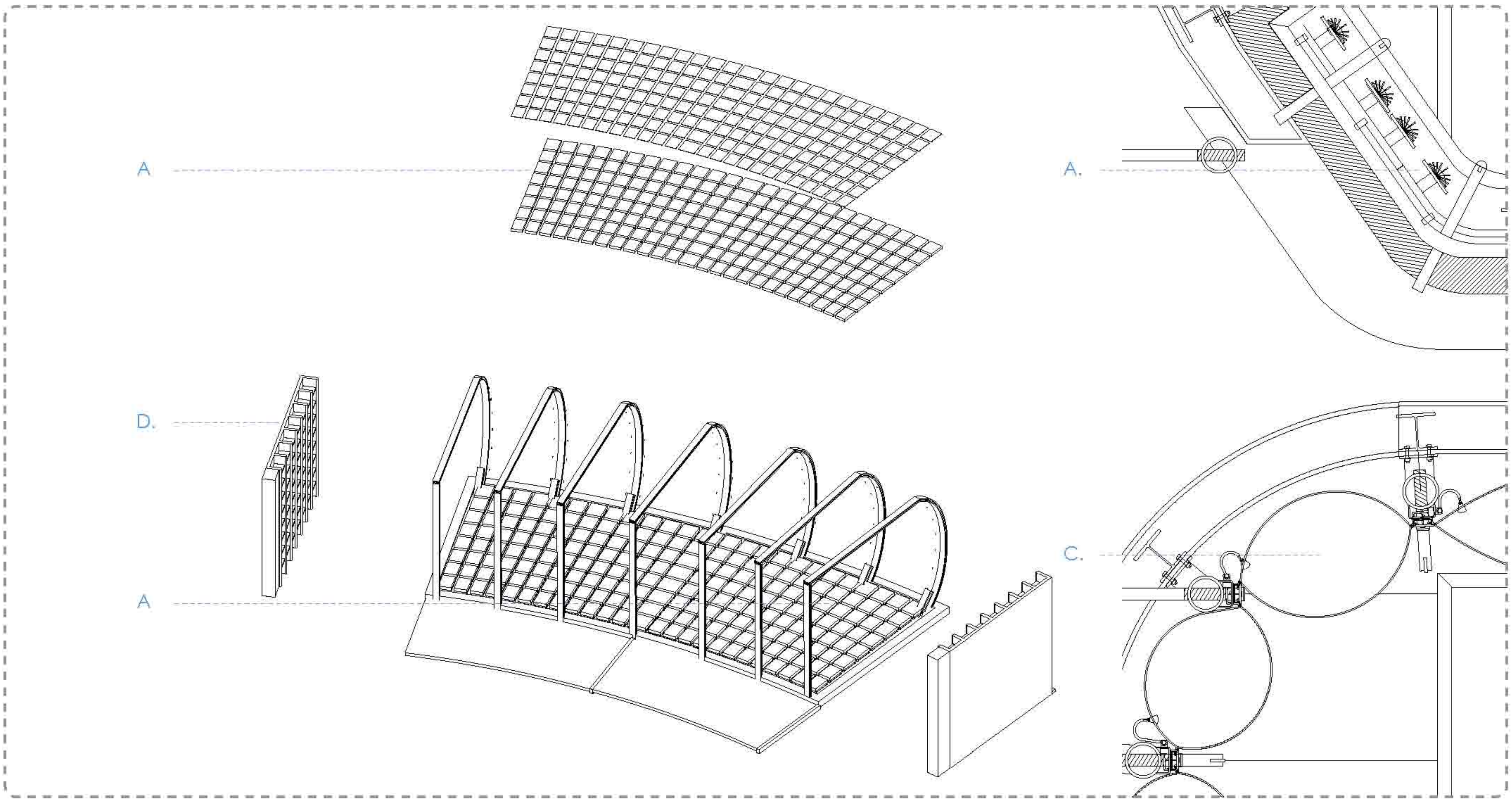


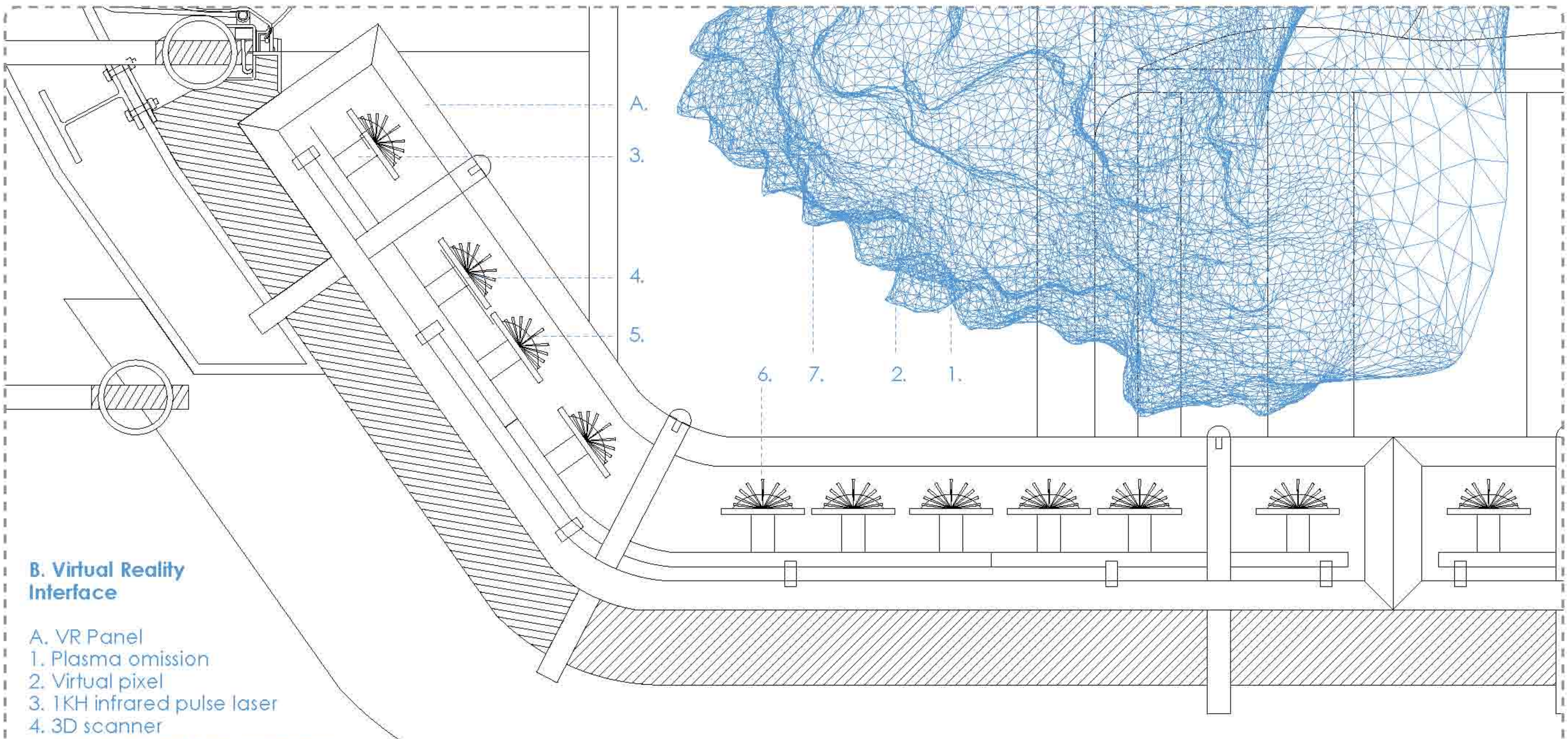
D.

4.6 [1] __MATERIAL

Internal Finish

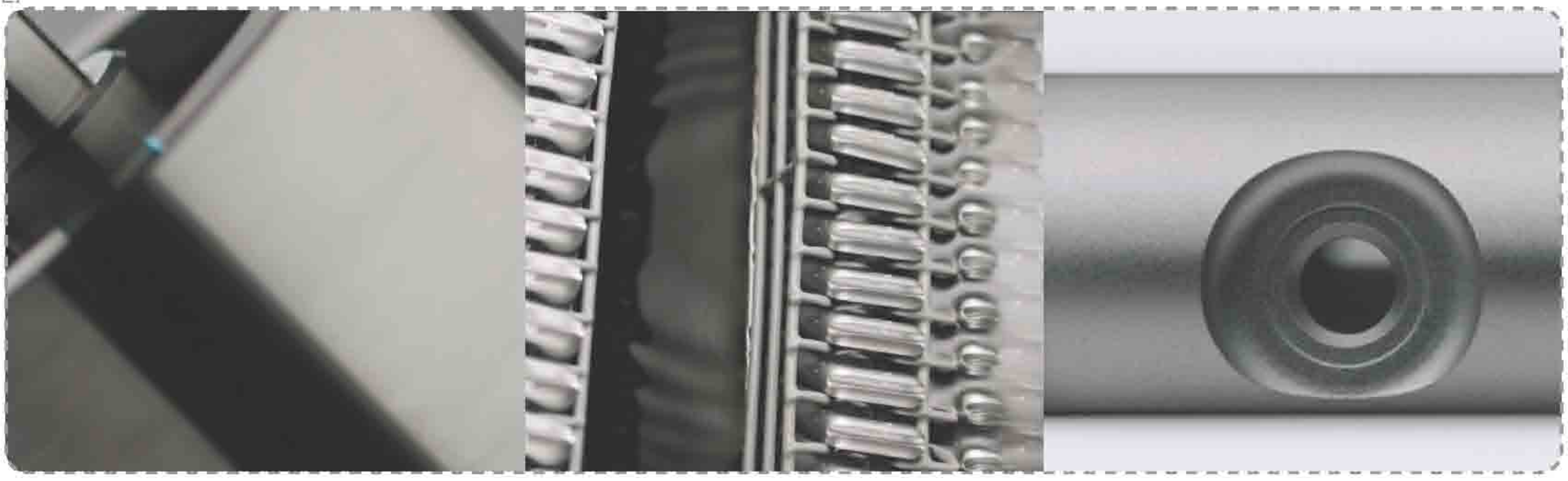
A. Virtual reality panels
B. Virtual reality interface
C. ETFE drone facade syste
D. 'Space Black' stainless steel





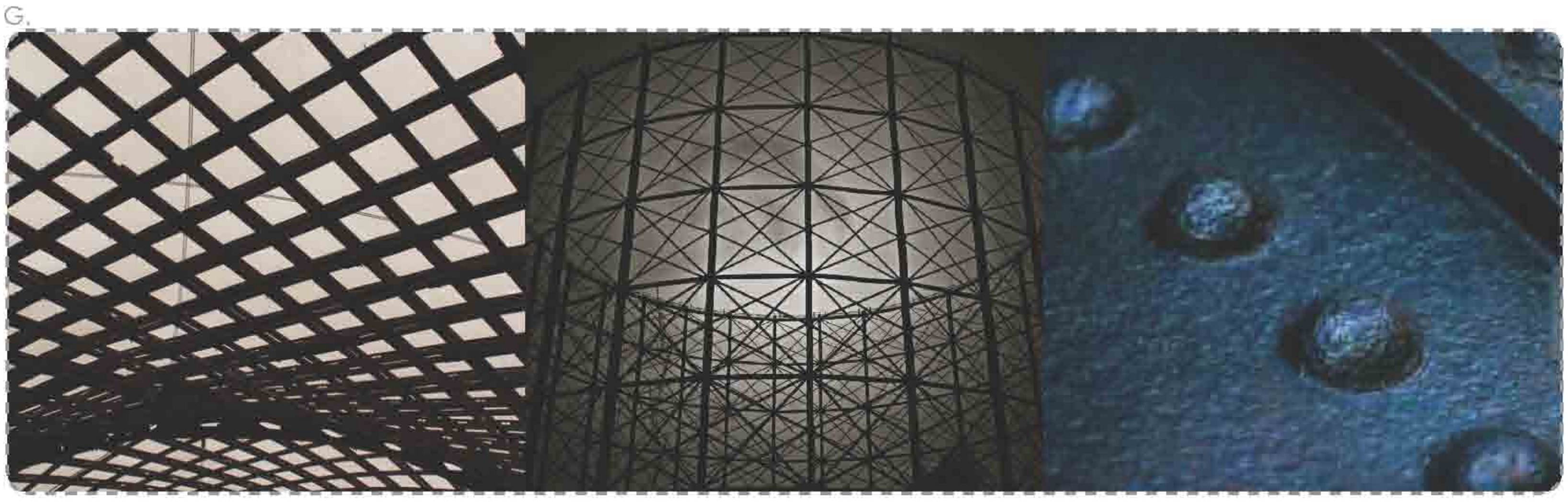
The worlds first screen less display:
Aerial Burton, a Japanese technology company have developed the worlds first screen less display. Their aerial 3D display projects text and images in mid air using a phenomenon known as 'plasma omission'. Images are constructed by creating virtual 'pixels' in mid air by firing 1KH infrared pulse lasers into a 3D scanner which reflects and focuses the pulses of the laser to specific points in the air. The molecules at this point are ionised and energy is released as photons, therefore creating what appears to be an illuminated pixel

E.



F.

G.

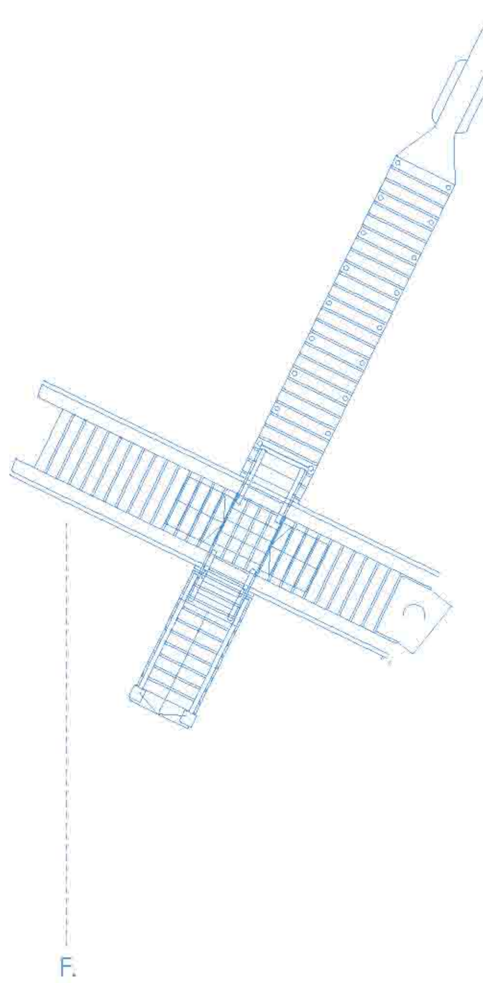


H.

4.6[2] __MATERIAL

External Material

E. Zirconia finished aluminium alloy
F. Char finished larch wood
G. Black painted cast iron
H. Yellow polymer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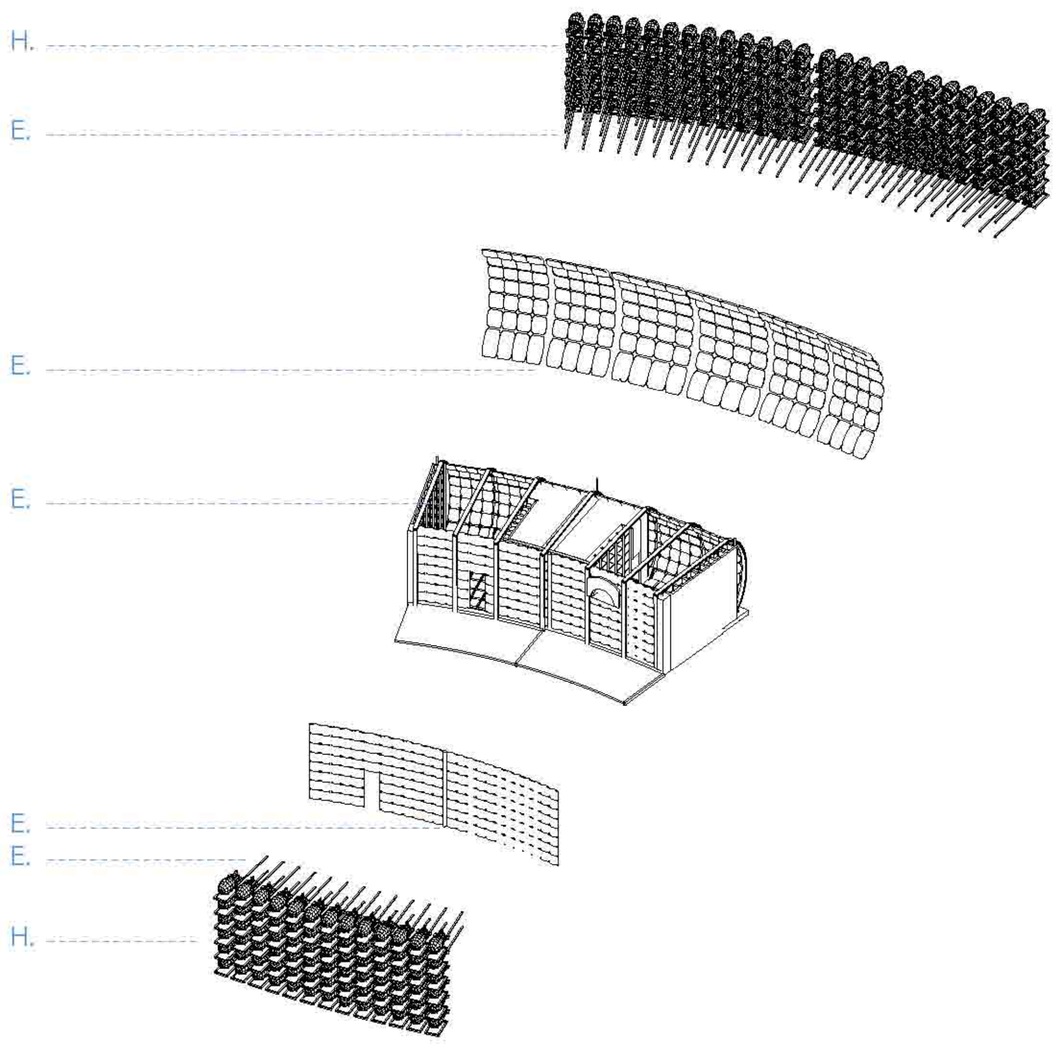
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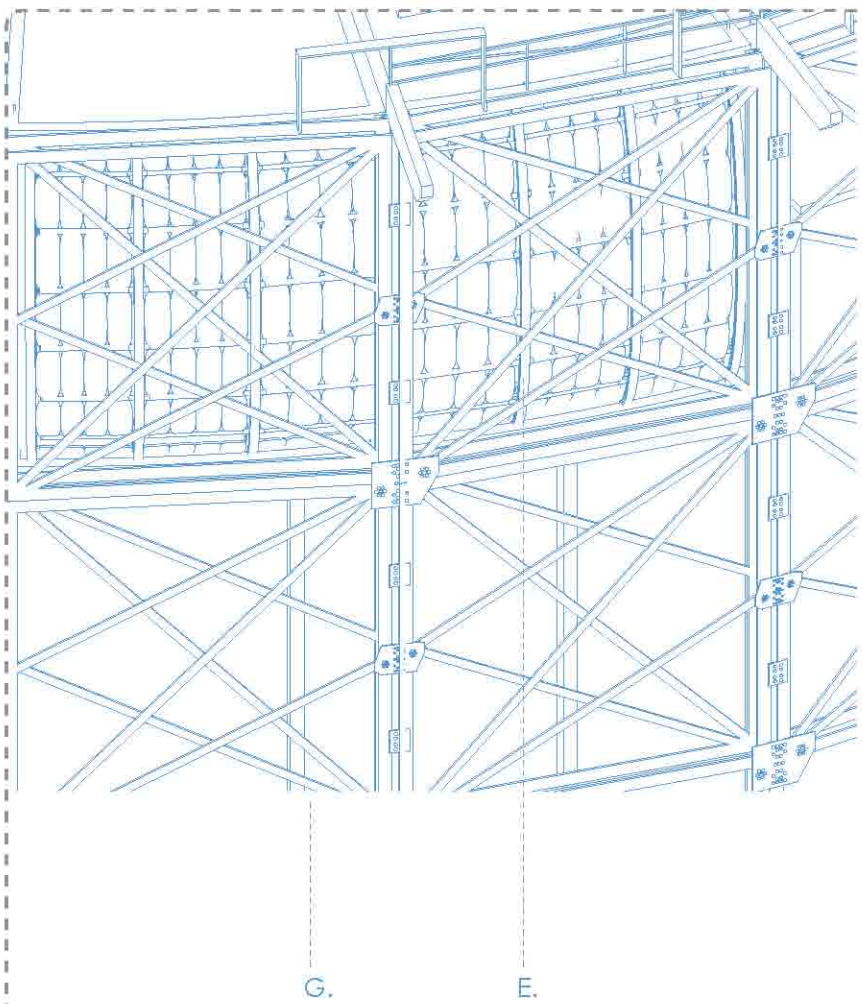
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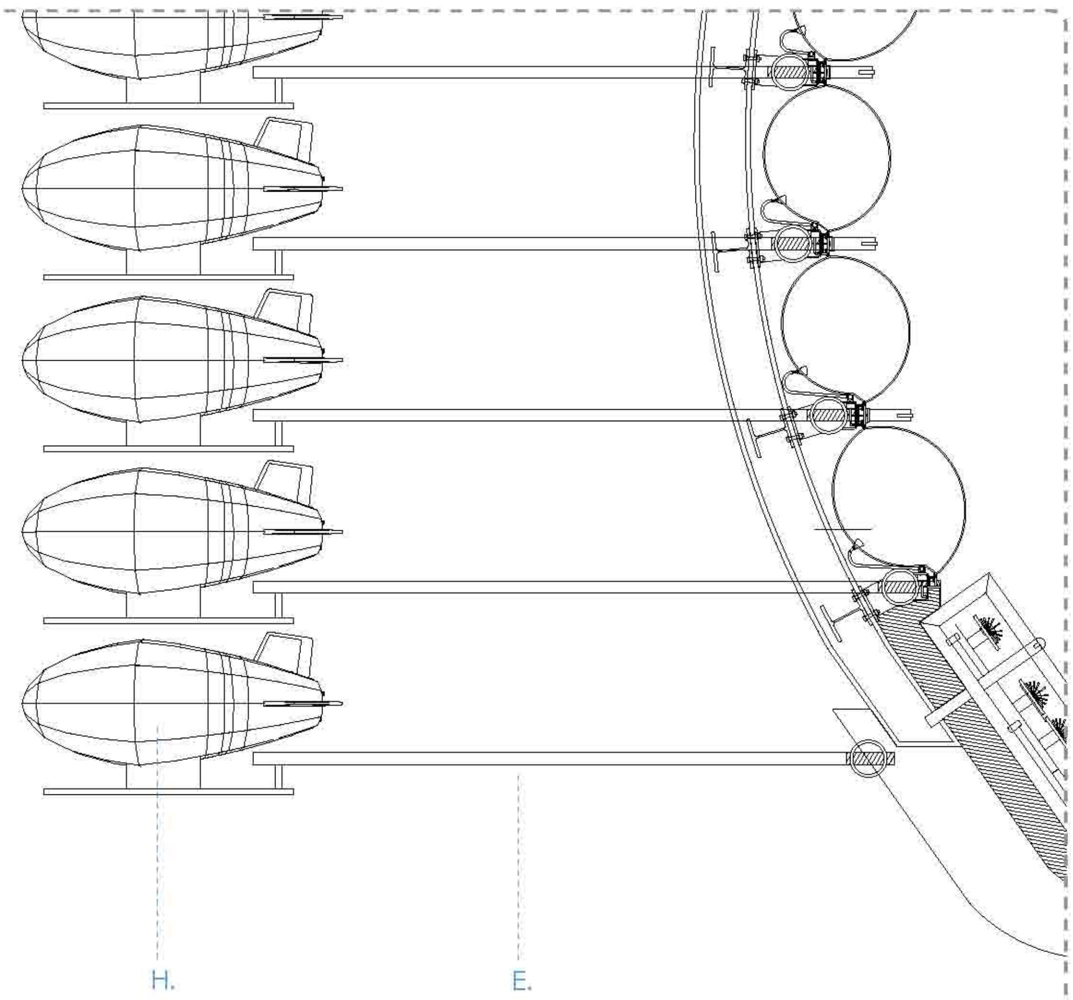
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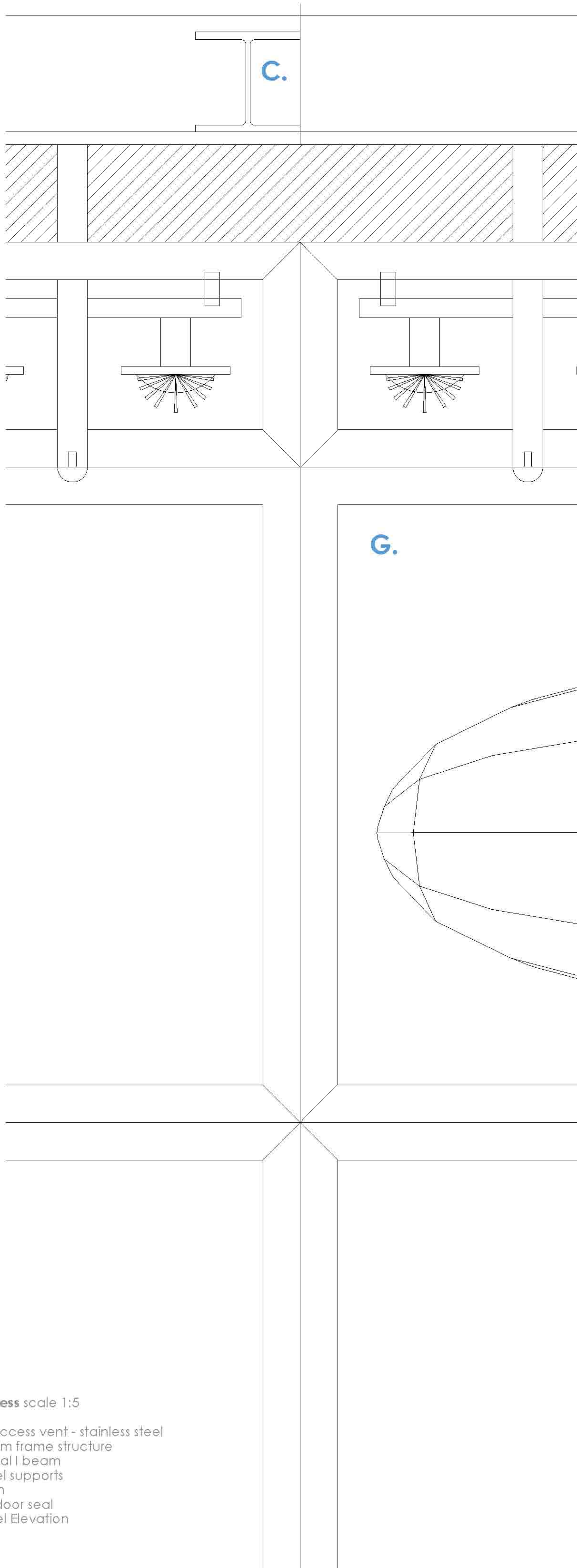
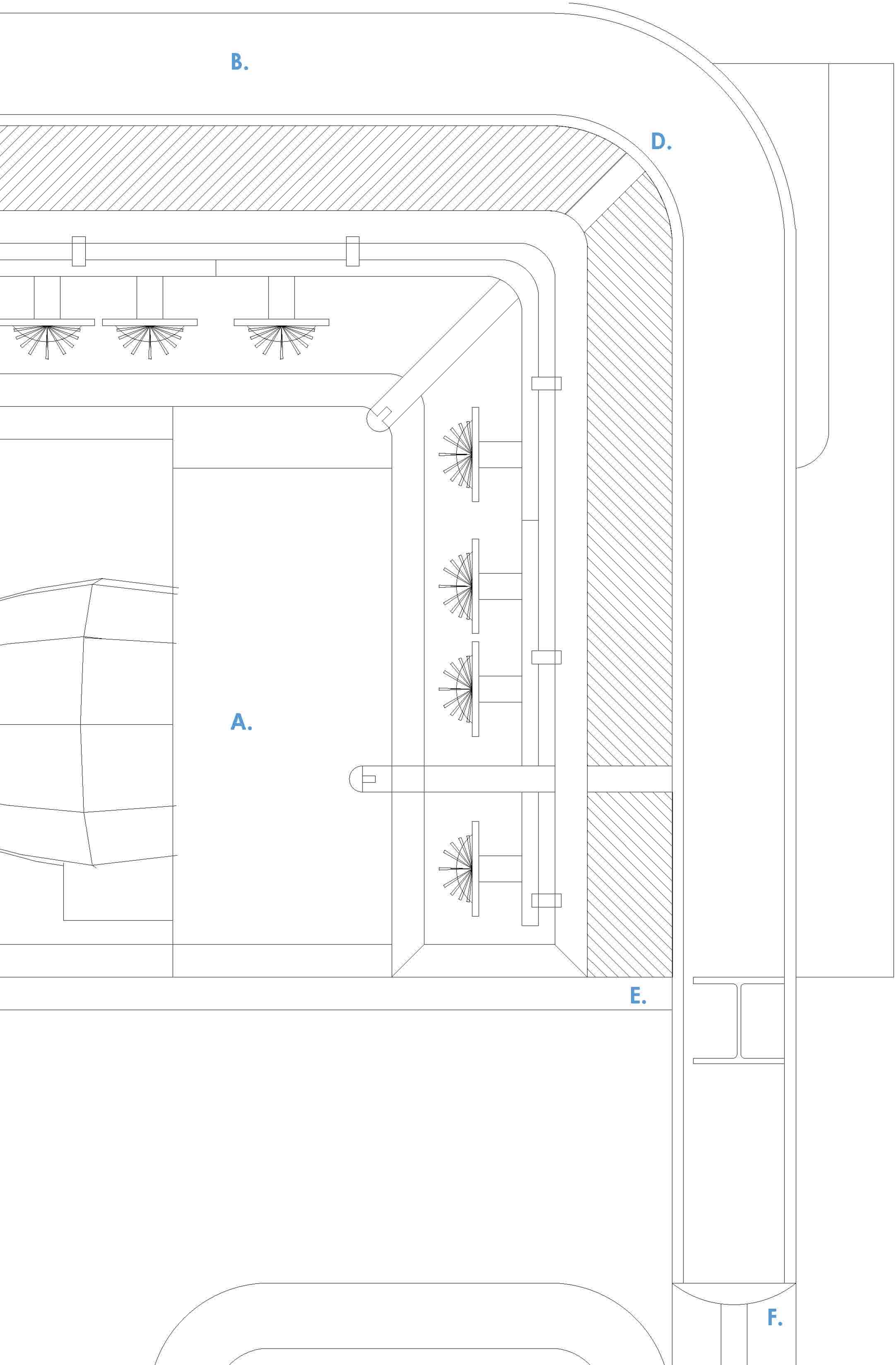


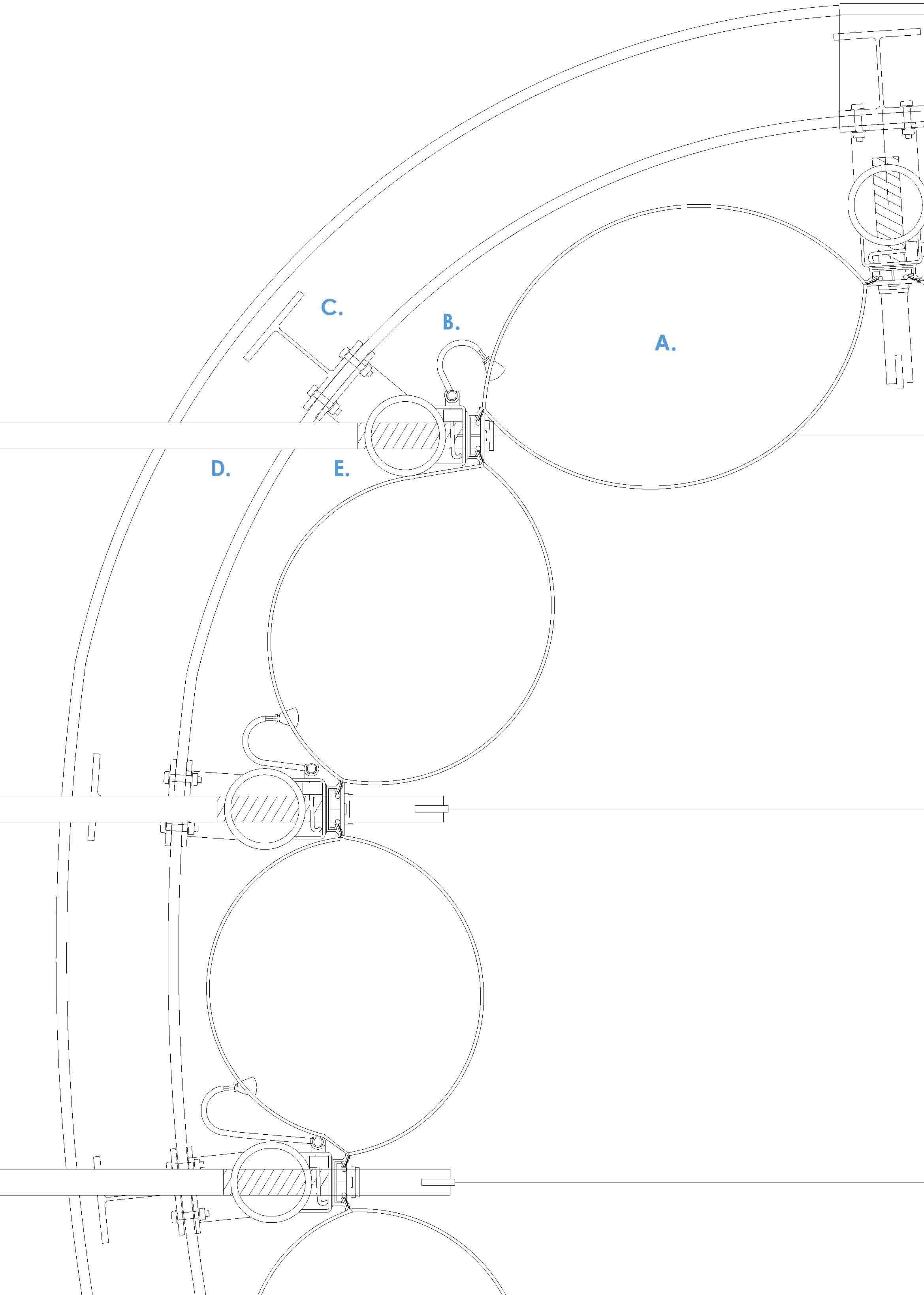
4.7 1:5 __KEY DETAILS

External Material

Drone Access scale 1:5

A. Drone access vent - stainless steel
B. Aluminium frame structure
C. Horizontal I beam
D. VR panel supports
E. Insulation
F. Rubber door seal
G. VR Panel Elevation


B.
D.
A.
E.
F.


C.
B.
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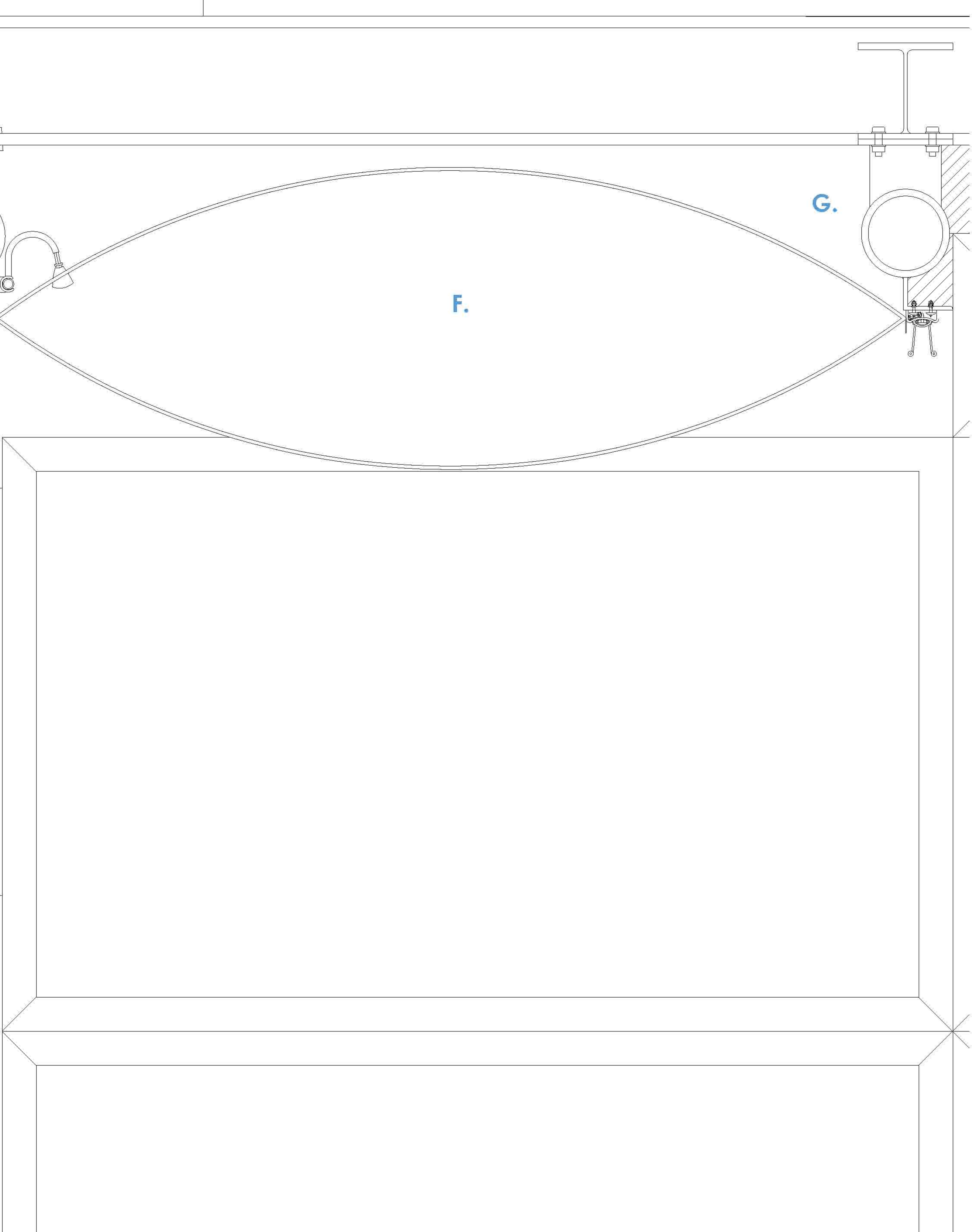
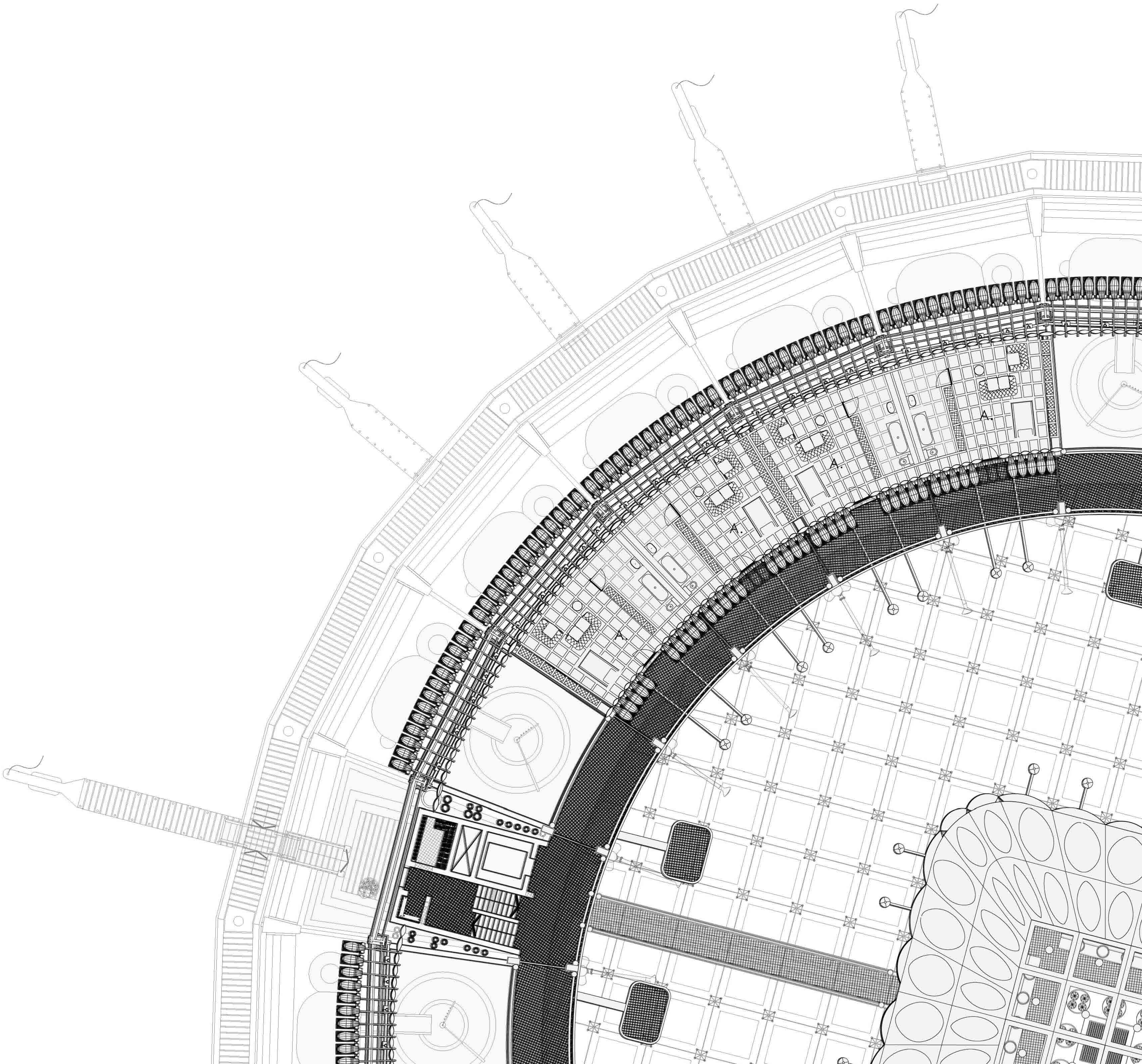


Drone Access scale 1:5

A. ETFE cushion
B. ETFE inflation nozzle
C. Aluminium I Beam support
D. Aluminium rod [drone facade system]
E. Insulator composite system - prevents cold bridge
F. Detachable ETFE panel vent
G. Opening catch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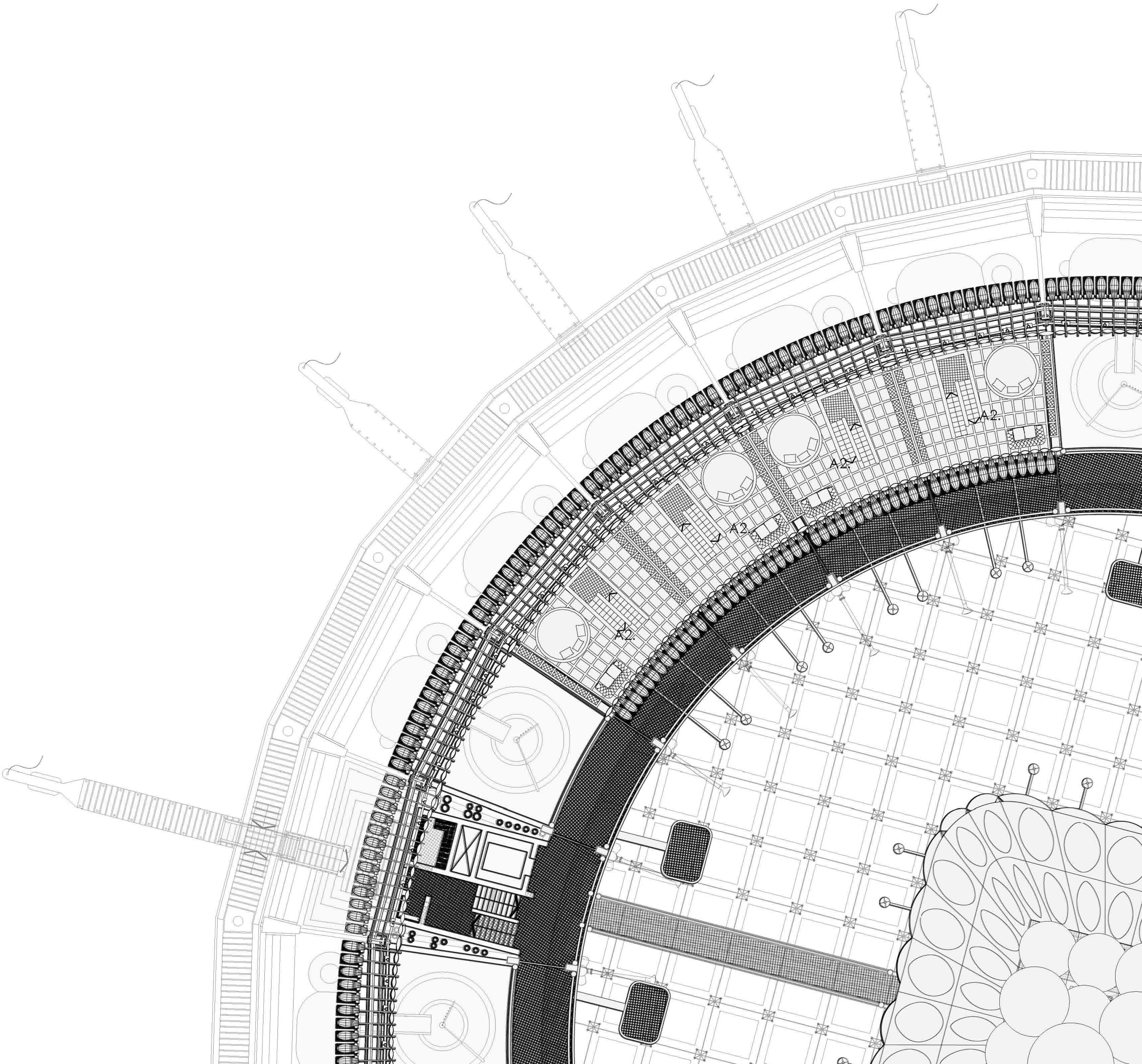
A2.
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