

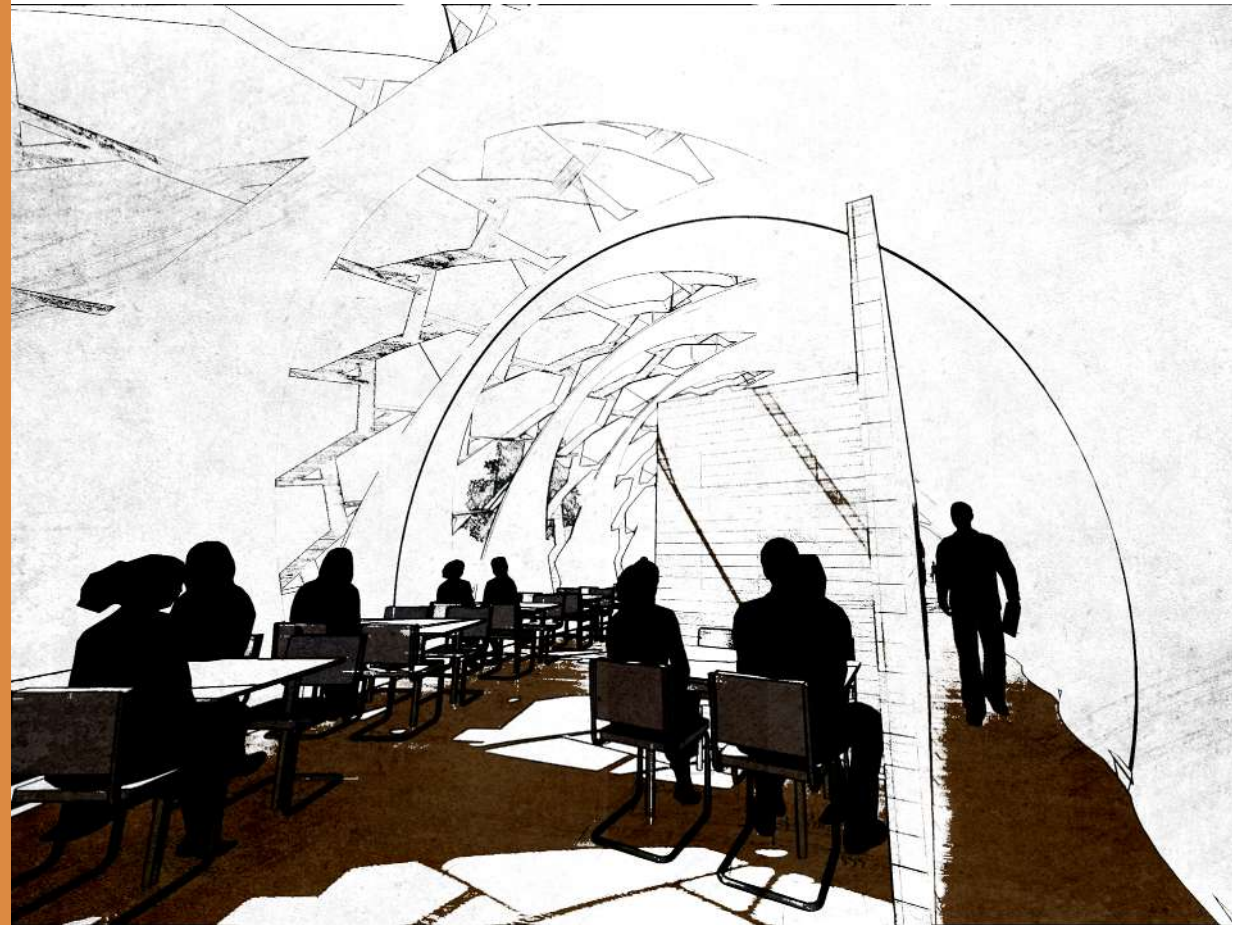
## LIVERPOOL BIENNIAL PAVILION

BA Architecture - 3rd Year (2015 -2016)

University of Liverpool

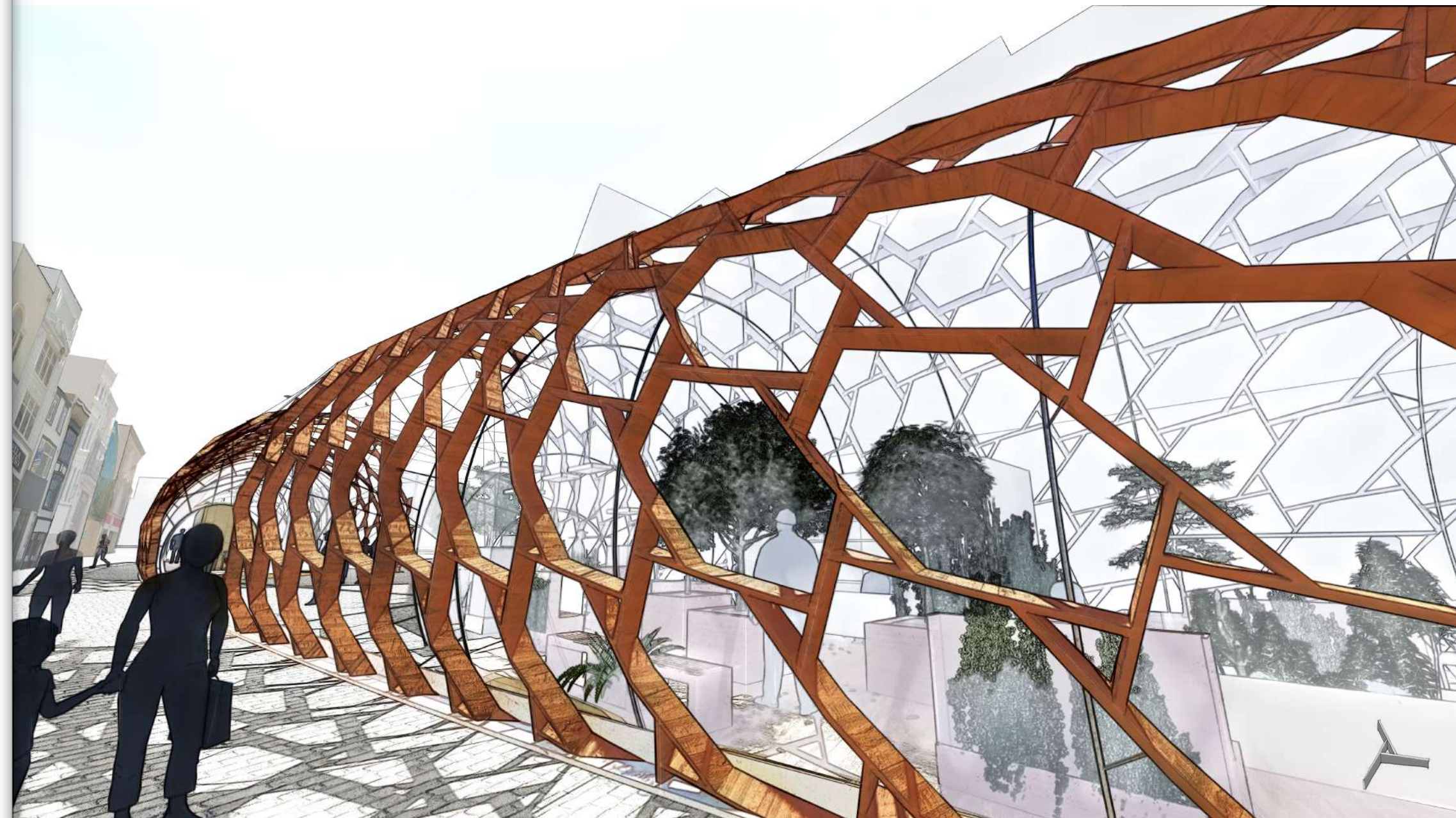
Project Type - Public Pavilion Design

Location - Church Street, Liverpool

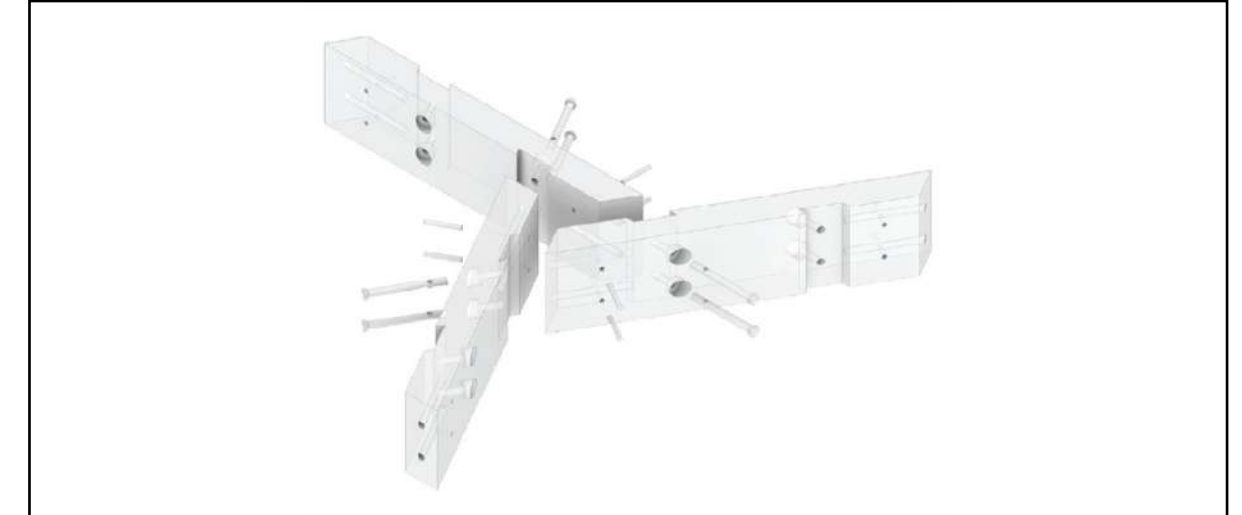
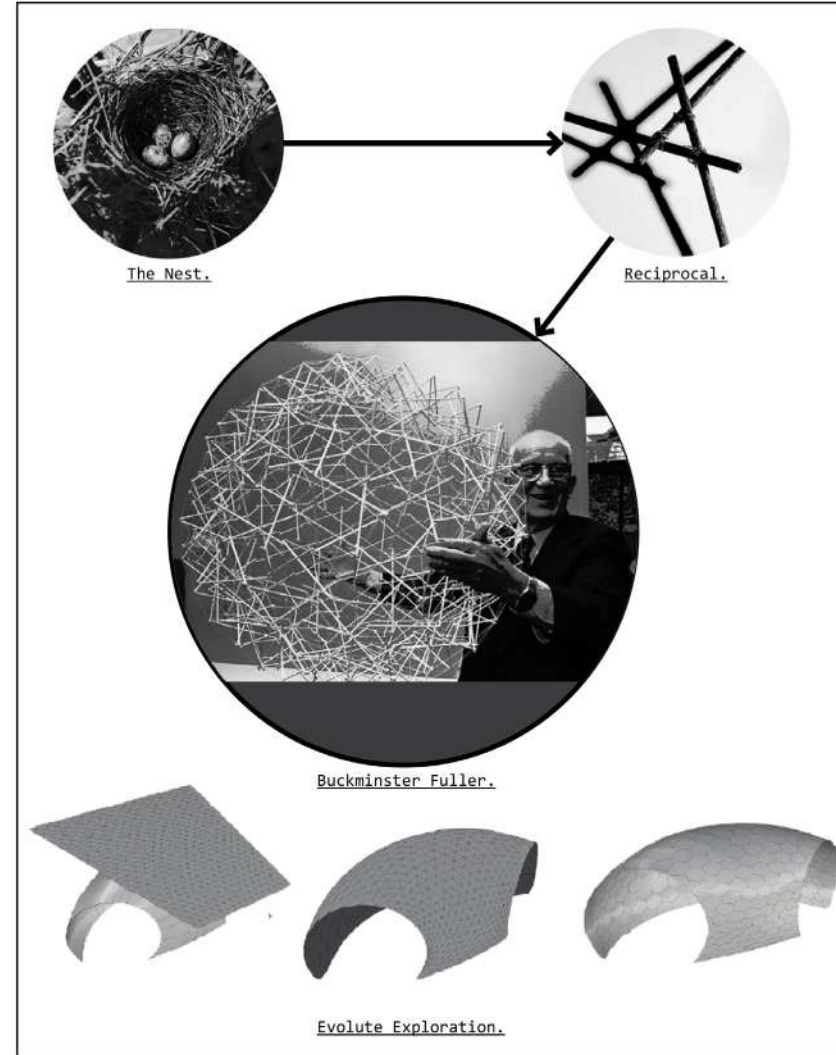


## LIVERPOOL BIENNIAL PAVILION

The brief specified a temporary structure for the Liverpool Art Biennial. The structure is required to provide shelter, respond to its immediate context, and also mimic a biological form occurring in nature. The pavilion is primarily composed of a reciprocal frame inspired by the structural principles of the Eurasian blackcap bird-nest.

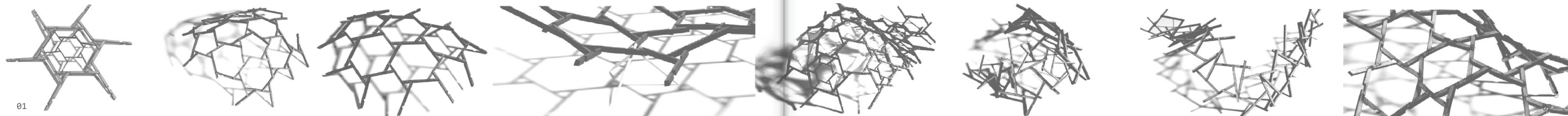


# THE RECIPROCAL STRUCTURE



The project was divided into two stages. Stage 1 (group work) involved site analysis, and preliminary research on biomorphic structures; gathering information to define relevant parameters in the project. We studied existing parametric structures inspired by nature, yet stable enough to serve as a shelter and support basic human needs. Here, I gathered informations and defined grasshopper algorithms used in developing the primary form.

The Reciprocal Structure was initially inspired by the blackcap and its nest. Each member of the structure is supported by another, hence creating a vector active form. The project was laso inspired by the works of Buckminster Fuller; encompassing tensegrity and geodesic domes. By translating definitions stated by Mr. Fuller to grasshopper algorithms, I was able to define a system for reciprocal domes. I also explored the Evolute Tools (software), which provides prefabrication data for each structural member, useful for CNC cutting and boring of unique members. Finally, I studied the Kreed Pavilion to gain detailed understanding of the structure, joints and composition.



# THE SITE.



Outdoor Sitting spaces. Mostly in use.



A different way to relax. A different place to go.



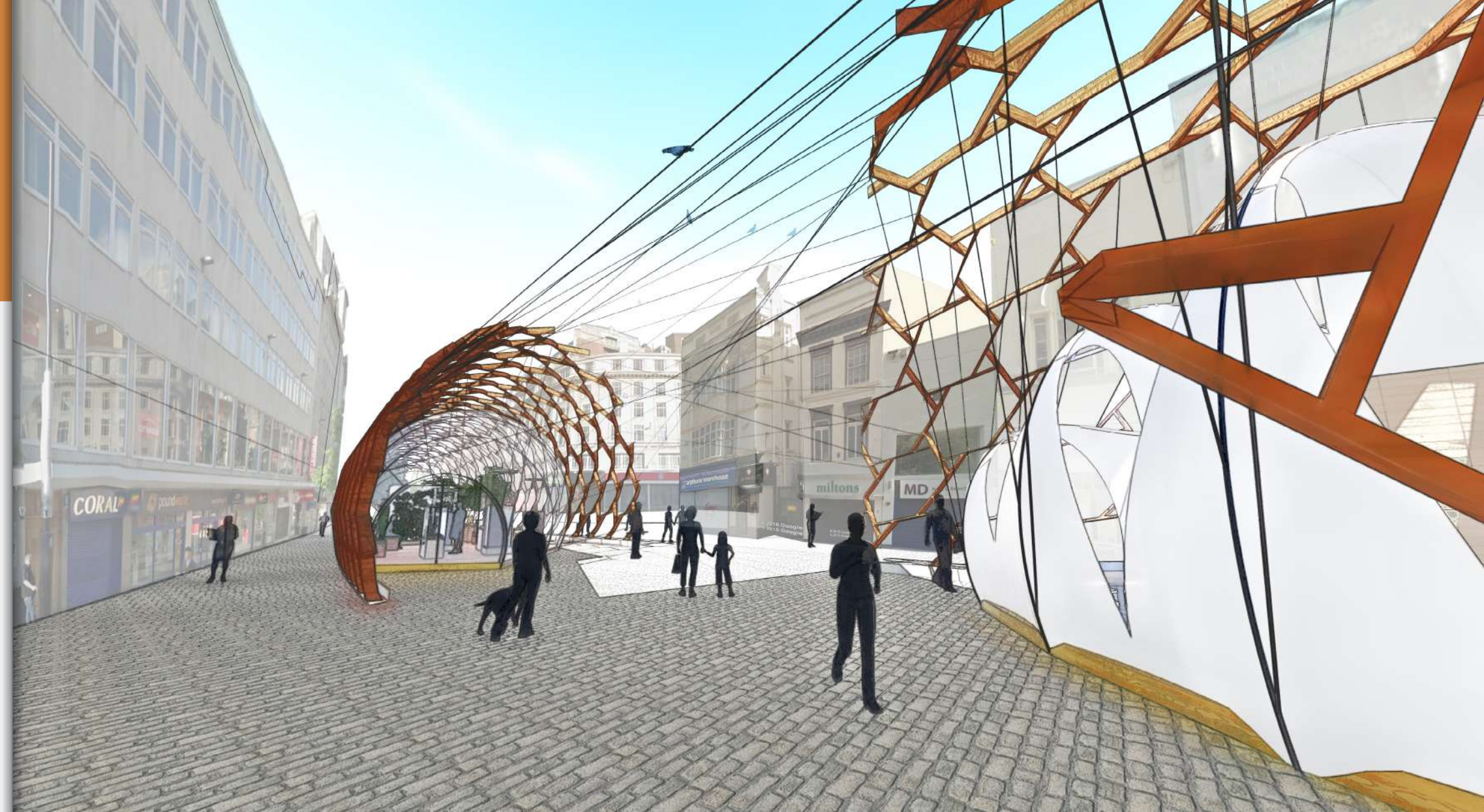
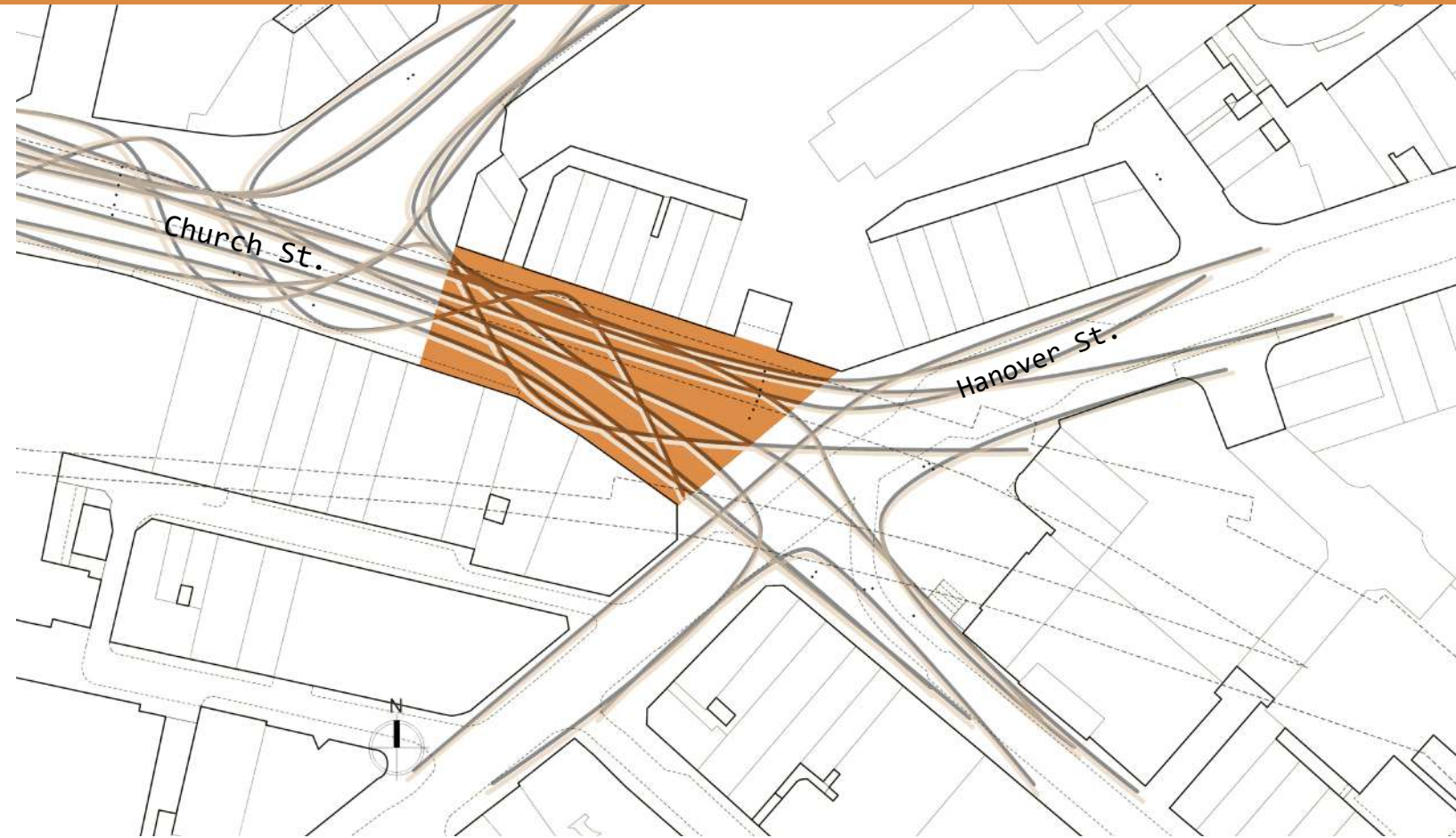
Shops adjacent to the site.



The Pedestrian Valley.



Trees promoting serenity in busy space.

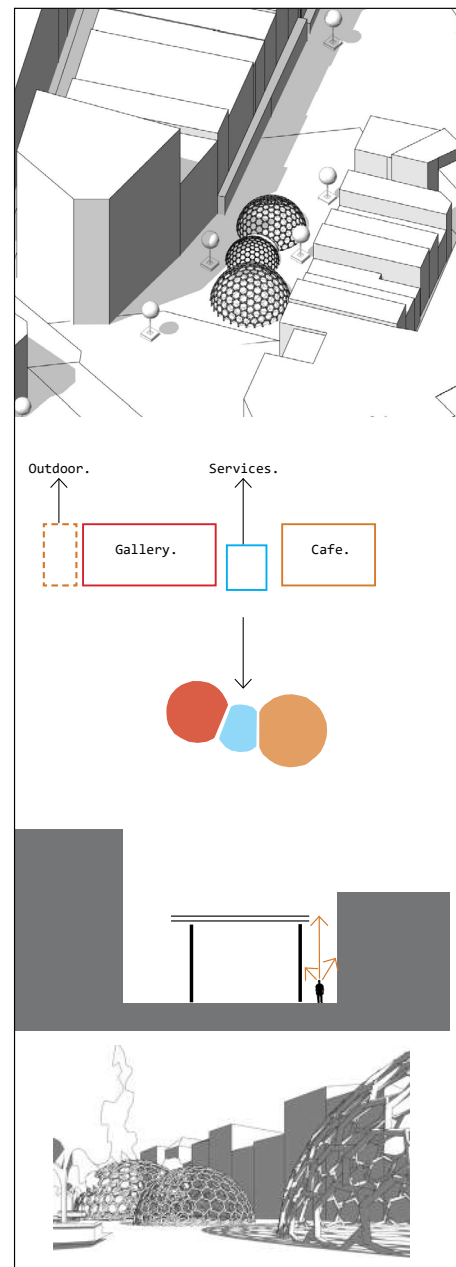


The site is about the junction of Church & Hanover Street; an area that tends to mark an entrance into Liverpool One. The site is predominantly defined by pedestrian activity. As well as creating a display gallery, the constant flow of people through in daytime tends to pose the most prominent design issue as the pavilion should not obstruct the existing path. The site is surrounded by shops and banks, as such; an increased level of consideration was put into identifying boundaries, offsets, as well as transparency.

Liverpool suffers from high levels of rainfall and uncomfortable weather conditions thereby restricting outdoor activities, therefore the resulting shelter would employ passive heating to provide favorable conditions for dwelling. This area of the city is consumed by commercial activity lacks of biodiversity and scarce vegetation cover. The few trees present have a significant impact in the atmospheric perception of the space.

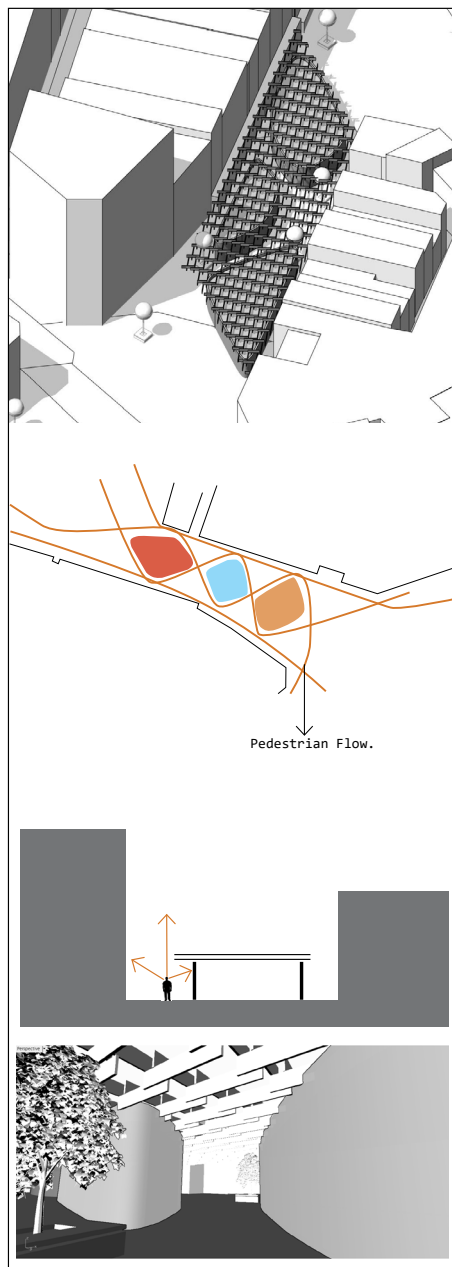


# MASSING PROCESS.



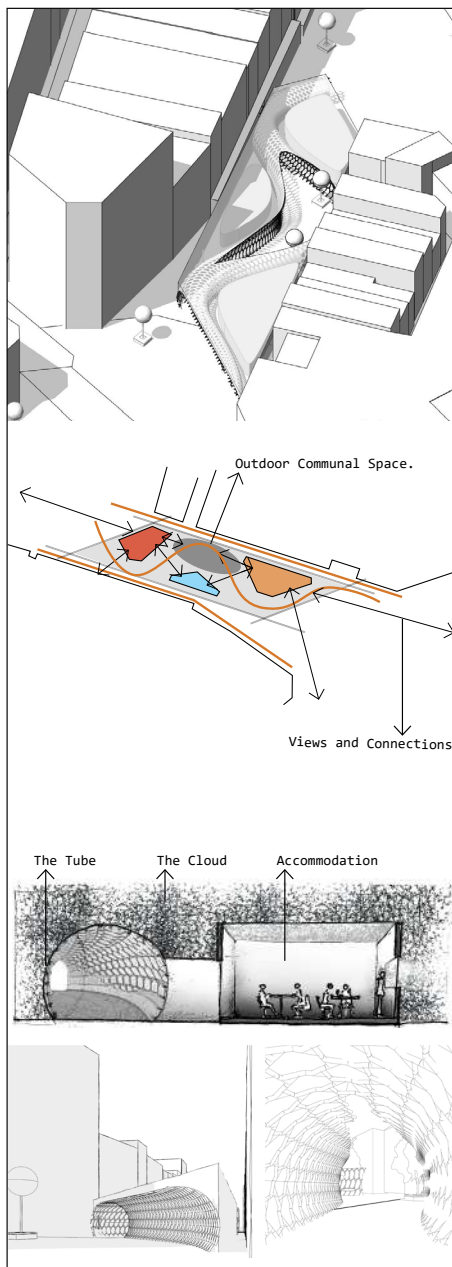
01

Geodesic Domes (Modular Members).



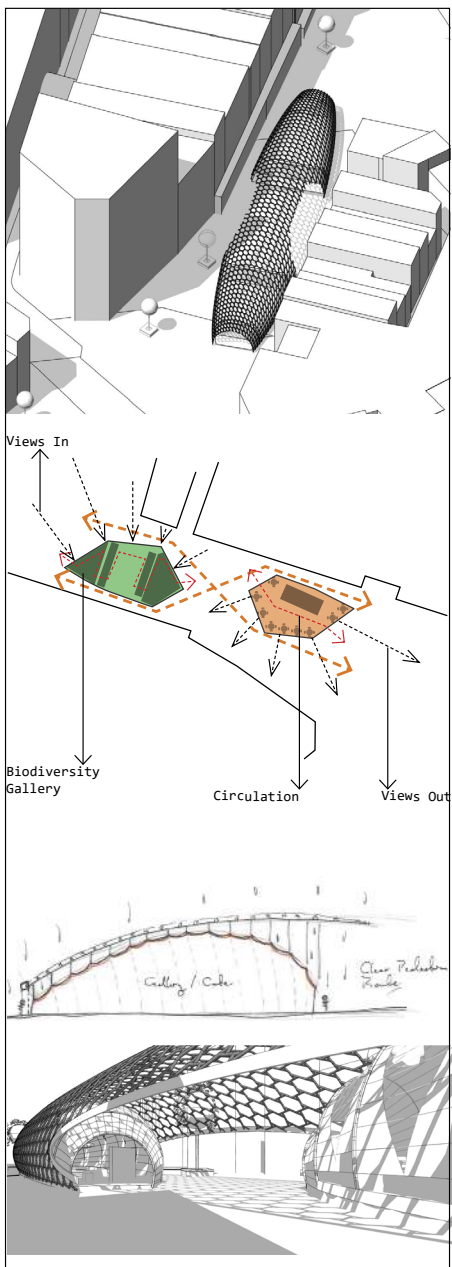
02

Site Response Strategy.



03

The Birds Nest and Transparency.  
Inspired by Arne Quinze & The Lead Pencil Studio.



04

Ellipsoidal Frame + Tensile Membrane.

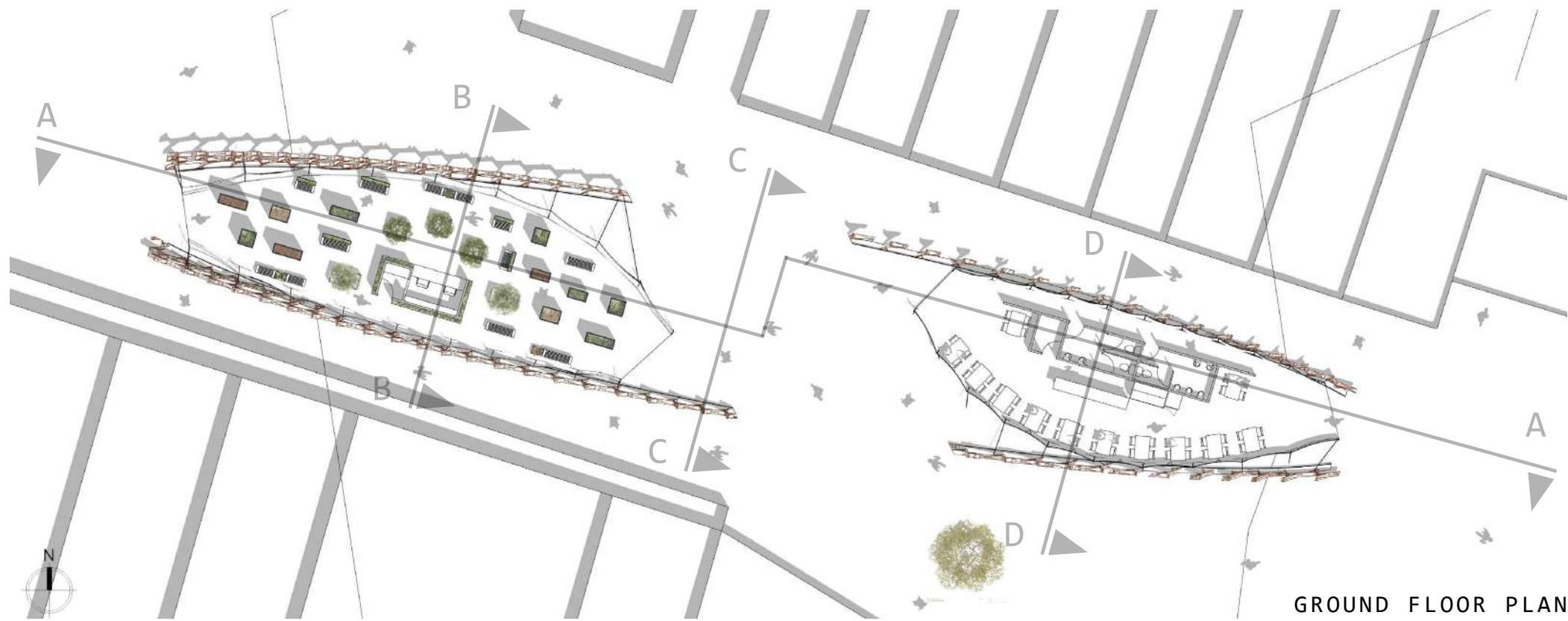


I have identified the site as a pedestrian passage, as such, a high structure in this space would be seem intimidating; perceived as an obstruction. The program was further simplified into two spaces. A cafe to serve the public; directed towards Hanover street and the Lyceum Building; getting the best views in lower density, and a gallery for biodiversity, directed towards the city centre which provides potential visitors. The final massing concept was realized by identifying the pros and cons of the previous concepts and eliminating the flaws with new design ideas. The resulting design involves the manipulation of PVC membrane with the steel cable supports to form an enclosure, hence producing a very harmonic structure as it is fairly ellipsoidal. Here I have simplified the program into two main spaces hoisted by the reciprocal timber frame.

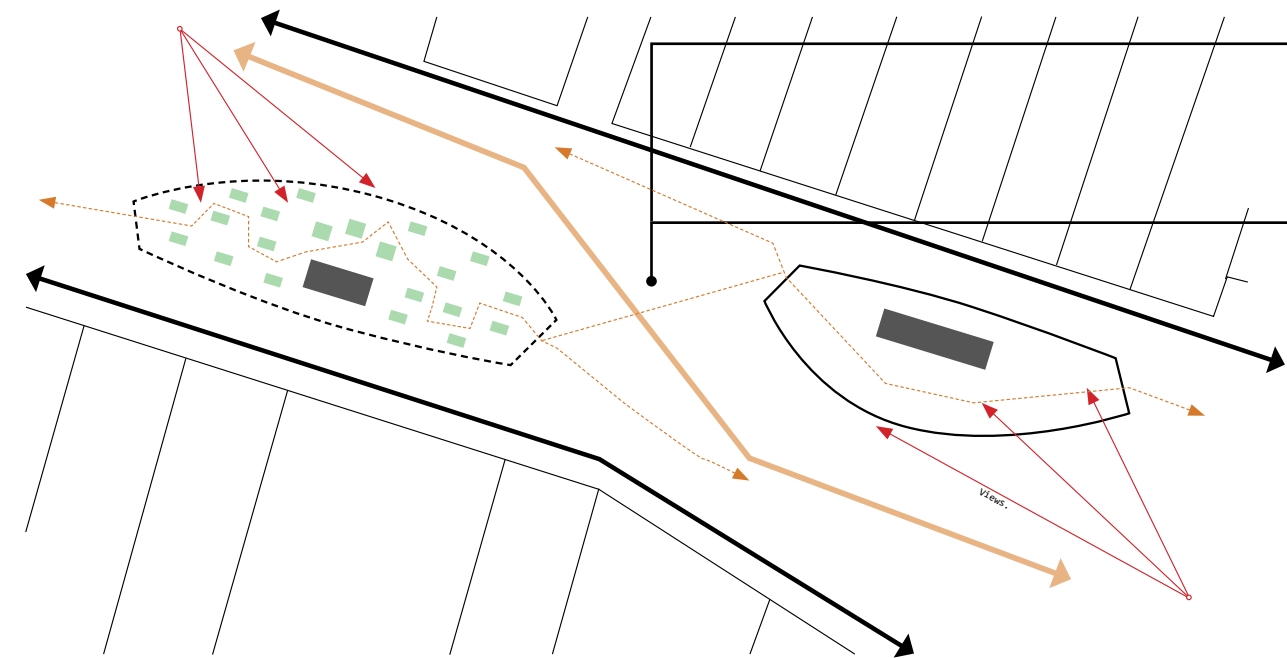
## FEATURES

- Unified Structure.
- Open Circulation.
- Design Flexibility
- The Structure can be dismantled and assembled easily.
- Controlled variation in modules.
- Although site specific, the design will function in a different location.
- Material properties of the primary structure(wood) are expressed.
- Existing Site Function is Retained.





GROUND FLOOR PLAN

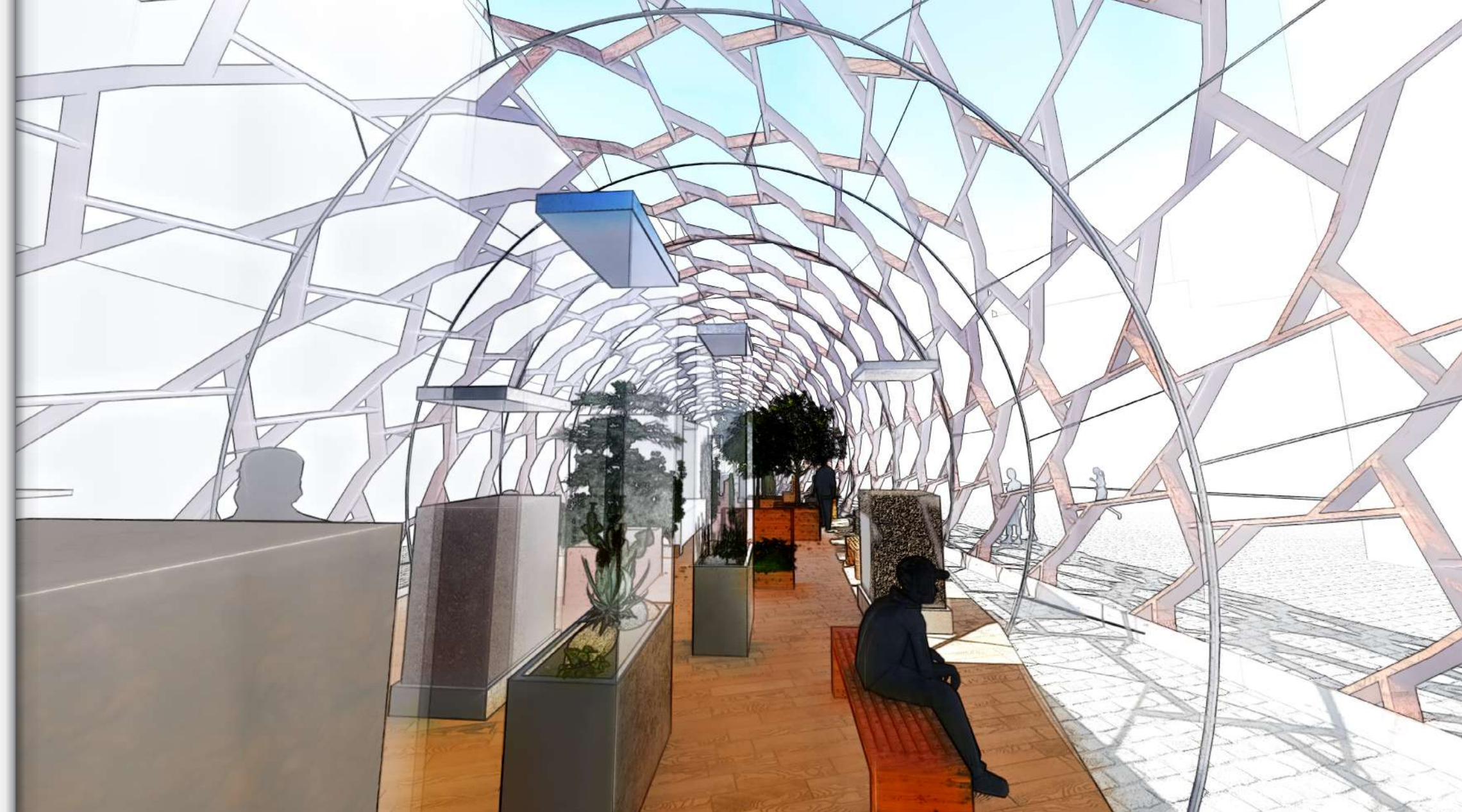


The broken reciprocal structure is reconnected by steel wire cables; giving the impression of an attraction field between the two forms.

This pre-existing route is now seen as a passage within the building.

Division in structure referencing pedestrian path. The pavilion integrates with the site and existing circulation in its typology, circulation and transparency.

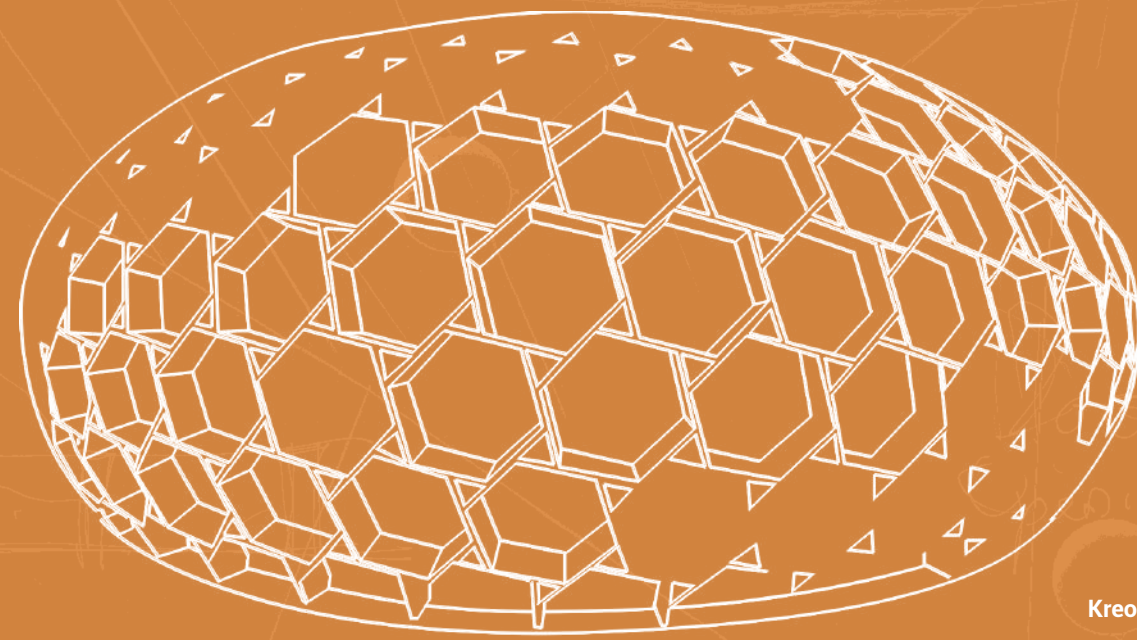
PARTI DIAGRAM



**Cities & Biodiversity** - Cities pose a treat to the environment because of their resource use, they occupy the best lands, lands with water, fertile soil, etc. The presence of cities so far has only had a negative impact on the ecosystem and biodiversity. The urban population is divorced from nature, therefore, one would have to visit special places (nature reserves to connect with nature). Here I proposed a biodiversity gallery, the idea is to introduce nature into the city as a form of art, thereby creating awareness to the public on the ecosystem, the possibilities and advantages of man reconnecting with the rest of nature. Thereby pro-actively promoting and encouraging biodiversity. The following are a few organisms/elements which can be found in Liverpool and can reside on site; 1. Trees/Shrubs. 2. Non-vertebrates. 3. Birds. 4. Green/Living Walls.



THE PAVILION.



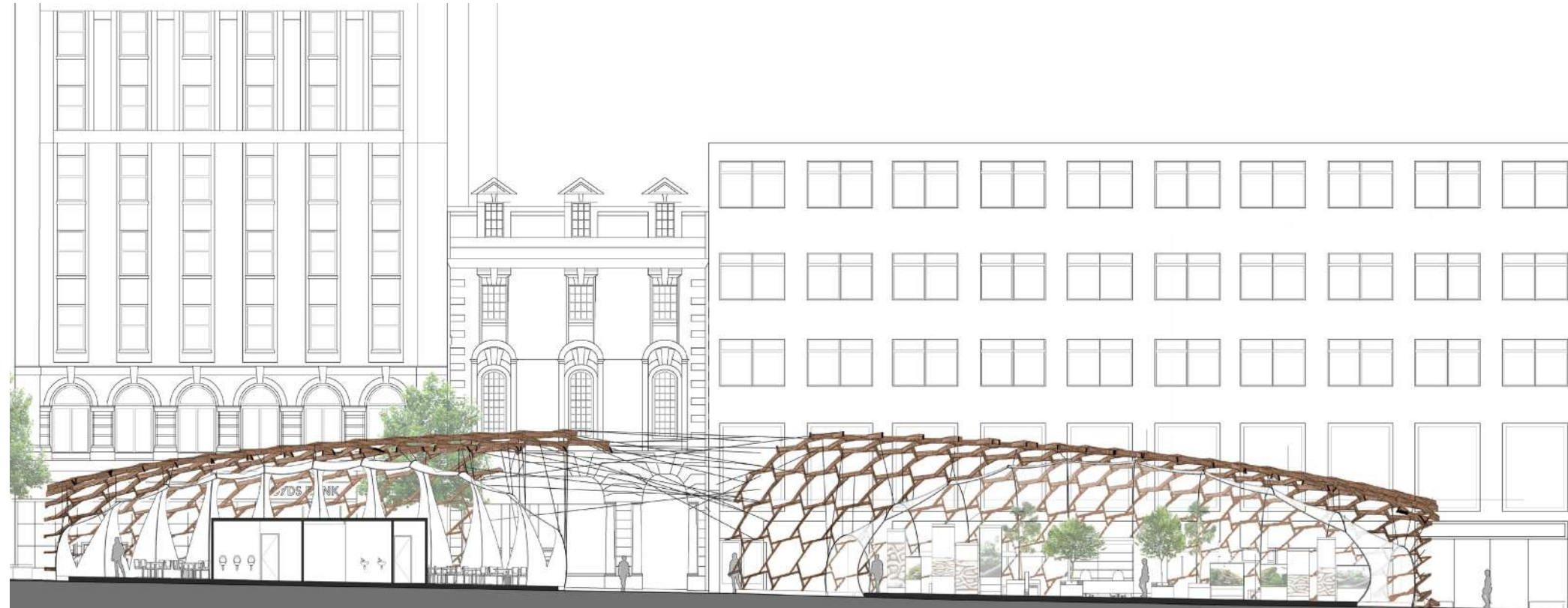
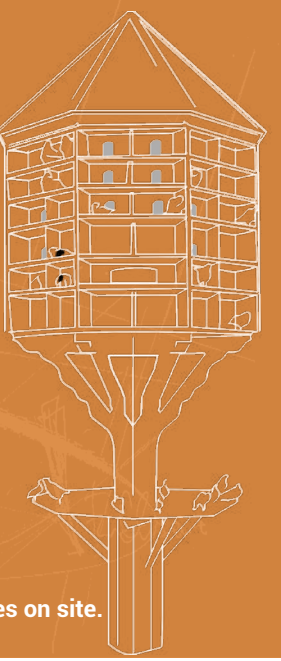
Kreod Pavilion.



Humanity & Biodiversity.



Pigeons - Common vertebrates on site.



SECTION A-A.

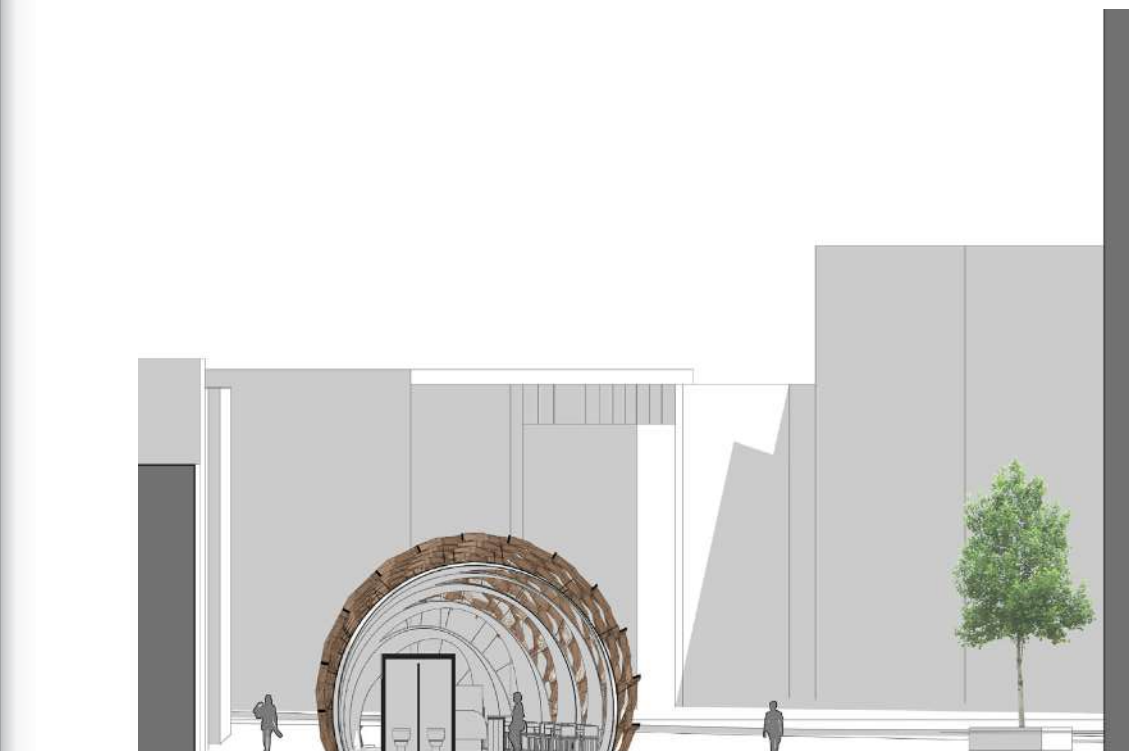
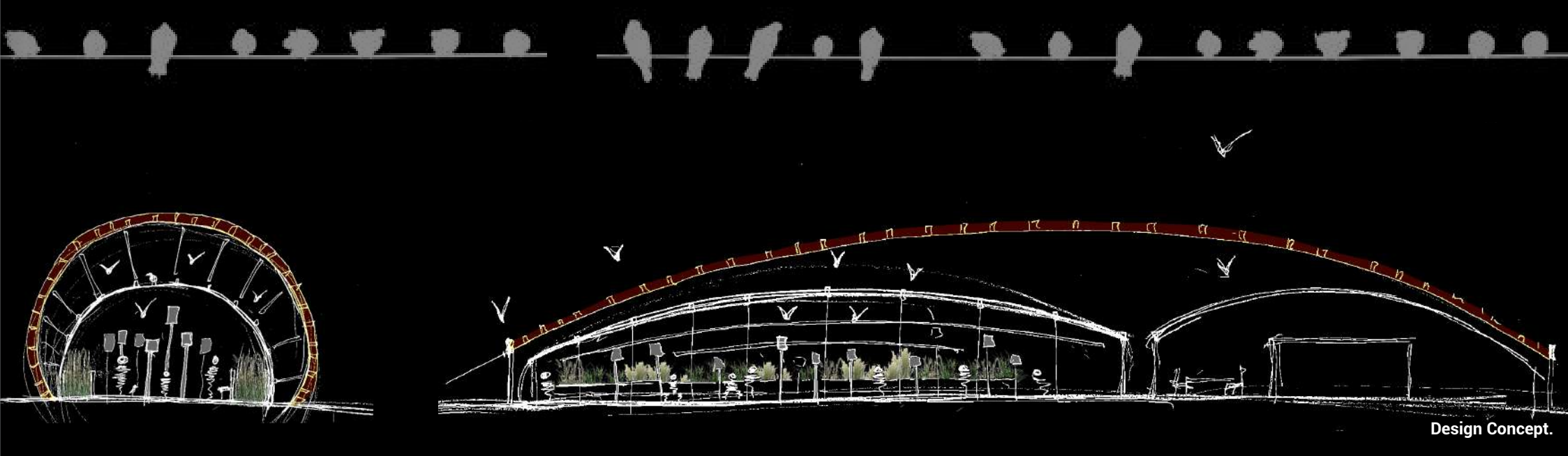


SECTION B-B.

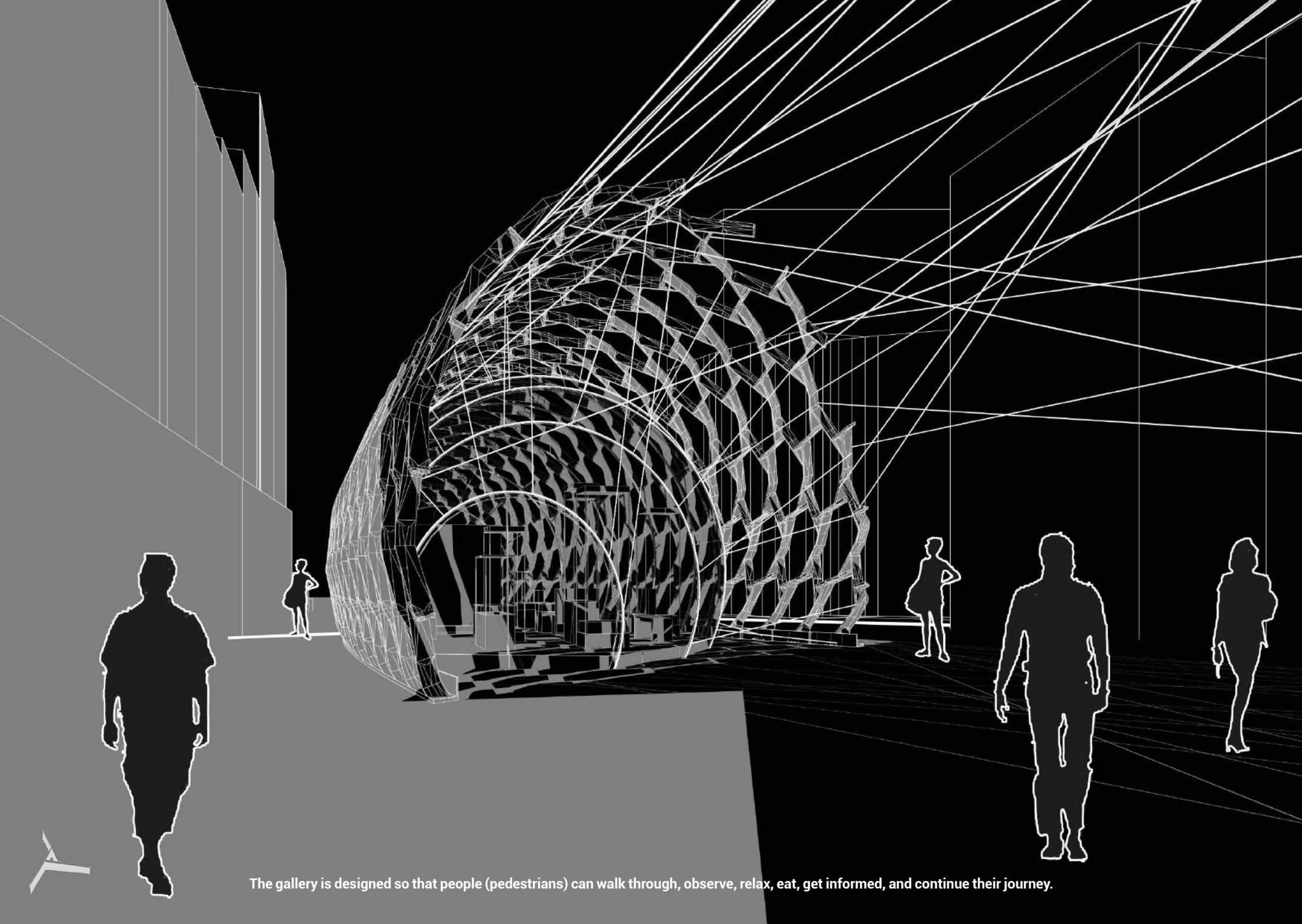


SECTION C-C.

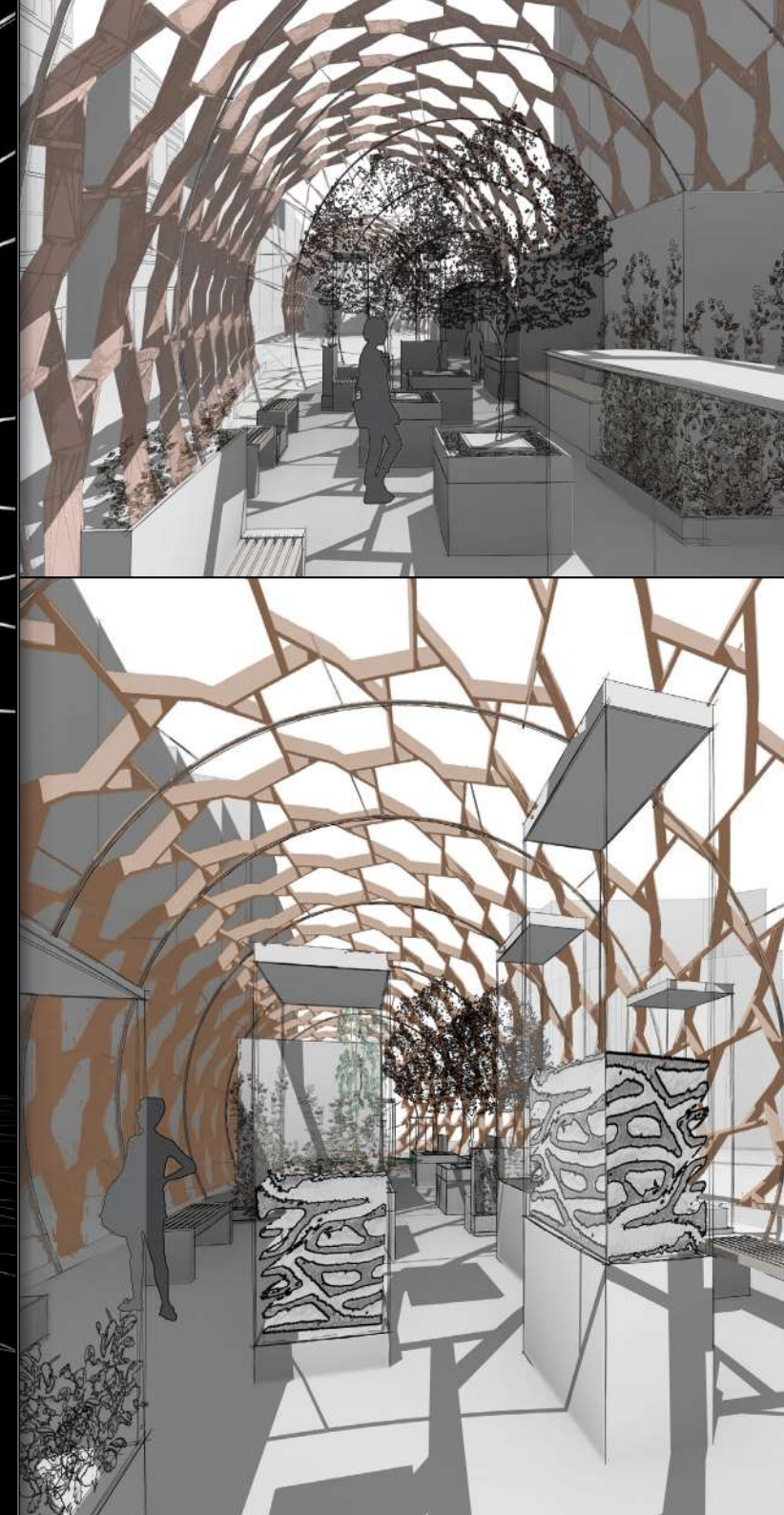
THE PAVILION.



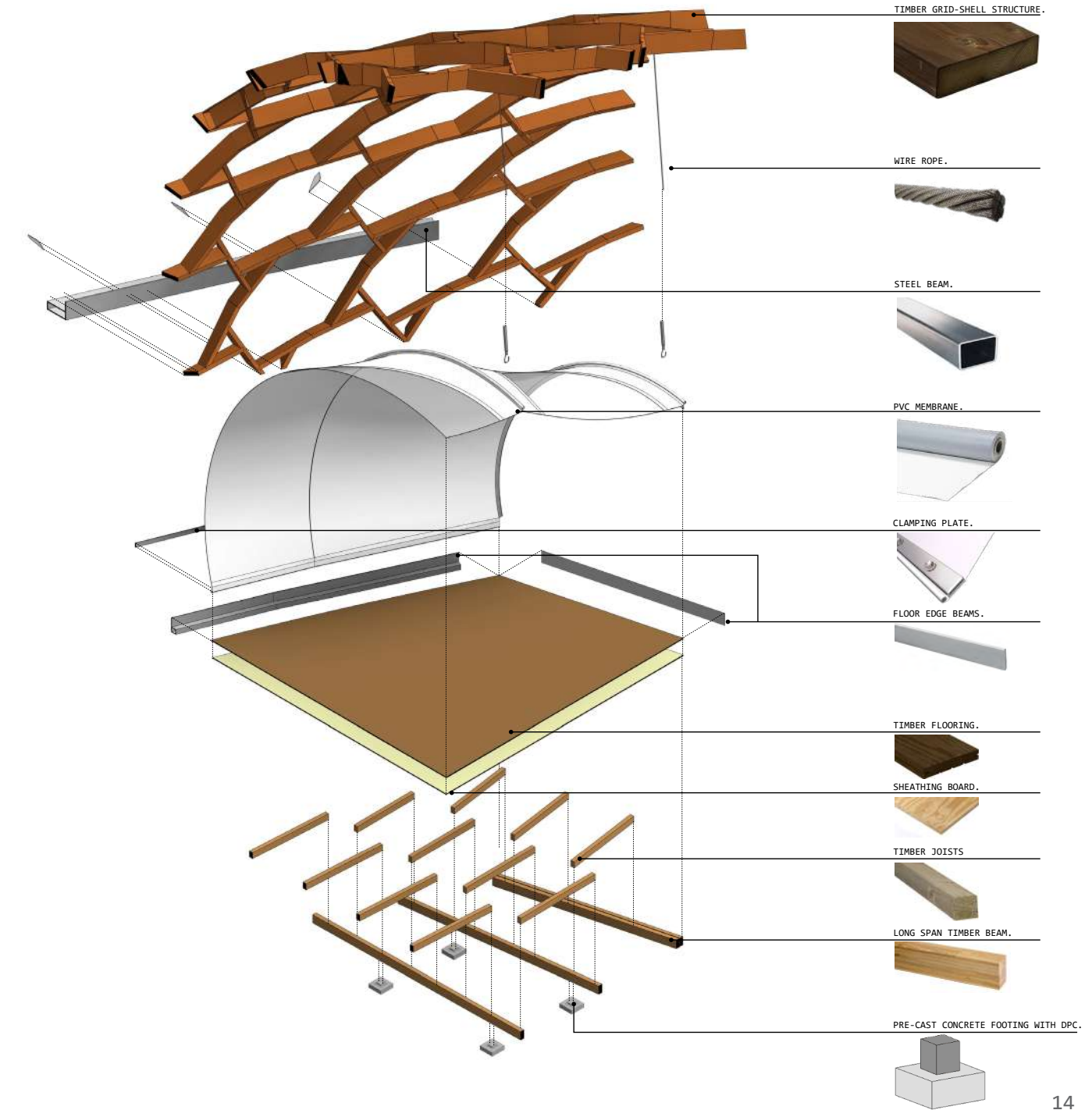




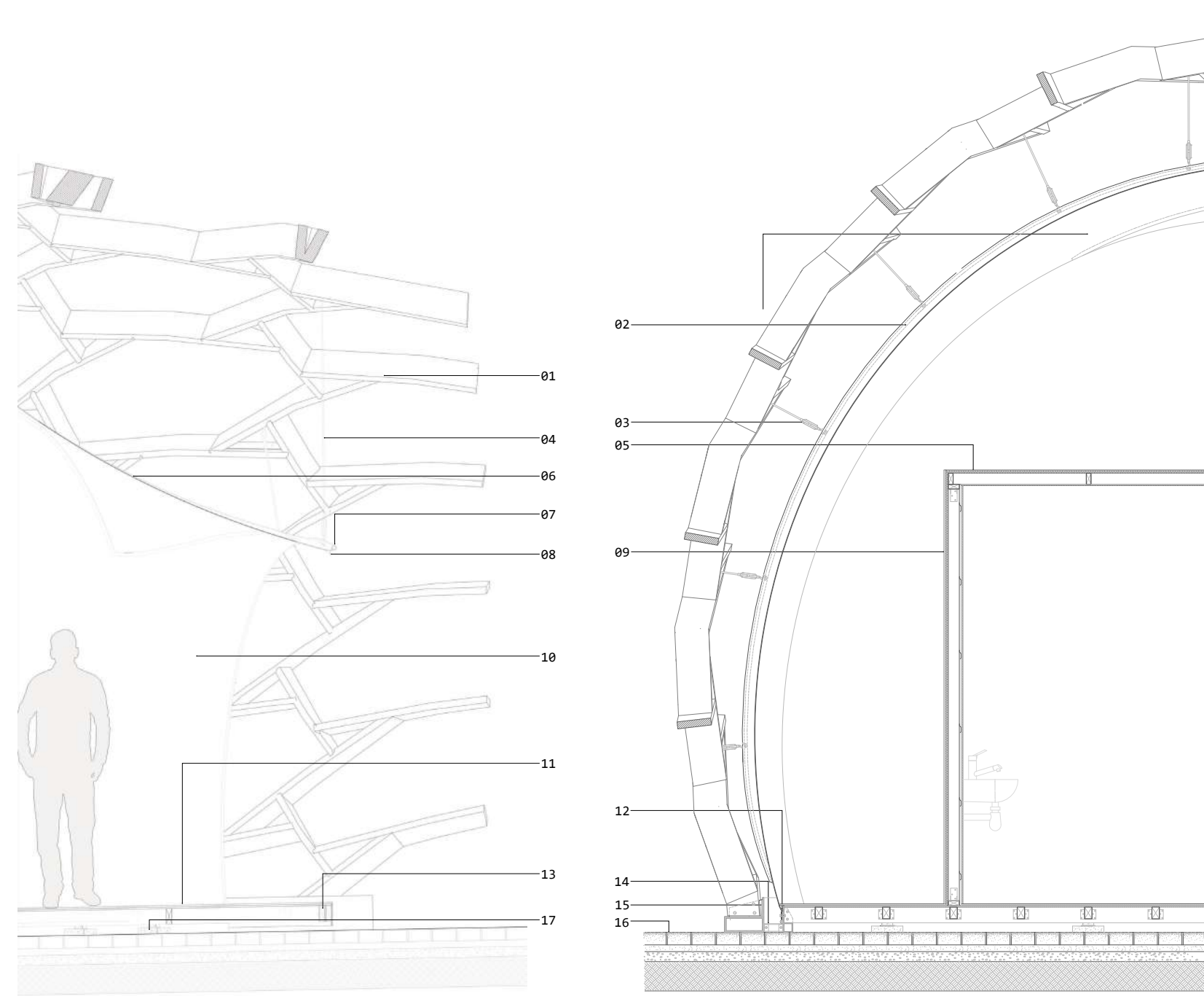
The gallery is designed so that people (pedestrians) can walk through, observe, relax, eat, get informed, and continue their journey.



**DETAIL .**  
Exploded Axonometric



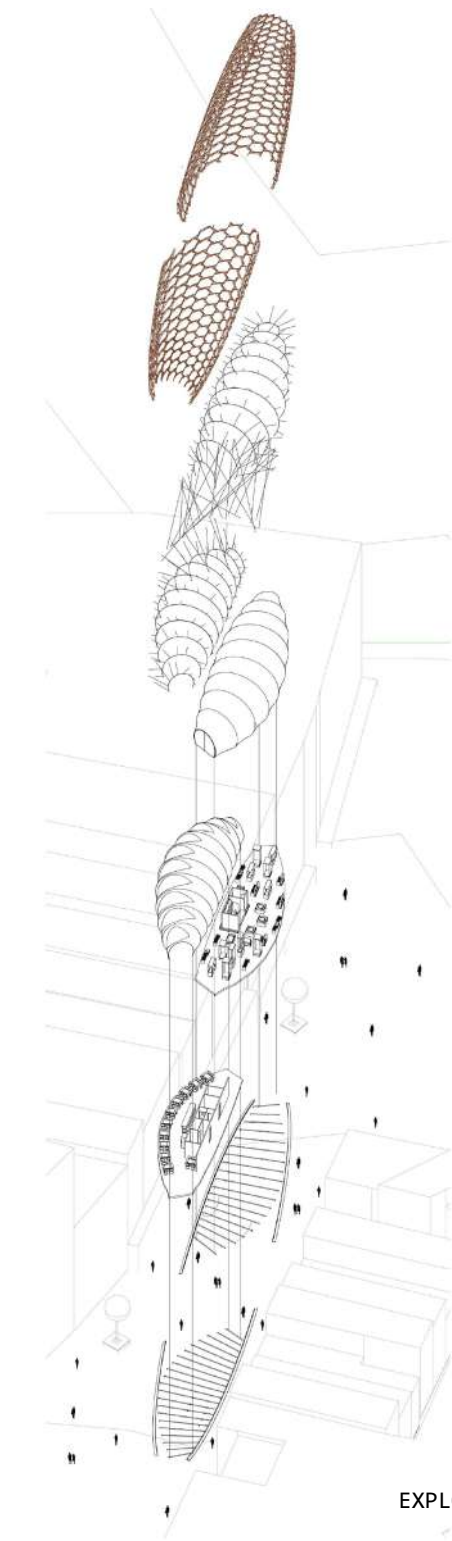
**DETAIL.**  
2D CAD Section.



DETAIL 01

DETAIL 02

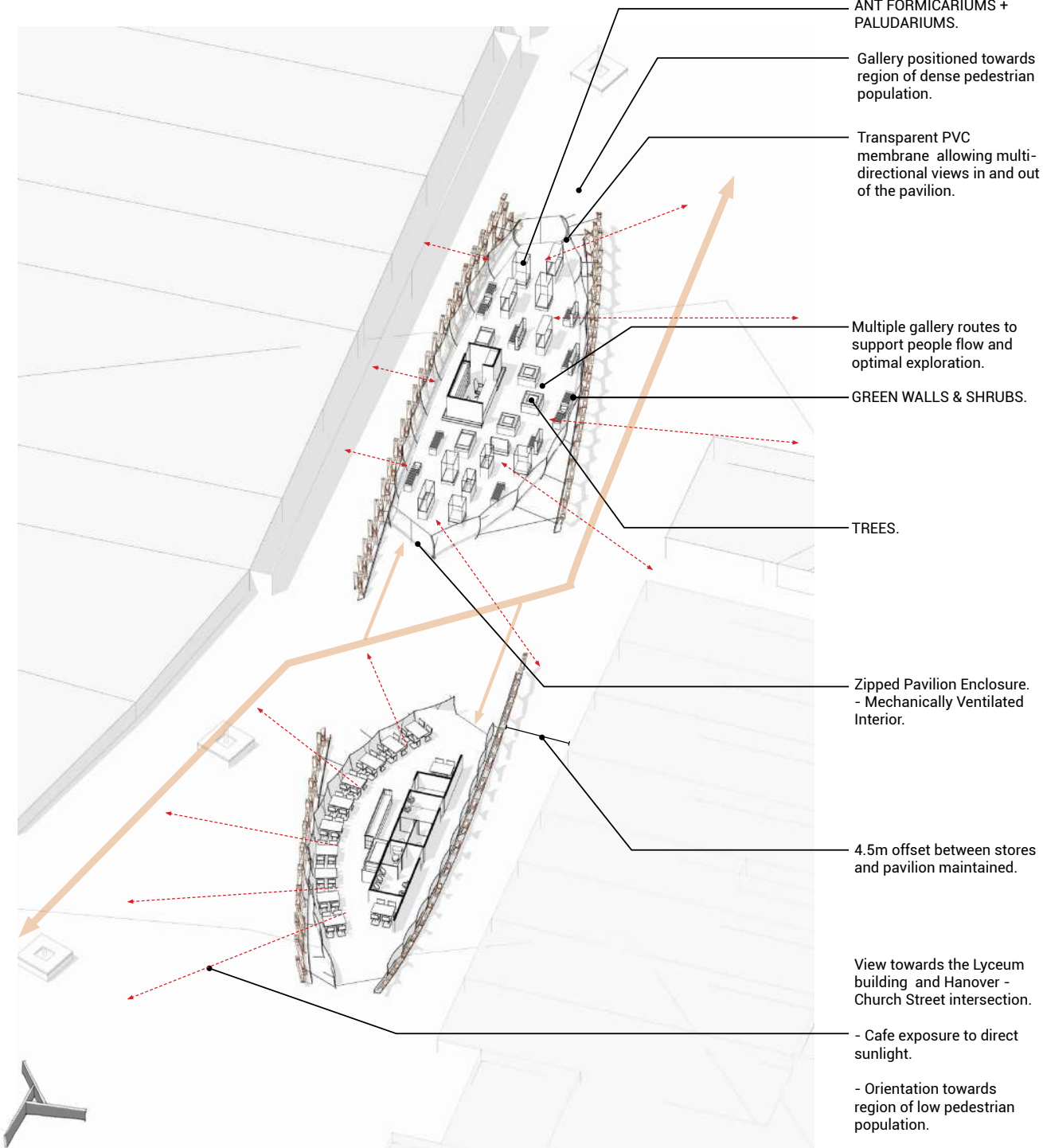
1. Reciprocal Grid Shell Structure.
2. Weld Seam Joint.
3. Turn-buckle.
4. Steel Wire Cable
5. 10mm Plywood Finish.  
15mm Acoustic Insulation.  
10mm Plywood Sheathing Board.  
75mm Timber Frame Structure.  
10mm Plaster Board.
6. Transparent PVC Membrane.
7. Keder Cord in Knurled Weld Seam Hole.
8. Zip Attached to Fabric to Close Structure.
9. 12mm Timber Wall Finish.  
15mm Acoustic Insulation  
10mm Plywood Sheathing Board.  
70mm Wide Stud Wall Construction  
Resilient Bars (Impact Sound Insulation).  
10mm Plaster Board.
10. PVC Membrane.
11. 12mm Timber Flooring.  
10mm Plywood Sheathing Board.  
100mm Deep Timber Floor Structure.
12. Fixed Edge Membrane Joint (Clamping Rail on Keder Pipe).
13. Bolted Steel to Timber Connection (Edge Beam).
14. T-section Steel Beam for Bracing.
15. Unconventional Welded Steel Section.
16. Existing Pavement.
17. Pre-cast Foundation Pad coated with DPC.



EXPLODED AXONOMETRIC

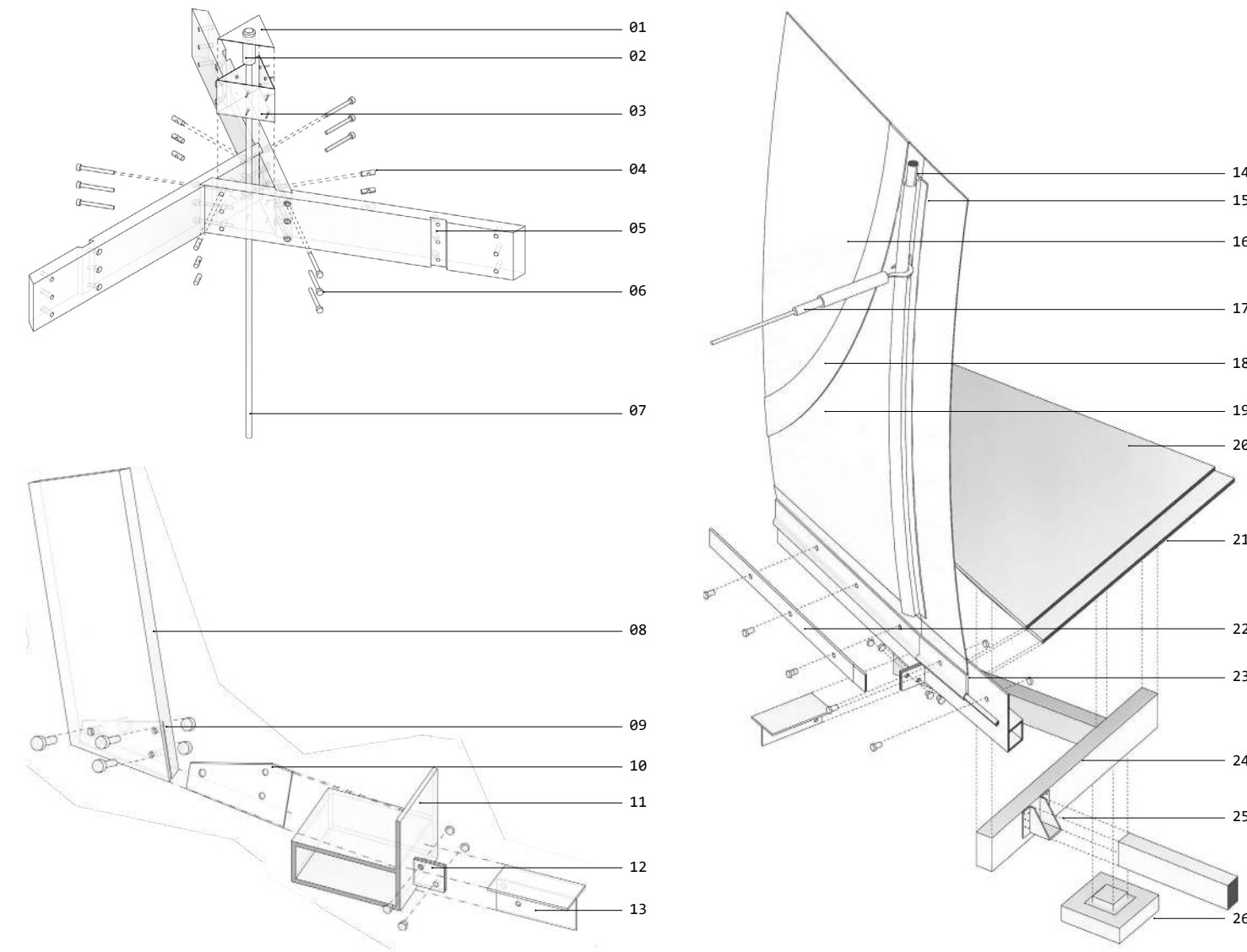
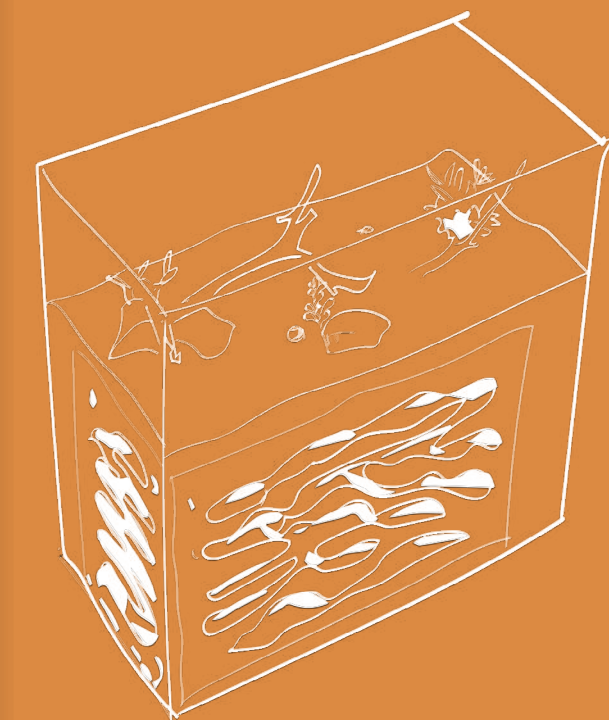


# FUNCTION.

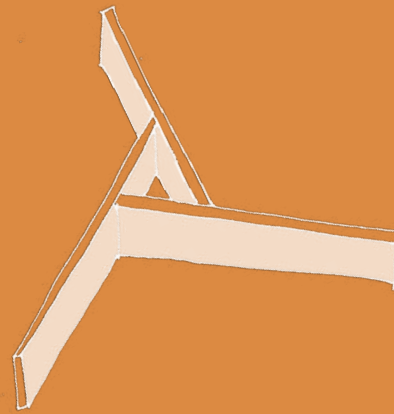


The resulting gallery houses several formicariums, paludariums and terrariums alongside a variety of plants; educating the public on the importance of biodiversity and presenting it as a form of art. The transparent PVC skin of the gallery also enhances the green house effect. As well as aiding the green house effect, trees absorb CO<sub>2</sub>, releasing oxygen back into the air. They also absorb pollutant gases and filter air particles by trapping them on leaves. In addition they also evoke the sense of tranquility in the space. The green house effect alongside mechanical humidifiers, maintain a temperate micro-climate in the gallery. Hence providing an method for passive heating and regulating the internal atmosphere. The gallery is seen as a passage in the city, rather than an entity its own.

The realized construction is one that can be dismantled, assembled and relocated easily. This approach to temporary construction is on that can be replicated on varying forms, yet composed of the same material elements.



- |                        |                                     |   |
|------------------------|-------------------------------------|---|
| 01. Bracket Plate.     | 10. Welded Steel Plate.             | 19. Opaque White PVC Membrane.          |
| 02. Threaded Stud Fit. | 11. Curved Steel Beam.              | 20. Kebony Timber Flooring.             |
| 03. Steel Bracket.     | 12. Steel Plate.                    | 21. Plywood Sheathing Board.            |
| 04. Metal Dowels       | 13. T-section Steel Brace.          | 22. Keder Clamp Rail.                   |
| 05. CNC Cut notch.     | 14. Keder Cord.                     | 23. Folded Membrane with FEP Foil.      |
| 06. Bolts.             | 15. Knurled Weld Seam Hole.         | 24. Floor Grid Structure.               |
| 07. Wire Cable.        | 16. Transparent PVC.                | 25. Metal Joist Hangers.                |
| 08. Kebony Timber.     | 17. Turnbuckle + Threaded Stud Fit. | 26. Pre-cast Pad + Damp Proof Membrane. |
| 09. CNC Cut Slot.      | 18. Welded Seam Joint on PVC.       |   |



THE LIVERPOOL BIENNIAL PAVILION