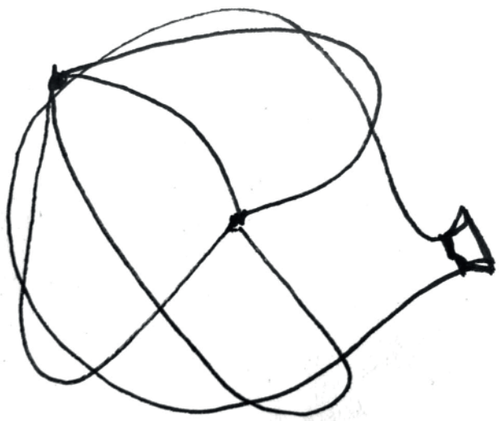
A hostel for wonderers

AN AIR OF FLEXIBILITY

Faruq Agberemi and Catherine van Dorssen

:can inflatable architecture be a facilitator in encouraging interaction between Berlins' wanderers and Berlins' refugees?



IN . FLAT . A . BLE

adj. Designed to be filled with air or gas before use: an inflatable mattress.

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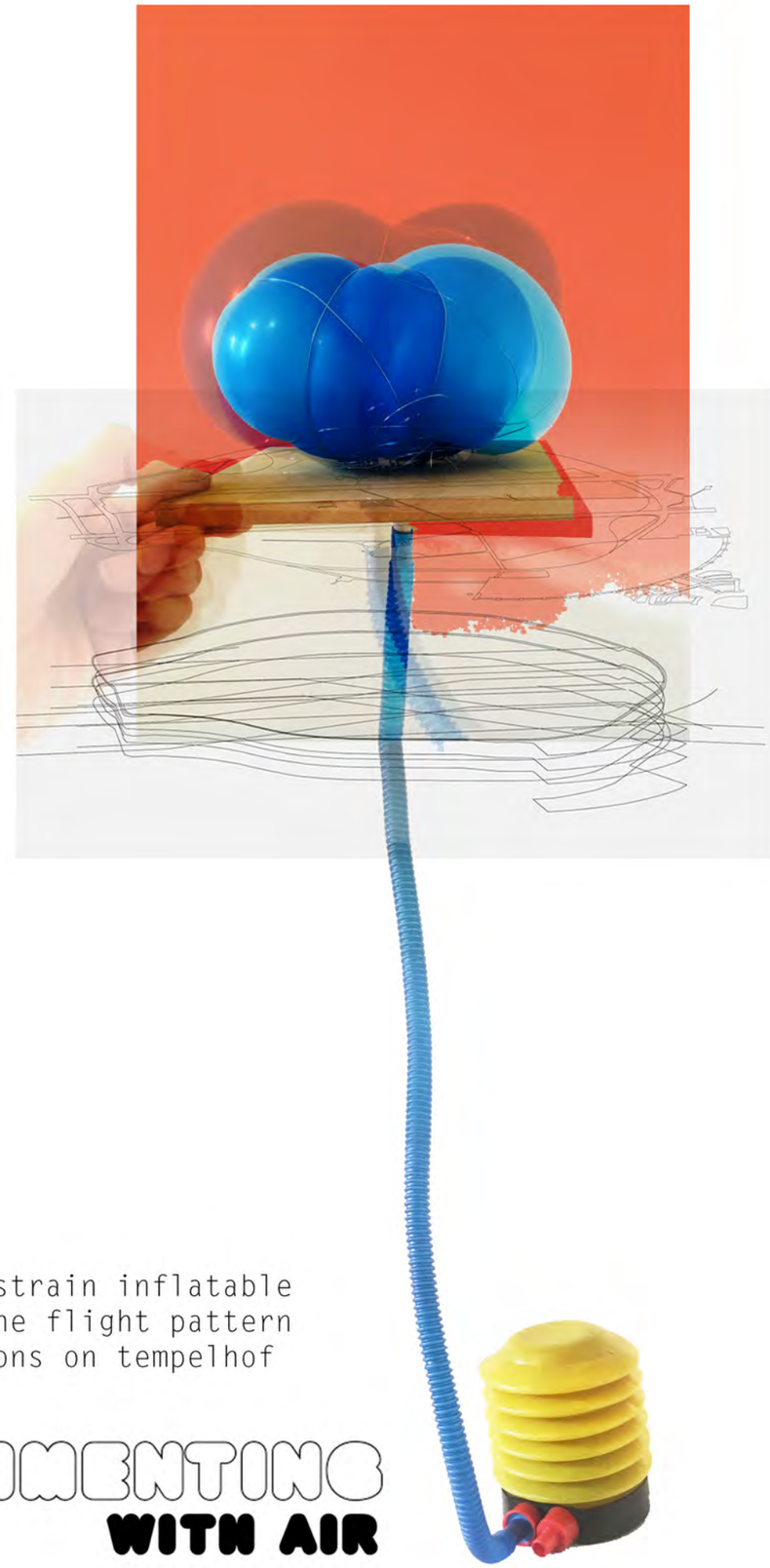
DESIGN ETHOS
The narrative for this project was inspired by our experience on the site, the history of the site, primary users of our proposal; refugees & wanderers and artist study which falls in line with the interdisciplinary approach of the atelier. The vast dissimilarity been inside the building and on the roof inspired us to capture this difference in experience. Artist study on Petillon, Christo and Jean Claude, inspired the idea of creating a soft piece of architecture that juxtaposes the hard structure of the Tempelhof. Their works show how juxtaposing soft material on hard landscapes forces viewers to perceive the landscape or space differently which could be vital to the Temelhof considering its rich history. Research into the history of the site brought us to the Humboldt balloon first voyage and the use of the air field as a stage for flight testing in 1893. This inspired our exploration of flexible inhabitable inflatables. Through experimentation with models, as encouraged by the atelier, we explored three technological approaches; inflatable structural ribs, inflatable skins attached to cross laminated timber structure and kinetic structure inspired by the Hoberman sphere in an attempt to create flexible, temporary dwellings. By designing a masterplan, we were able to propose modular spatial strategies with pneumatic typologies that could be repeated across the site depending on the flux of users.



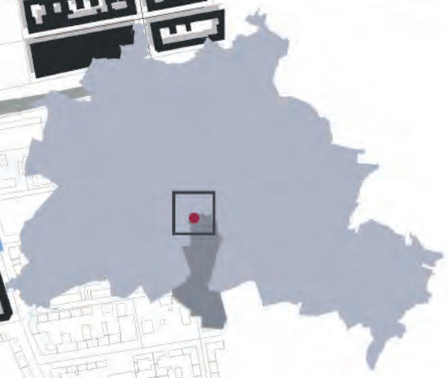
Ties used to restrain inflatable skin reflect the flight pattern of air expeditions on tempelhof field.

EXPERIMENTING WITH AIR

Karl-Marx-Strasse

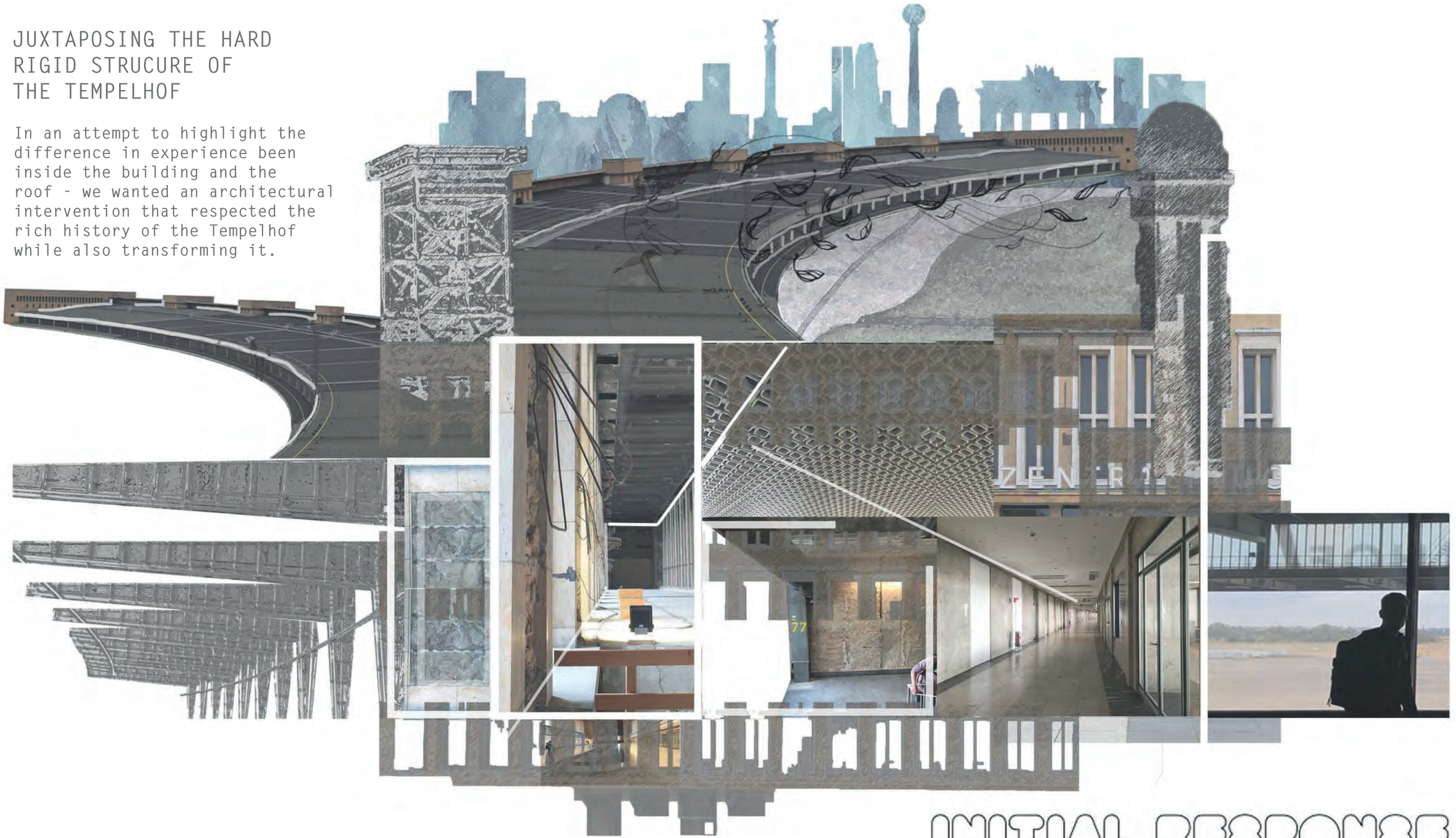
Columbiadamm

Tempelhofer Damm



JUXTAPOSING THE HARD RIGID STRUCURE OF THE TEMPELHOF

In an attempt to highlight the difference in experience been inside the building and the roof - we wanted an architectural intervention that respected the rich history of the Tempelhof while also transforming it.



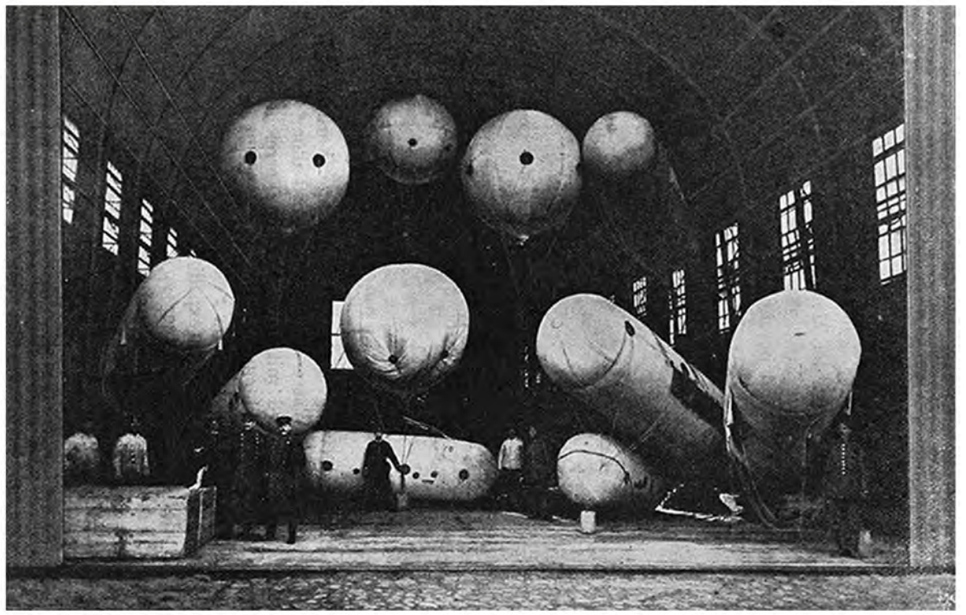
INITIAL RESPONSE TO TEMPELHOF

INHABITABLE INFLATABLE

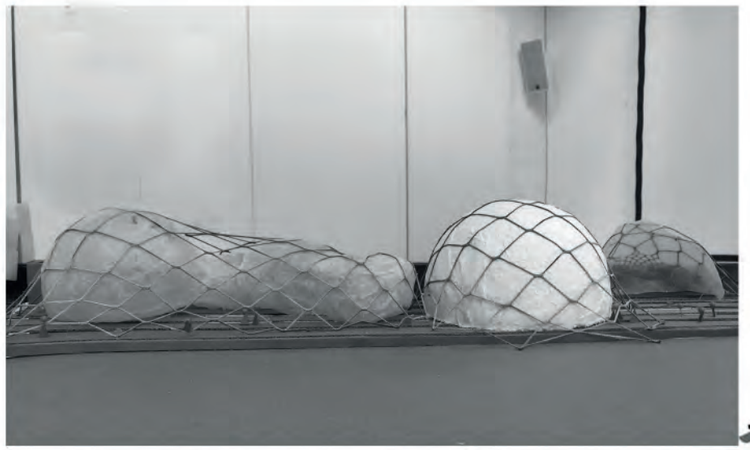
SITE HISTORY

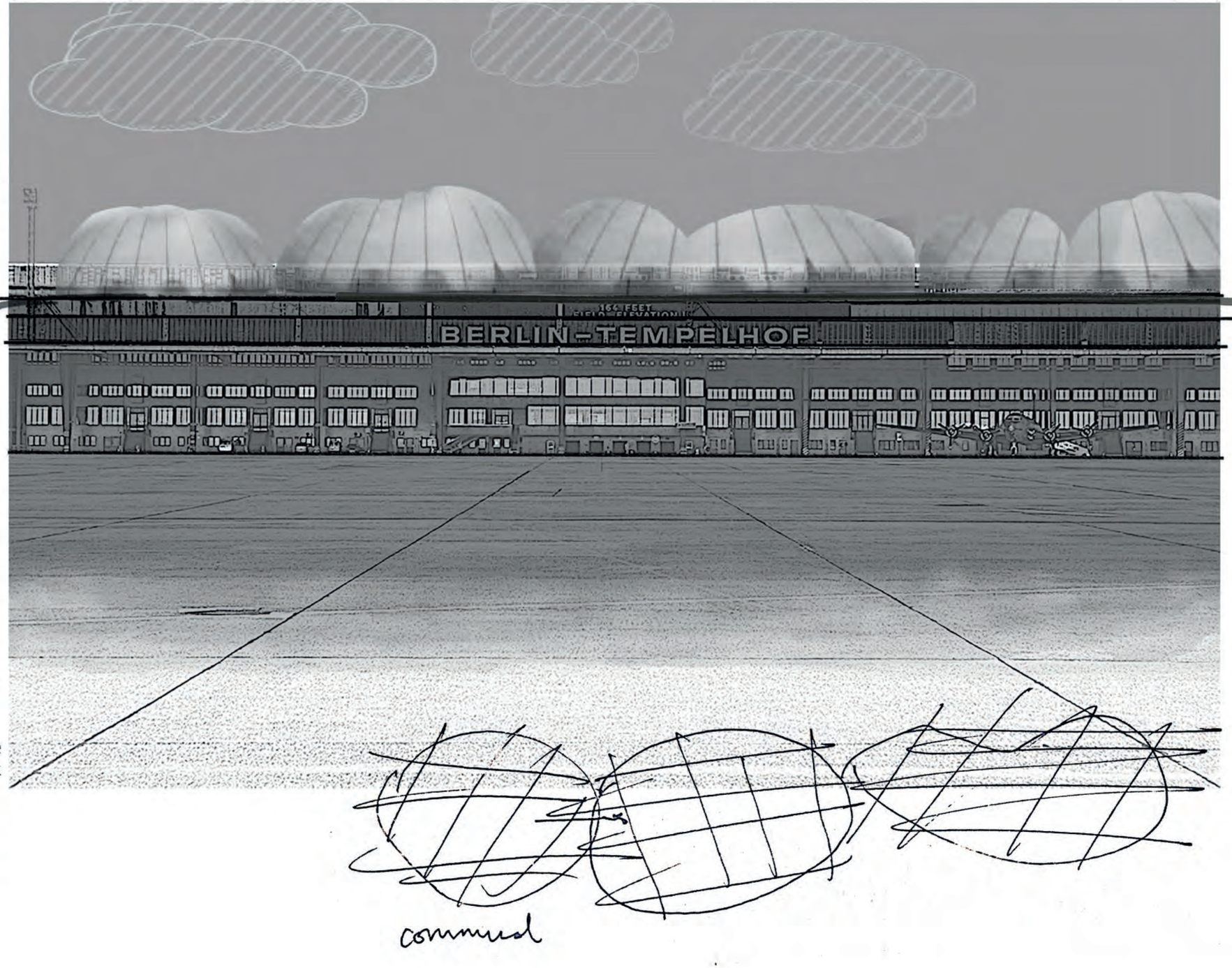
Tempelhof airfield was used to test some of the world's first aircrafts. The Humboldt balloon was launched on its maiden voyage on March 1, 1893 leading to a series of other expeditions. This inspired our exploration of flexible inhabitable inflatables and creating an architectural intervention that is associated with air .

1893, Tempelhof Airfield



1907, Tempelhof





Reflections from Berlin

The strong and historically serious architecture which defines the Tempelhof airport first struck as we stood before this intimidating building. The extensive tarmak and concrete used in the site required a more lightharted addition. Our aim was to create a soft piece of architecture to juxtapose the hard structure of Tempelhof.

a journey of

INFLATABLES

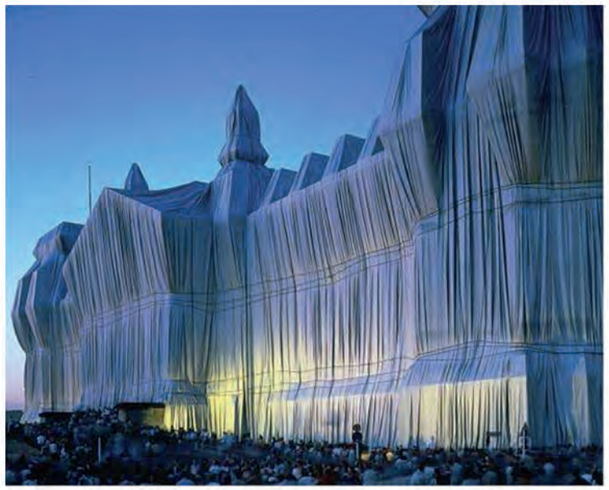
Linking increasing pressures and fluxuations in balloon air with fluxuations of refugees and tourists in Berlin

MATERAIL JUXTAPOSITIONS WITHIN ARTWORK

Juxtaposing soft material on hard landscapes forces viewers to perceive the landscape or space differently which could be vital to the Temelhof considering its rich history.

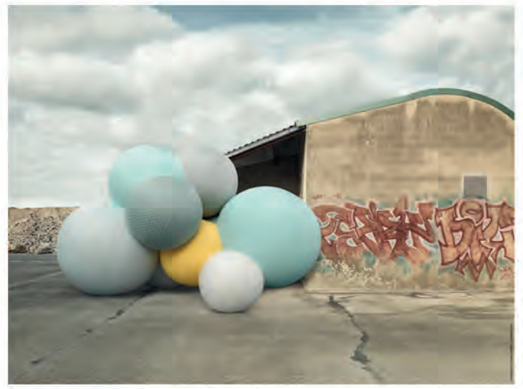
Christo & Jean-Claude

Christo & Jean Claude's art works bring a new bring a new perspective to familiar landscapes, encouraging a refreshed appreciation and allowing viewers to perceive and understand the locations with a new appreciation of their formal, energetic, and volumetric qualities.



Charles Petillon

Petillon used his balloon invasions as metaphors. Their goal is to change the way in which we see the things we live alongside each day without really noticing them. Their fragile and vibrant appearance was achieved with the use of contrasting materials and opacity which is a method that can be applied to our proposal.



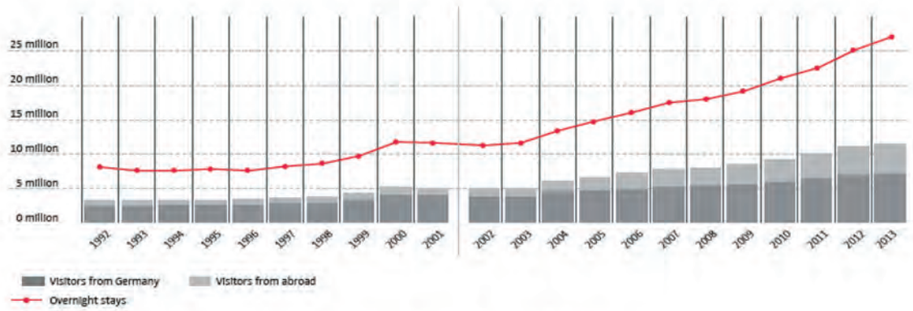
[M I G R A N T]
:
a person who moves from one place to another in order to find work or better living conditions.

[R E F U G E E]
:
A person who has been forced to leave their country in order to escape war, persecution, or natural disaster

[W A N D E R E R]
:
Itinerant people, who wander from place to place with no permanent home

[A S Y L U M S E E K E R]
:
Someone who leaves their own country, often because of political unrest or war, and who travels to another country hoping that the government will protect them and allow them to live there.

Studying fluxuations of the different users of the site. Through defining the terms of persons we were able to understand the needs of the Refugees and Wanderers.

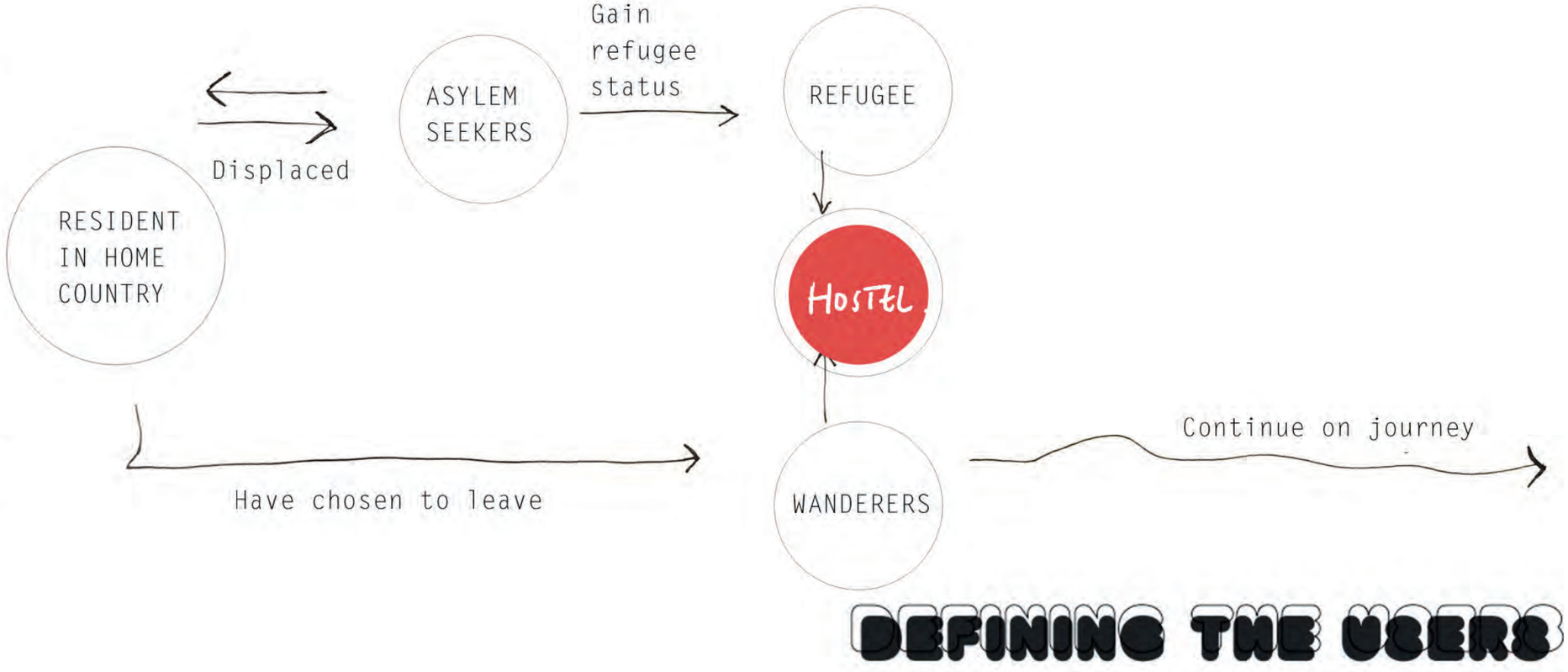


Number of overnight stays and visitors to Berlin from Germany and abroad [1992 - 2013]

source Berin-Brandenburg Statistics Office

Guest to Berlin stay on average 2.4 days*

Total of 31.15 million overnight stays in 2017

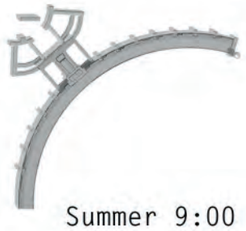


DEFINING THE USERS

SITE SHADING

Winter 13:00

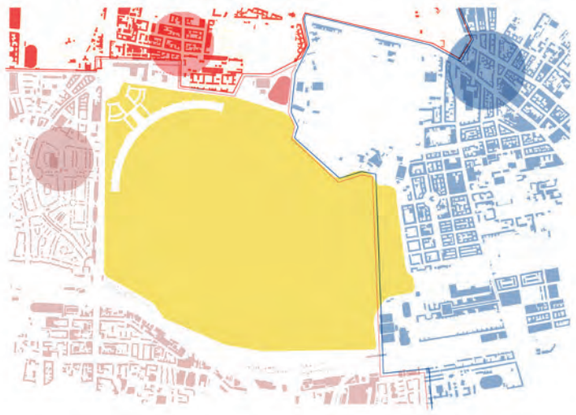
Winter 9:00



Summer 9:00

Summer 13:00

Summer 19:00



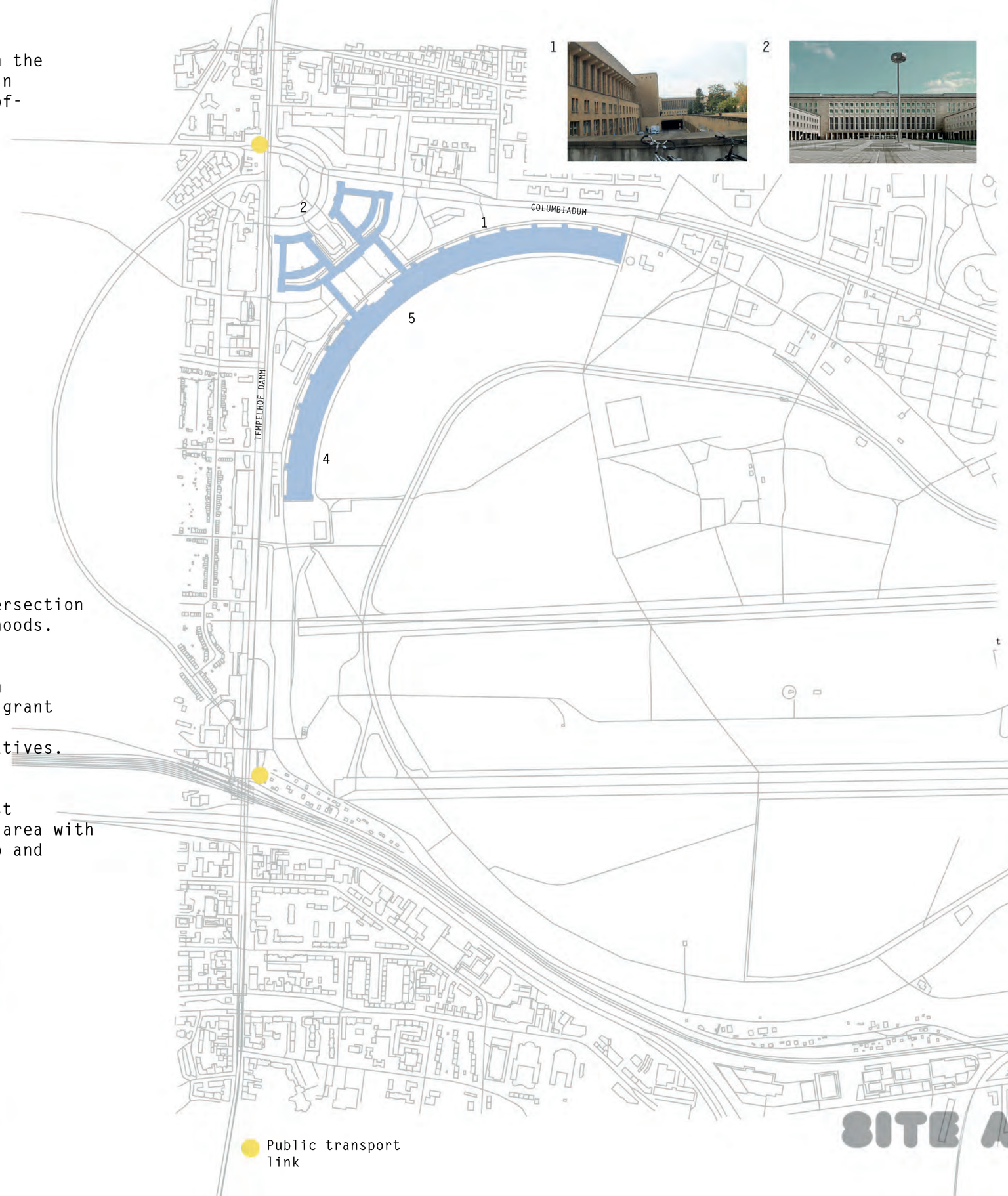
Site is situated in the south-central Berlin borough of Tempelhof-Schöneberg

Roof relies on a cantilever system to accomodate 100,00 people.

It lies at the intersection of three neighbourhoods.

Kreuzberg
youthful population
high number of immigrant families
high number of creatives.

Neukolln is the most ethnically diverse area with Large Turkish, Arab and Kurdish population.



1

2

3

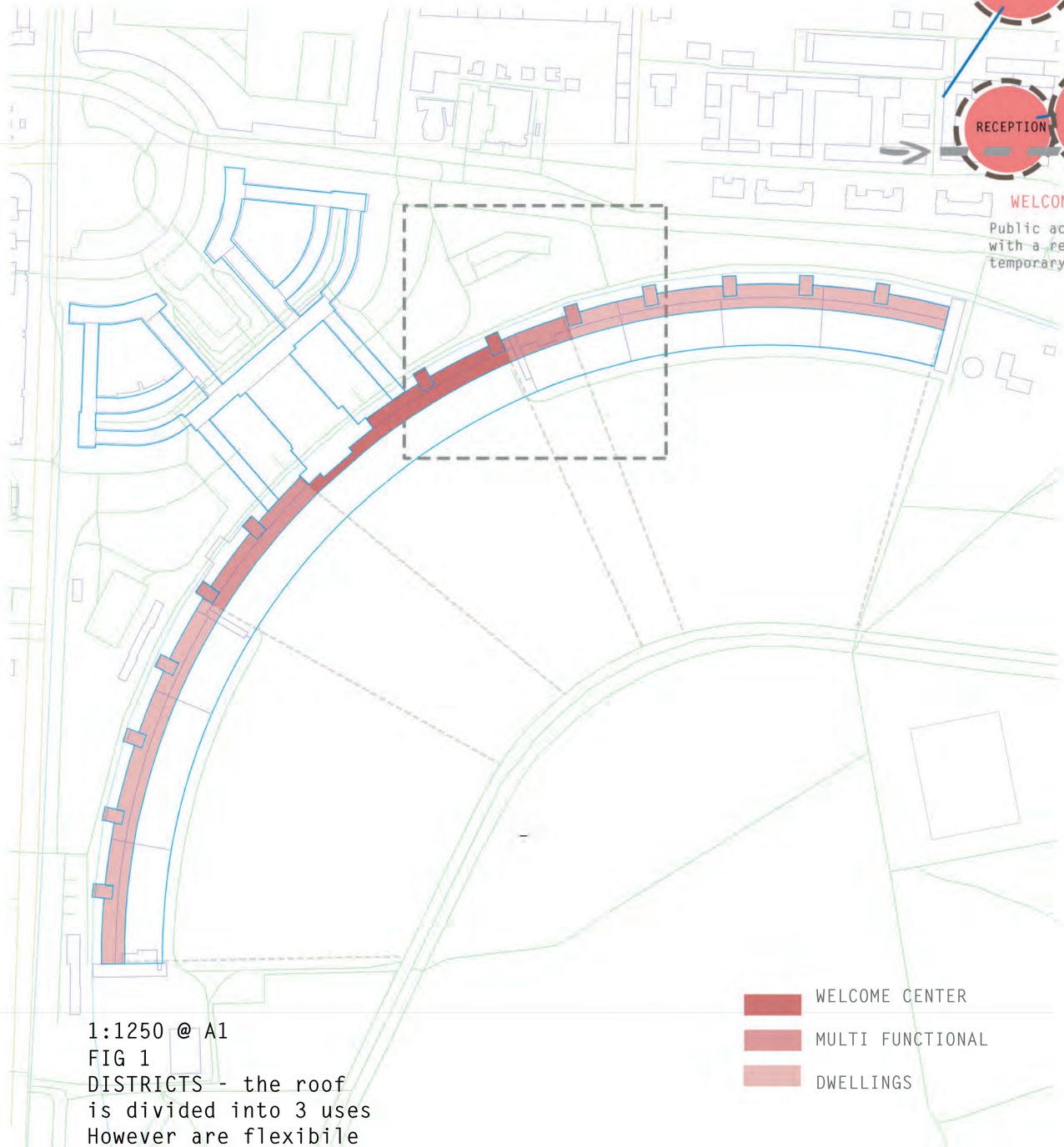

4


5


6


Public transport link

SITE ANALYSIS



1:1250 @ A1
FIG 1
DISTRICTS - the roof is divided into 3 uses However are flexibile and have the potential to change.

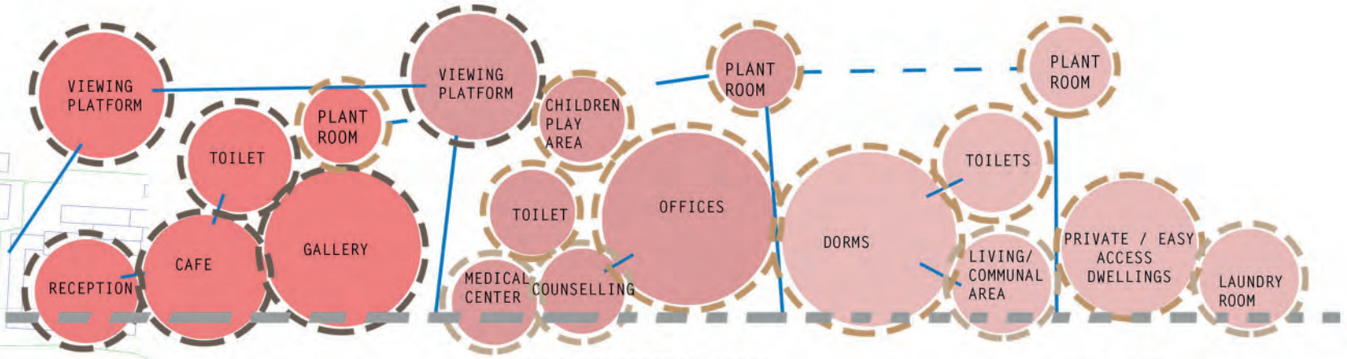


Fig 2

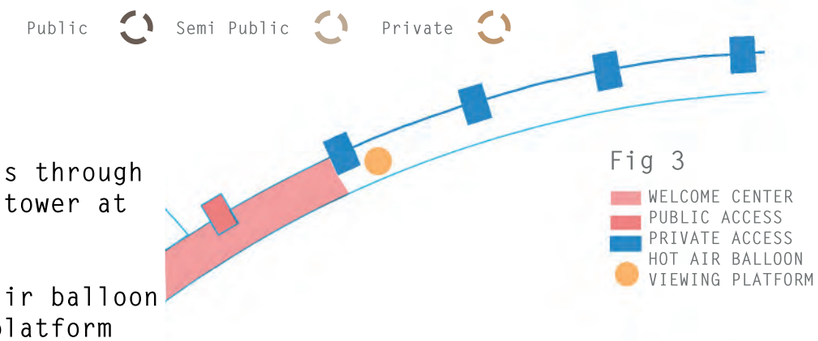


FIG 3
ACCESS - Public access through the public staircase tower at the welcome center.

LANDMARK - A rising air balloon serves as a viewing platform for visiters of Berlin

Fig 3

FIG 4
PATHS - 3m route through site allowing users to engage with views of the airfield.

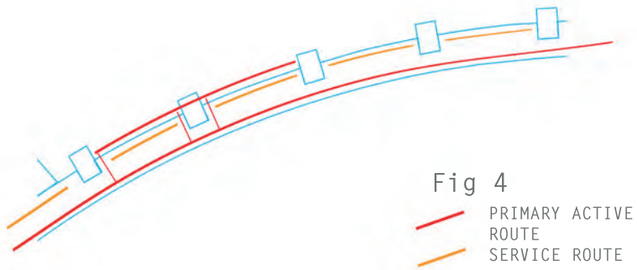


Fig 4

FIG 5
Raised level allows users to walk along a raised platform, covered by an inflatables tube, to reach the top of the towers.

Seating spaces encouraging gathering and interaction will be provided by changing levels on the active route.

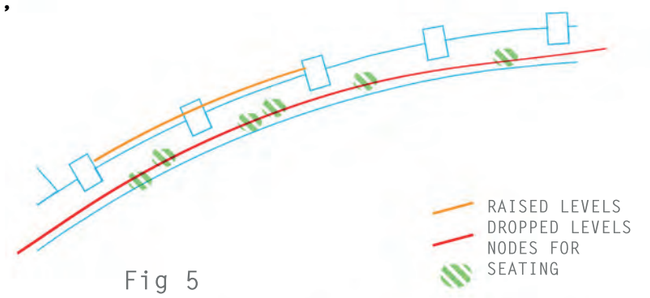
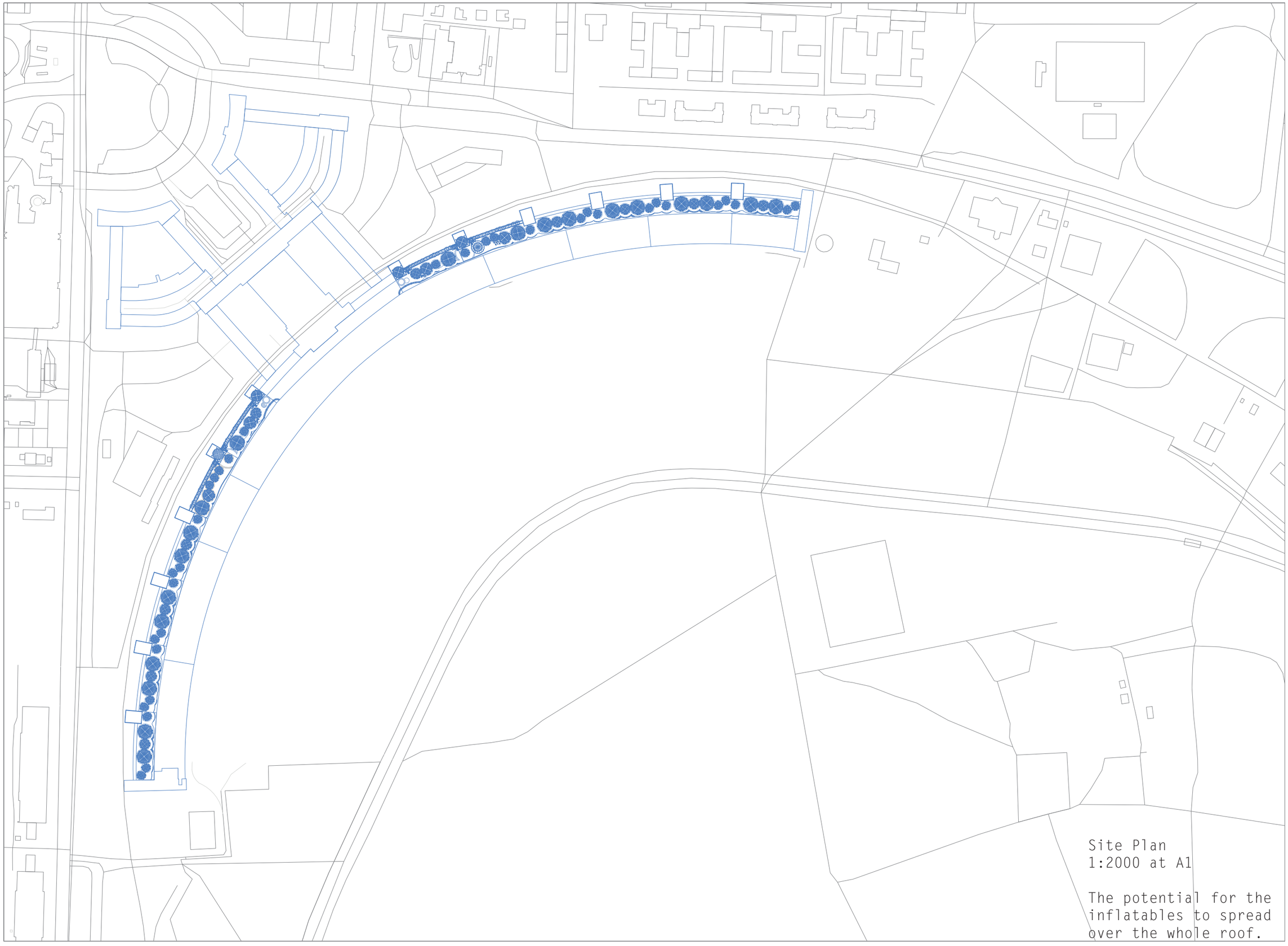


Fig 5

PROGRAMME OF PROJECT

MASTER PLANNING &ZONING
into districts informed by function, public & private spaces needed by users, potential flux in refugee and wanderers. This led to the proposal of three site types; Welcome centre, multi-functional site and dwellings.

- Public
- Semi-public/Communal
- Private



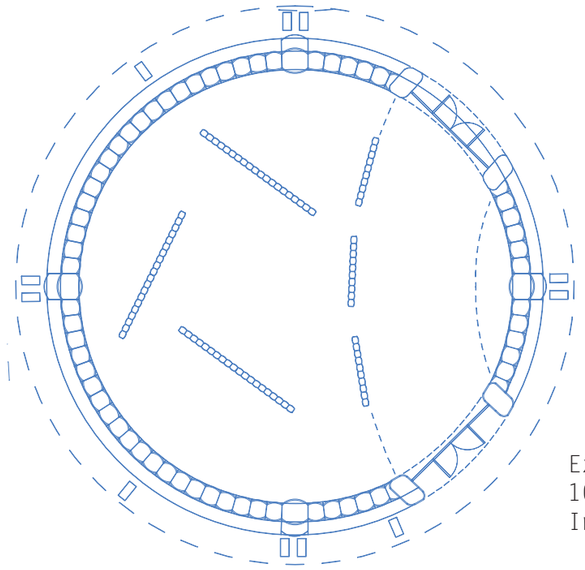
Site Plan
1:2000 at A1

The potential for the inflatables to spread over the whole roof.

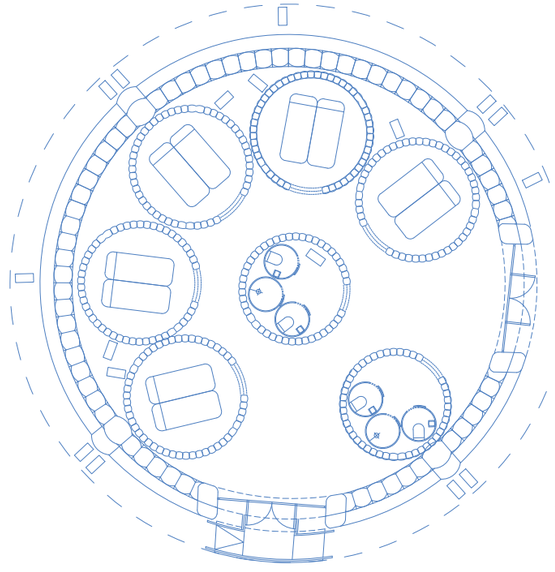
Size 4
ø 15m

2 perpendicular openings

Group Refugee
Focus workshops
3 Private inflatable pods



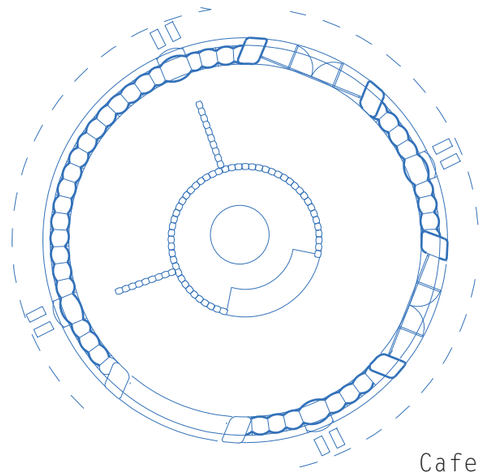
Exhibition space
100 people
Inflatable walls



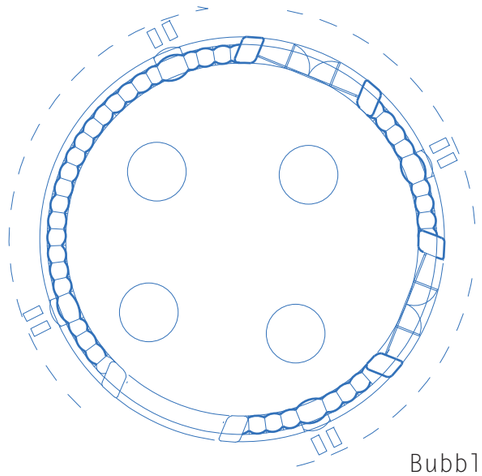
Max 5 inflatable rooms
10 persons
3 showers
3 Toilets

Size 3
ø 12m

Opening on 3 sides



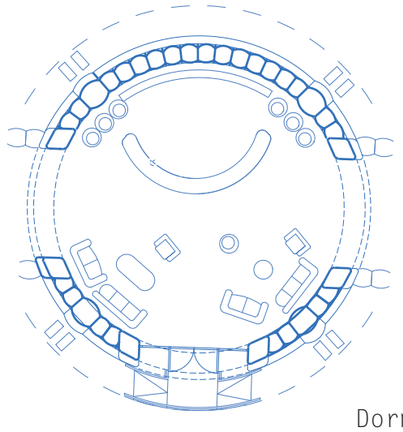
Cafe



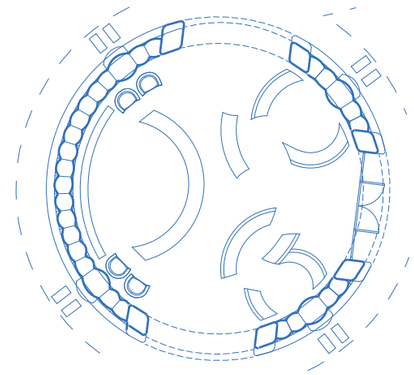
Bubble ontop of viewing tower

Size 2
ø 10m

Double opening



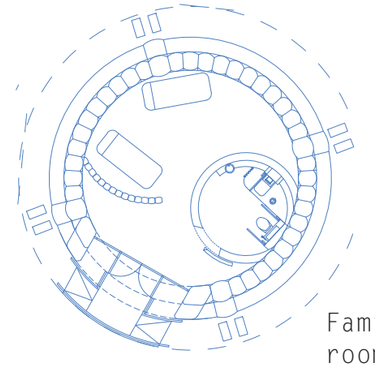
Dorm
kitchen



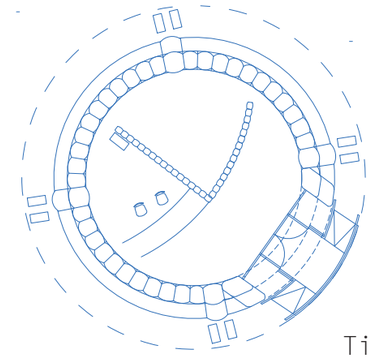
Lounge area

Size 1
ø 8m

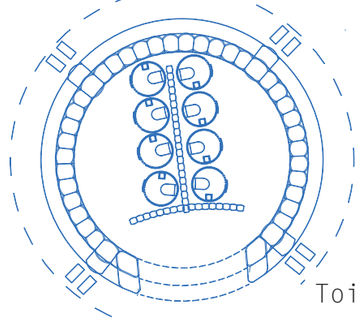
Single opening



Family room

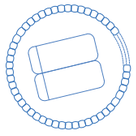


Ticket room



Toilets

Toilet/shower
1800mm ø

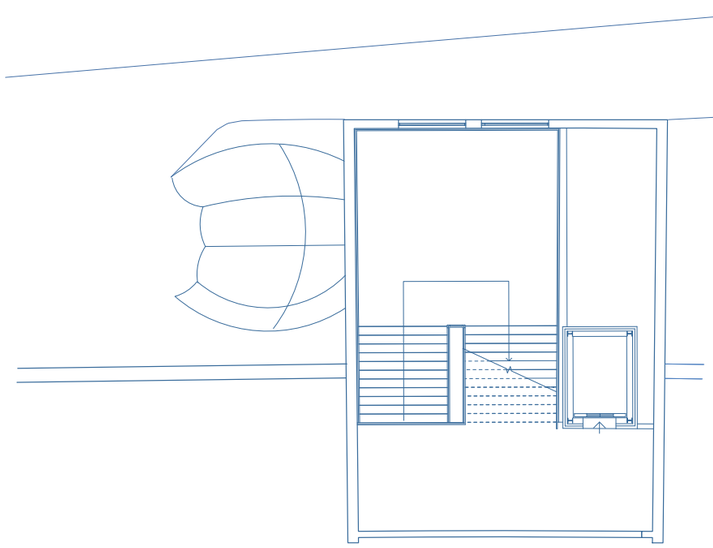


Bedrooms
2000mm ø

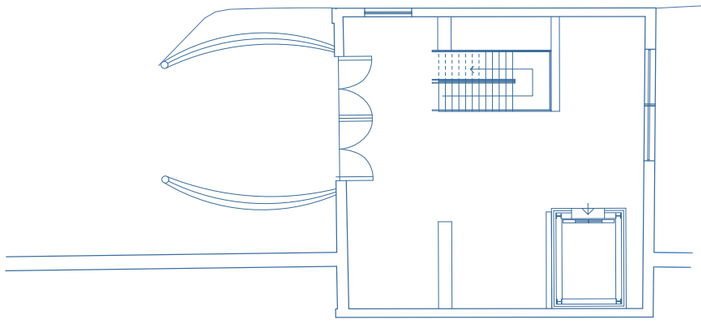
Toilet

Each size inflatable can be used for a magnitude of activities - Above show some potential options.
Free standing inflatable walls can be positioned to close spaces

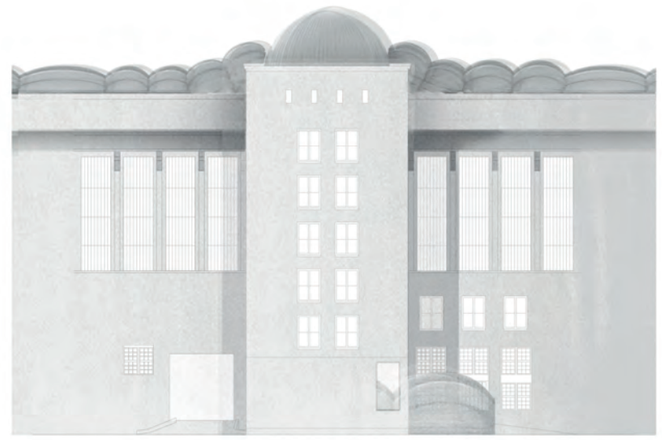
SPACE SITUATIONS



Reciprical Floors
1:100 at A0



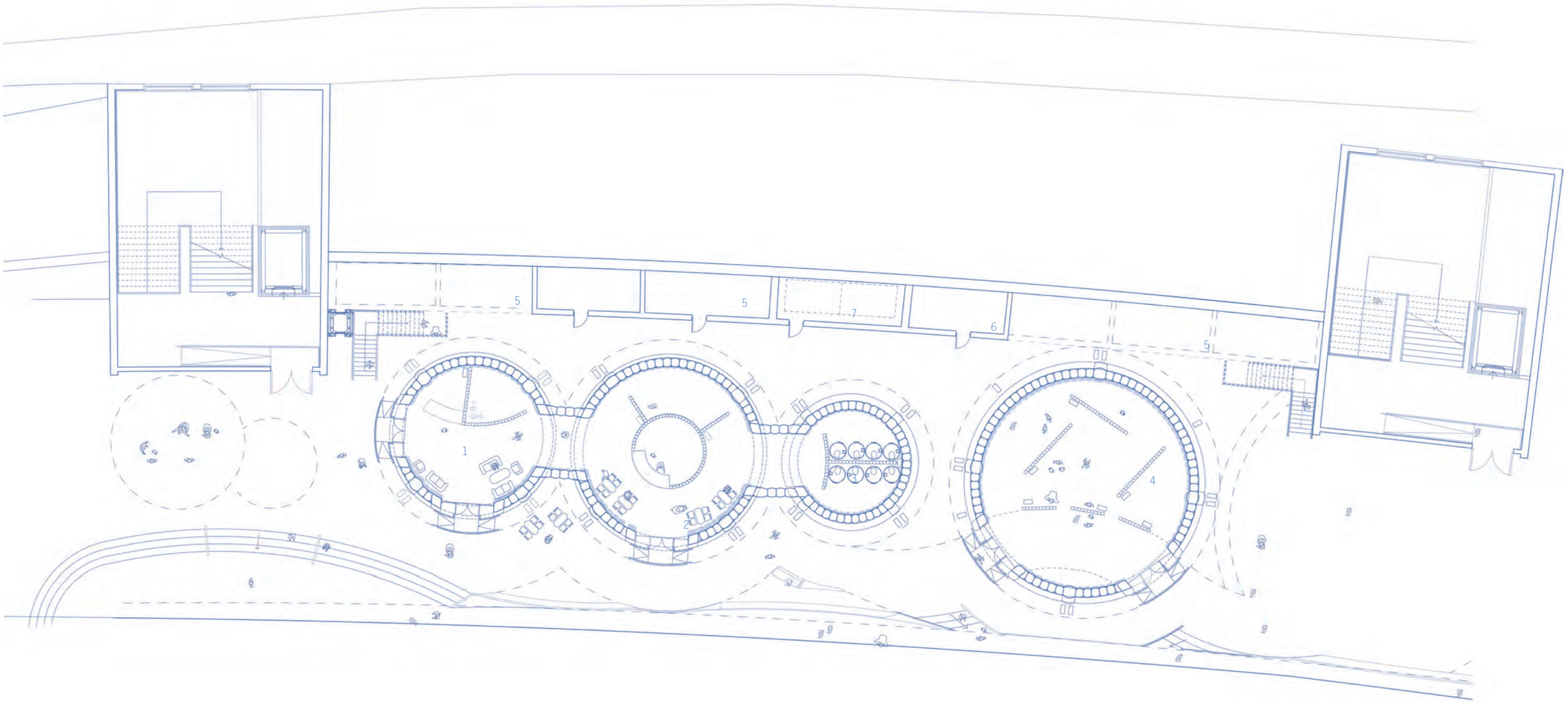
Ground Floor
1:100 at A0



Back elevation 1:200 A1

Enterance tower plans
1:100 at A0

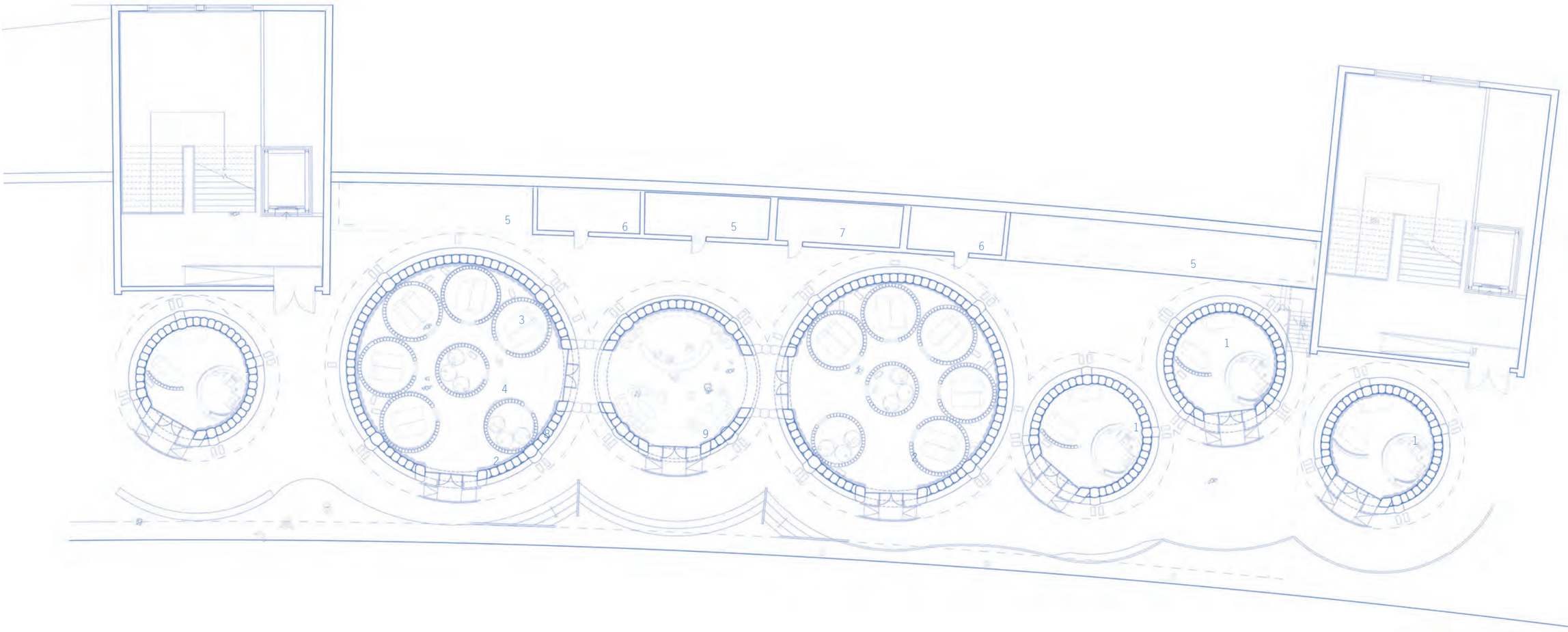
0 2m 4m 6m 8m 10m 20m 30m



1 Reception
2 Cafe
3 WCs
4 Exhibition Space
5 Storage for inflatables and
temporary flooring when not in use
6 Plant room
7 Water store

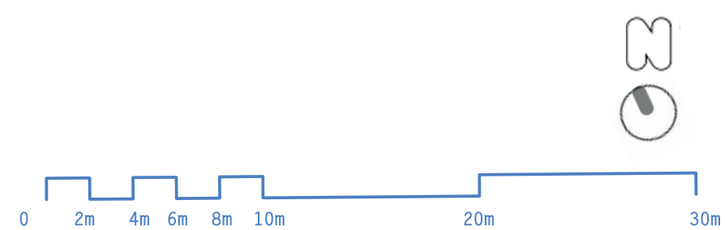
Possible layout for Welcome Site
1:100 at A0
(+ 1700mm from installed decking)

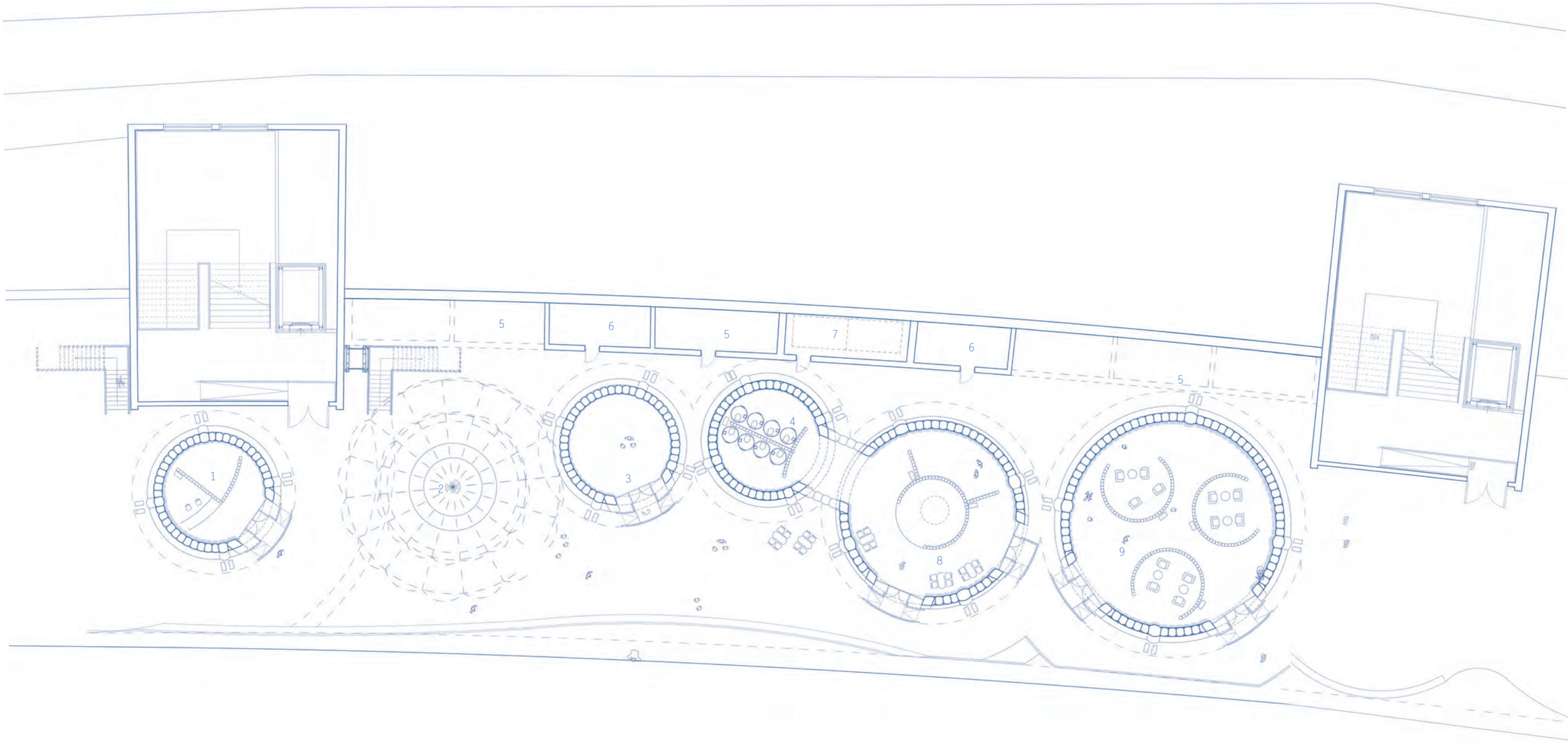
0 2m 4m 6m 8m 10m 20m 30m



1 Hostel rooms (disabled and family accessible)
2 Hostel
3 Dorms
4 WCs
5 Storage
6 Plant room
7 Water store
8 Showers
9 Kitchen and lounge area

Possible layout for hostel site
1:100 at A0

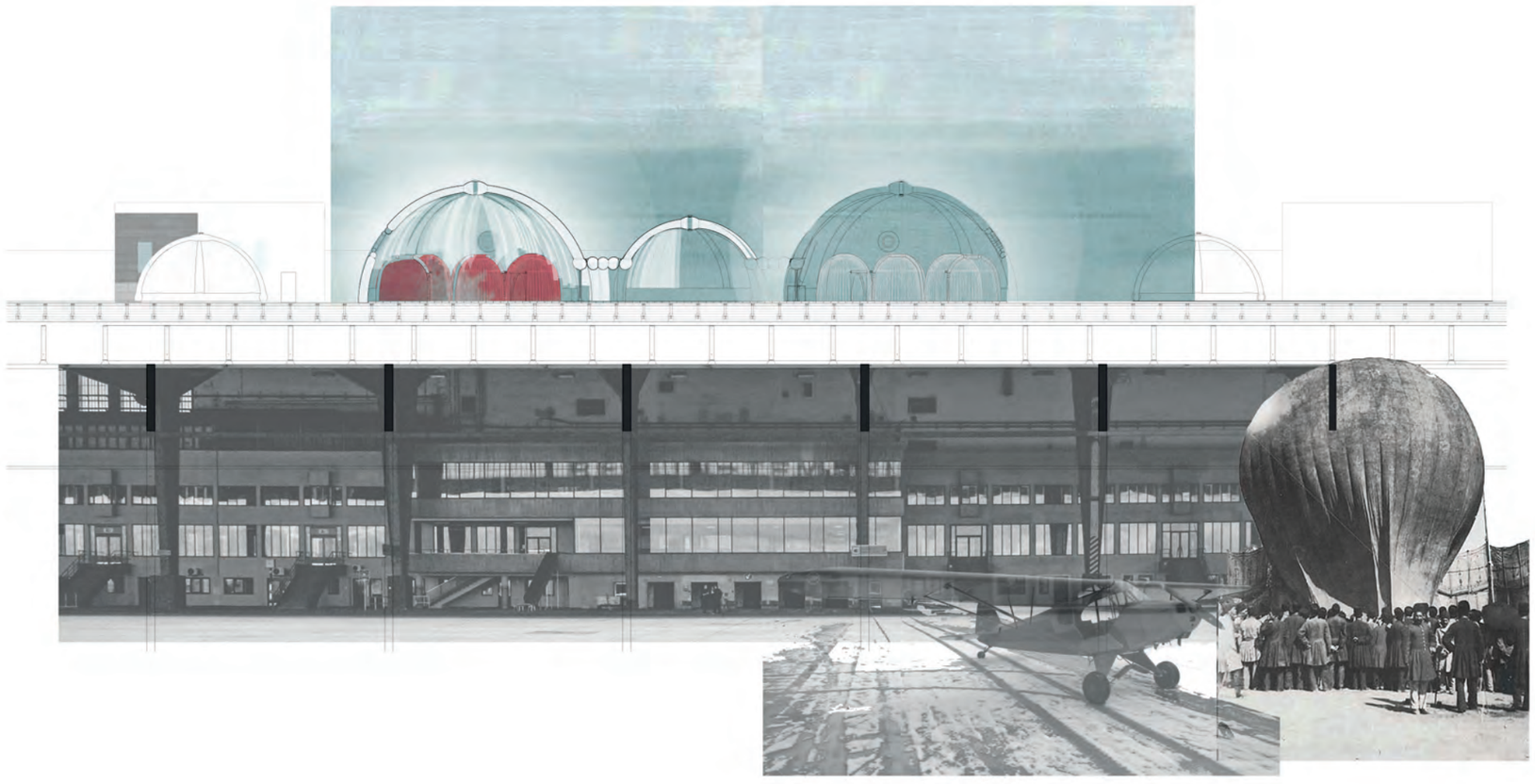




1 Ticket office
2 Viewing balloon landing zone
3 Waiting room
4 WCs
5 Storage
6 Plant room
7 Water Store
8 Cafe
9 Refugee support groups

Proposed layout for ‘visitor site’
1:100 at A0

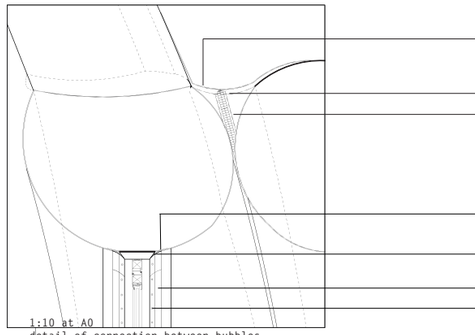
Front elevation Across all 3 site types
1:200 at A1



Long section through Dorms
A1 1:100

Vent - attached to etfe with interlocking plastic plates either side of fabric

Aluminum framed ribs to prevent collapse in case of fire



1:10 at A0
detail of connection between bubbles

Join between inflatable dome and tubing

0.3mm Etfe additional layer, to prevent rain seapage through zipper

High performance Size 20 Zipper

Seam line of zipper to etfe

To hold Aluminium door frame flush to inflatable frame

Double layer etfe at door rim

30mm x 160mm aluminium arch with 7mm poppers, positioned 80mm apart
Etfe skirt

7mm eyelets to attach

Zipper size 20 to to join inflatable dome and tubing

Inflatable frame 700mm diameter

Hinged Aluminium door frame supported by aluminium arch (see 1:10 detail above)

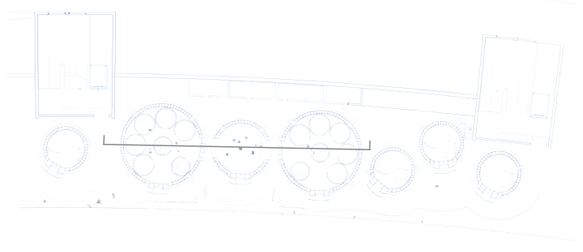
Aluminium hand rails with foot plates
(act as additional support for frame)

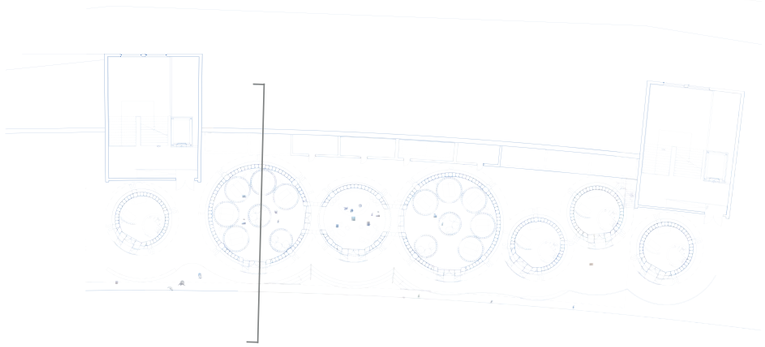
Raised timber deck flooring

80mm Insulation

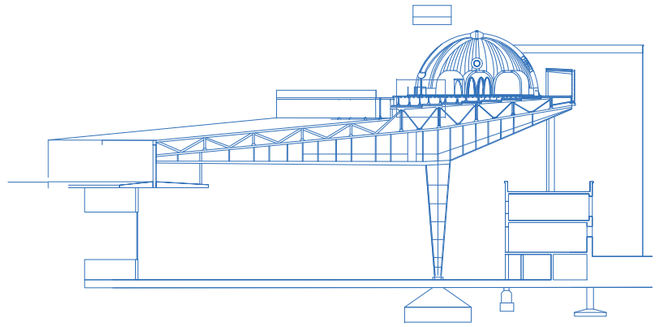
1:20 at A0
detail of the meeting of the 15000mm dorm inflatable and connection tube

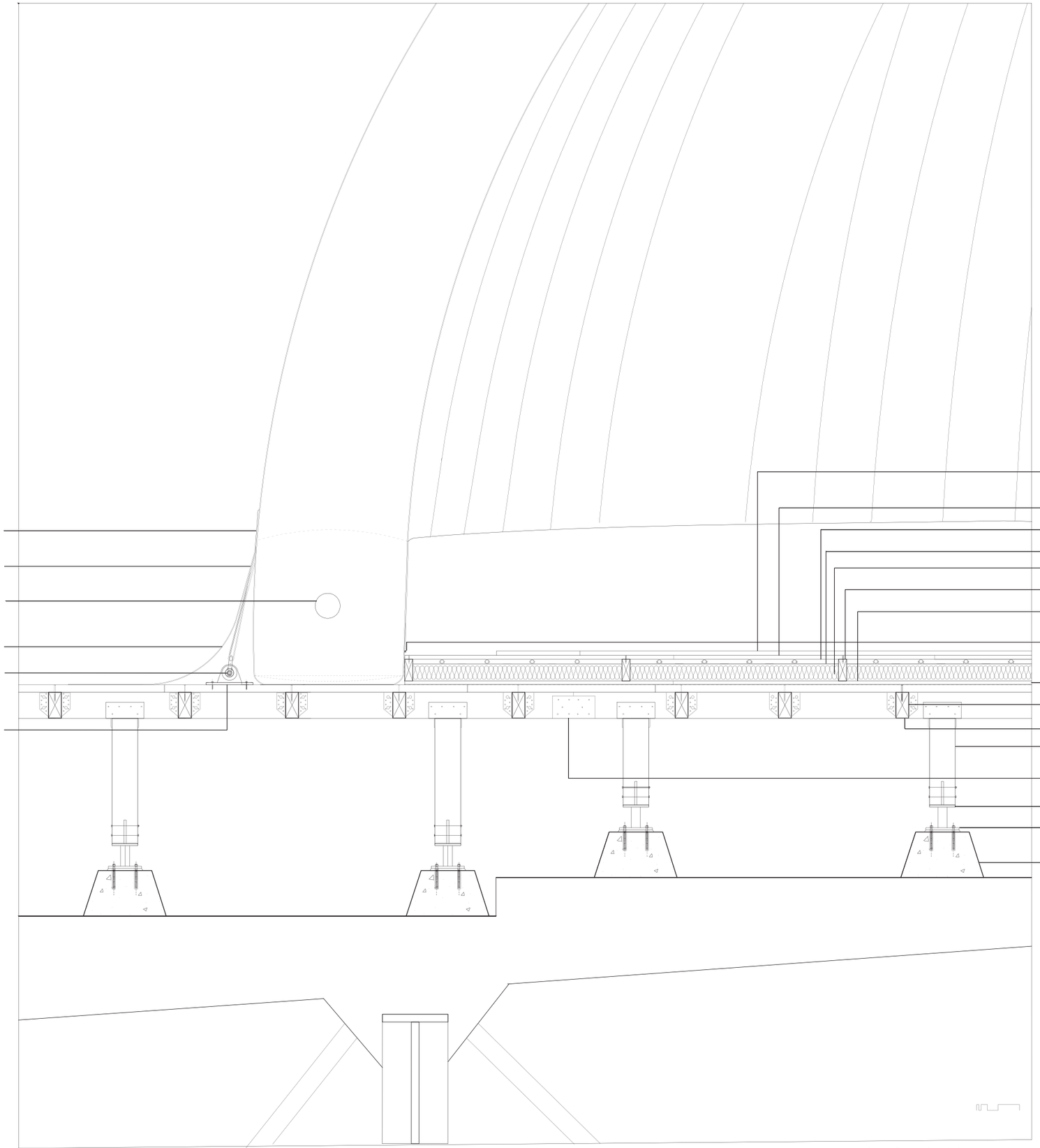
Inflatable beds (2 per dorm)
Tatami mats inside the dorm rooms sitting on exposed plywood flooring





Short Section A-A
Hostel Dorm Inflatable
1:100 at A1





Glued etfe covering to strengthen strap to rib

600mm etfe strap (length) - sewn into seam of etfe material joins

Hole in etfe for airflow into circumfrance rib

weighted 0.3mm Etfe skirting

27mm steel shackle (grade s)

115mm x 85mm Padeye 10mm base plate

20mm Tatami matting (covering soft flooring areas e.g Inside dorm room inflatables)

18mm exposed plywood finish

Underfloor heating pipes Ø16mm

Plastic clip rail

80mm Insulation board

38mm x 100mm Timber joists

18mm plywood

Waterproof membrane running under plywood (attached to etfe inside skirting via zipper)

35mm x 120mm Timber decking boards

75mm steel screw

120mm x 60mm Timber bearers

Joist hangers

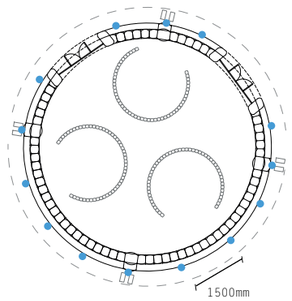
120x120 Timber columns

joist plate

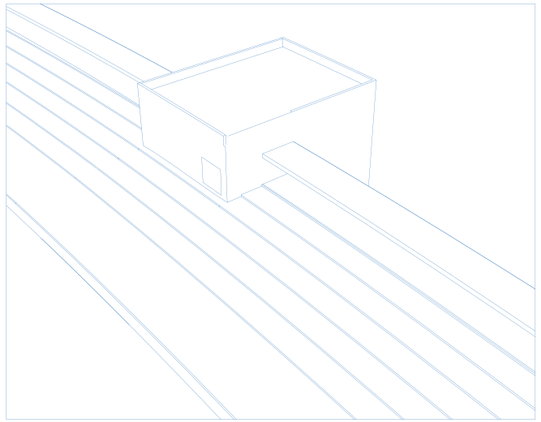
Post cap

10mm Post base bolted with 4xØ13mm and 4xØ8.5mm

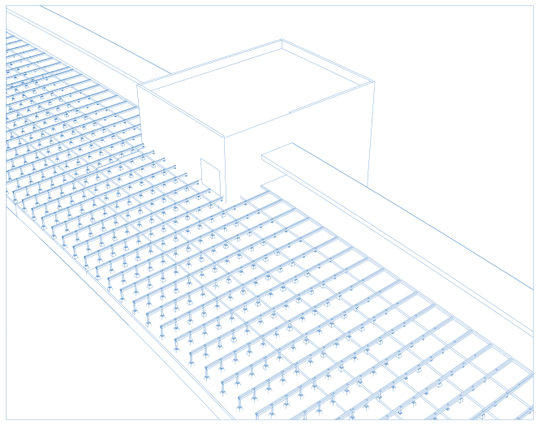
Resin set bolts into concrete foundations



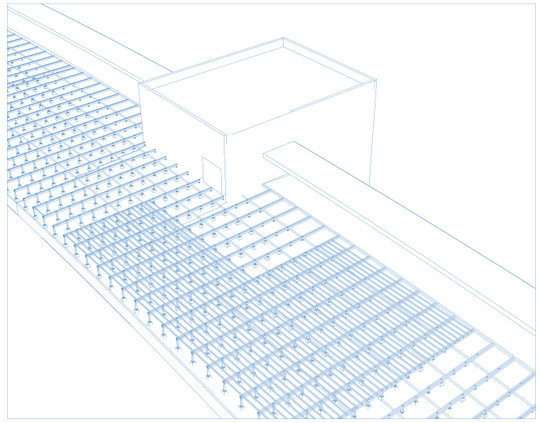
Scale 1:10 at A1

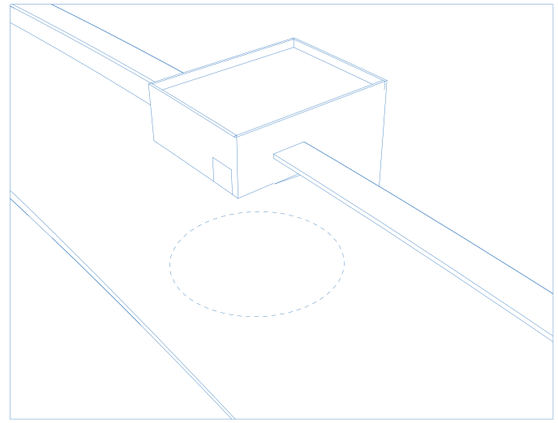


1. Determin Site, delivery of decking components



2.Lay water piping, sewerage and electricty beneath decking. Begin to ay timber decking foundations, timber columns and bearers





4. Mark out diameter for circle inflatable position

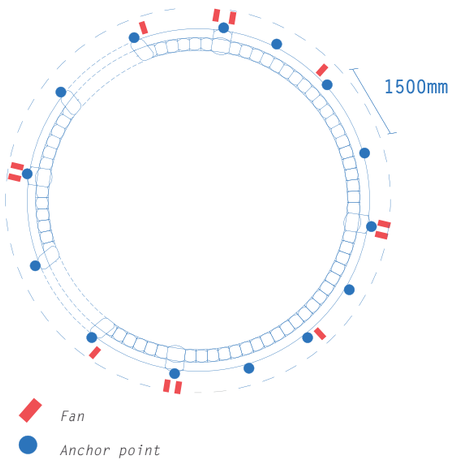
5. Lay waterproof membrane sheeting.Install first layer of plywood over marked out area

6. Place timber joists in line with plywood. Lay insulation and piping for underfloor heating system

7.Install top layer of Plywood flooring

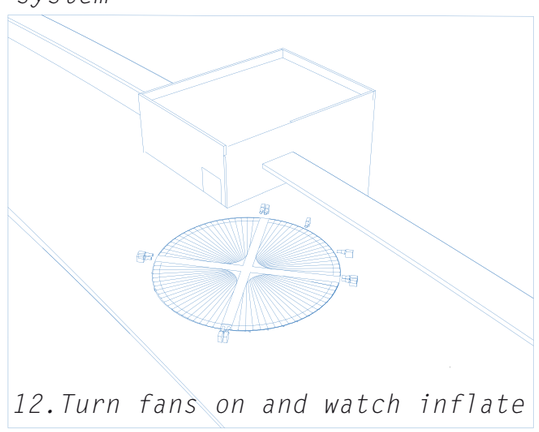
8. Arrival of inflatable!

9. Unpack and roll out etfe inflatable

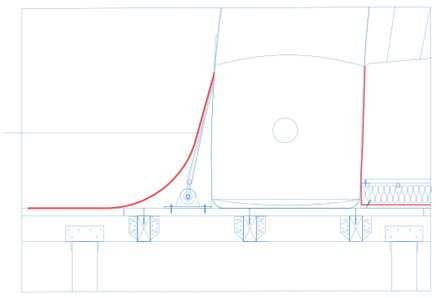


10. Attach anchorage points at 1500mm on diameter of plywood and with correspondence to dome rib straps.

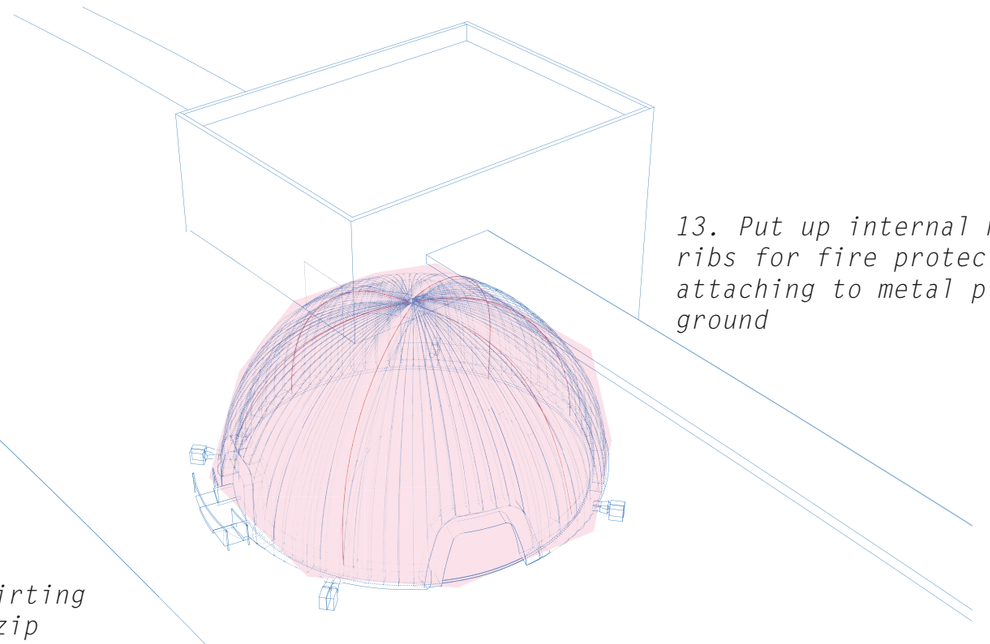
11. Position 12 fans at correct distances



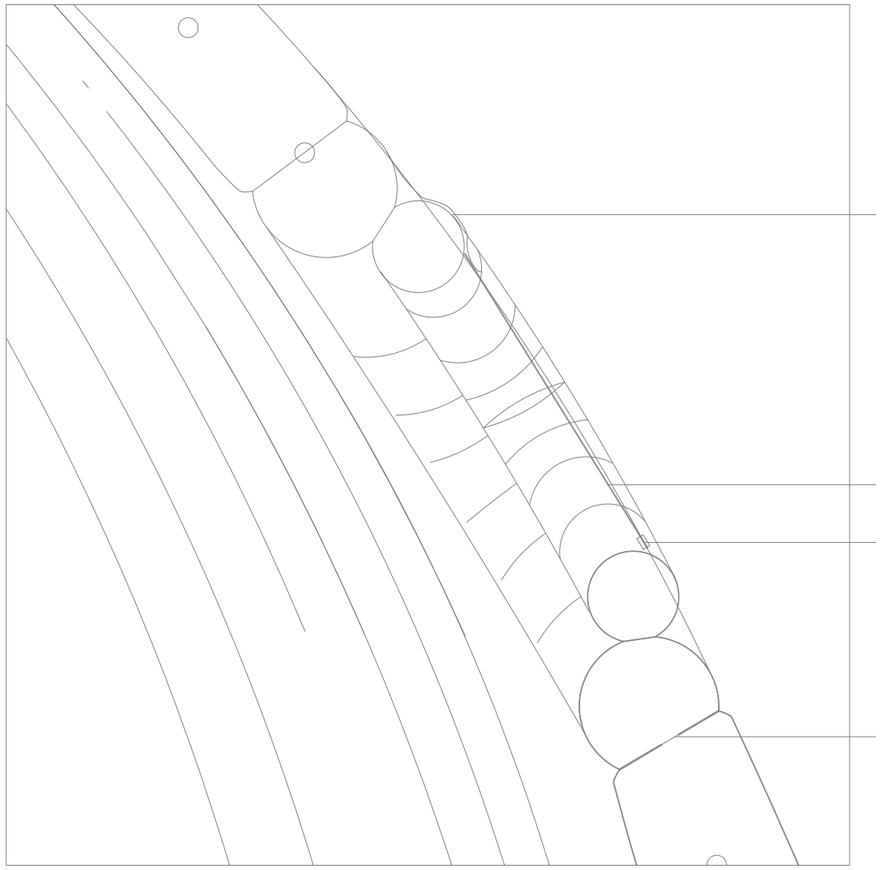
12.Turn fans on and watch inflate



14. Position skirting externally and zip waterproof membrane to internal zip.



13. Put up internal metal ribs for fire protection, attaching to metal plate at ground



ETFE skirt over window to prevent rain from remaining in material seam

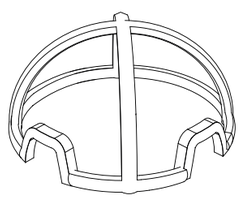
Transparent ETFE 0.3mm

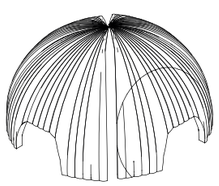
Zipper fastening size #20

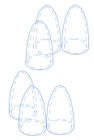
Gap in ETFE to allow air to pass into window rim structure

1:10
Zipper window opening

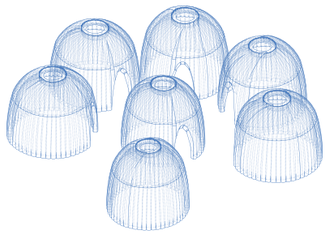
Seperate fans maintain air pressure in different portions of inflatable. This prevents complete collapse if one section is punchured



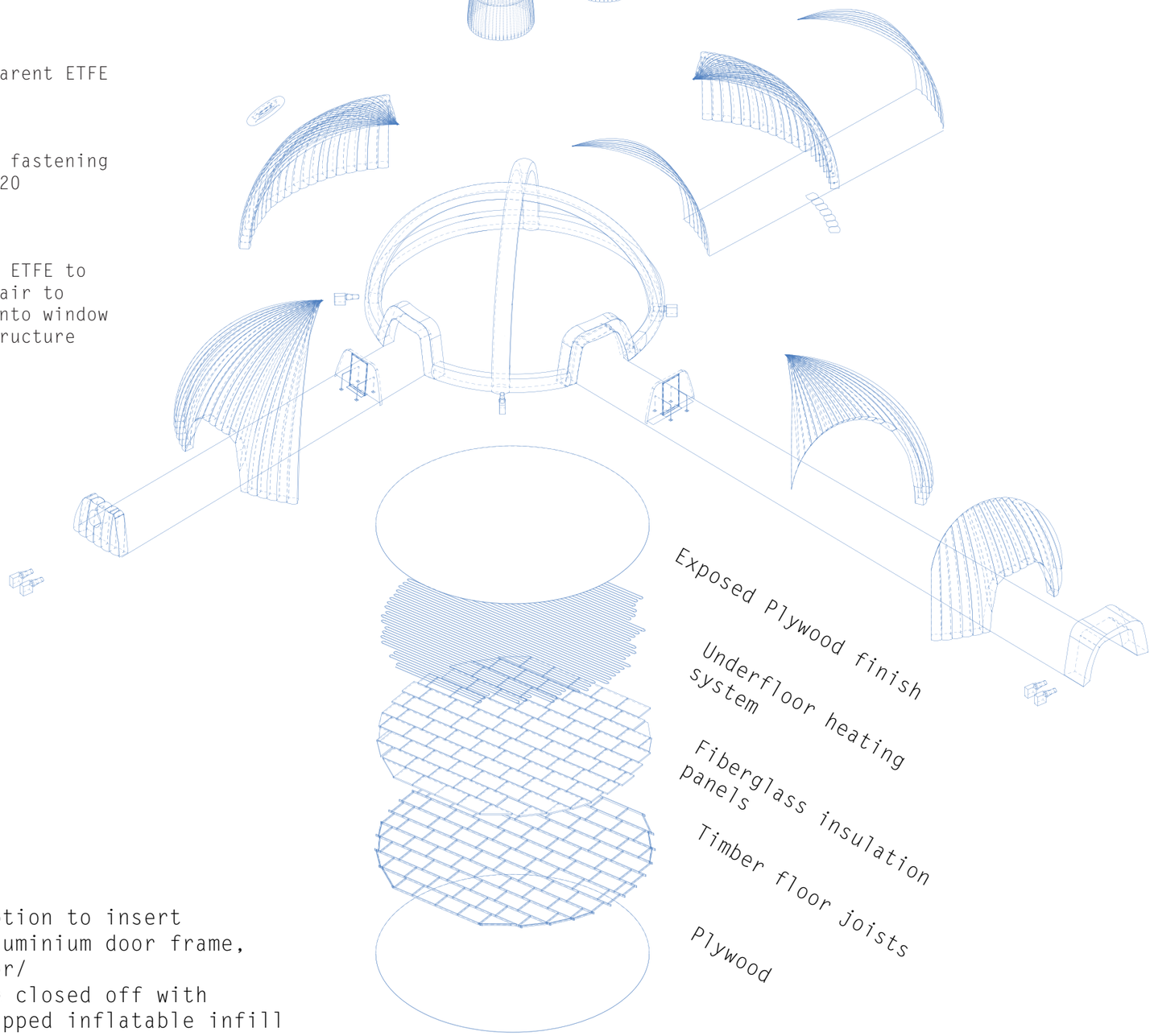




Toilet Pods



Dorm pods



Option to insert aluminium door frame,
/or/
be closed off with zipped inflatable infill wall

Exposed plywood finish

Underfloor heating system

Fiberglass insulation panels

Timber floor joists

Plywood

1:100 model of hostel dorm site

REGULATIONS

FIRE

B1 Appendix E
Designed to accommodate more than 10 individuals, and as such cannot be classified as a dwelling house .

B1, Section 3
3.2 Escape Route Design (Fig 1)
With a maximum of 30 occupants, inhabiting the large inflatable with bedrooms, having two exits allowed inlftable type to acheieve a travel distance of less that 18m.

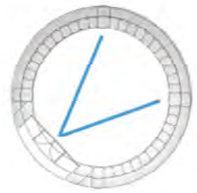
3.9 Alternative Escape Routes
Inflatables with more than one exit are placed at more that 45 degrees angle from the farthest point.

3.10 Inner Rooms
When the extra small inflatable is attached to another inflatable; an inner room (connected inflatable) and access room (big iflatable) is created. Travel distances don't exceed limits,the inner room is entered directly off the access room and the occupant capacity of the inner room does not exceed 60.

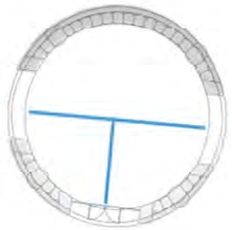
B1,Section 4
Design for vertical escape (Fig 2)
Existing fire protected cores will be used to get to the fire assembly point outside the Tempelhof airport. The staircase satisfies the regulation for vertical escape.

TRAVEL DISTANCE FOR EACH INFLATABLE SIZE

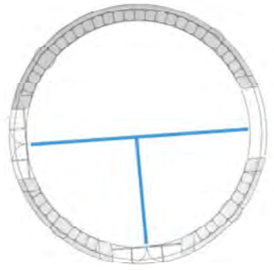
Fig 1



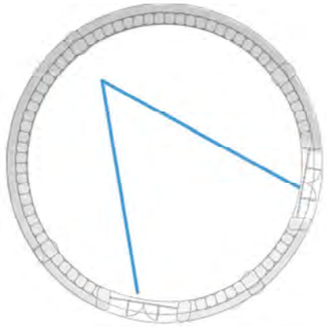
< 9m Travel Distance



< 18m Travel Distance



< 9 m Travel Distance



< 18m Travel Distance

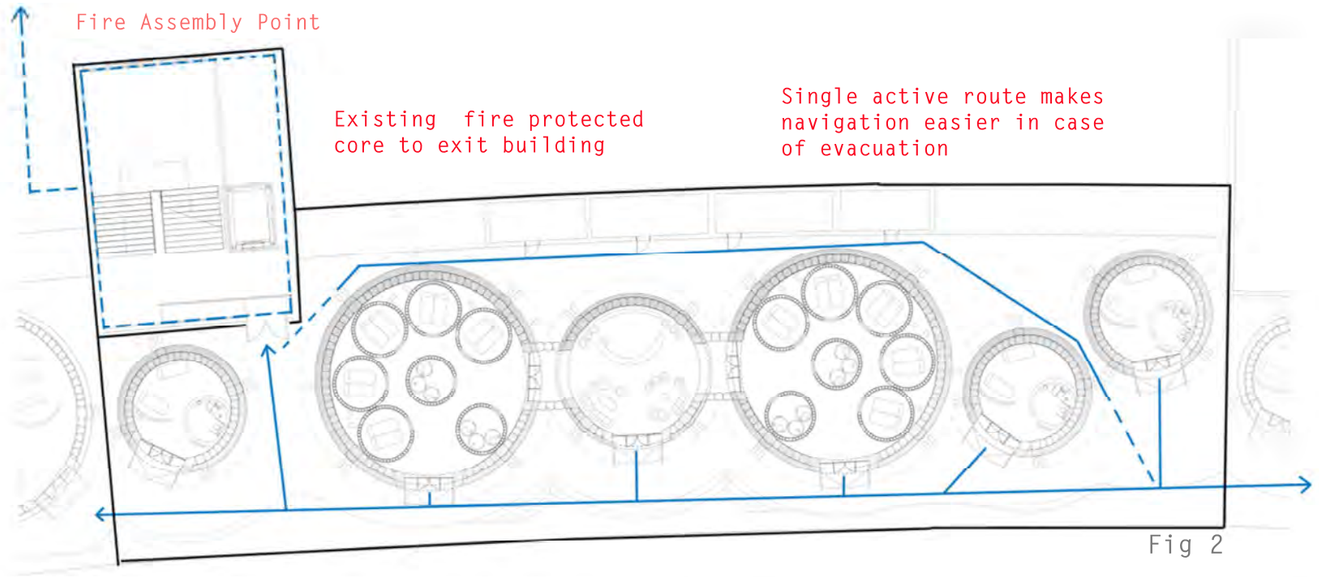


Fig 2

ETFE FIRE RATING
ETFE has a low flammability (270c) and is considered self extinguishing. Hot smoke causes the material to soften and shrink away from the fire source. ETFE has been comprehensively tested:
DIN 4102 Class B1
EN 13501-1 Class B-s1,d0
NFP 92-505 M2
NFPA 701 Pass

ETFE STRUCTURAL STRENGTH (Fig 3)
ETFE absorbs structural movements by conforming to change geometry. This dampens sudden wind gusts.

Fig 4
In the case of fire and the inflatable no longer having structural stregth, 2 steel rings on the small inflatables and 4 on the big inflatables will provide strucutral support for the inflatable giving people enough time to escape.

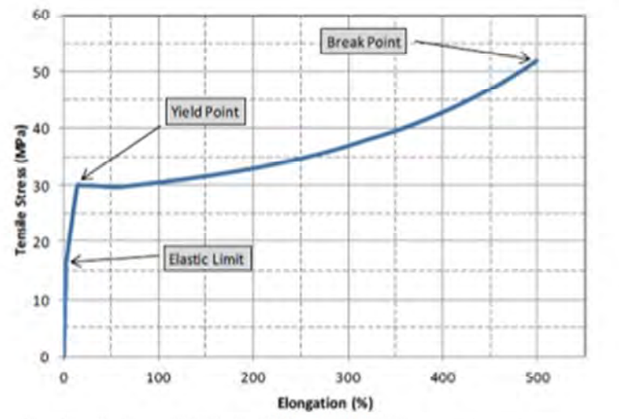


Fig 3

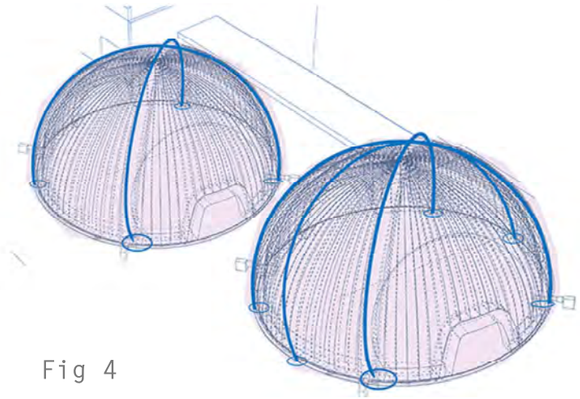


Fig 4

REGULATIONS

PERSONAL SAFETY

K, Protection from falling

Stairs - Riser & Going, Landing & Handrails (Fig)

The stairs and ramps on the site will be used on a day to day basis,considered as a general access stairs. They meet the regulations for riser and going.
Max Riser: 170mm Max Going: 400
Max risers before landing: 12

Ramps in the core for easy access and the entrance of each inflatable to make up for the height difference created by the deck and insulated floors. (Fig)

Handrails are designed in line with Part K (Fig)

M Access

1.10 Communal lifts and stairs

In accordance with part M regulations, the lift for the viewing platform has a landing of 1500 x 1500 and a clear opening width of 800mm.

Q1 - Unauthorised Access

To control unauthorised access, only the staircase tower for the welcome center will be used as a main entrance.The other staircase towers will be used only by inhabitants of the site.

BUILDING SERVICES

Fig 2

Insulated casings run under the deck with pipes and cables from the plant room to supply toilets and kitchens with water and electricity.

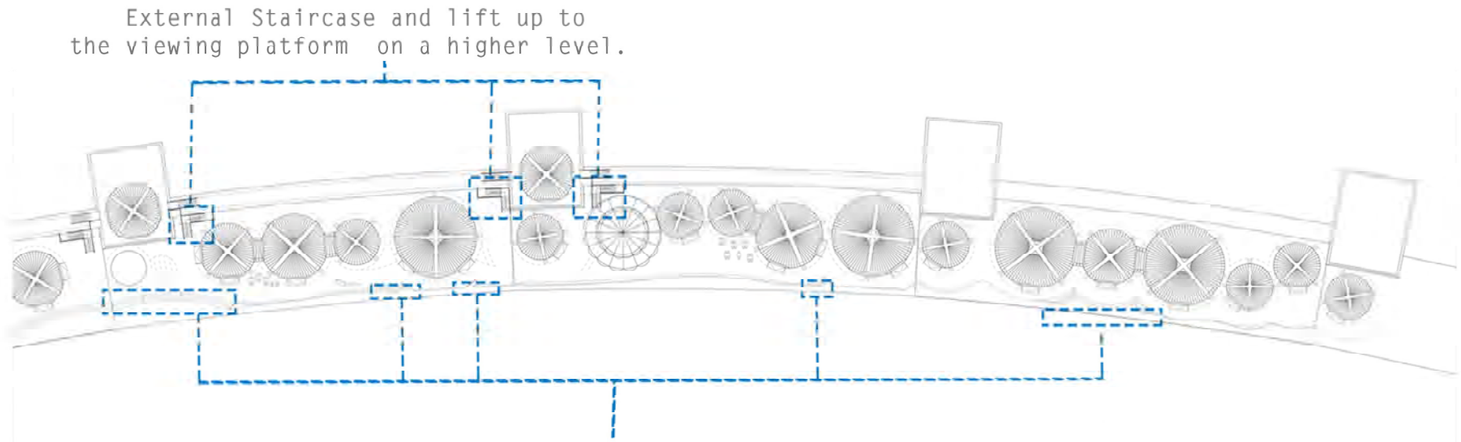


Fig 1

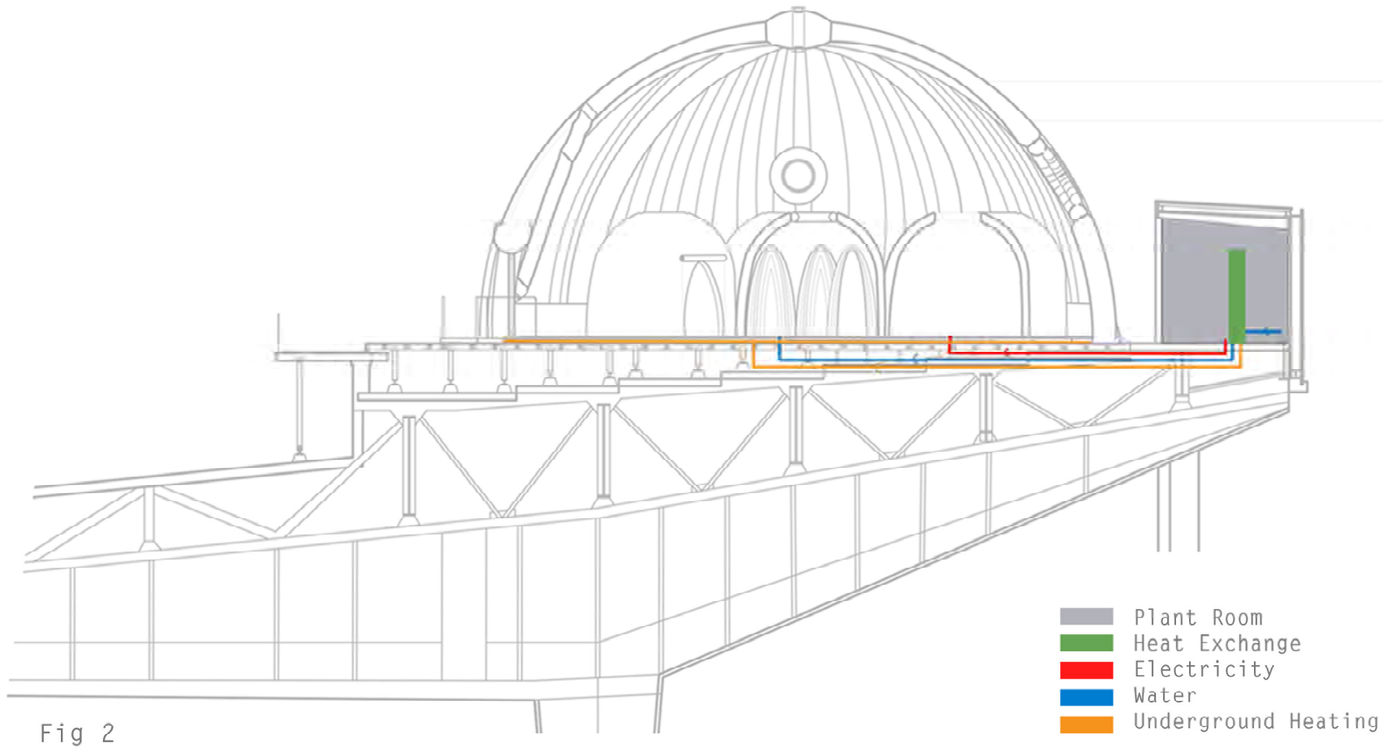


Fig 2

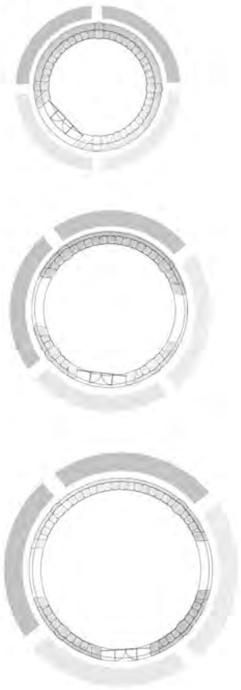
ENVIRONMENTAL RESPONSE

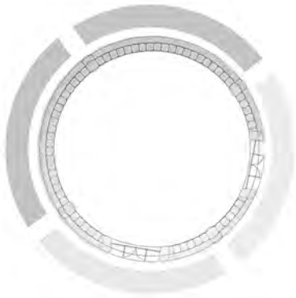
Fig 1
Inflatables designed with tranluscent and transparent sides informed by the potential use of each inflatable, the need for privacy in some of the inflatables, solar gains and natural light.

The choice of ETFE as the material has its environmental advantages. Transportation is much easier as it can be rolled & takes up less space The cleaning and maintenance of ETFE is also minimal.

Fig 2
U value of trapped air; and 3 layers of ETFE; combined with the white reflective properties control internal temperature during winter and summer.

Fig 3
Inflatables and internal spaces can be slightly rotated to harness natural heat and lightsdepending on their position on the site.





Transluscent with transparent top.

Transparent with top fritting.

Fig 1

U-VALUE

1/0.13 + 1.96 + 6.8 + 0.13 = 0.11W/m2.K.

3 layers of ETFE = 1.96W/m2K
600mm of trapped air = 6.8W/m2K

Fig 2

Fig 8

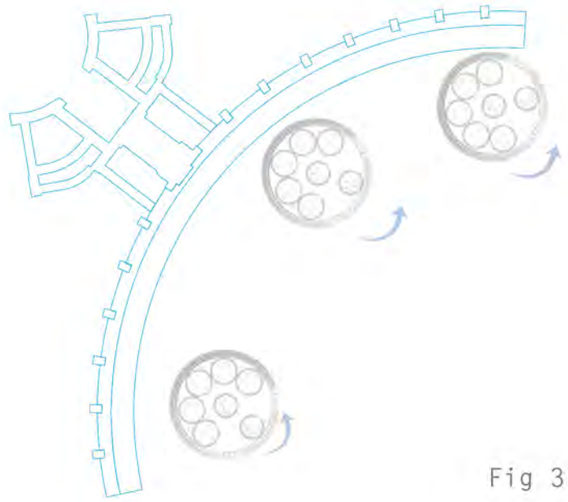


Fig 3

Fig 4 & 5
Patterns on transparent parts of the inflatables known as 'fritting' allows the inflatable to harness winter solar gains and summer shading.Top of the north section of inflatable will be transparent to to get natural light without the sun glare.

Fig 6
Ventilation will be achieved with windows on the large inflatable and a vent at the top of each inflatable.

Fig 7
Underground heating to warm up internal spaces during winter.

Fig 8
Electricity will be provided both by harnessing the sites wind power with windmills in the airfield and connecting to the existing grid of the Tempelhof Airport.

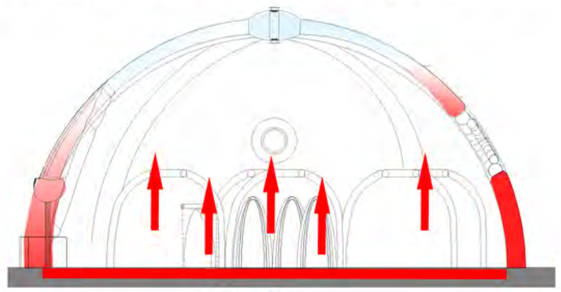


Fig 7

	Transparent	Translusent	Print (fritted)	White
Used	50% Northern segments	50% Southern segment	Top 30% (intensity decreases down dome)	
Transmittance (%)				
Visible Light (380-780mm)	90.5	91.7	63.2	40.5
Ultra Violet (300-380)	83.5	88.2	58.2	1.0
Sun Light (300-2100mm)	91.9	90.4	63.7	50.1

Fig 4

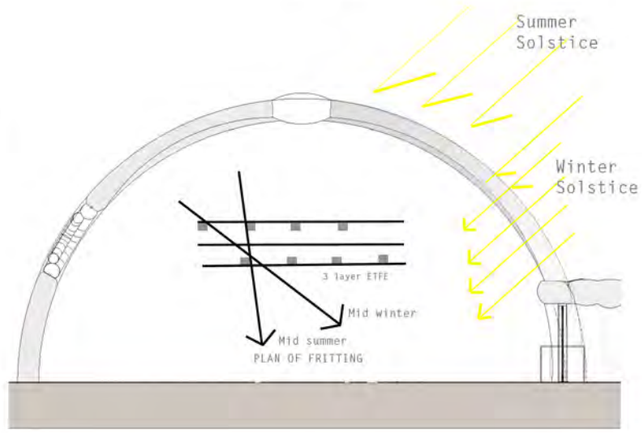


Fig 5

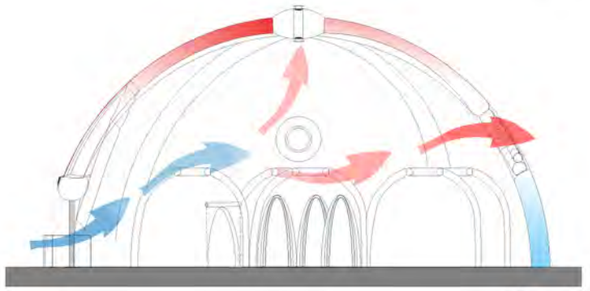


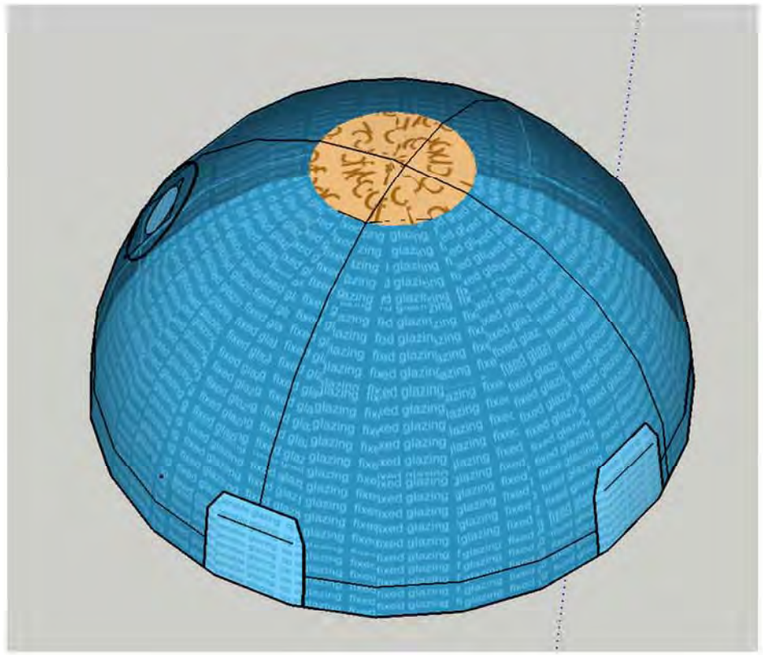
Fig 6

ENVIRONMENTAL PERFORMANCE

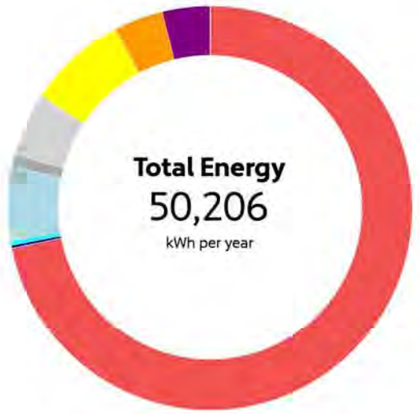
Sefaira was the used to produce the following diagrams for running costs, energy usage and CO2 for one large 15 meter inflatable dome.

One should however look at theses figures with caution due to a very simple nature of the model used to produce them. The program provides only limited ways to label the elements of the model and due to the inflatable properties of the proposed scheme there was no acurrate to represent these materials,

In addition the model required to have at least one roof to begin analysis, the domes outer skin falls more in the catagory of 'fixed Window'.



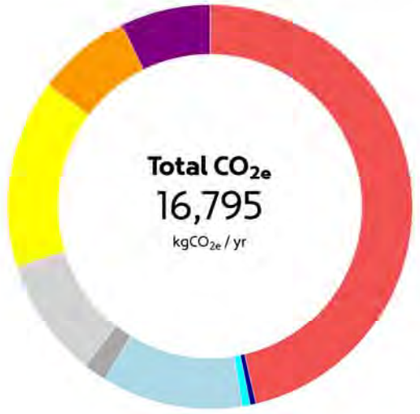
Annual Energy Use



Segment	kWh per year	% of total use
Heating	**36,039**	**72 %**
AHU	15	0 %
Zones	36,024	72 %
Humidification	0	0 %
Cooling	**3,264**	**7 %**
AHU	120	0 %
Heat Rejection	169	0 %
Zones	2,975	6 %
Fans	**3,042**	**6 %**
AHU	489	1 %
Zones	2,553	5 %
Interior	**5,955**	**12 %**
Lighting	3,970	8 %
Equipment	1,985	4 %
Pumps	**1,906**	**4 %**

Berlin - Baseline Concept. Produced by Faruq Agberemi from Manchester School of Architecture, 13 Dec 2018 @ 20:12:29

Annual CO_{2e} (Exc. Renewables)



Segment	$kgCO_{2e}$ / yr	% of total use
Heating	**7,784**	**46 %**
AHU	3	0 %
Zones	7,781	46 %
Humidification	0	0 %
Cooling	**2,077**	**12 %**
AHU	77	0 %
Heat Rejection	108	1 %
Zones	1,892	11 %
Fans	**1,935**	**12 %**
AHU	311	2 %
Zones	1,624	10 %
Interior	**3,787**	**23 %**
Lighting	2,525	15 %
Equipment	1,262	8 %
Pumps	**1,212**	**7 %**

Berlin - Baseline Concept. Produced by Faruq Agberemi from Manchester School of Architecture, 13 Dec 2018 @ 20:12:09

Annual Energy Cost (Exc. Renewables)

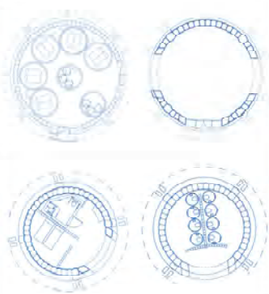
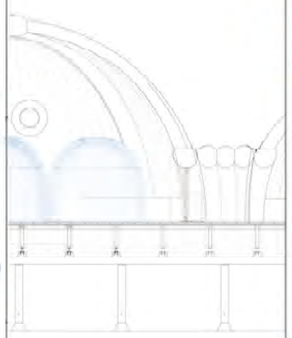
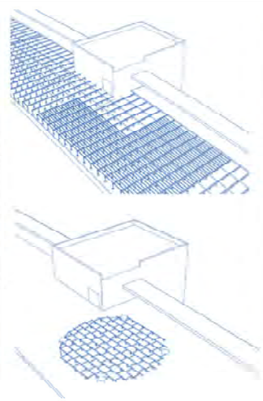
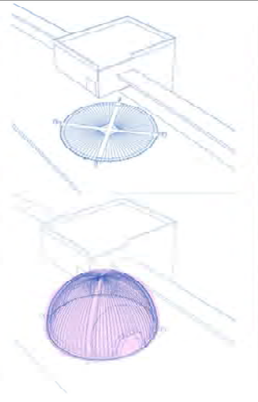
Segment	€ per year	% of total use
Heating	**€2,919**	**38 %**
AHU	€1	0 %
Zones	€2,918	38 %
Humidification	€0	0 %
Cooling	**€1,113**	**14 %**
AHU	€41	1 %
Heat Rejection	€58	1 %
Zones	€1,014	13 %
Fans	**€1,038**	**13 %**
AHU	€167	2 %
Zones	€871	11 %
Interior	**€2,031**	**26 %**
Lighting	€1,354	17 %
Equipment	€677	9 %
Pumps	**€650**	**8 %**

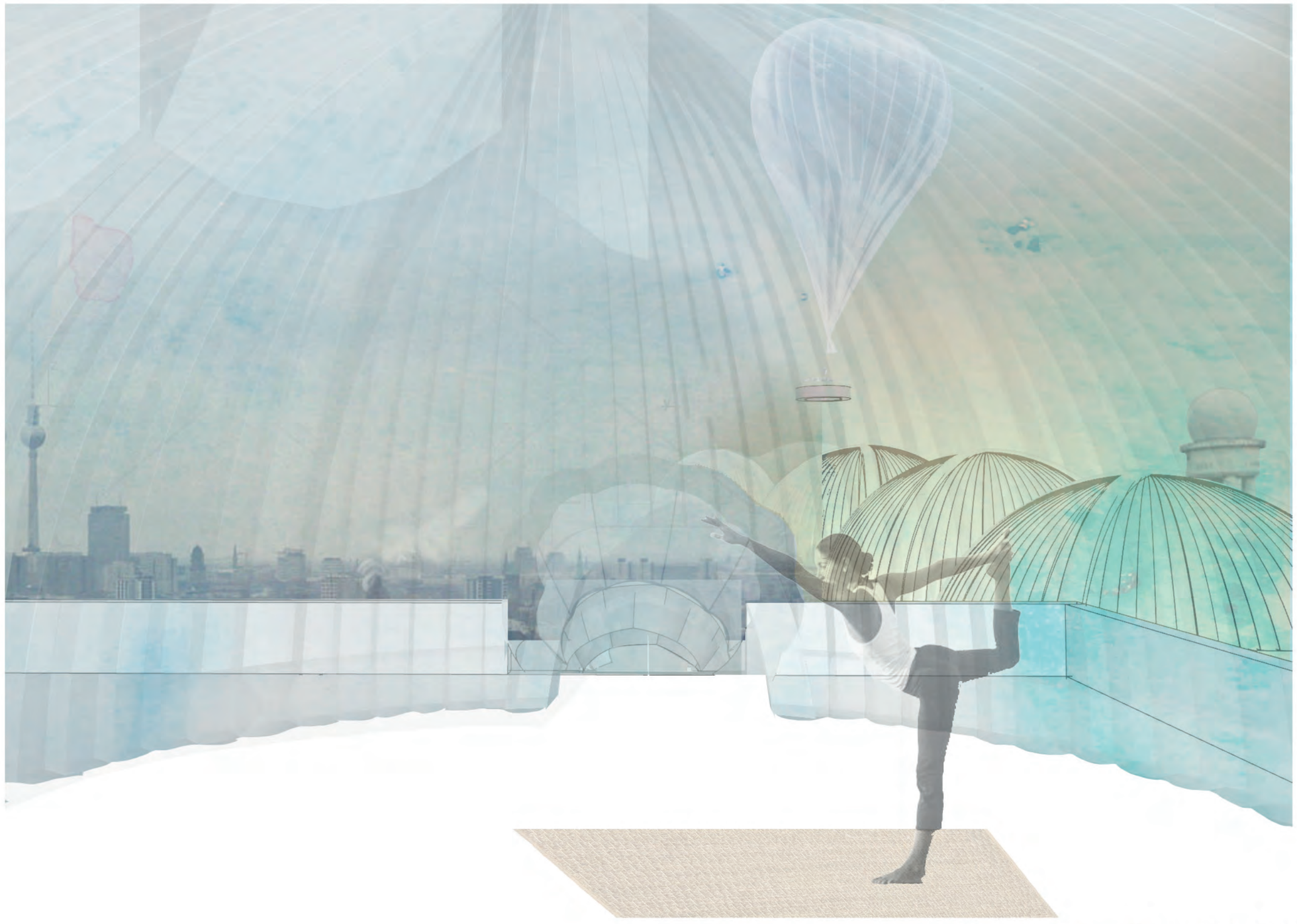
Berlin - Baseline Concept. Produced by Faruq Agberemi from Manchester School of Architecture, 13 Dec 2018 @ 20:12:39

RIBA

The Plan of Work Organises the progress of designing , constructing, maintaining and operating building projects into a number of key work stages The content of stages may vary or overlap to suit specific project requirements.
The RIBA Plan of Work 2013 should be used solely as guidance for the preparation of detailed professional services contracts and building contracts.

RIBA Plan of Work 2013

	0 Strategic Definition	1 Preparation and Brief	2 Concept Design	3 Developed Design	4 Technical Design	5 Construction	6 Handover and Close Out	7 In Use
Tasks Core Objectives	Identify client's Business Case and Strategic Brief and other core project requirements.	Develop Project Objectives including Quality Objectives and Project Outcomes Sustainability Aspirations Project Budget , other parameters or constraints and develop Initial Project Brief Undertake Feasibility Studies and review of Site Information	Prepare Concept Design including outline proposals for structural design, building services systems, outline specifications and preliminary Cost Information along with relevant Project Strategies in accordance with Design Programme . Agree alterations to brief and issue Final Project Brief	Prepare Developed Design including coordinated and updated proposals for structural design, building services systems, outline specifications, Cost Information and Project Strategies in accordance with Design Programme	Prepare Technical Design in accordance with Design Responsibility Matrix and Project Strategies to include all architectural, structural and building services information, specialist subcontractor design and specifications, in accordance with Design Programme	Offsite manufacturing and onsite Construction in accordance with Construction Programme and resolution of Design Queries from site as they arise.	Handover of building and conclusion of Building Contract	Undertake In Use services in accordance with Schedule of Services
Procurement *Variable task bar	Initial considerations for assembling the project team.	Prepare Project Roles Table and Contractual Tree and continue assembling the project team.	The procurement strategy does not fundamentally alter the progression of the design or the level of detail prepared at a given stage. However, Information Exchanges will vary depending on the selected procurement route and Building Contract . A bespoke RIBA Plan of Work 2013 will set out the specific tendering and procurement activities that will occur at each stage in relation to the chosen procurement route.			Administration of Building Contract , including regular site inspections and review of progress.	Conclude administration of Building Contract	
Programme *Variable task bar	Establish Project Programme	Review Project Programme	Review Project Programme	The procurement route may dictate the Project Programme and may result in certain stages overlapping or being undertaken concurrently. A bespoke RIBA Plan of Work 2013 will clarify the stage overlaps. The Project Programme will set out the specific stage dates and detailed programme durations.				
(Town) Planning *Variable task bar	Pre-application discussions.	Pre-application discussions.	Planning applications are typically made using the Stage 3 output. A bespoke RIBA Plan of Work 2013 will identify when the planning application is to be made.					
Key	Establish the project team and assess core programme requirements. Identify a business strategy through discussions with the client.	Review site information, assessing key parameters and constraints. Undertake feasibility studies and develop initial project brief. Continue to assemble project team.	Preparation of concept design in conjunction with relevant structural design and building services outline proposals. Agree and issue Final Project Brief.	Coordinated developed design including updated structural and building services proposals. Provision of cost information and project strategies.	Preparation of technical design package providing detailed construction information. To include all architectural, structual and services information alongside subcontractor specifications.	Realisation of building construction on site including off-site manufacturing and on-site construction in accordance with the agreed construction programme.	Conclusion of the building contract and handover of the building to the client.	Review of project performance including post-occupancy evaluation.
								
UK Government Information Exchanges	Not required.	Required.	Required.	Required.	Not required.	Not required.	Required.	As required.
PROGRAMME DURATION	1 Week Site visit and workshop in Berlin	2 Weeks	2 Weeks	2-3 Weeks Pneumatic inflatble types.	2-3 Weeks	1 Week Nature of scheme only requires a short time to construct deck and inflate dwellings.	2 Weeks As site is predicted to grow as a result of the of the flexibility of proposal, site will be under constant inspection.	

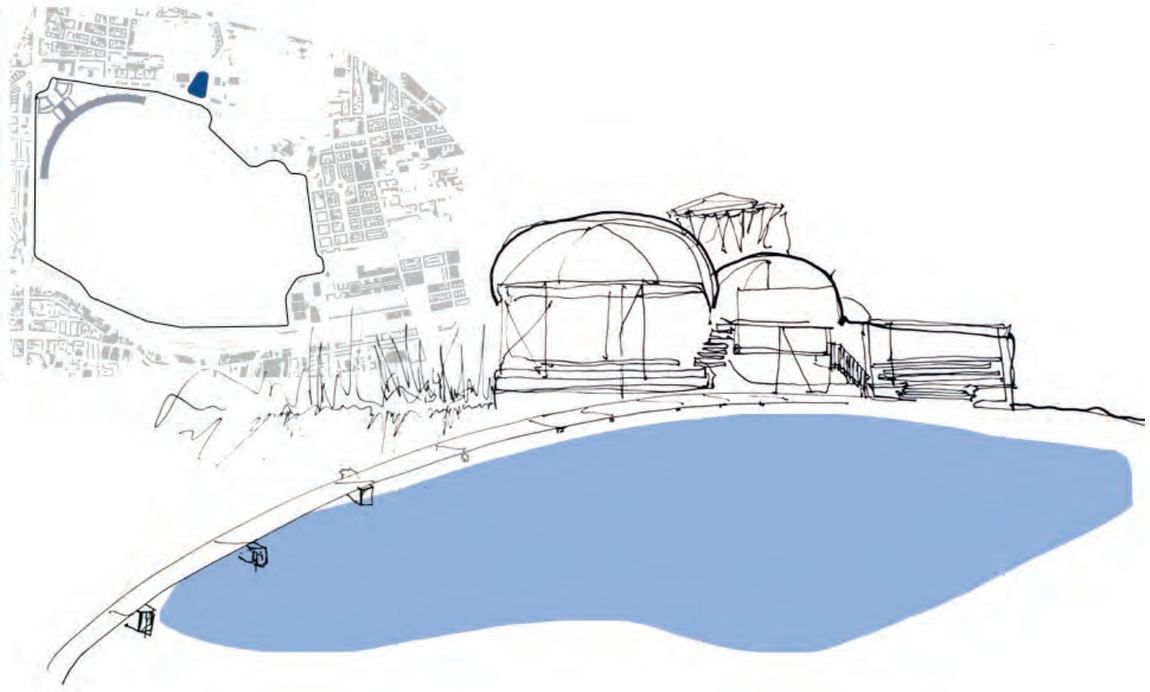


Perspective from viewing platform on tower - looking East

Bibliography

The Floating University :Raumlabor berlin

A source of inspiration located near to tempelhof site, the use of plastic to encase the temporary structure



Kengo Kuma - Tea House

Books
Herzog, Thomas. Pneumic Structure. A handbook of inflatable Architecture. Oxford University Press.

William McLean Air Structure (Form and Tec-nique)

Websites
Library of Congress ‘Refugee Law and Policy. Germany’ www.loc.gov/help/refugee-law/germany

ETFE Foil. A guide to Design. Amy Wilson 2013