TU Delft | aE Intecture Studio | P4 Presentation
Tutors: A. Snijders, M. Stellingwerf & Frank Koopman

popUP SUPERstructure

Manuella Borges | 4521463

Content

Content

In nature...

Keukenhof, the Netherlands
Images: online source

In architecture...

Modern Pentathlon Park, Toronto
Images: by author

Some causes that drive temporary architecture

Cause:	Natural Disaster	Events	
Purpose:	Shelter	Expo, Exhibit	Games, Concerts
Typology:	Housing	Folly, Pavillion →	Arena

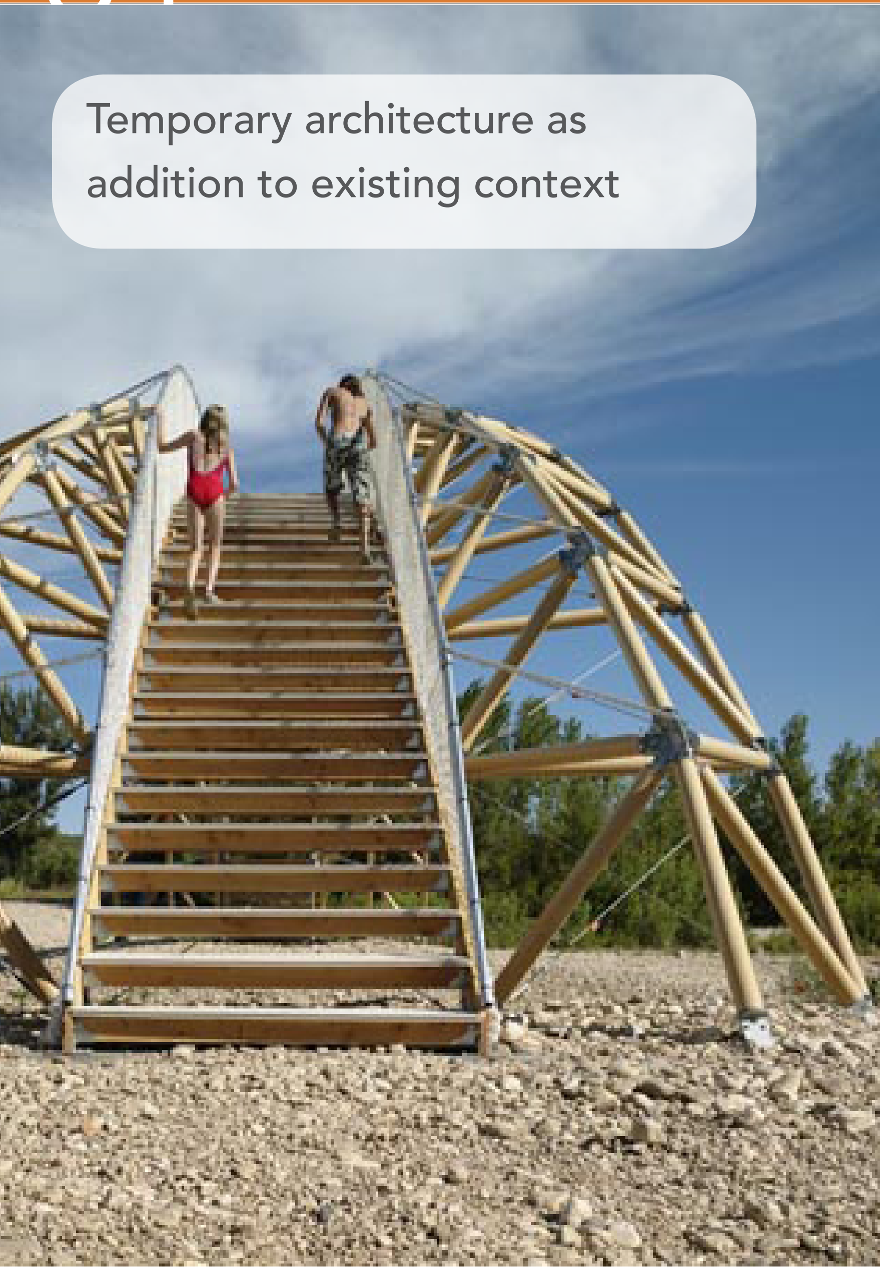
Types of temporary architecture

According to Robert Kronenburg, mobile and temporary building systems can be divided into three specific types:

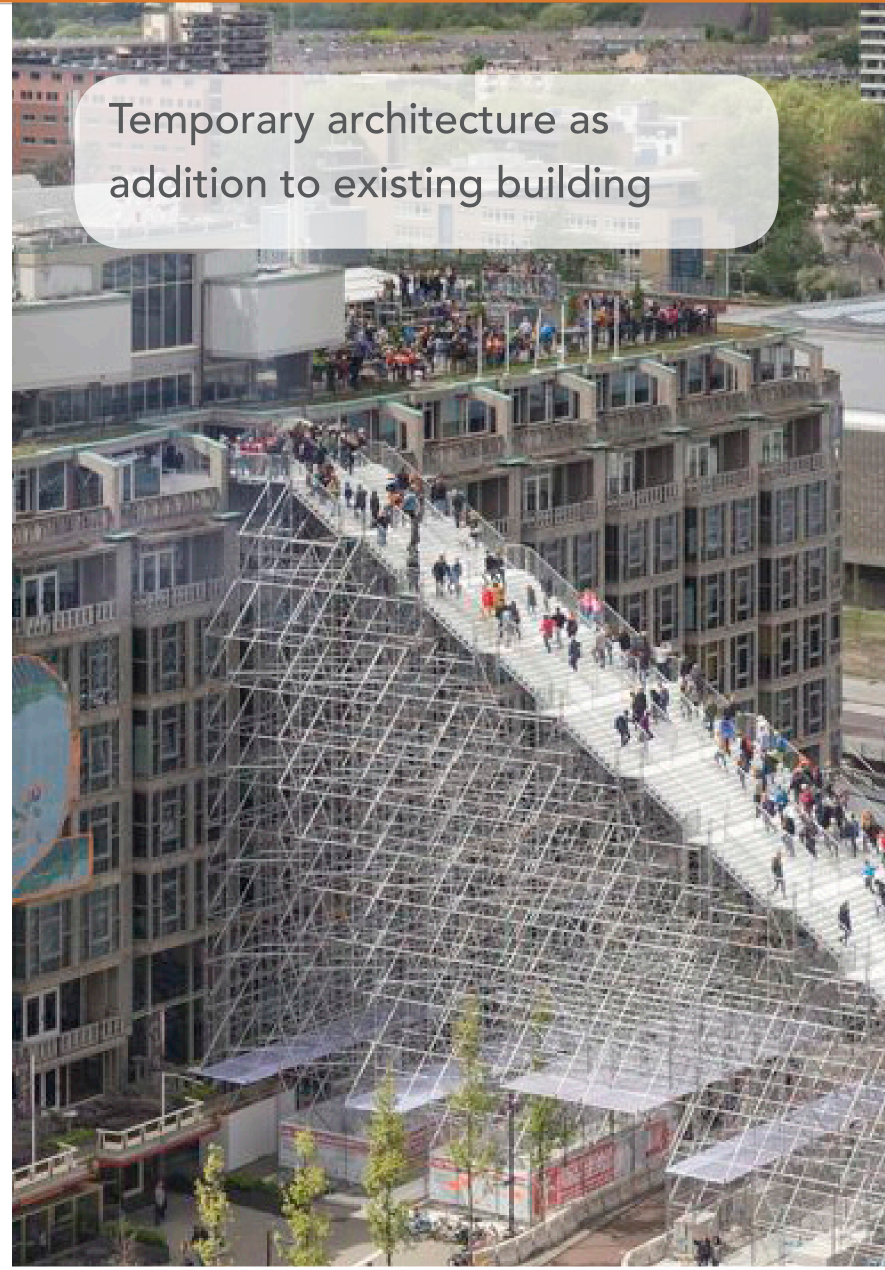
1) Portable buildings/structures

2) Relocatable buildings/structures

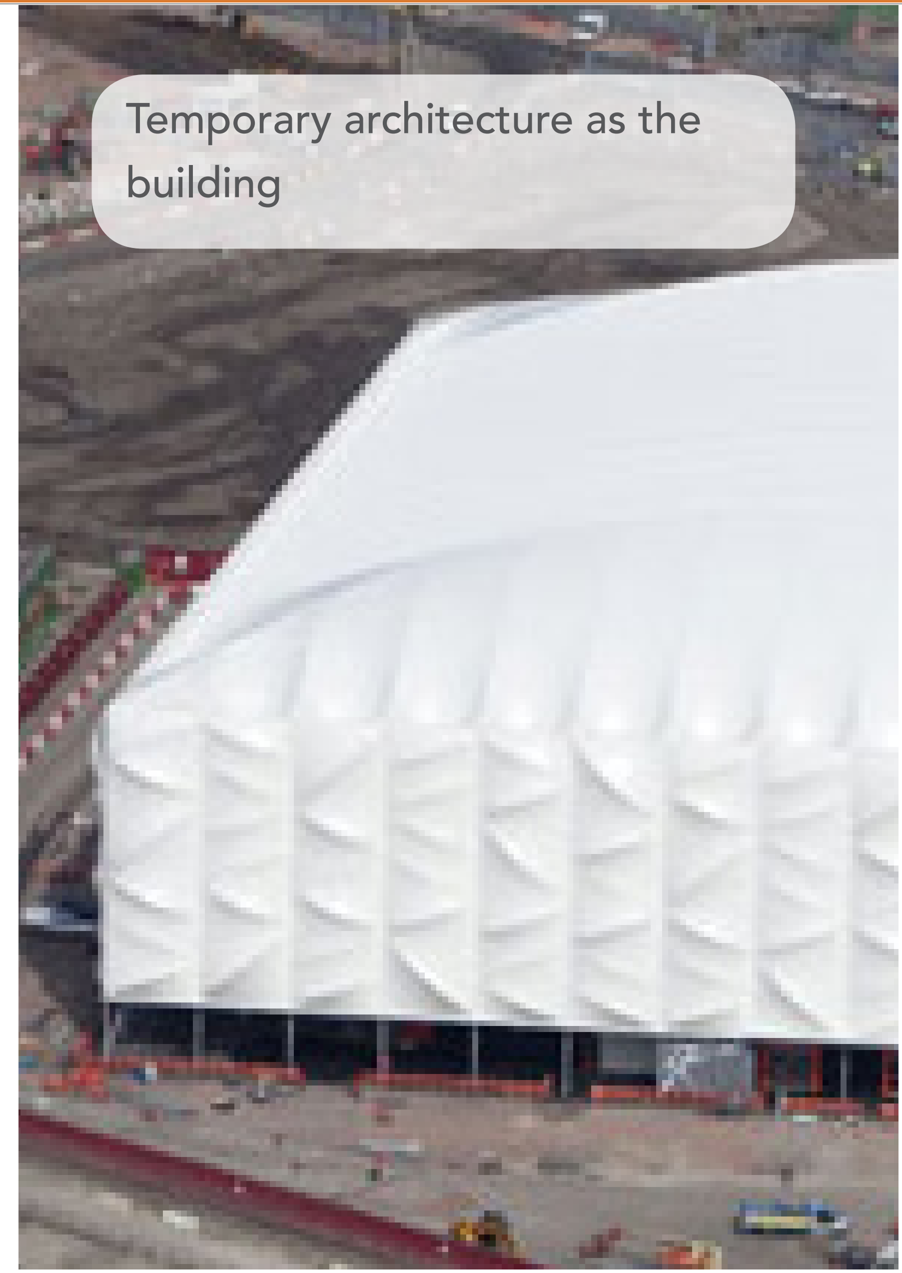
3) Demountable buildings/structures



Paper Bridge by Shigeru Ban, France
Images: online source



The stairs to Kriterion by MVRDV, Rotterdam



London 2012 Basketball Arena
by Sinclair Knight Merz

"However, portable (moveable) buildings, though temporary in location, are not temporary in use. Their portability is precisely what makes them not disposable. The fact that they can be re-used means that they can represent an efficient use of materials and resources, and should therefore be designed with care. They are high-quality products tuned to a specific need if not a specific location."

Kronenburg, Robert. Architecture in Motion. : Taylor and Francis, 2013. ProQuest Ebook Central. Web. 24 October 2016.

Design Goal: Folly/ Pavillion → Arena

FLEXIBILITY

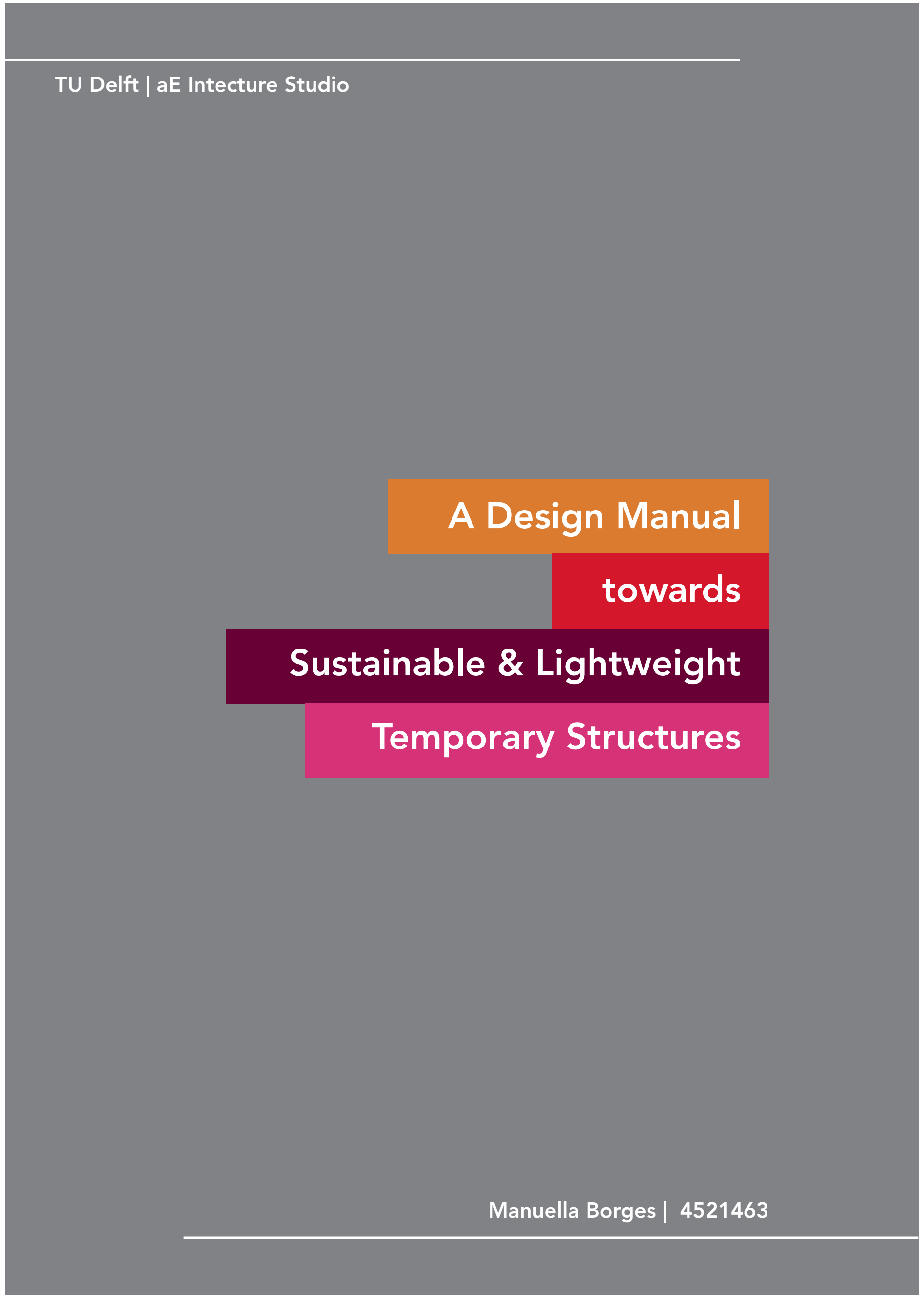
Temporary architecture is **not disposable,**

but rather it can mean **flexible & re-usable**

Overall Design Question

How can temporary architecture used in events be designed to be easily assembled and disassembled in order to adapt to different programmatic needs and project scales when its temporary need has ceased to exist?

Content



Technical Research Question

Which techniques will allow for the creation of a more sustainable and flexible temporary architecture?

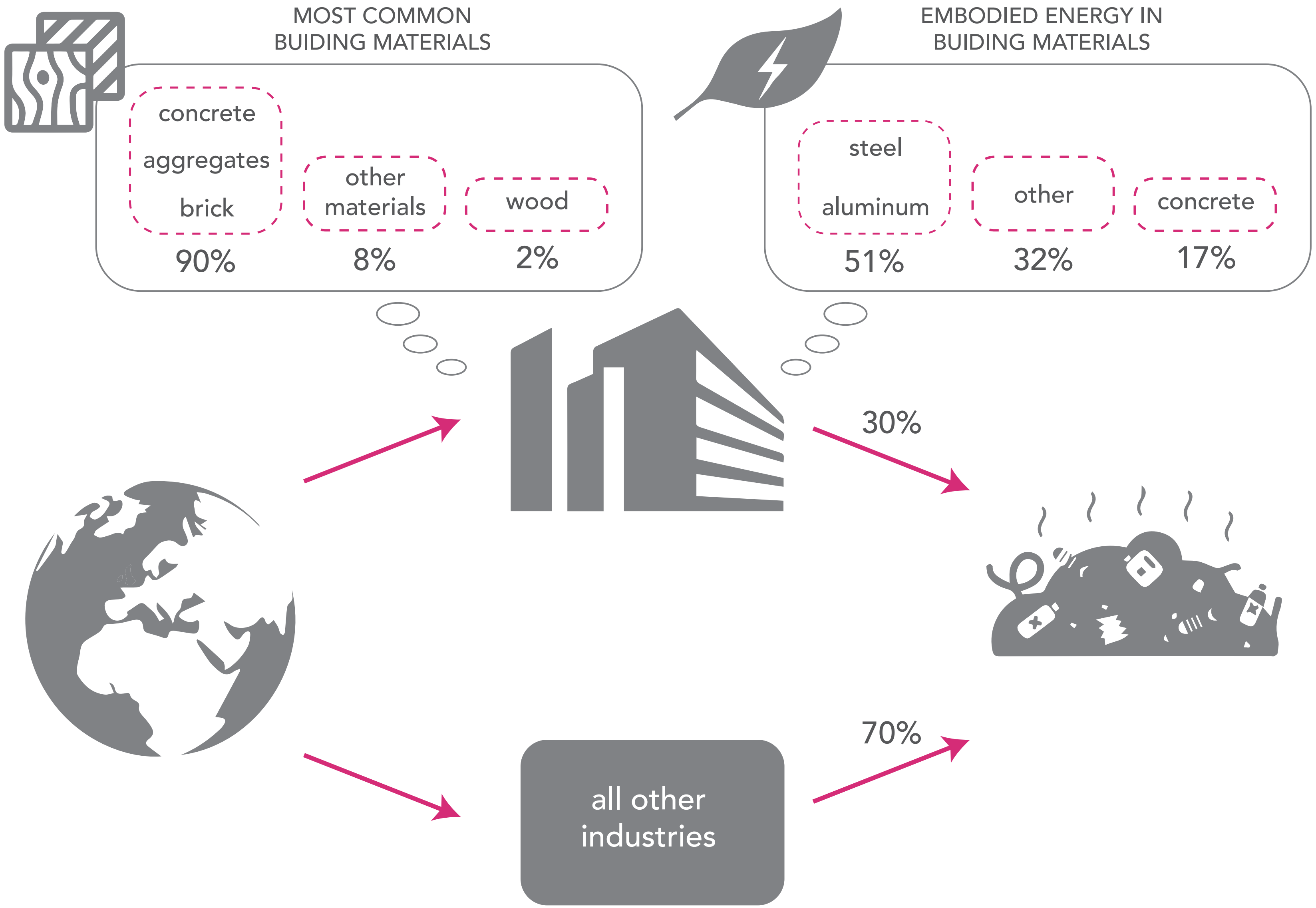
Sub-questions

What **materials** will be most suitable for the creation of lightweight and demountable structures that have low environmental impact?

What would be the optimal **sizes** for ease of handling and transportation?

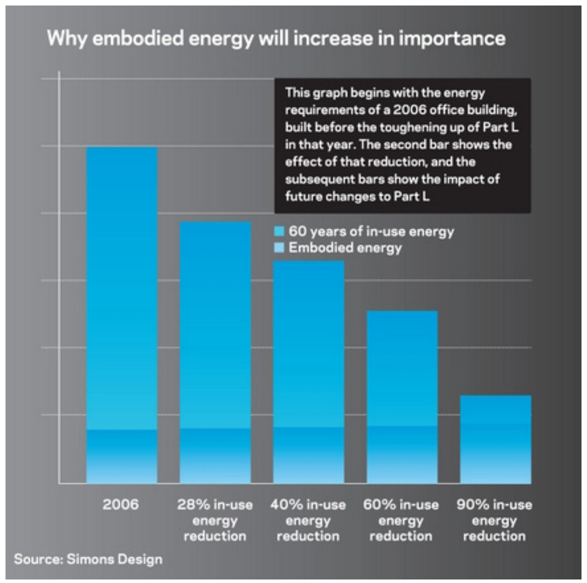
What assembly/disassembly methods and **connections** will be most suitable?

Problem statement concerning building materials



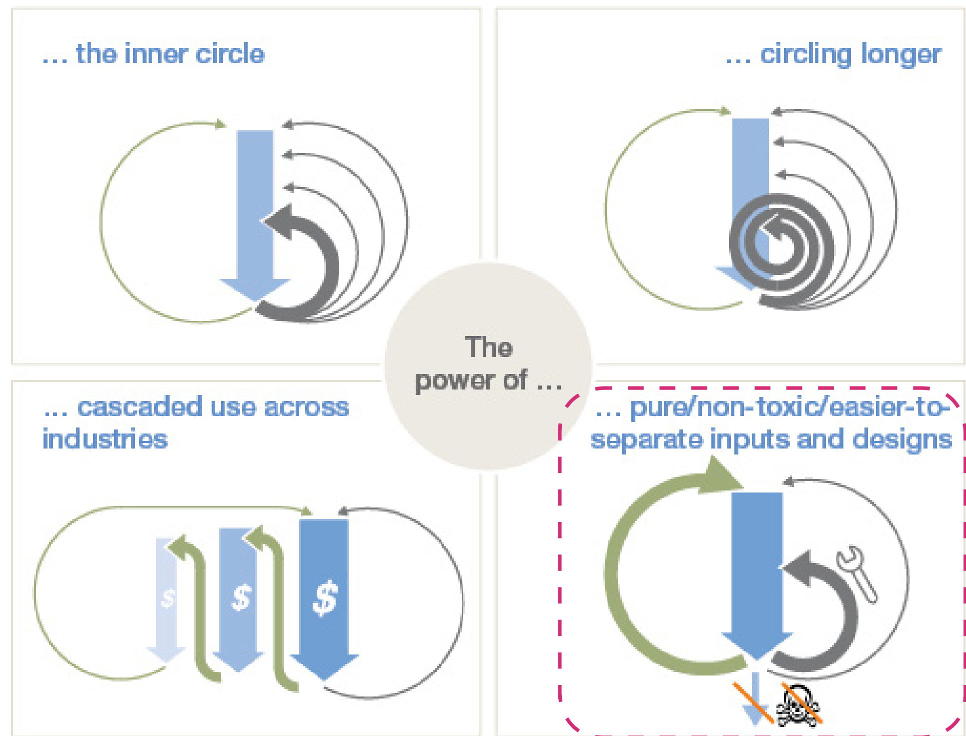
Problem statement concerning building materials

Embodied Energy of Materials as a Rising Issue



Embodied Energy Analysis.
Source: http://www.bdonline.co.uk/

The Pure Cicle as the Key for Material Re-use & Less Embodied Energy



Design for Disassembly
Modular
Lightweight
Temporary

Four Principles for Circular Economy
Source: Ellen MacArthur Foundation

Researched materials

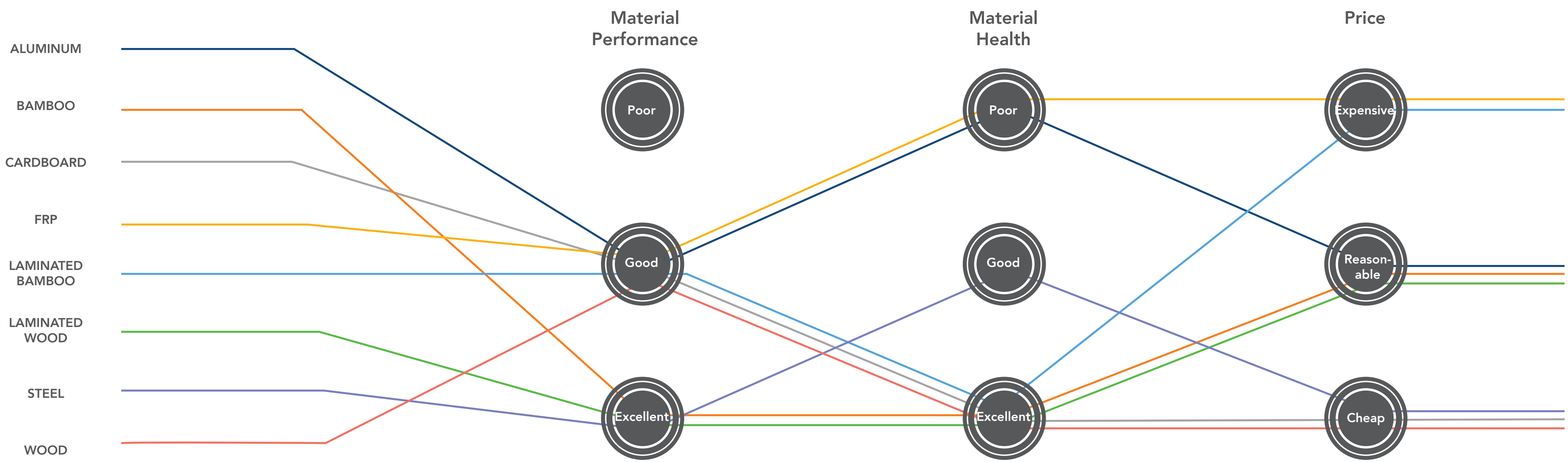
CATEGORY 1:
METALS & ALLOYS

CATEGORY 2:
COMPOSITES

CATEGORY 3:
NATURAL MATERIALS

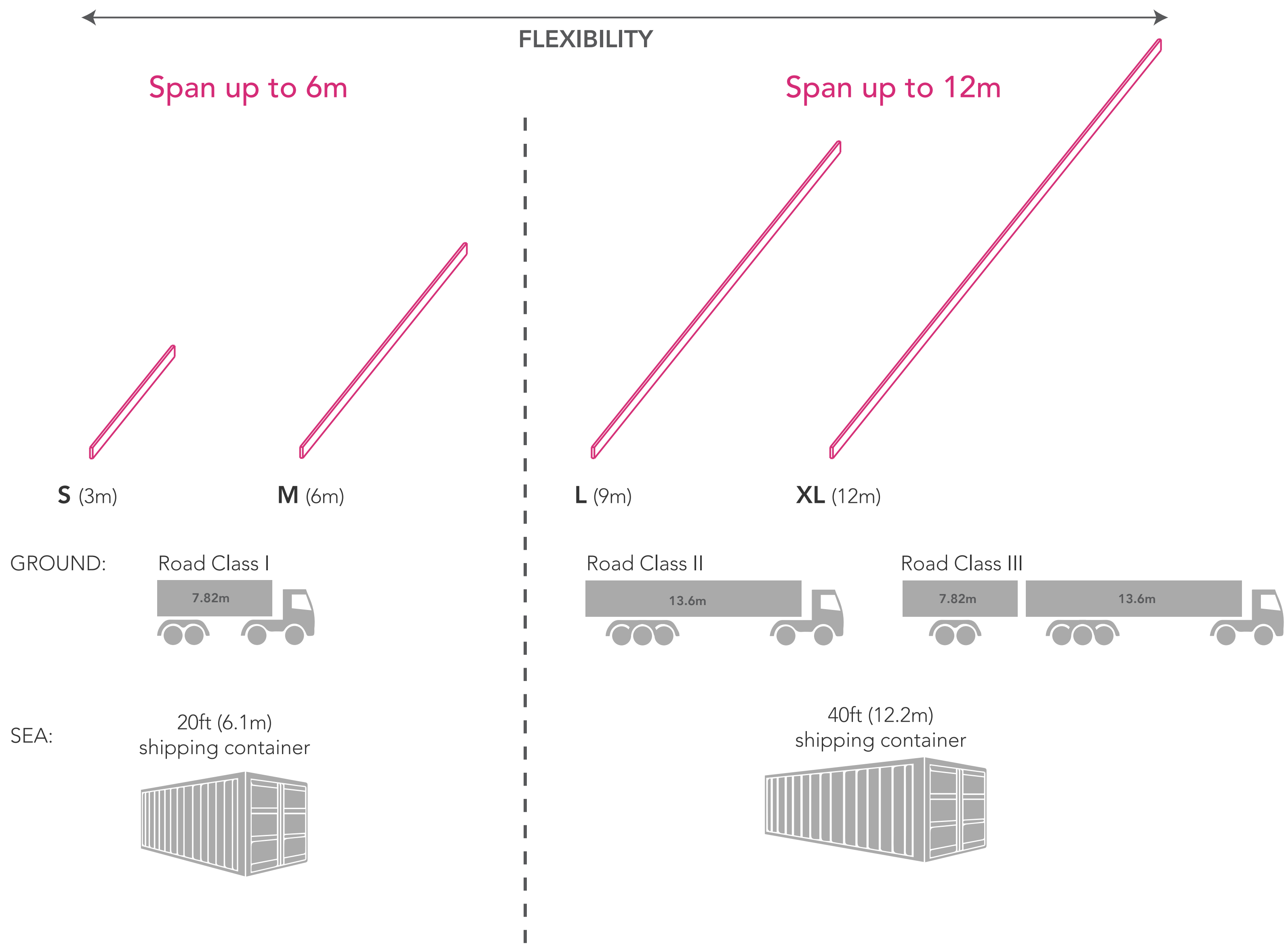
CATEGORY 4:
ENGINEERED MATERIALS

Final results per material & possible scenarios

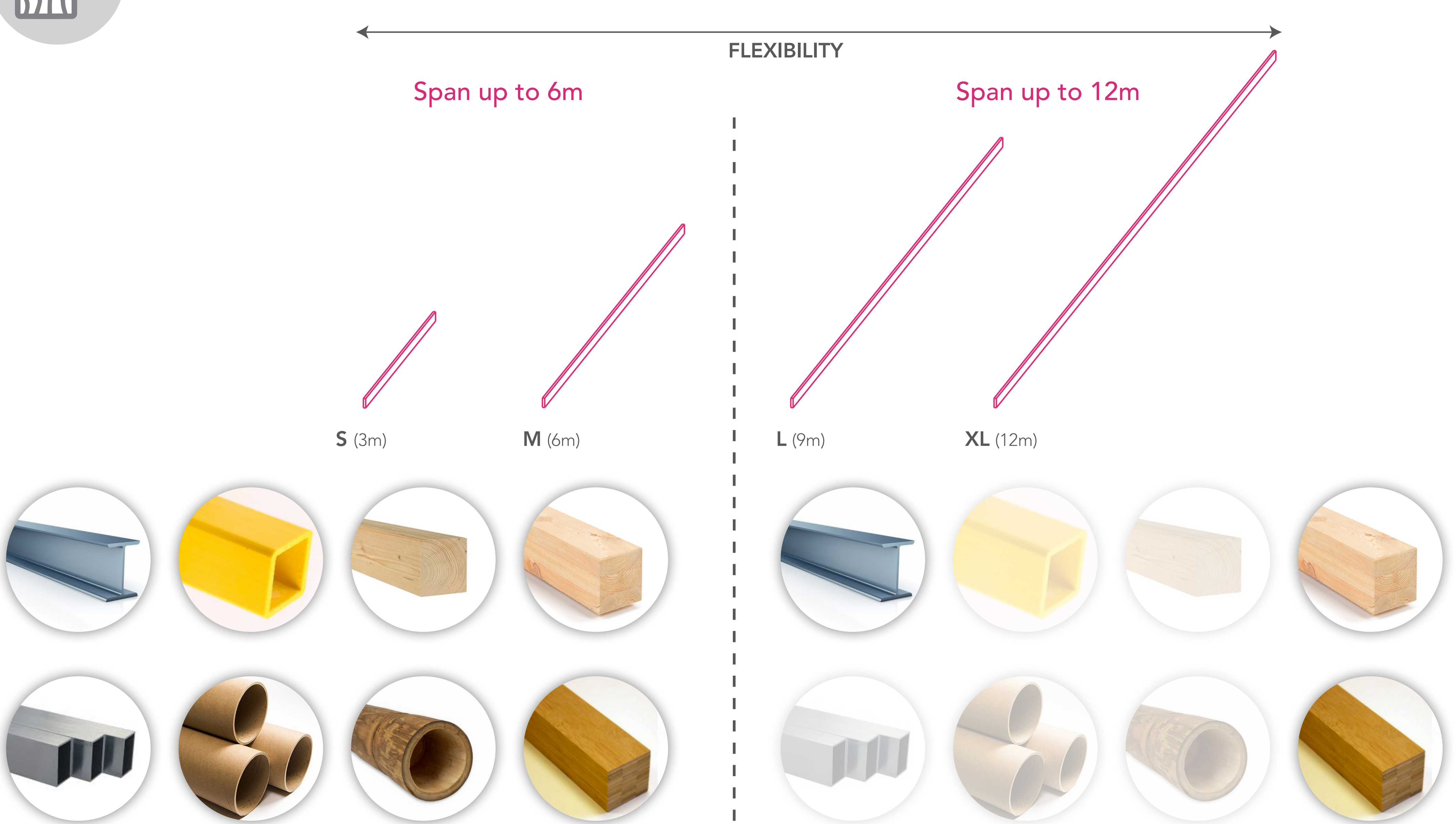


Criteria I: Material Performance	Criteria II: Material Health	Criteria III: Cost
Poor: 1 – 18 points	Poor: 1 – 18 points	Expensive: 1 – 18 points
Good: 19 – 36 points	Good: 19 – 36 points	Reasonable: 19–36 points
Excellent: 37 – 56 points	Excellent: 37 – 56 points	Cheap: 37 – 56 points

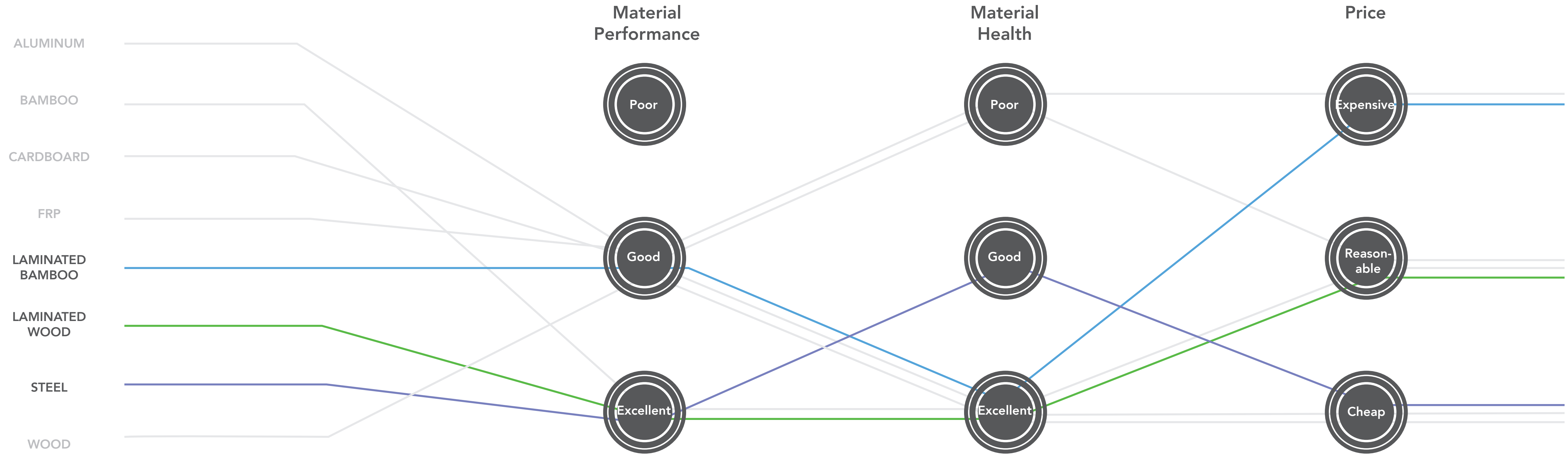
Material choice influenced by transportation methods and span sizes



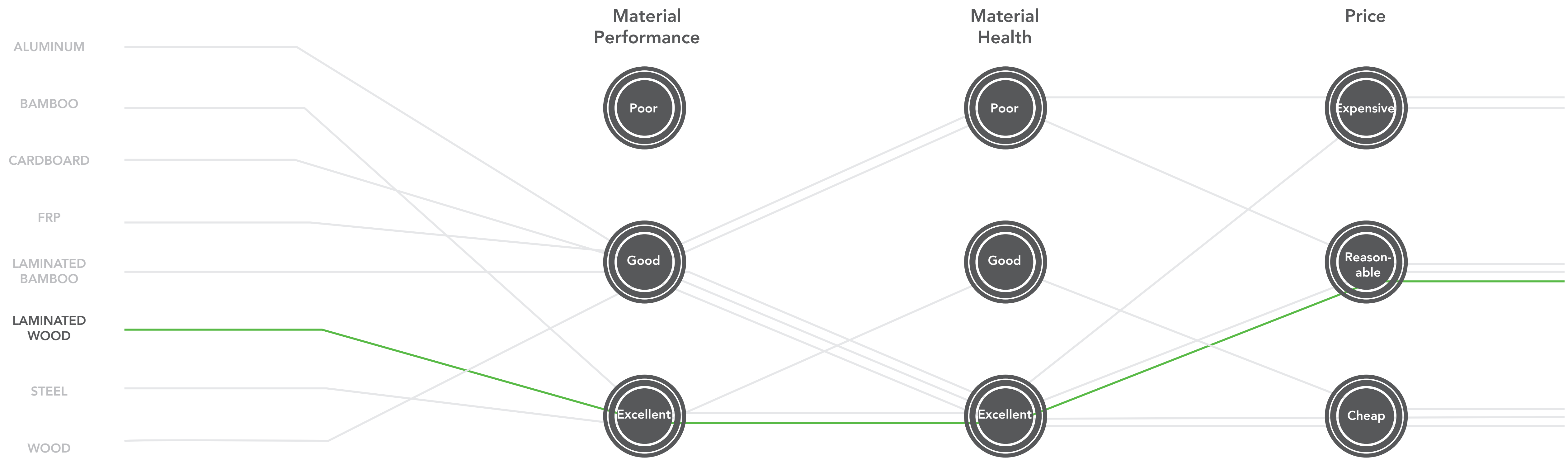
Material choice influenced by transportation methods and span sizes



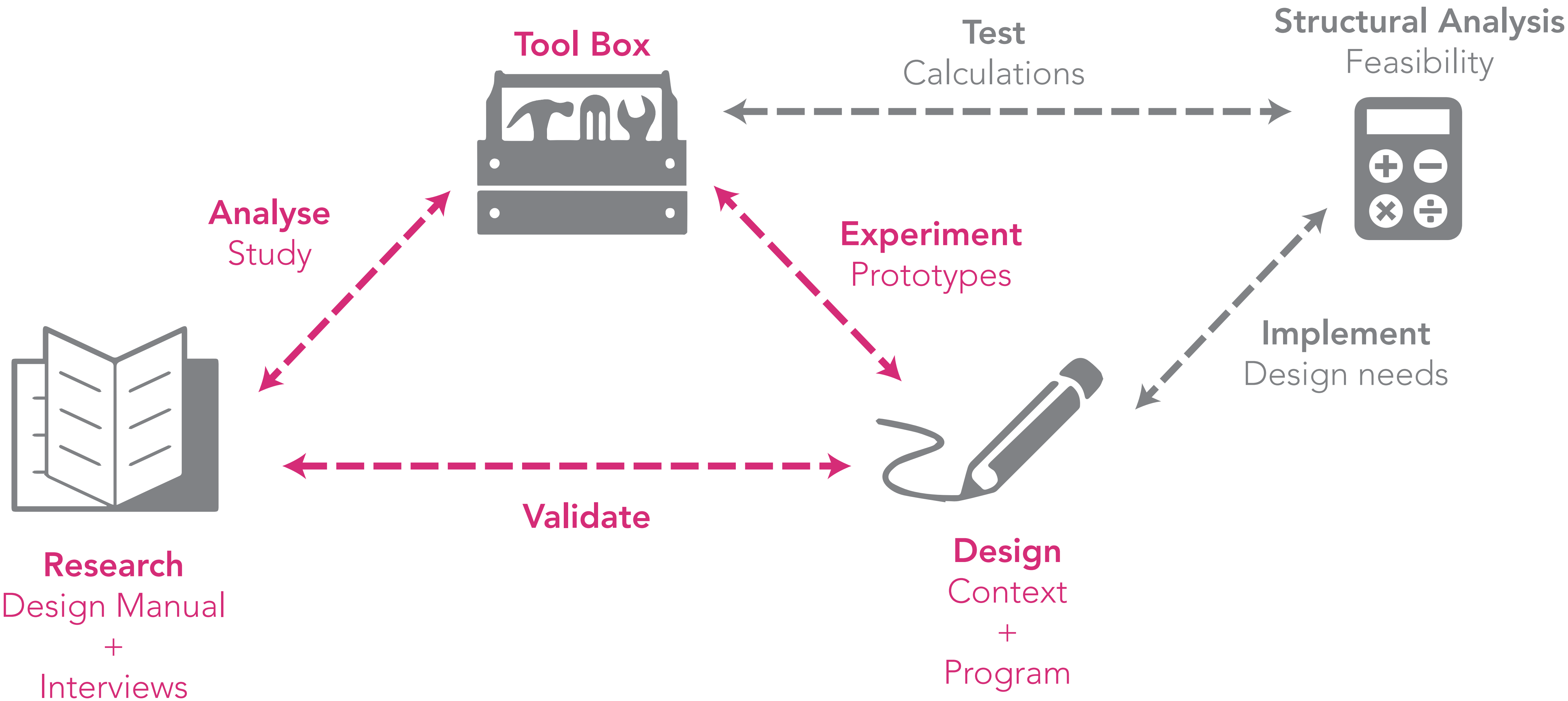
Shortlisted Materials

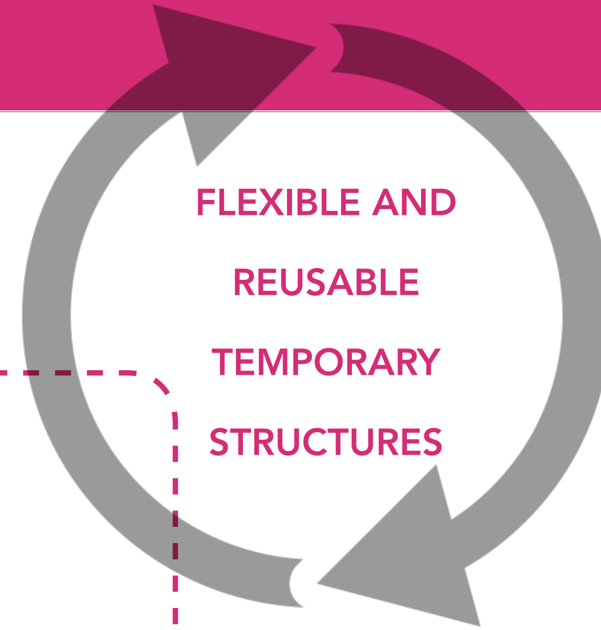


Chosen scenario

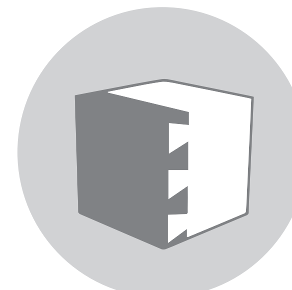


Methodology



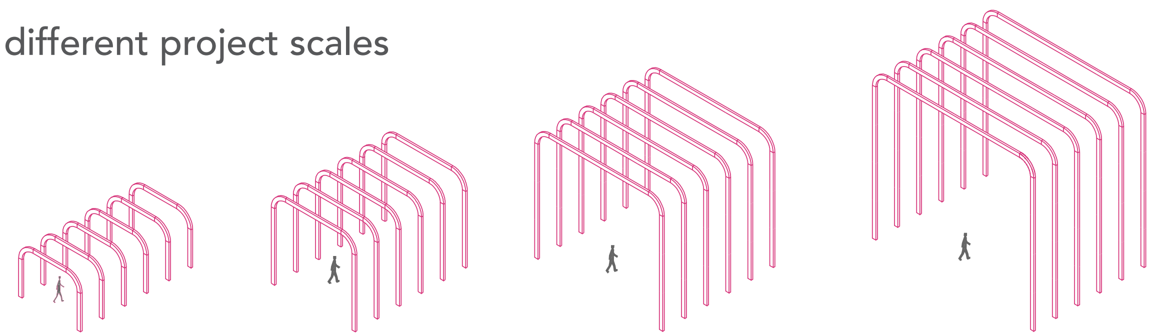


Design Principles

01	02	03
		
Lightweight	Flexible	Easy to Assemble
Durable	Modular	Easy to Disassemble
Sustainable	Easy to transport	Few parts
Affordable	Easy to handle on site	Simplified design

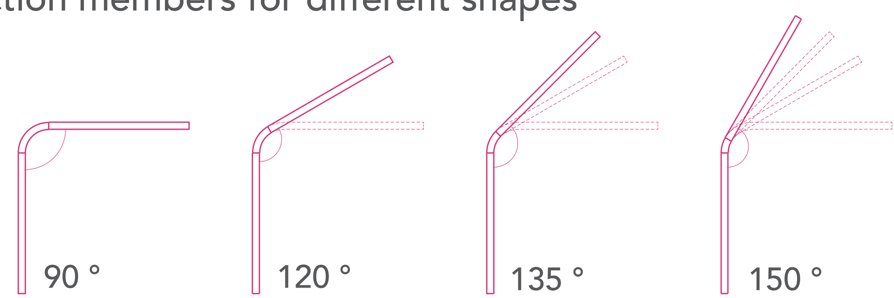
Modularity

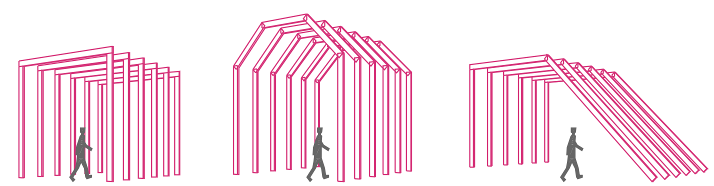
Modular sizes for different project scales



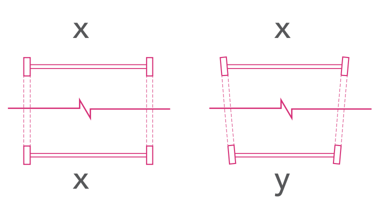
Flexibility

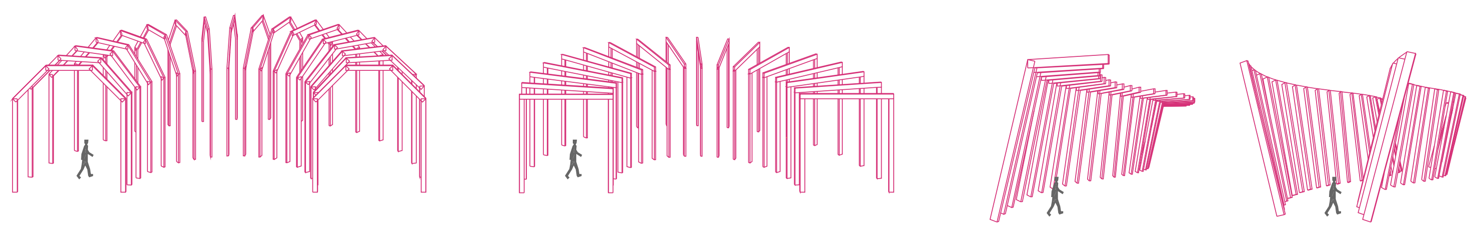
Curved connection members for different shapes





Bracing of different sizes to add curvature to designs

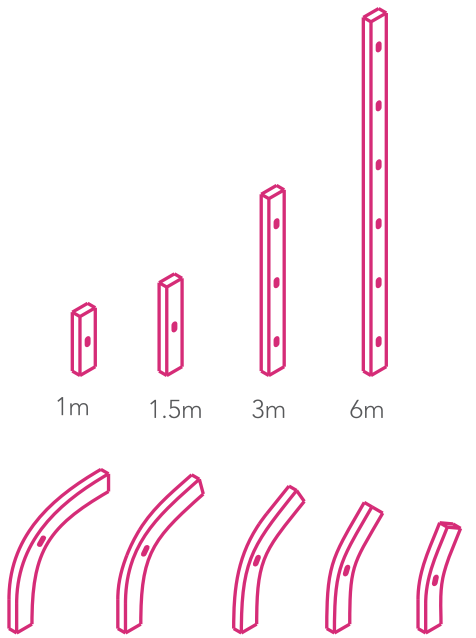




Preliminary Toolbox Design

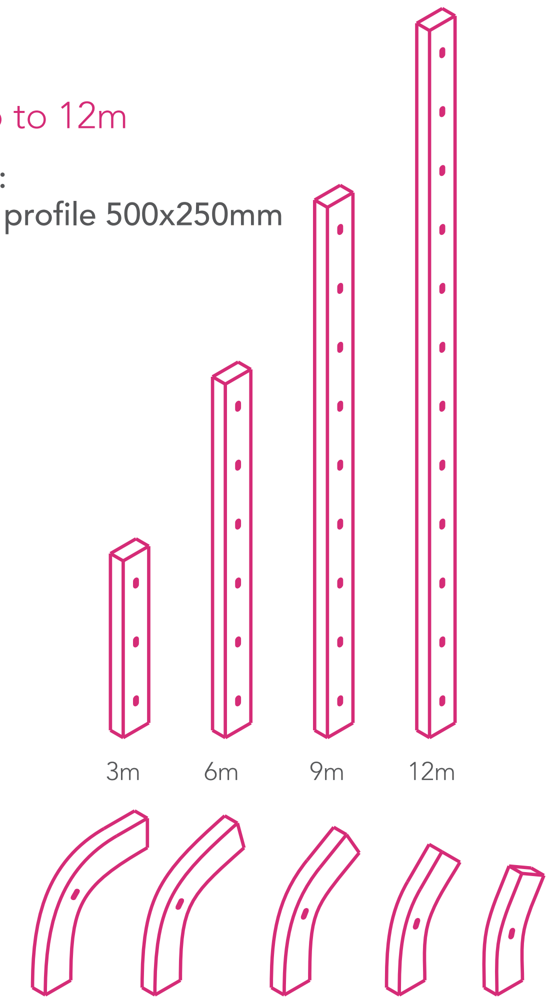
Span up to 6m

System I:
sectional profile 300x150mm

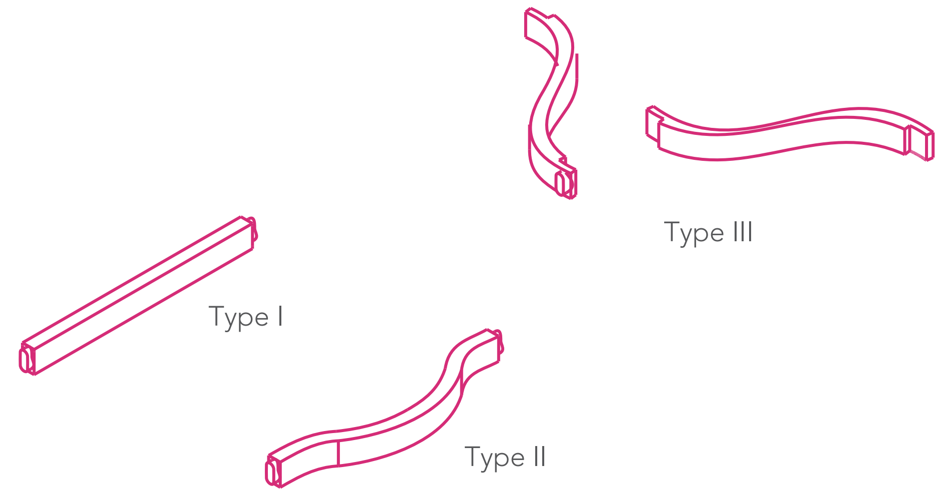


Span up to 12m

System II:
sectional profile 500x250mm

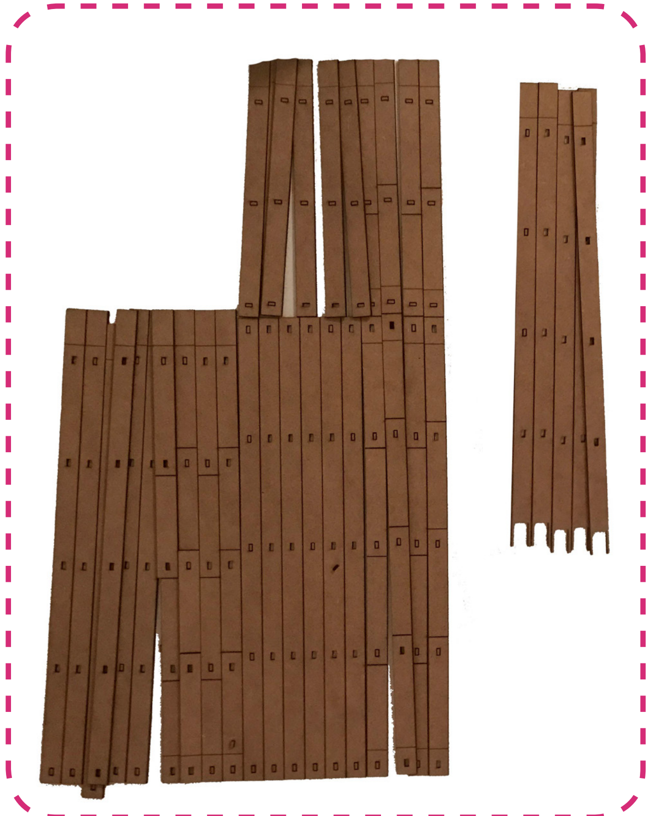


Primary Structure



Secondary Structure (Bracing)

First Model to test idea

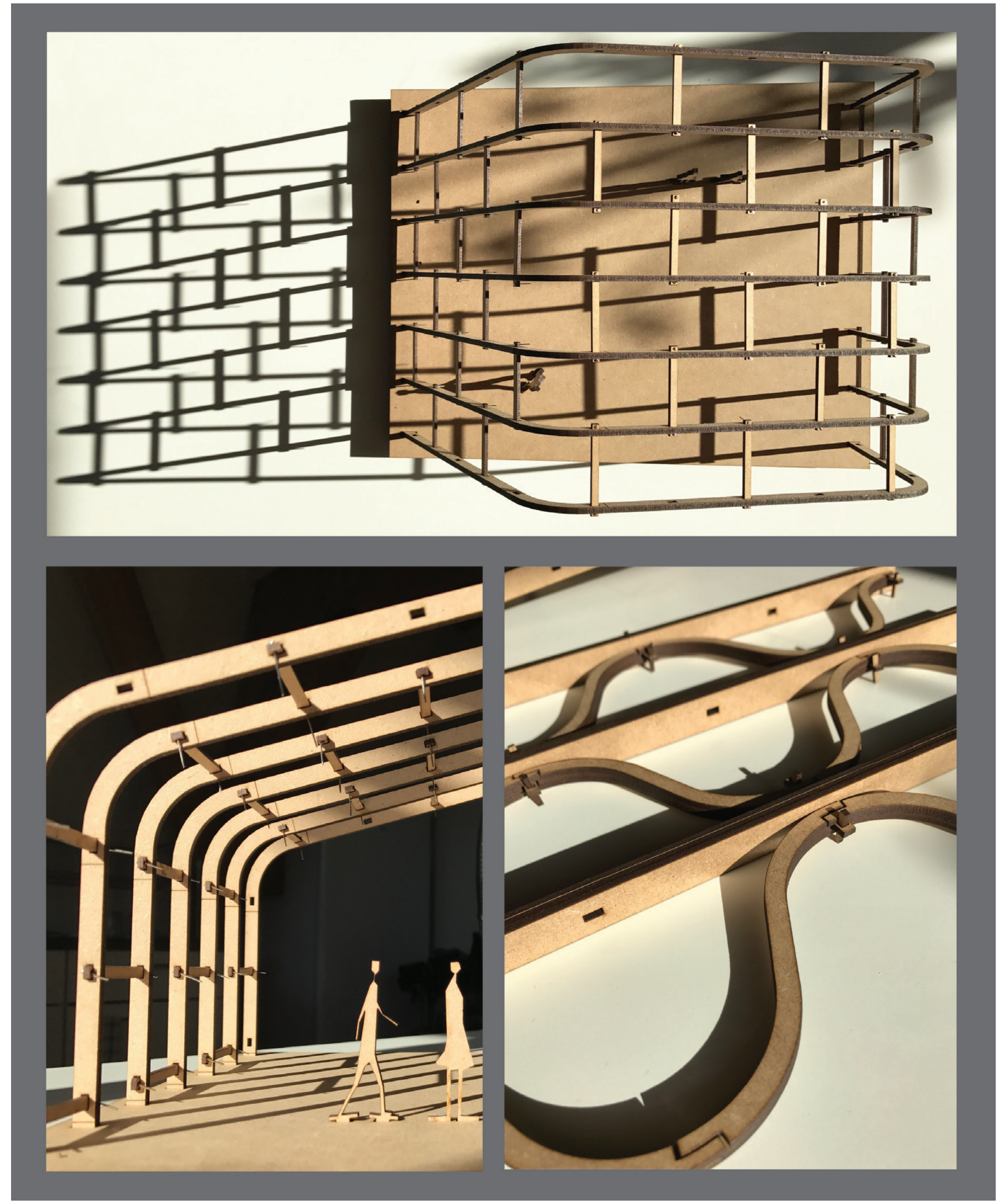


Modular sizes - main structure

Curved connection members

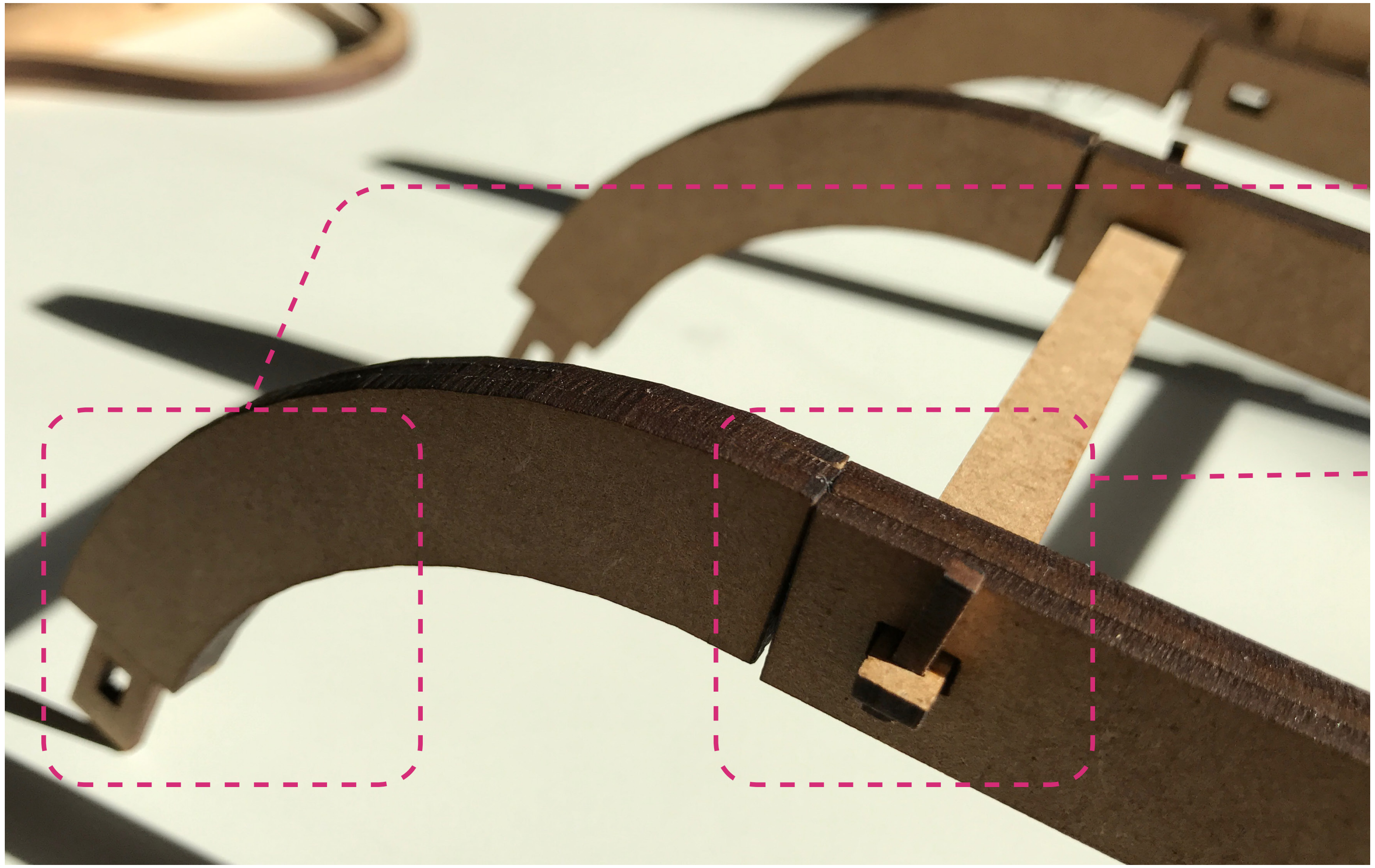
Bracing of different types for design customization

Before Assembly



After Assembly

First Model main findings



1) Wood on wood connections offered weak points with concentrated stresses in small woden sections.

2) Primary structure had reduced sectional profile at connection, which reduced structural instability

3) Linking primary and secondary structures (the bacing) created moment on the primary structure due to structural instability

SOLUTION:

a) Use much bigger wooden members
b) Adopt to steel connections and do some structural analysis

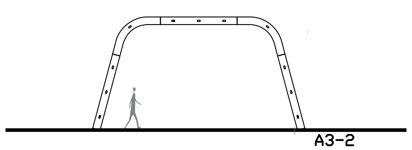
Structural challenge:

1) Determine the limits of toolbox design in terms of possible and structurally sound structures.

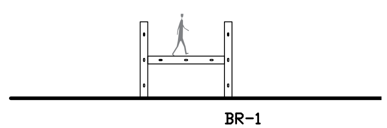
2) Design connections according to stress loads.

Possible typologies

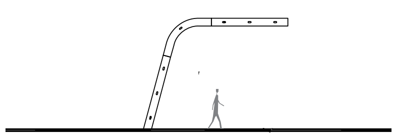
ROOFS



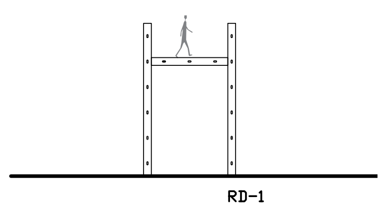
FOOTBRIDGES



CANOPIES



ROOF DECKS



Load Combinations:

Eurocode 1		Canadian Building Code	
H	1KN/m^2	Roofs	1,0 KN/m^2
C1	3KN/m^2	Assembly areas (class b)	2,4 KN/m^2
C5	5KN/m^2	Balconies and Footbridges	4,8 KN/m^2

EUROCODE 5
COMBINATIONS OF ACTIONS (LOADS)

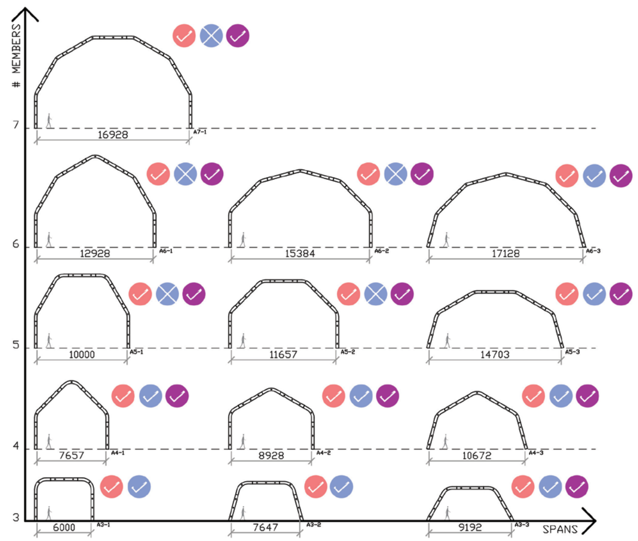
* Characteristic Actions according to		EN 1991
G_k	PERMANENT	e.g.; Self-weight
Q_k	VARIABLE	e.g.: wind, snow, traffic, imposed loads
A_k	ACCIDENTAL	e.g.: impact, fire

DESIGN SITUATION	γ_G	γ_Q
Structural Design Calculation		
favourable effect	1,0	-
unfavourable effect	1,35	1,5
Check at servicability limit state	1,0	1,0

FORMULAS USED :			
(not considering reduction factors Ψ0, Ψ1 and Ψ2 used to factor load reducing it depending on duration exposure)			
ULS	structural design	$1{,}35 * G_k + 1{,}5 * Q_k$	vertical axis for selft weight and imposed load
		$1{,}5 * Q_k$	horizontal axis for wind load
SLS	sevicability	$1{,}0 * G_k + 1{,}0 * Q_k$	vertical axis for selft weight and imposed load
		$1{,}0 * Q_k$	horizontal axis for wind load

Index

Roofs



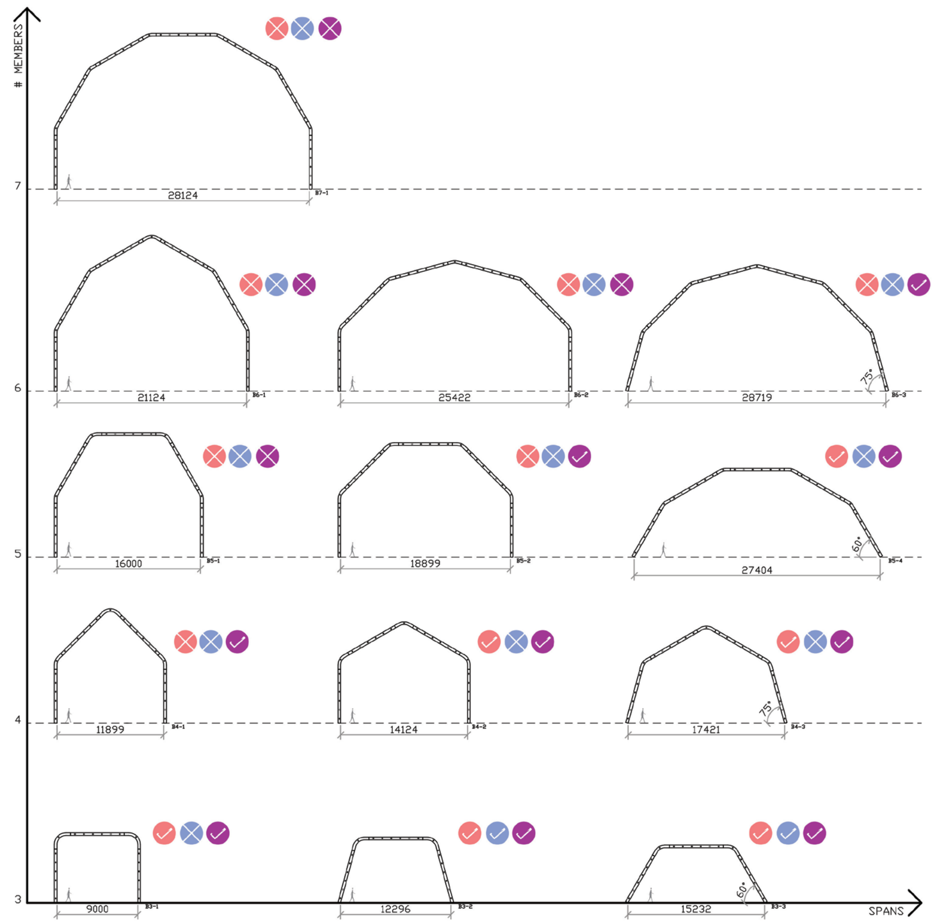
3m members

LEGEND SYSTEM I

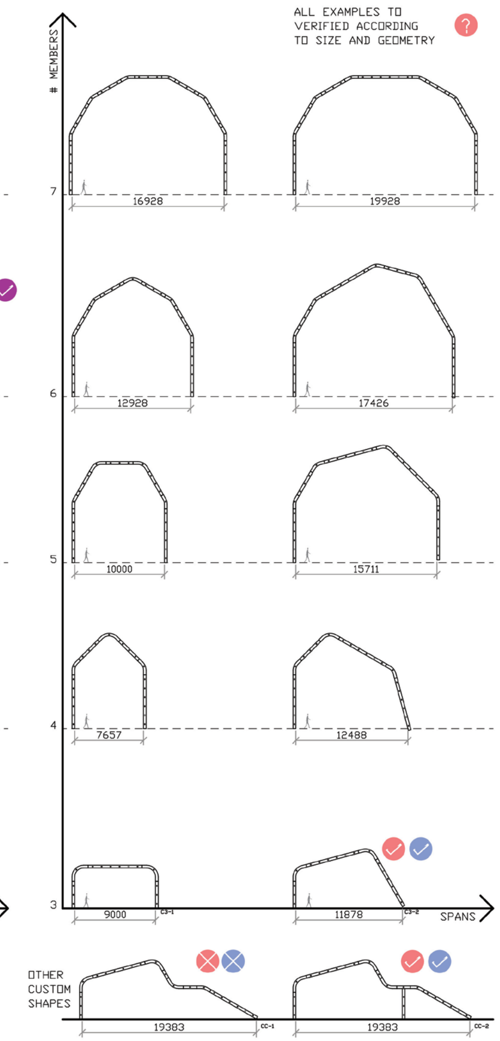
- FIXED SUPPORT CONNECTION FAILED 'SLS' CHECK
- FIXED SUPPORT CONNECTION PASSED 'SLS' CHECK
- HINGED SUPPORT CONNECTION FAILED 'SLS' CHECK
- HINGED SUPPORT CONNECTION PASSED 'SLS' CHECK

LEGEND SYSTEM II

- HINGED SUPPORT CONNECTION FAILED 'SLS' CHECK
- HINGED SUPPORT CONNECTION PASSED 'SLS' CHECK

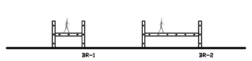


6m members

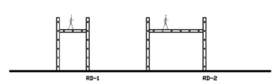


Hybrid members

Footbridges

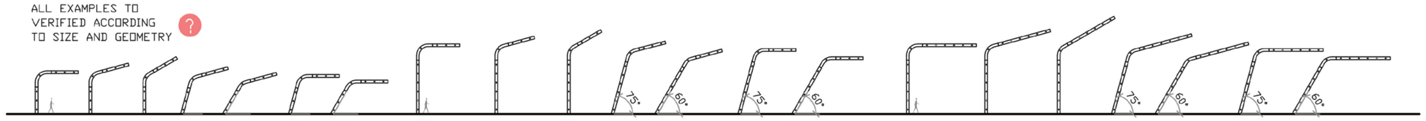


Usable Roofs



Canopies

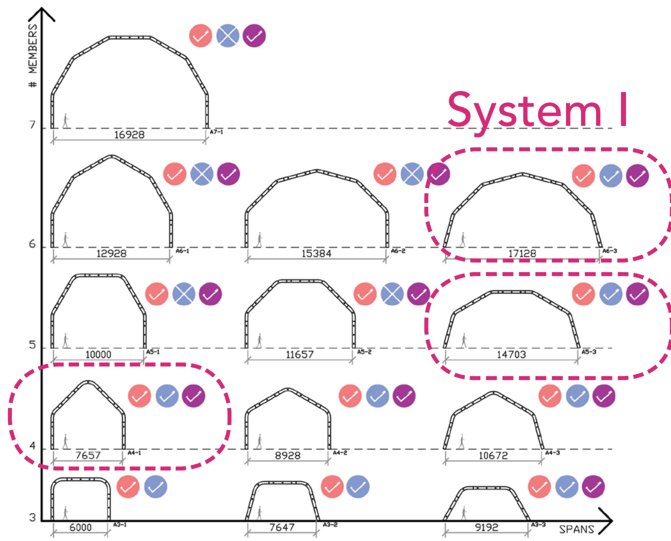
ALL EXAMPLES TO VERIFIED ACCORDING TO SIZE AND GEOMETRY



3m members | hybrid members | 6m members

Most critical frames

Roofs



3m members

LEGEND SYSTEM I

FIXED SUPPORT CONNECTION FAILED 'SLS' CHECK

FIXED SUPPORT CONNECTION PASSED 'SLS' CHECK

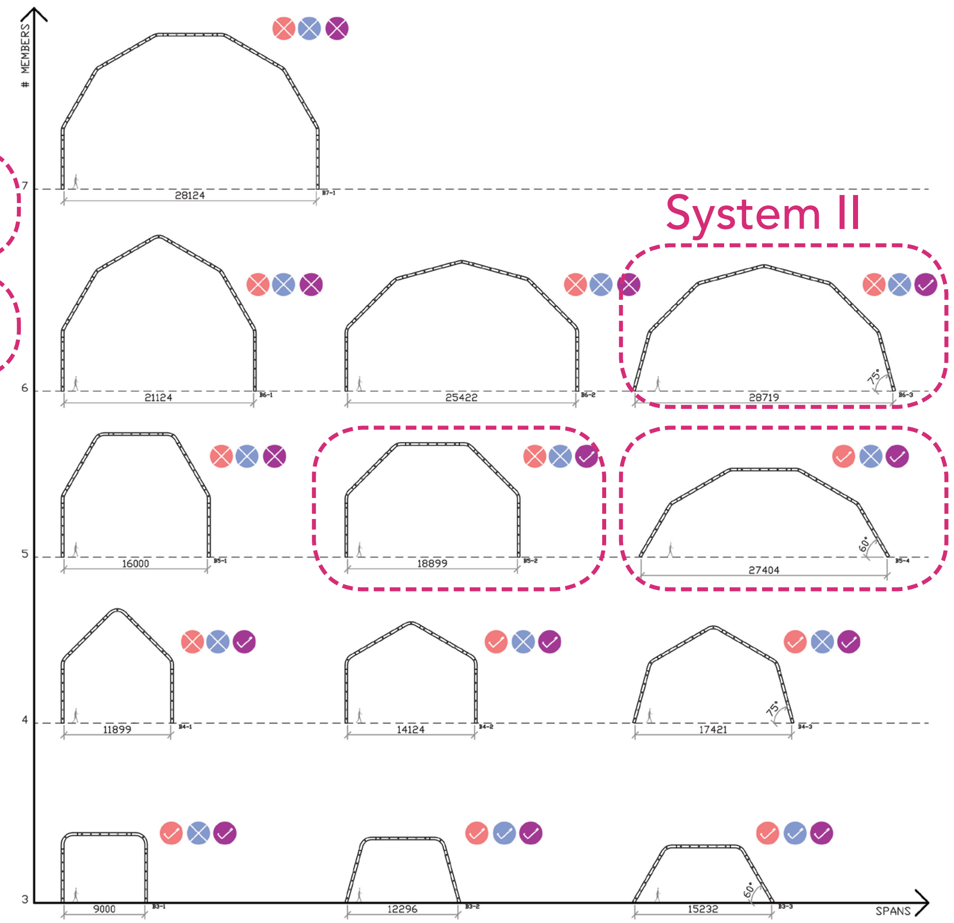
HINGED SUPPORT CONNECTION FAILED 'SLS' CHECK

HINGED SUPPORT CONNECTION PASSED 'SLS' CHECK

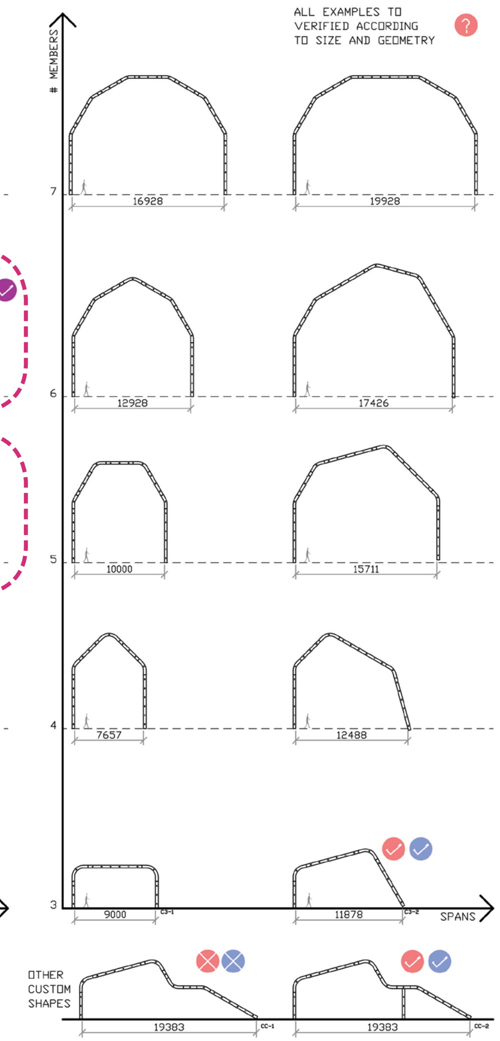
LEGEND SYSTEM II

HINGED SUPPORT CONNECTION FAILED 'SLS' CHECK

HINGED SUPPORT CONNECTION PASSED 'SLS' CHECK



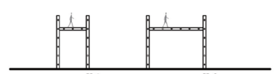
6m members



Hybrid members

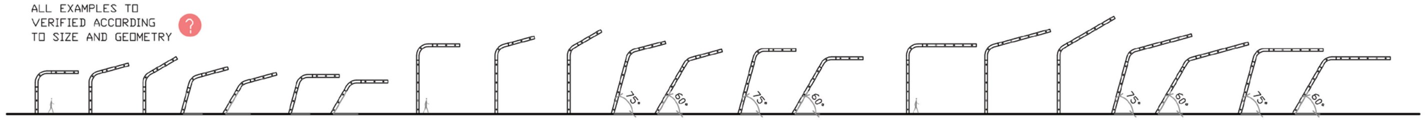
Footbridges

Usable Roofs



Canopies

ALL EXAMPLES TO VERIFIED ACCORDING TO SIZE AND GEOMETRY



3m members hybrid members 6m members

Most critical roof frames that passed SLS analysis for System I

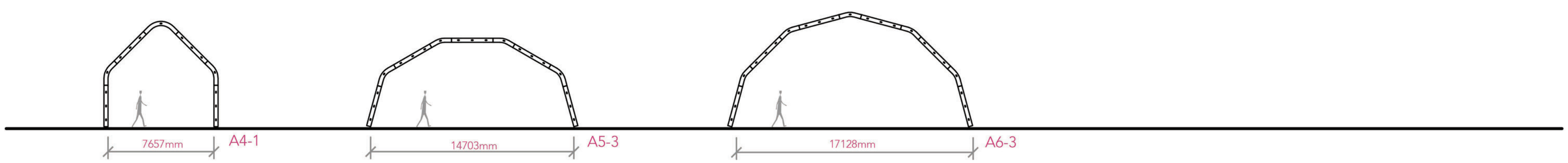
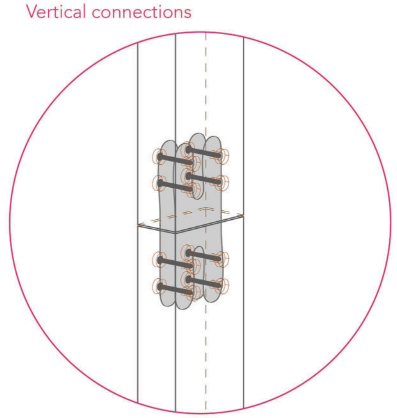


Table of maximum stresses at connections

PINNED BASE CONNECTION - SYSTEM I

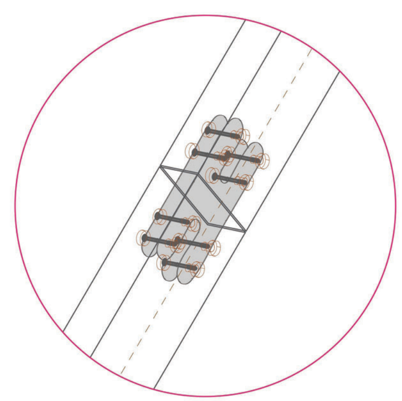
FRAME TYPE	VERTICAL CONNECTION				INCLINED CONNECTION				HORIZONTAL CONNECTION			
	AxialForceN (KN)	ShearForce F (KN)	Bending Moment M (KN.m)	Stress σ (KN/m²)	AxialForceN (KN)	ShearForce F (KN)	Bending Moment M (KN.m)	Stress σ (KN/m²)	AxialForceN (KN)	ShearForce F (KN)	Bending Moment M (KN.m)	Stress σ (KN/m²)
SLS												
A4-1	-10,8	3,8	11,5	2312	-9,3	-3,9	-11,6	-2781	-	-	-	-
A5-3	-	-	-	-	-13,4	4,8	-12,8	-3138	-8,1	-4	-1,2	-446
A6-3	-	-	-	-	-17,7	6	-16,5	-4055	-	-	-	-
ULS												
A4-1	-16,1	5,7	17,1	3437	-13,8	-5,8	-17,4	-4168	-	-	-	-
A5-3	-	-	-	-	-19,8	7,1	-19,1	-4678	-11,9	-6	-1,9	-686
A6-3	-	-	-	-	-26,2	8,9	-24,6	-6041	-	-	-	-

Vertical connections



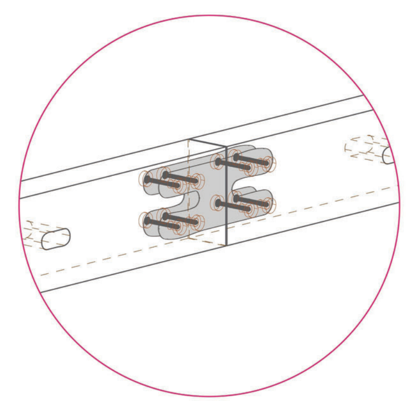
+ compression
± shear
± bending moment

Inclined connections



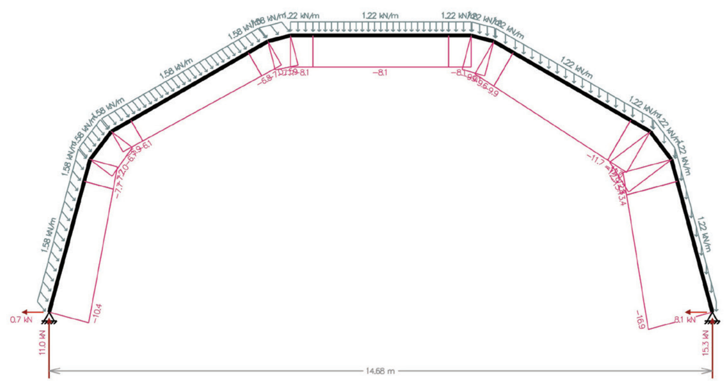
± compression
± shear
± bending moment

Horizontal connections

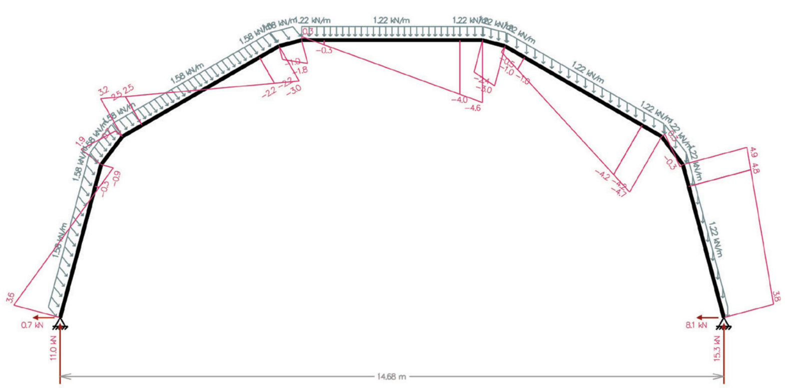


- compression
± shear
- bending moment

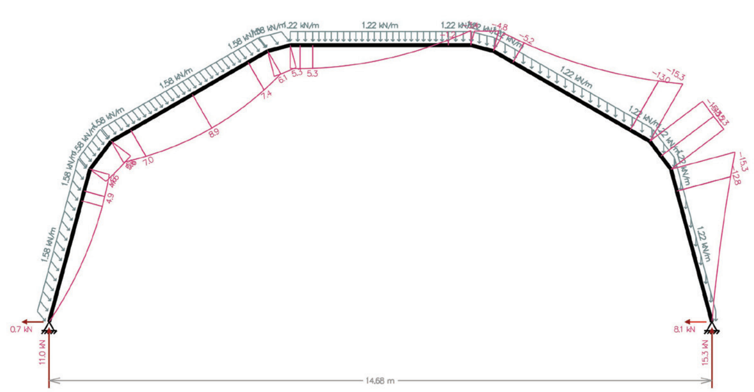
System I: Frame analysis example



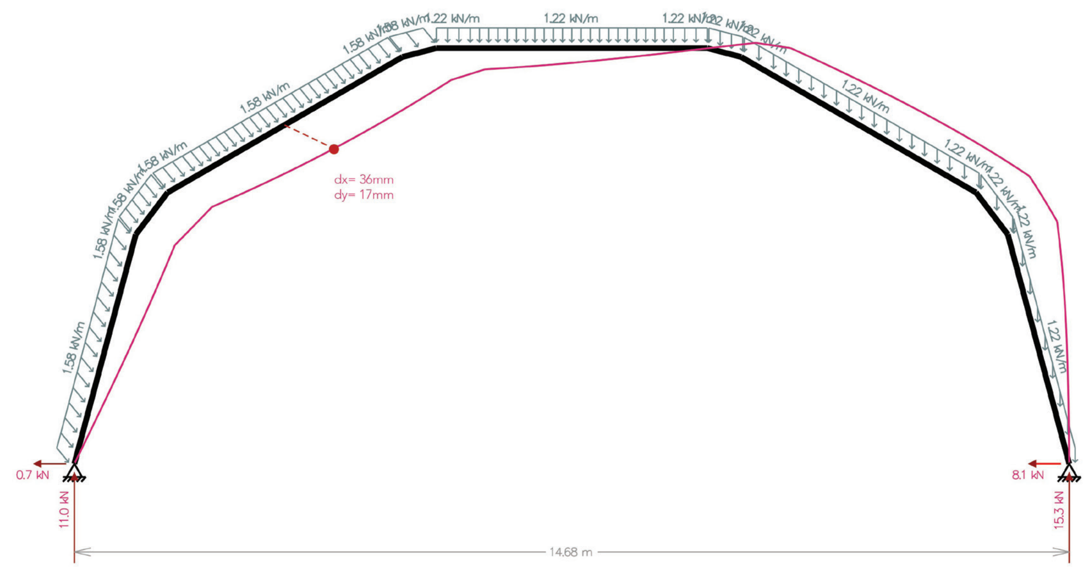
Axial Force



Shear Force



Bending Moment

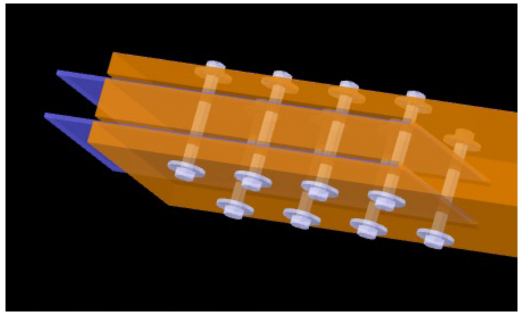


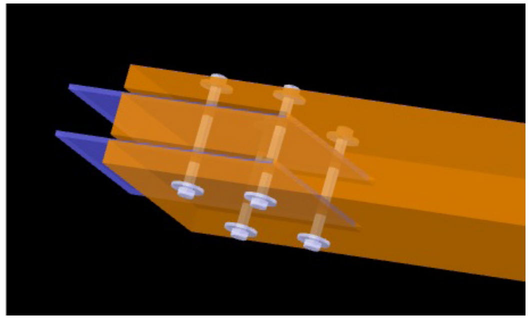
Deflection

Deformation factor on image = 20x

Max. allowable deflection = L/180 = 82mm

System I: Connection verification





Inclined Connection

Results:
2 steel plates of 8mm
8 bolts of 20mm diam. (on each side of connection)

Observation
Calculations done based on Eurocode. Model is for illustration using a similar system with steel plates and bolts inserted into Glulam wood.

Inclined connections presented significant stresses due to moment and axial forces as well as relatively moderate shear forces.

Horizontal Connection

Results:
2 steel plates of 8mm
4 bolts of 16mm diam. (on each side of connection)

Observation
Calculations done based on Eurocode. Model is for illustration using a similar system with steel plates and bolts inserted into Glulam wood.

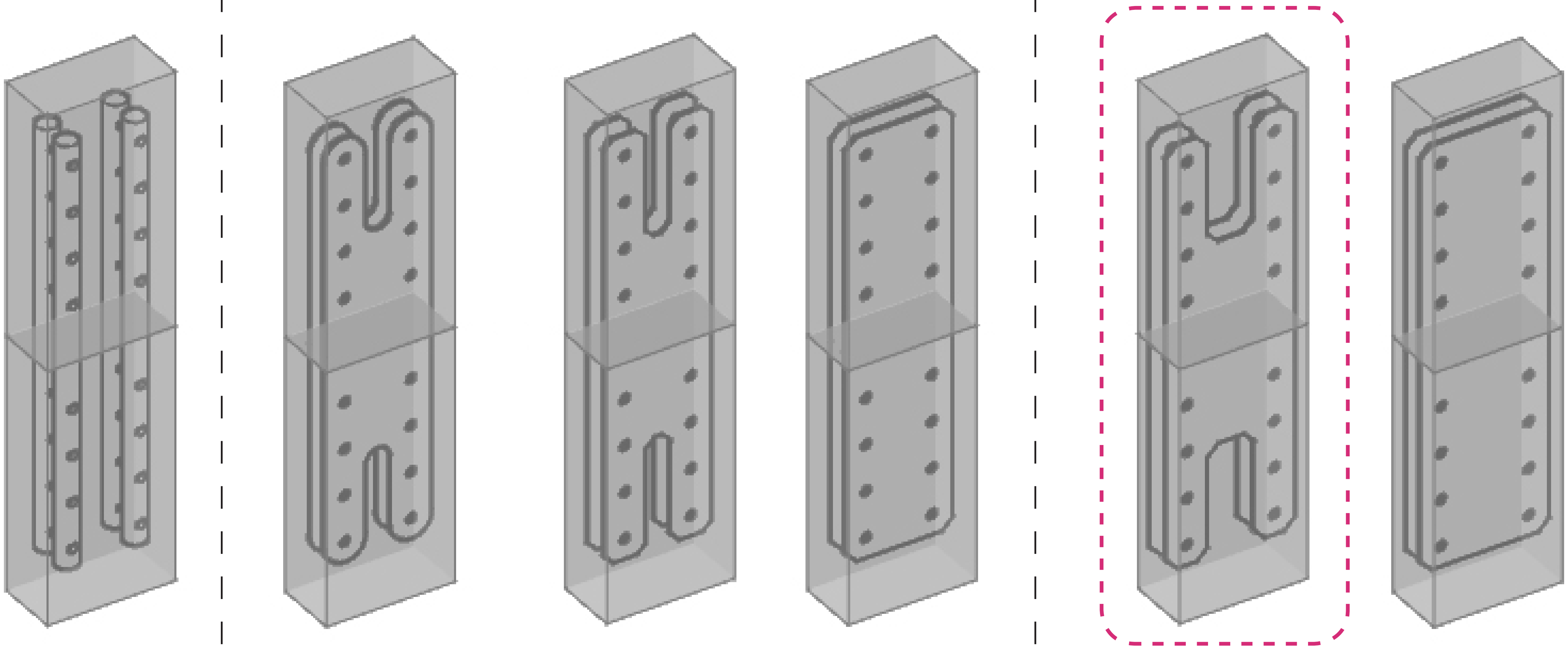
Due to little moment on the horizontal connection, 4 bolts instead of 8 were sufficient and bolts needed to address mainly shear forces.

System I: Connection design

INSERTED CONCEALED BARS

INSERTED CONCEALED PLATES

INSERTED VISIBLE PLATES



OPTION A

OPTION B

OPTION C

OPTION D

OPTION E

OPTION F

Most critical roof frames that passed SLS analysis for System II

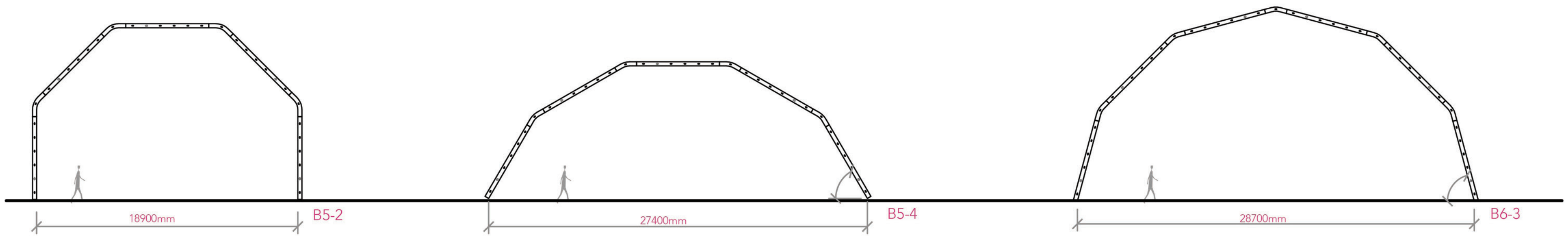
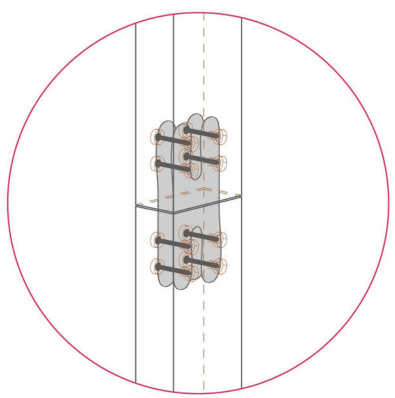


Table of maximum stresses at connections

PINNED BASE CONNECTION - SYSTEM II

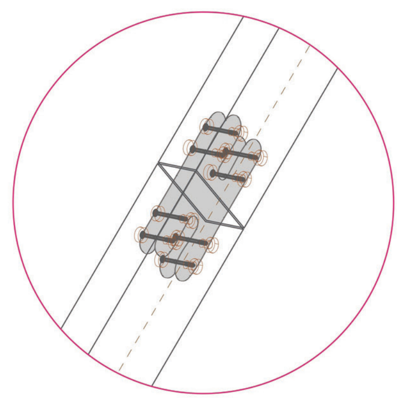
FRAME TYPE	VERTICAL CONNECTION				INCLINED CONNECTION				HORIZONTAL CONNECTION			
	AxialForceN (KN)	ShearForce F (KN)	Bending Moment M (KN.m)	Stress σ (KN/m²)	AxialForceN (KN)	ShearForce F (KN)	Bending Moment M (KN.m)	Stress σ (KN/m²)	AxialForceN (KN)	ShearForce F (KN)	Bending Moment M (KN.m)	Stress σ (KN/m²)
SLS												
B5-2	-20,2	8,3	50,1	10668	21,9	-7,7	-50,7	-10763	-8,3	-9,8	20,8	4431
B5-4	-	-	-	-	-85,8	21,3	-32,3	-9074	-69,4	-24,6	-26,1	-7334
B6-3	-	-	-	-	-29,2	-10,1	37	7561	-	-	-	-
ULS												
B5-4	-	-	-	-	-125,5	33,1	-45,9	-12974	-104,1	-36,3	-40,7	-11344

Vertical connections



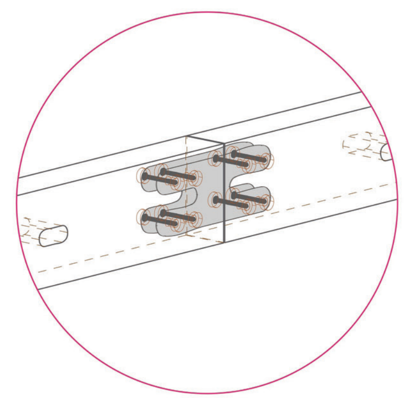
± compression
- shear
+ bending moment

Inclined connections



+ compression
± shear
+ bending moment

Horizontal connections



± compression
± shear
- bending moment

Most critical roof deck frames that passed SLS analysis for System I

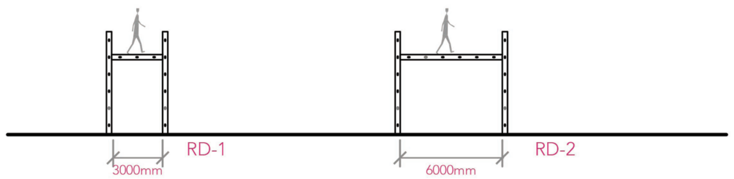
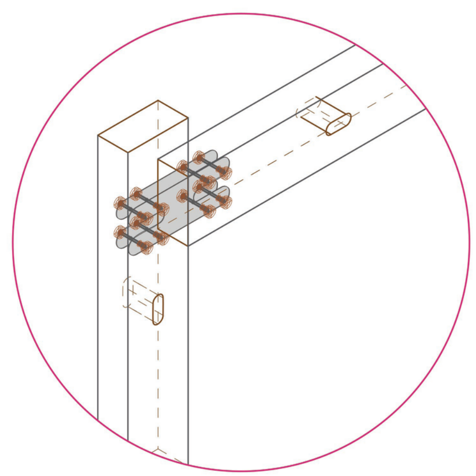


Table of maximum stresses at connections

PINNED BASE CONNECTION - SYSTEM I

FRAME TYPE	VERTICAL CONNECTION				INCLINED CONNECTION				HORIZONTAL CONNECTION			
	AxialForceN (KN)	ShearForce F (KN)	Bending Moment M (KN.m)	Stress σ (KN/m²)	AxialForceN (KN)	ShearForce F (KN)	Bending Moment M (KN.m)	Stress σ (KN/m²)	AxialForceN (KN)	ShearForce F (KN)	Bending Moment M (KN.m)	Stress σ (KN/m²)
SLS												
RD-2	-18,7	4,4	19,7	3956	-	-	-	-	-4,4	-18,7	-19,7	-4469
RD-1 beam300	-13,8	2,5	11,3	2201					-2,5	-13,8	-11,3	-2563
RD-1 beam400	-14	2,4	10,7	2063					-2,4	-14	-10,3	-2339
RD-1 beam400 and cable30°	-8,5	3	2,8	432					-3	-8,5	-2,8	-688
RD-1 beam400 and cable45°	-8	2,4	1,9	244					-2,4	-8	-1,9	-475
ULS												
RD-2	-27,9	6,5	29,4	5904	-	-	-	-	-6,5	-27,9	-29,4	-6668

Vertical portion
of connection

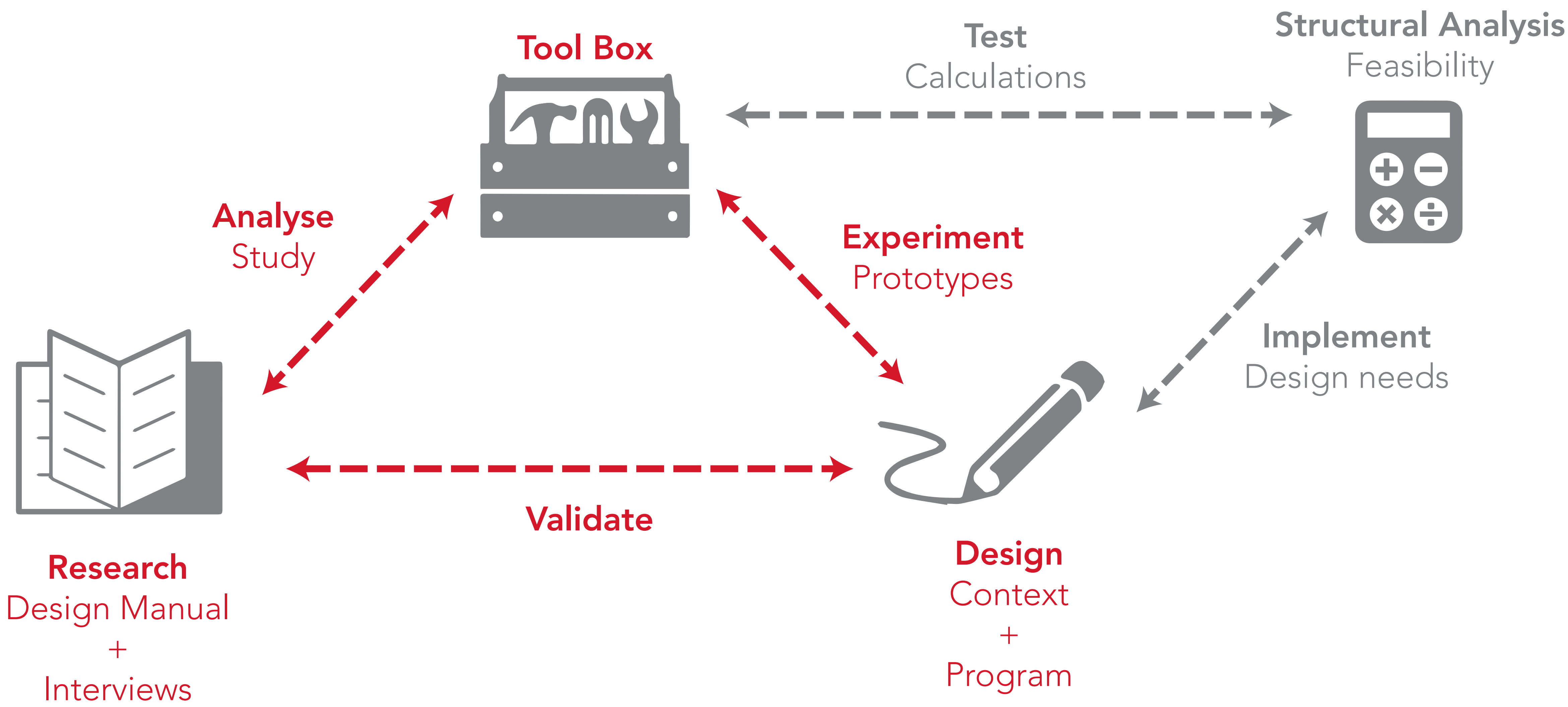


Horizontal portion
of connection

+ compression
- shear
+ bending moment

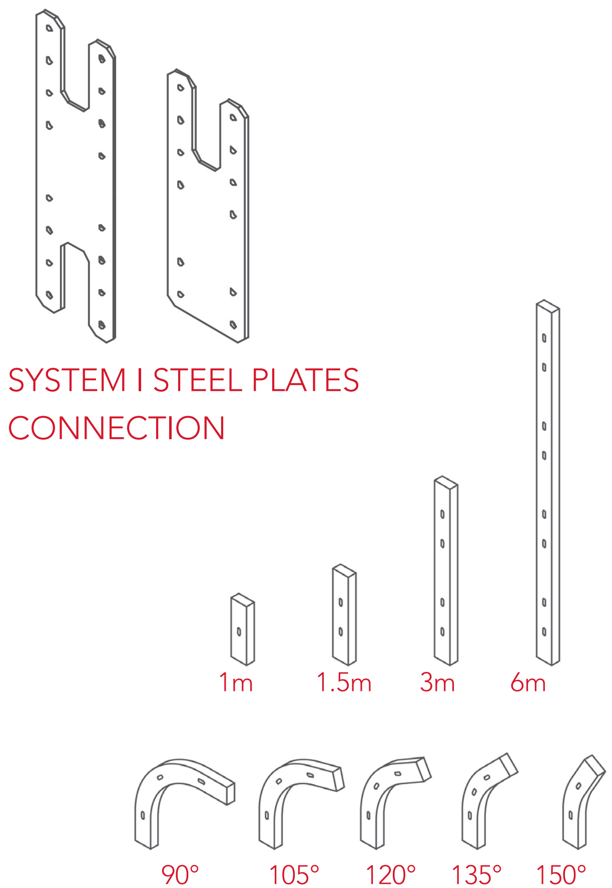
- compression
+ shear
+ bending moment

Content

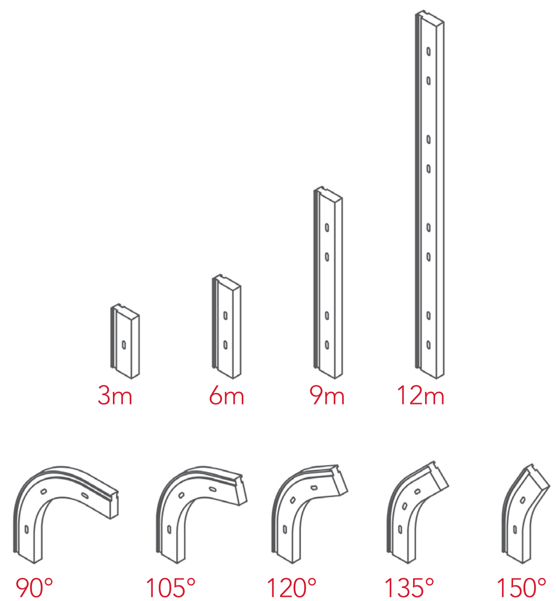

Tool Box
Test
Calculations
Structural Analysis
Feasibility
Analyse
Study
Experiment
Prototypes
Implement
Design needs
Validate
Research
Design Manual
+
Interviews
Design
Context
+
Program

Primary Structure - Main members and connections

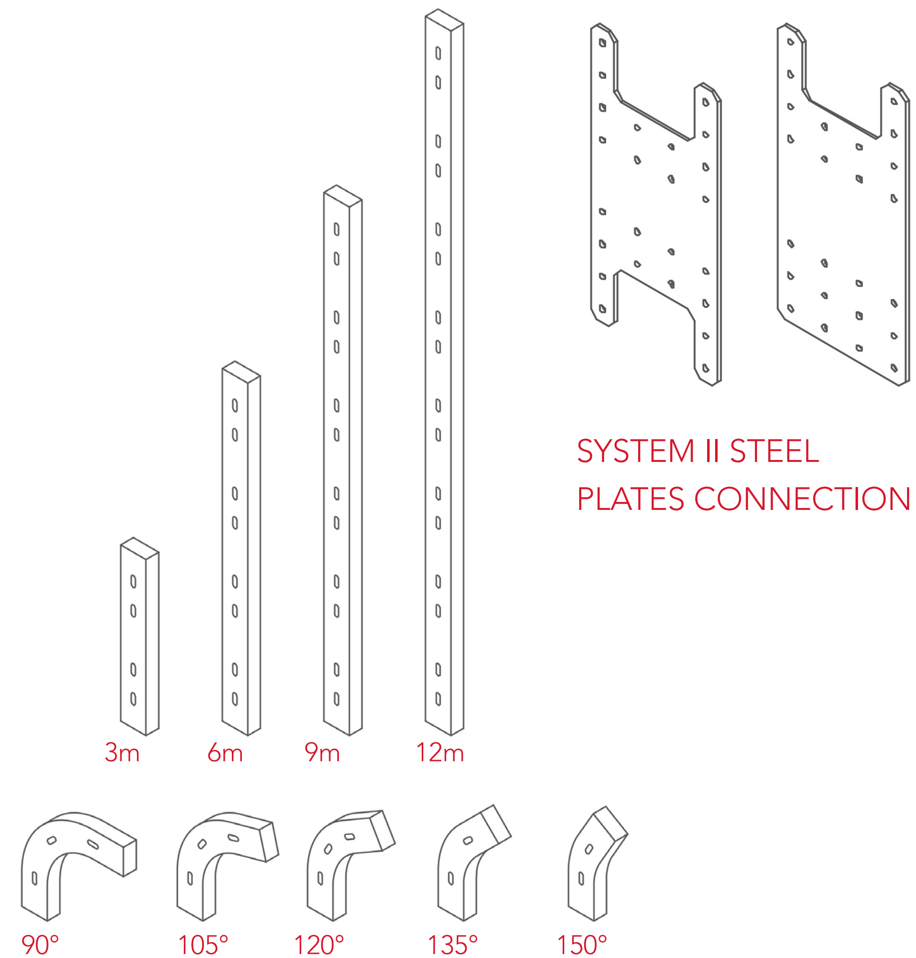
SYSTEM I:
sectional profile 300x150mm



sectional profile 400x150mm

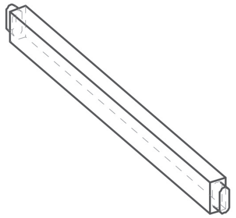


SYSTEM II:
sectional profile 500x250mm



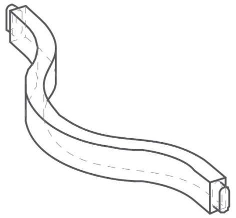
Secondary Structure - Bracing

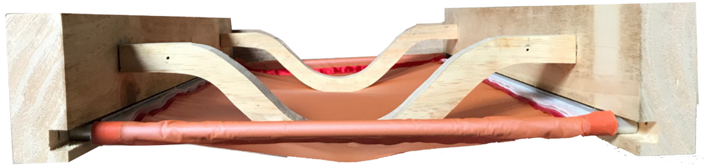
BRACING TYPE I



TOP VIEW

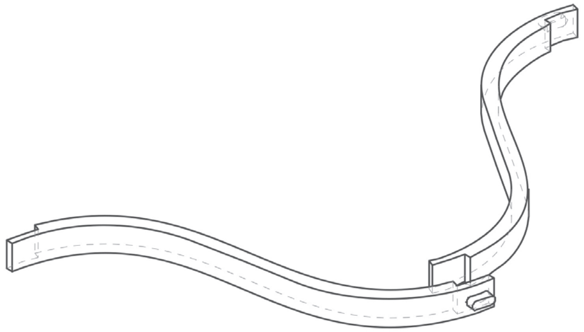
BRACING TYPE II

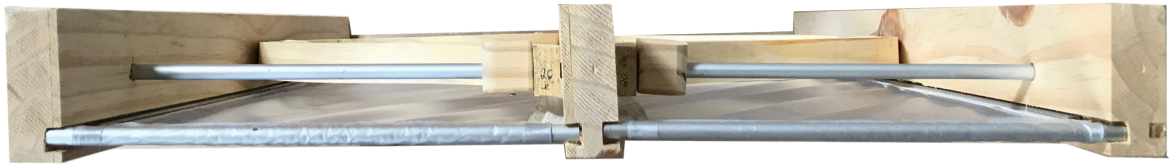




TOP VIEW

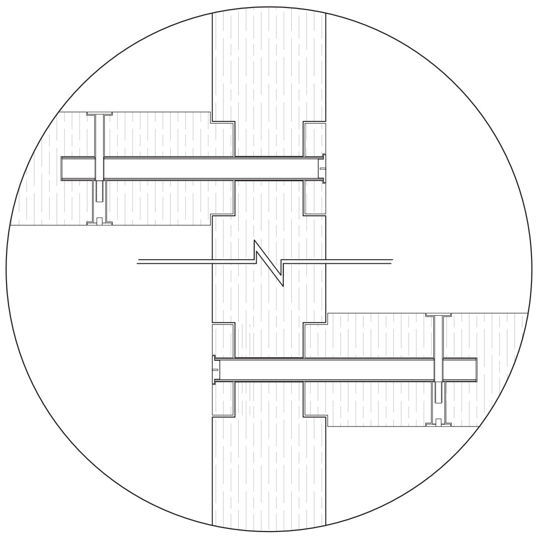
BRACING TYPE III



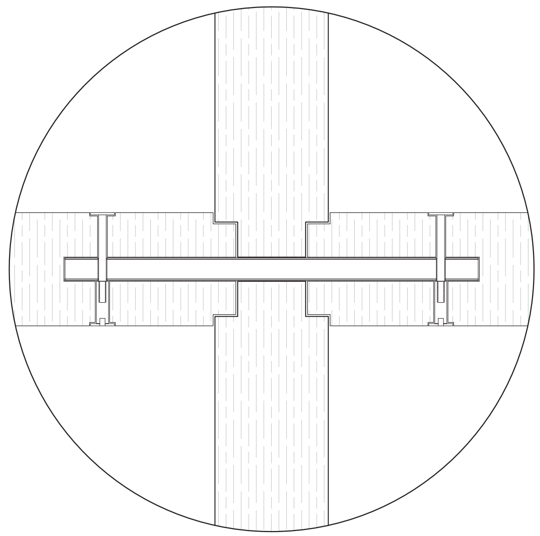


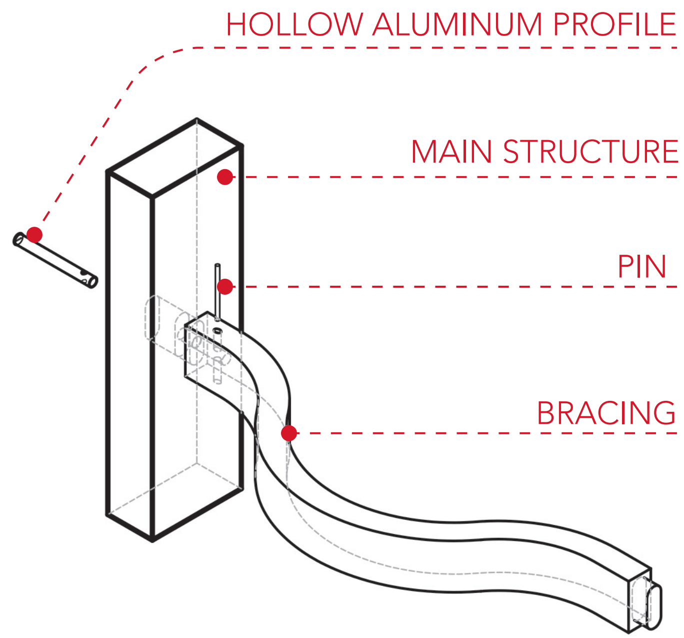
TOP VIEW

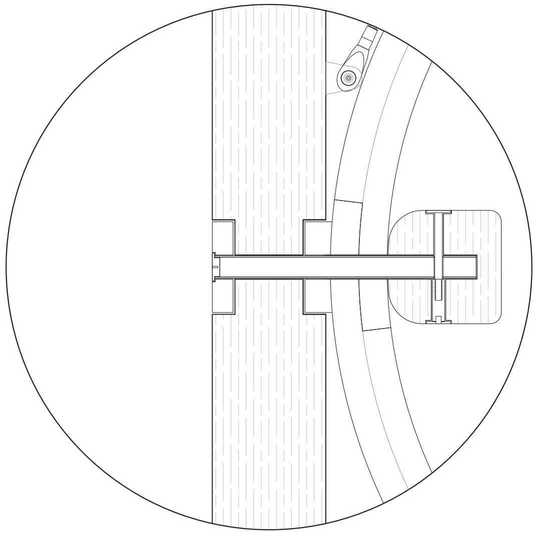
Secondary Structure - Connections



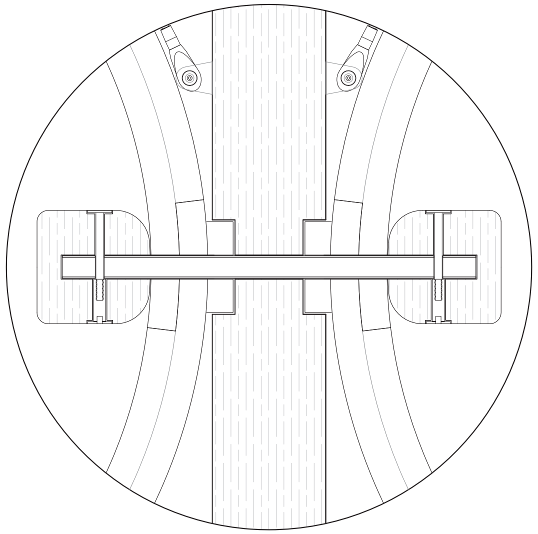
CONNECTION
FOR BRACING
TYPE I OR TYPE II



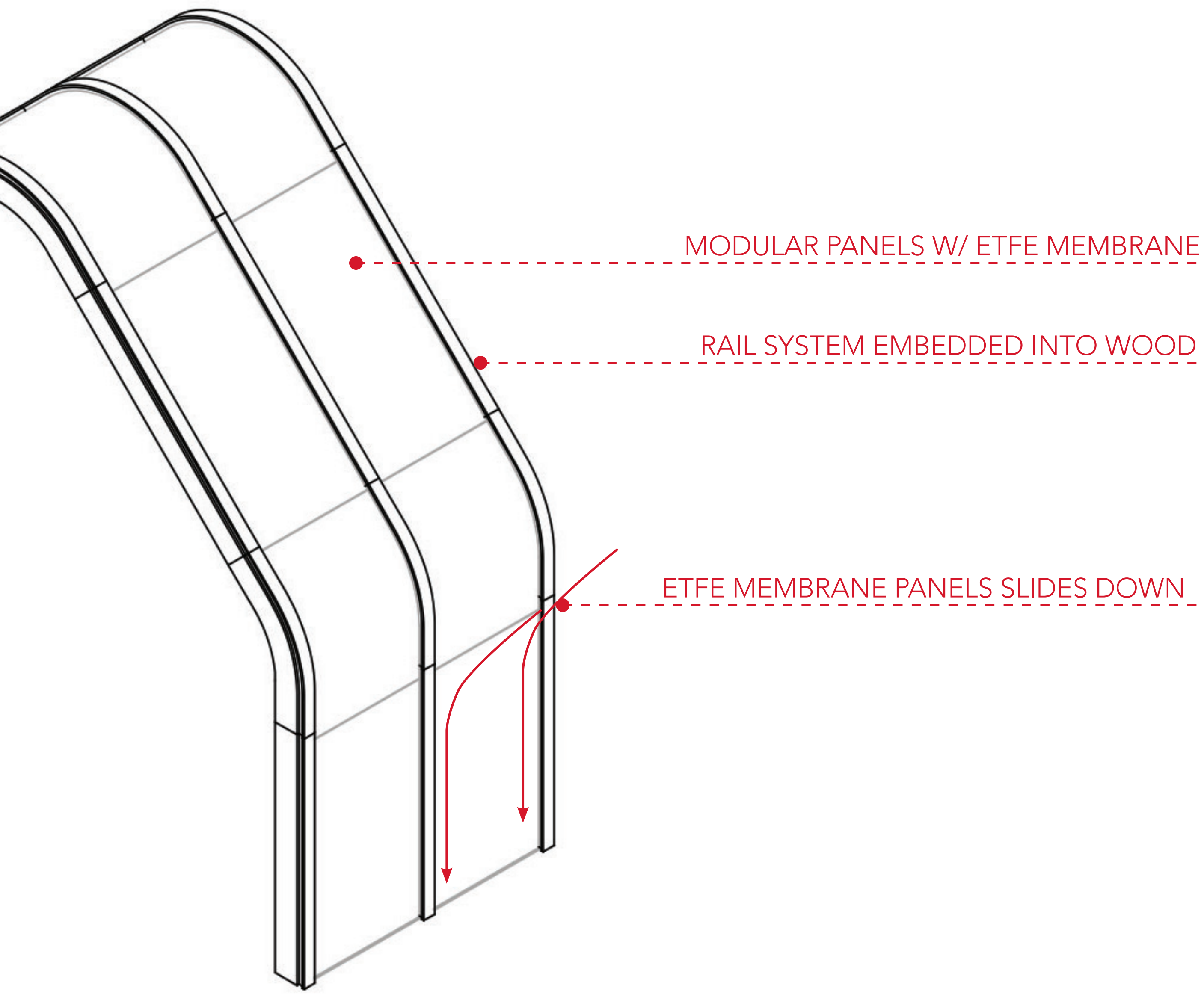


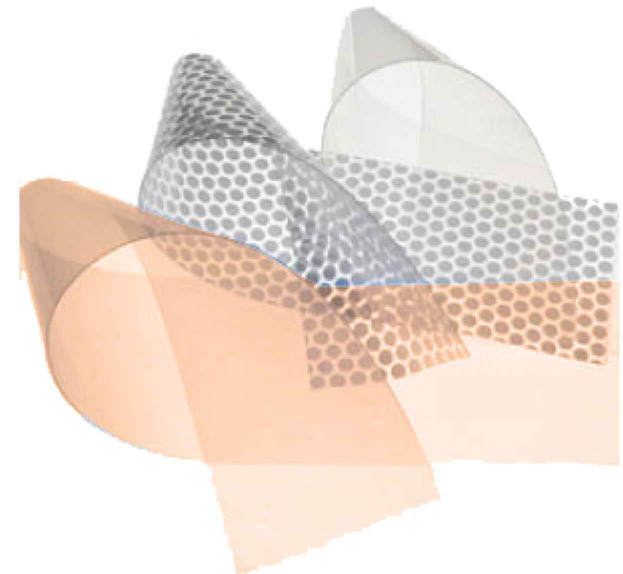


CONNECTION
FOR BRACING
TYPE III



Facade - Concept



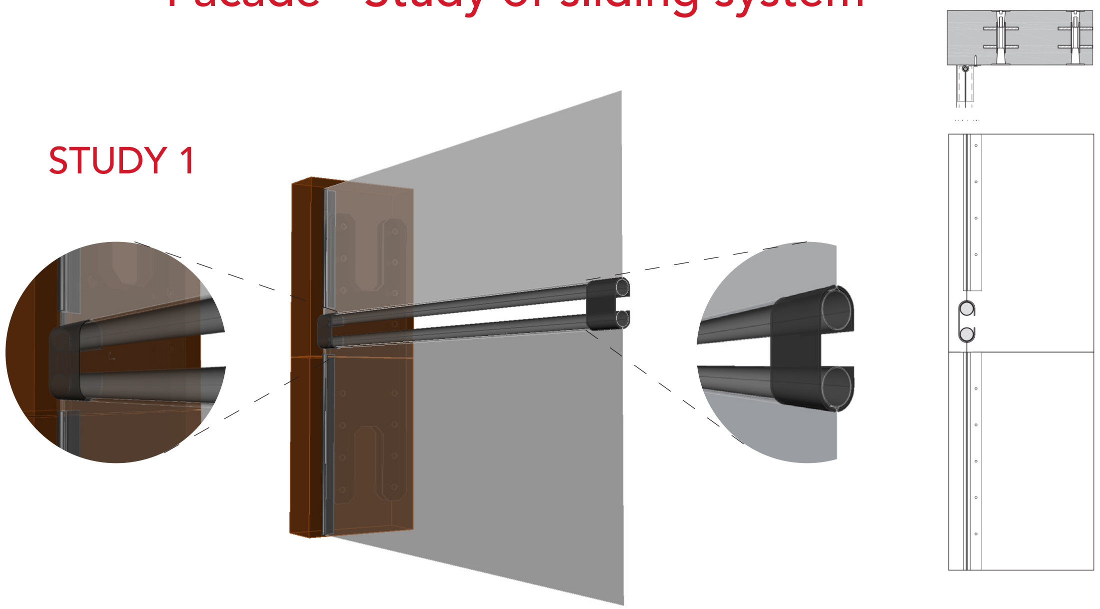


ETFE MEMBRANE
Different types to attend various building performances

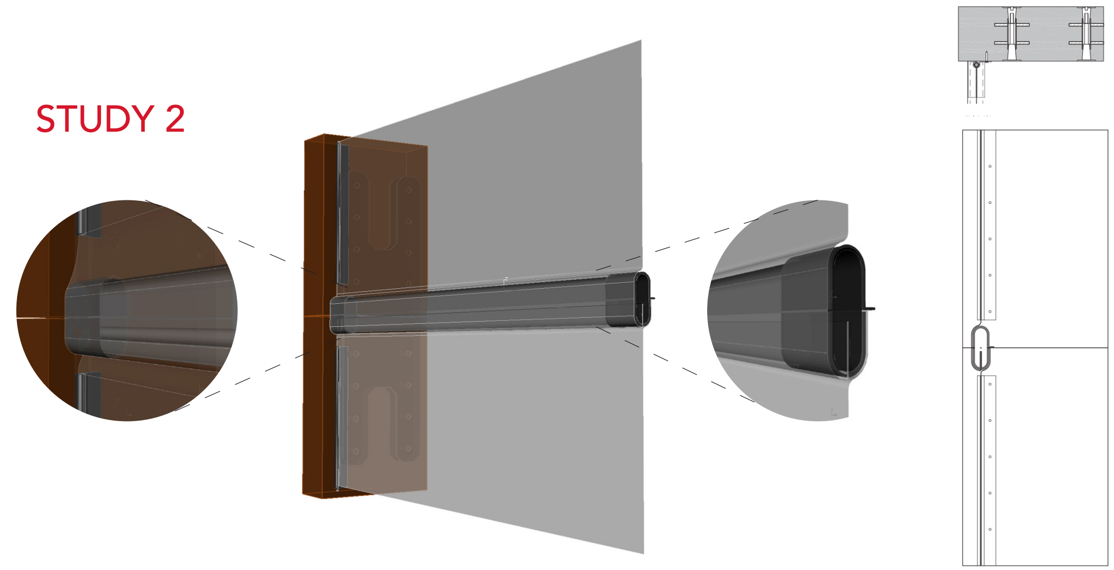
KEDER RAIL ALUMINUM PROFILE (various types exist)

Facade - Study of sliding system

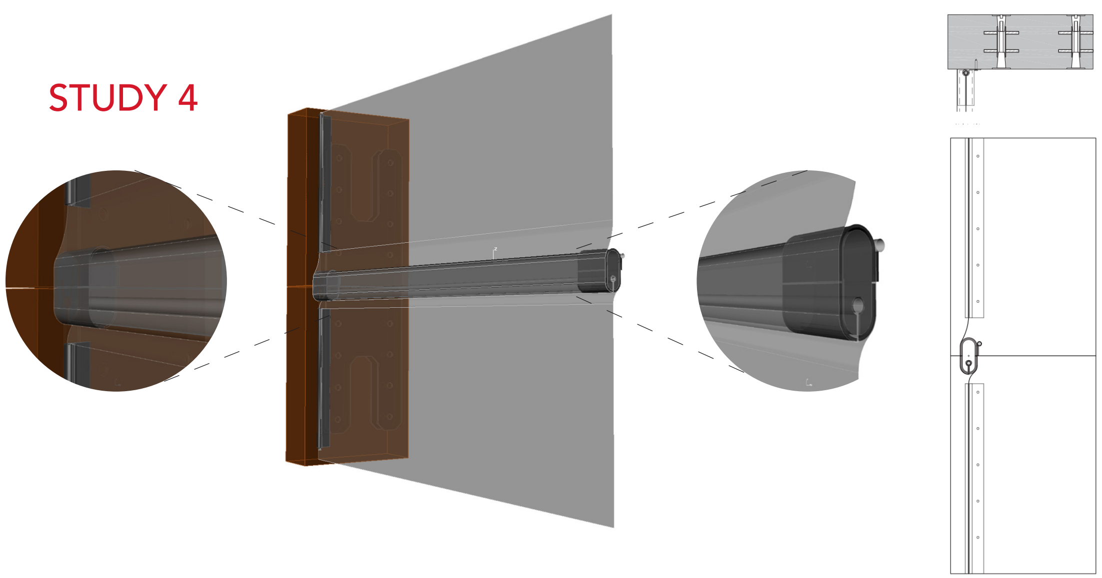
STUDY 1



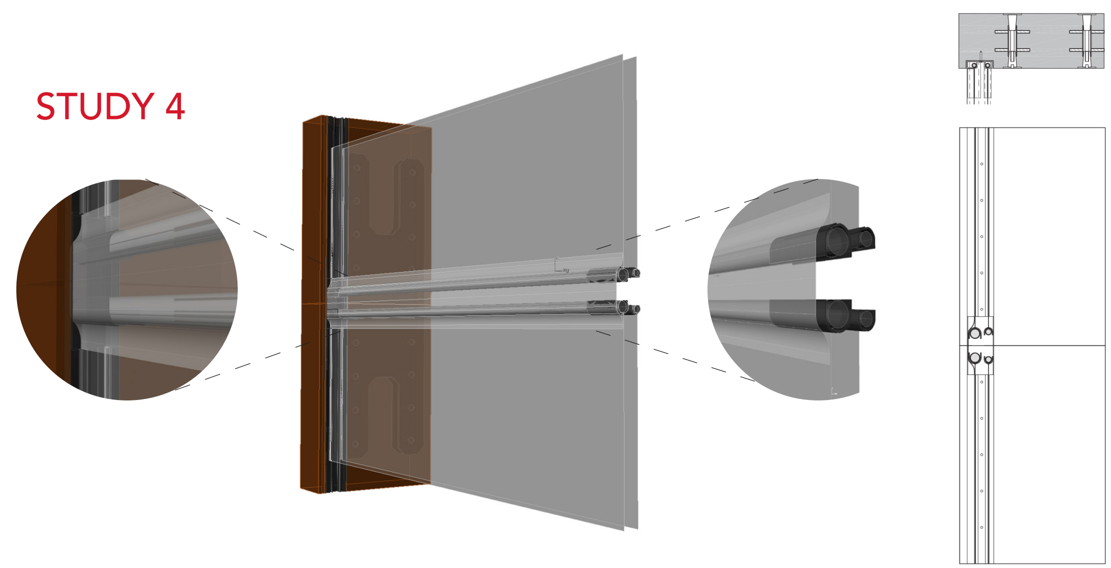
STUDY 2



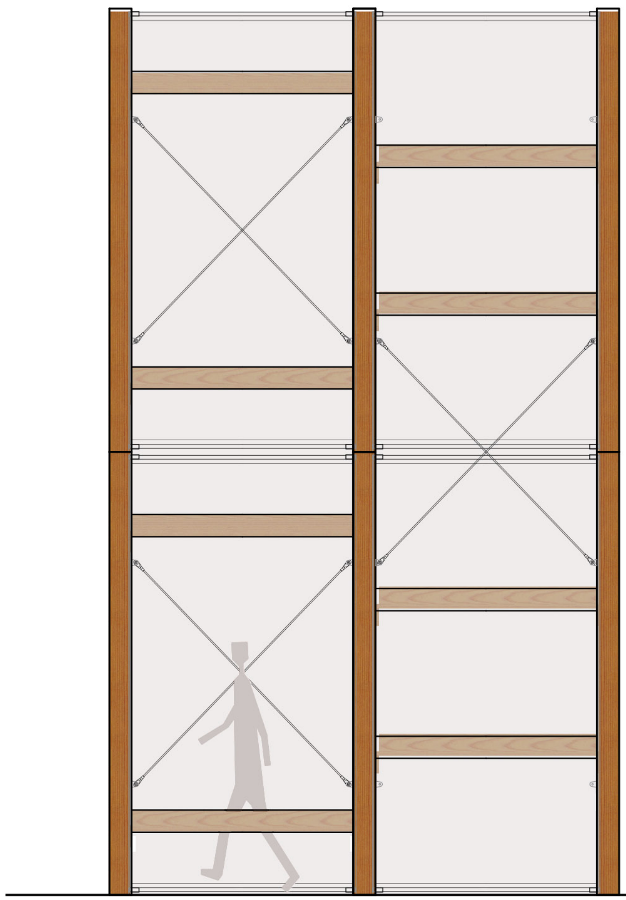
STUDY 4



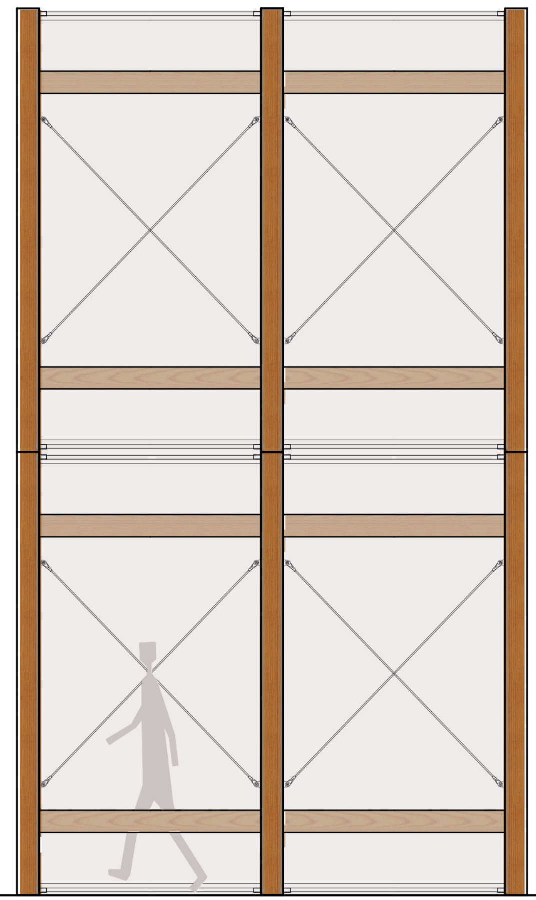
STUDY 4



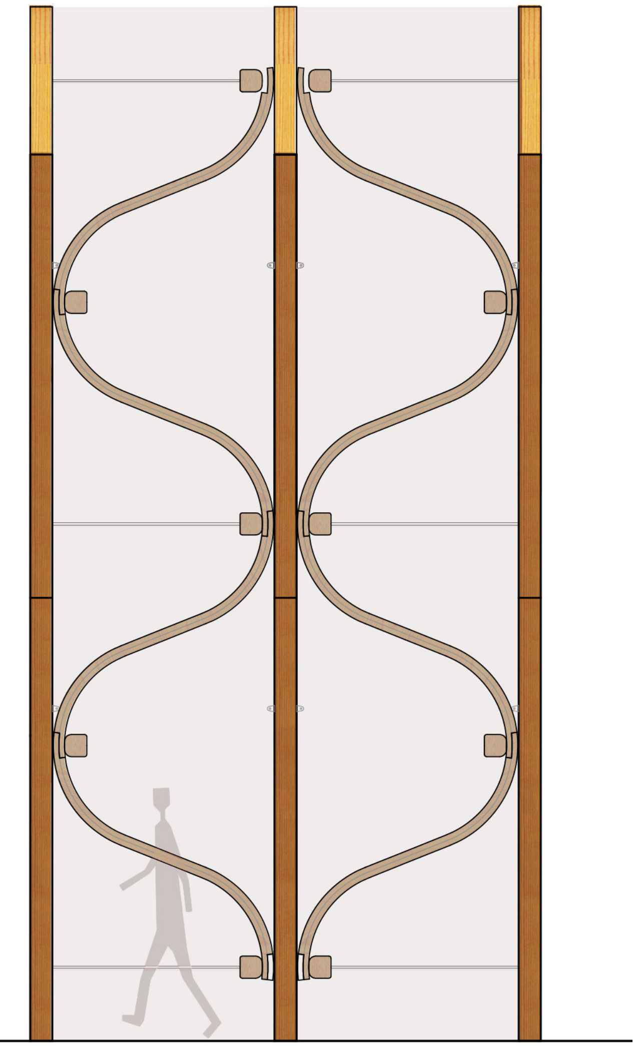
Facade - possible arrangements



FACADE WITH BRACING TYPE I OR TYPE II

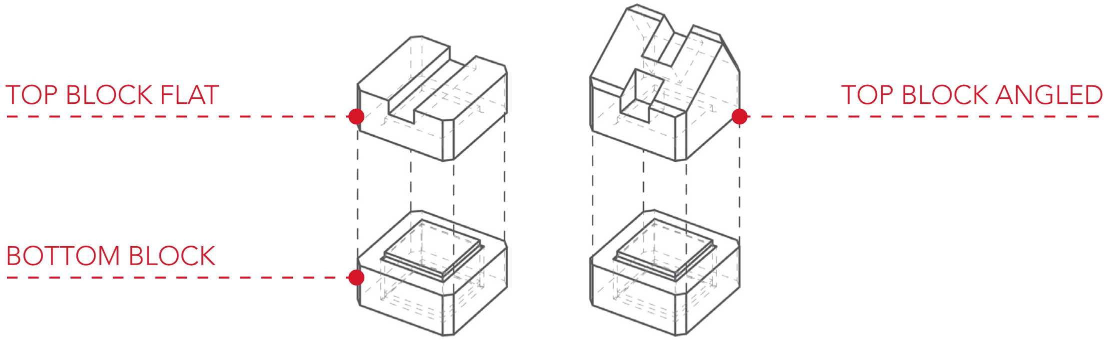


FACADE WITH BRACING TYPE I OR TYPE II

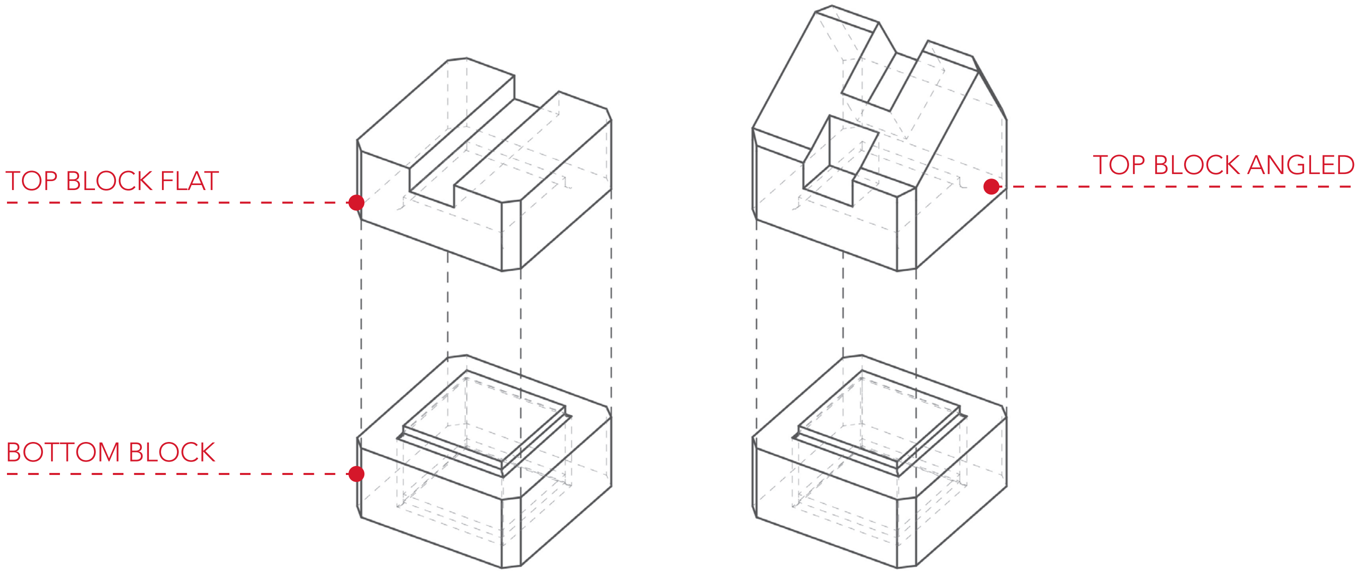


FACADE WITH BRACING TYPE III

Stackable Foundation

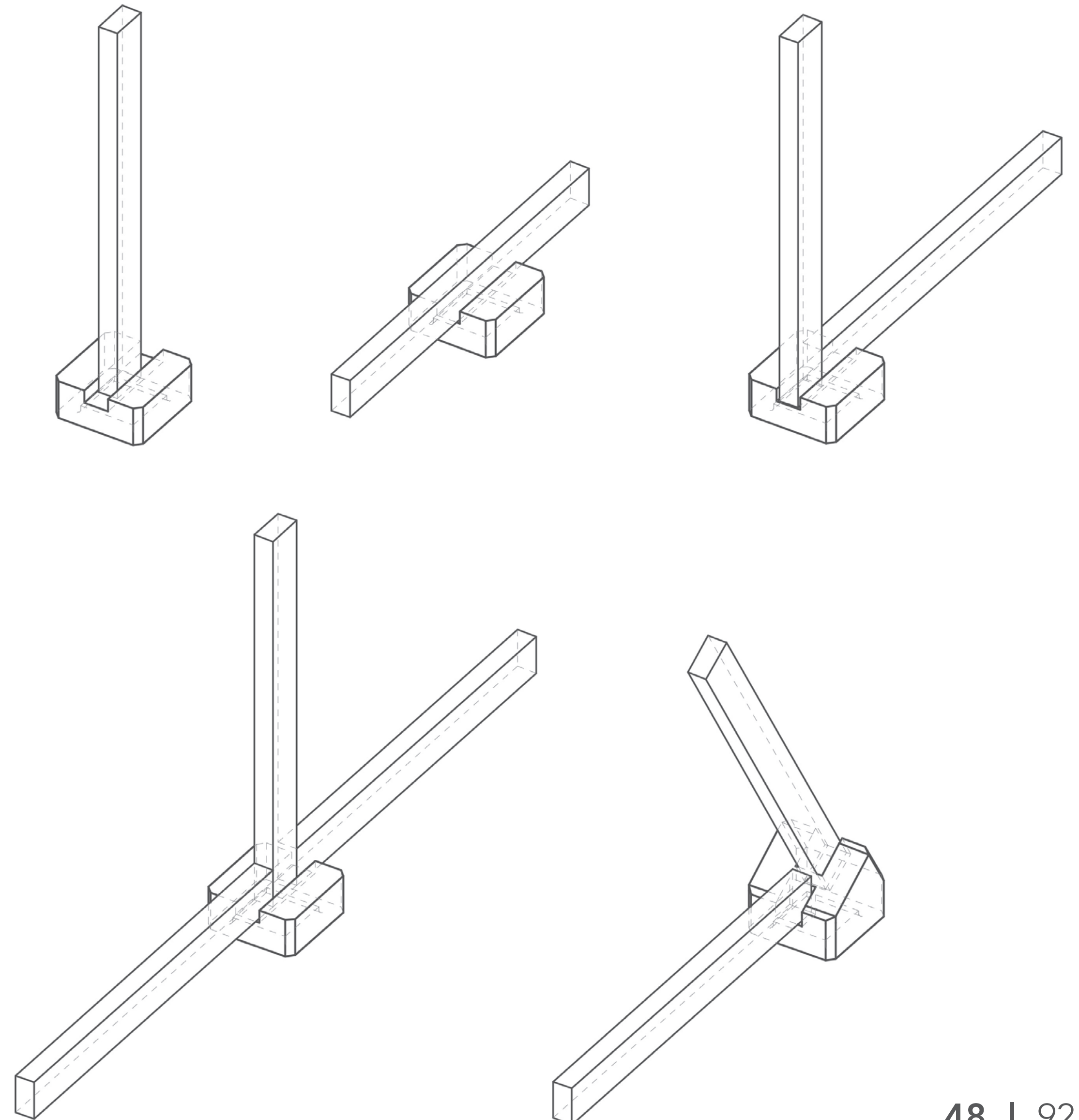


SYSTEM I
Lightweight concrete footing (700 x 700mm)

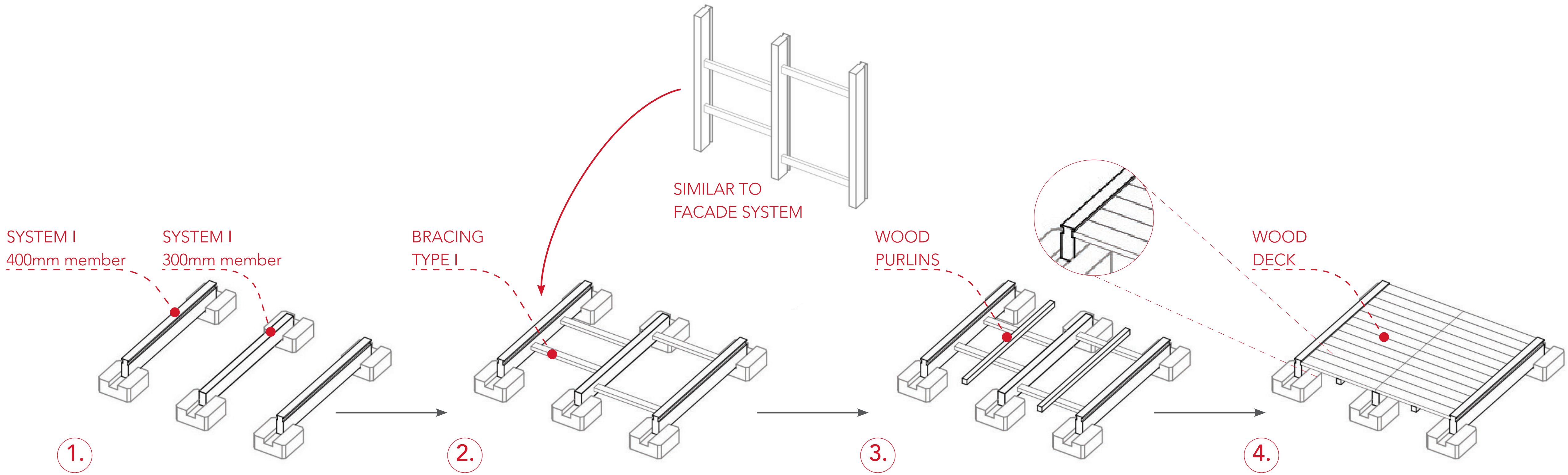


SYSTEM II
Lightweight concrete footing (1200 x 1200mm)

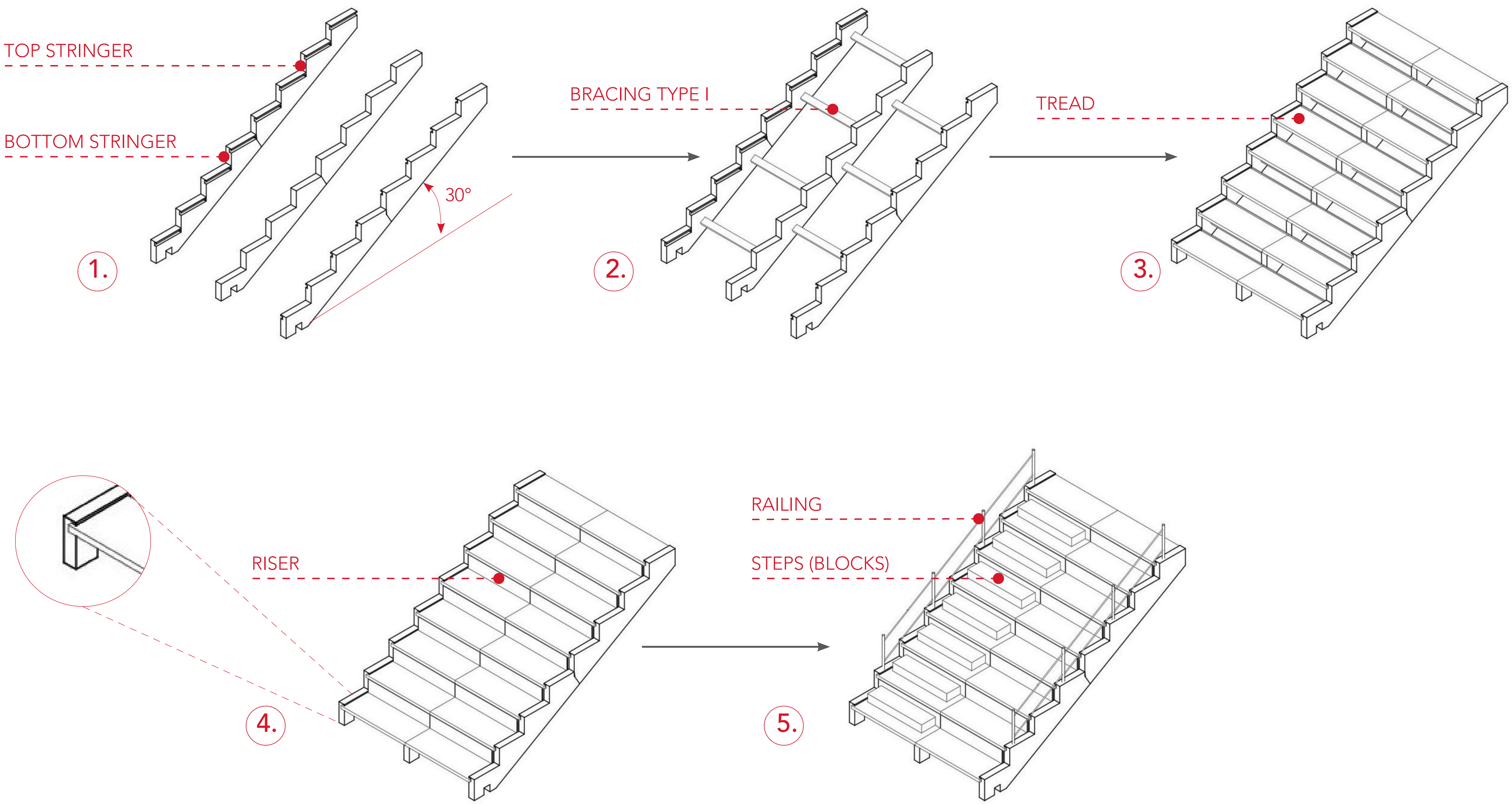
Possible Configurations

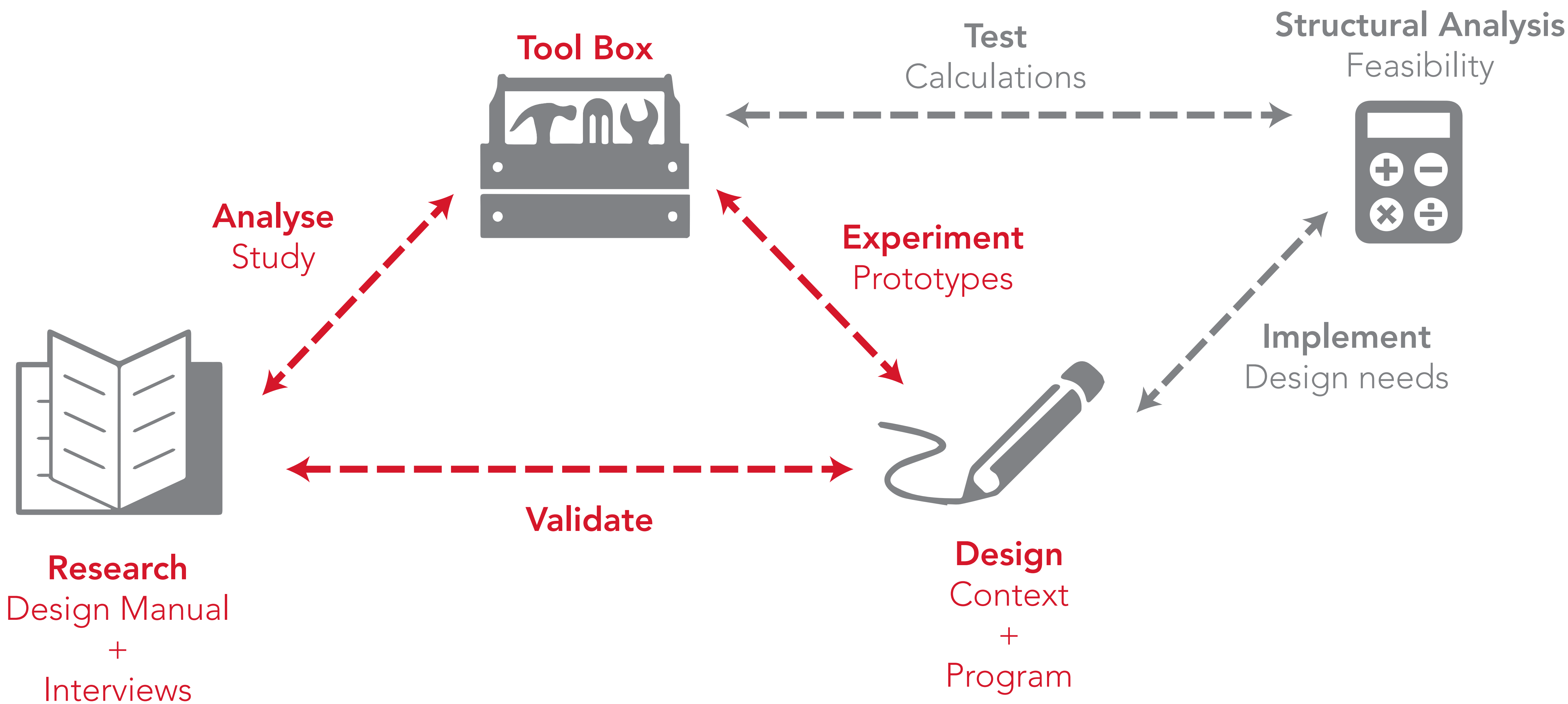


Flooring

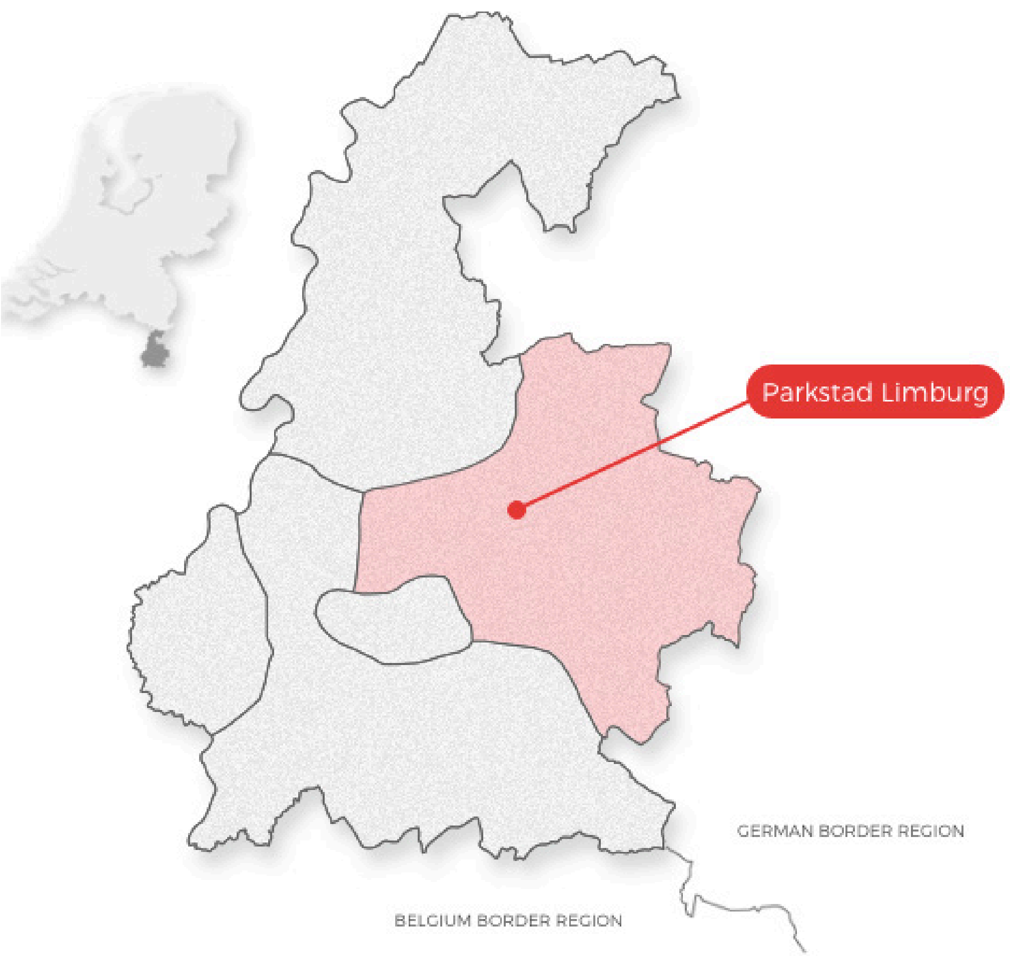

SIMILAR TO
FACADE SYSTEM
SYSTEM I
400mm member
SYSTEM I
300mm member
BRACING
TYPE I
WOOD
PURLINS
WOOD
DECK
1.
2.
3.
4.

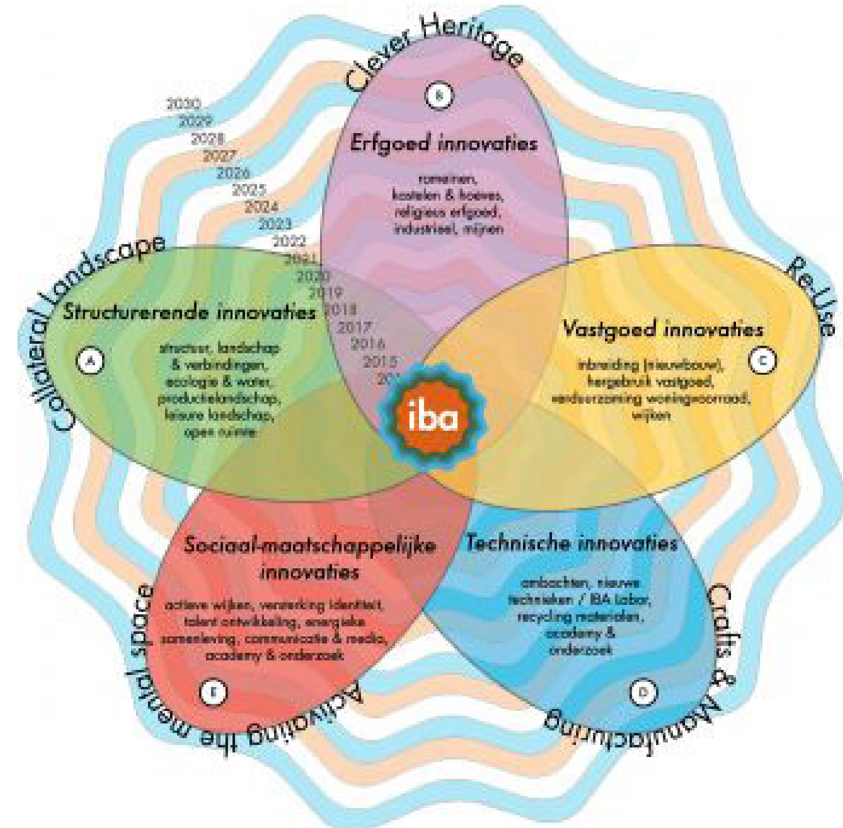
Stairs


TOP STRINGER
BOTTOM STRINGER
30°
1.
BRACING TYPE I
2.
TREAD
3.
RISER
4.
RAILING
STEPS (BLOCKS)
5.


Tool Box
Test
Calculations
Structural Analysis
Feasibility
Analyse
Study
Experiment
Prototypes
Implement
Design needs
Validate
Research
Design Manual
+
Interviews
Design
Context
+
Program

Context - Why IBA Parkstad?

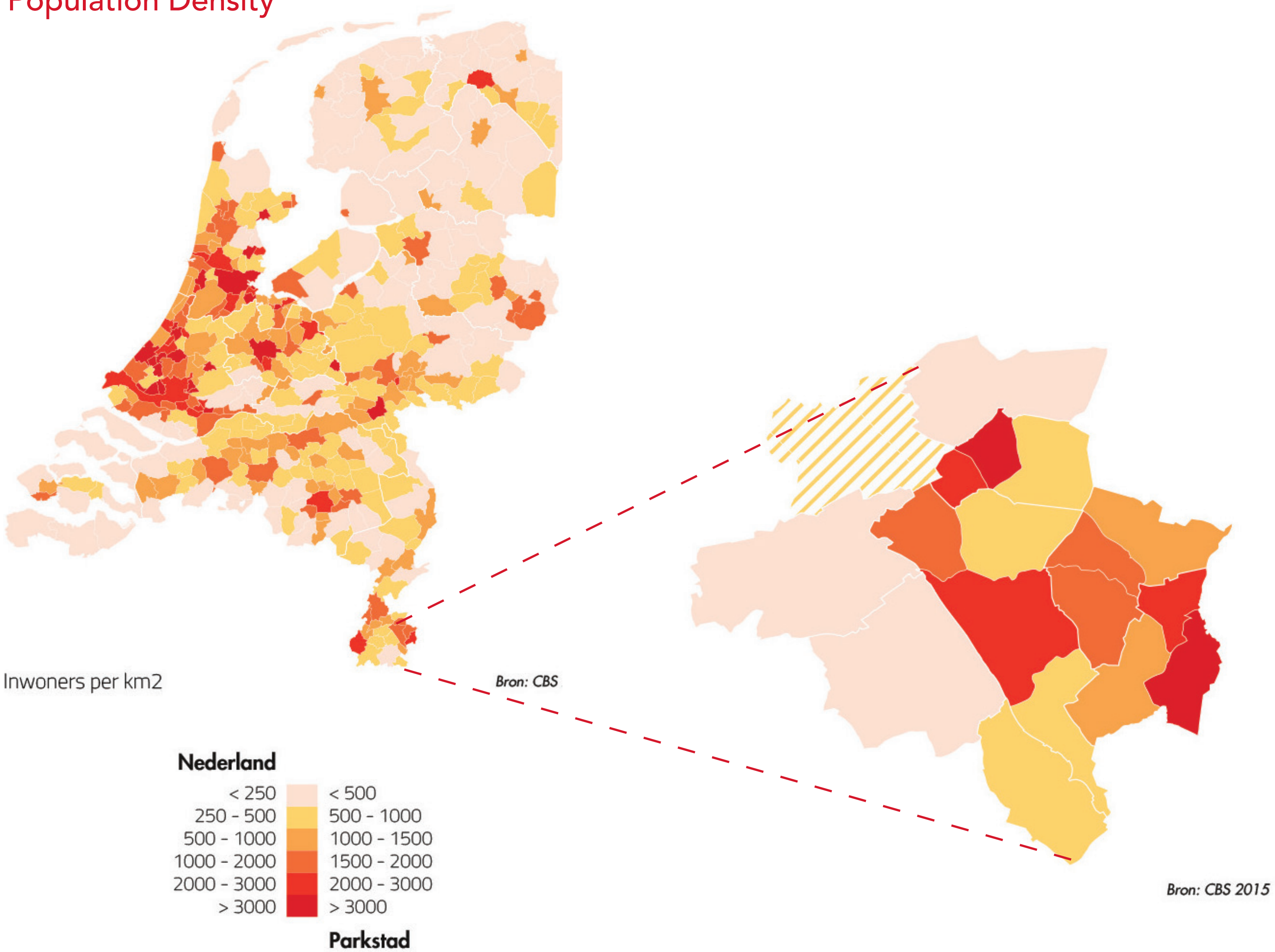




International Event/Expo to be held in 2020 in order to showcase future-proof, innovative and experimental projects that will draw attention to the region and help boost its economy and restore the pride of its citizens.

Context - The Parkstad Region Challenge

Population Density



-875
birth surplus in 2013

9%
unemployment

2,05
average household size

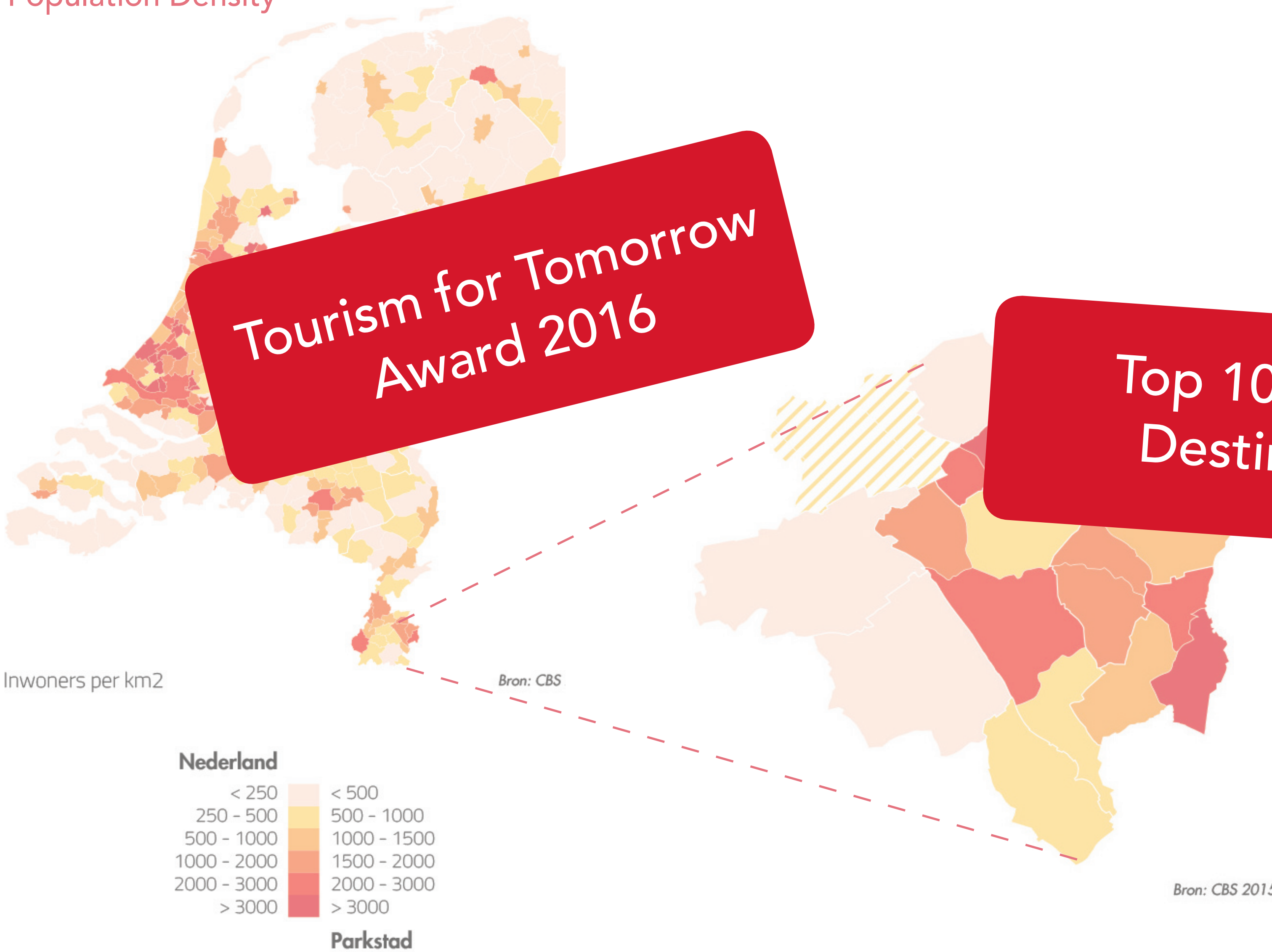
1.180
population density inhabitant per km^2

Shrinking Region

Data Source: Handboek IBA Zomer2015

Context - The Parkstad Region Challenge

Population Density



Tourism for Tomorrow Award 2016

Top 100 Green Destinations

-875
birth surplus in 2013

9%
unemployment

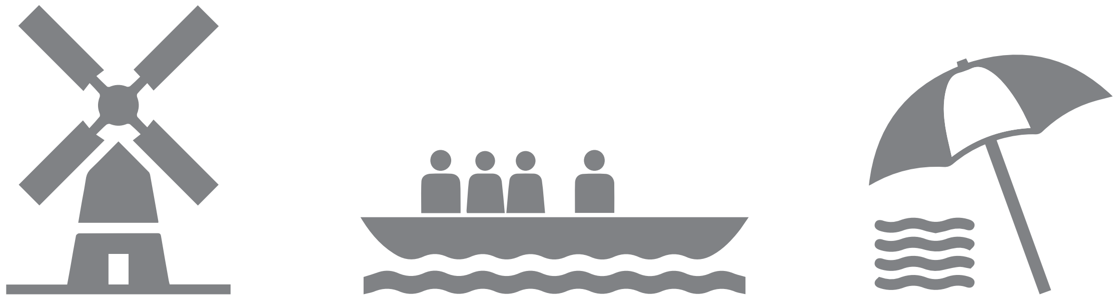
2,05
ousehold size

1.180
population density inhabitant per km^2

Shrinking Region

Context - Dutch nature as seen by Tourists

Data Source:
(source: https://www.mooistenatuurgebied.nl/over-de-natuur)
Images: online source

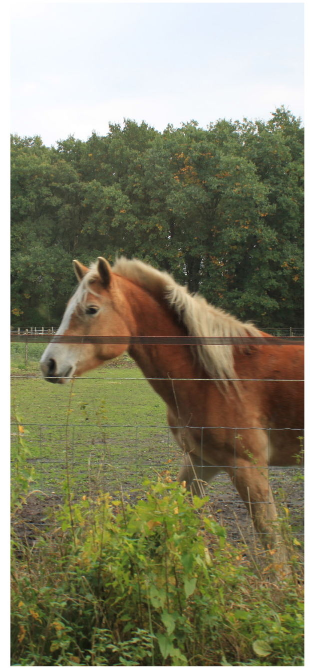


as seen by the Americans, British and Chinese

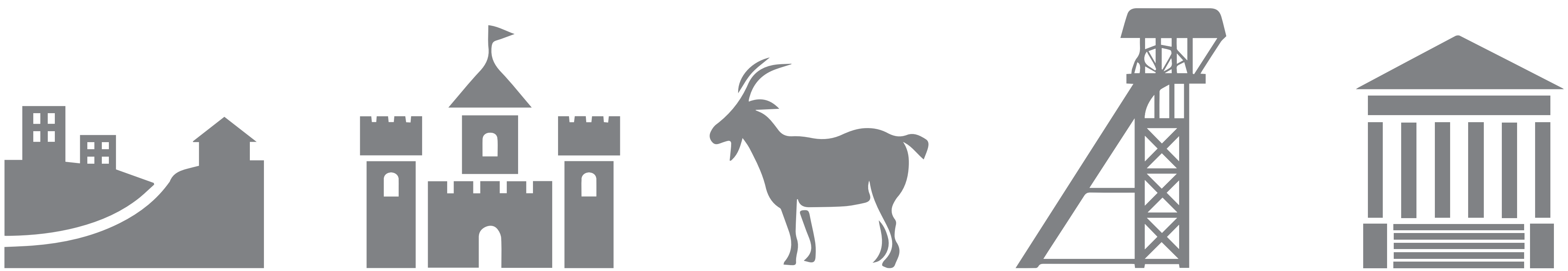
as seen by Belgians and Germans

Context - What makes the Parkstad Region unique?

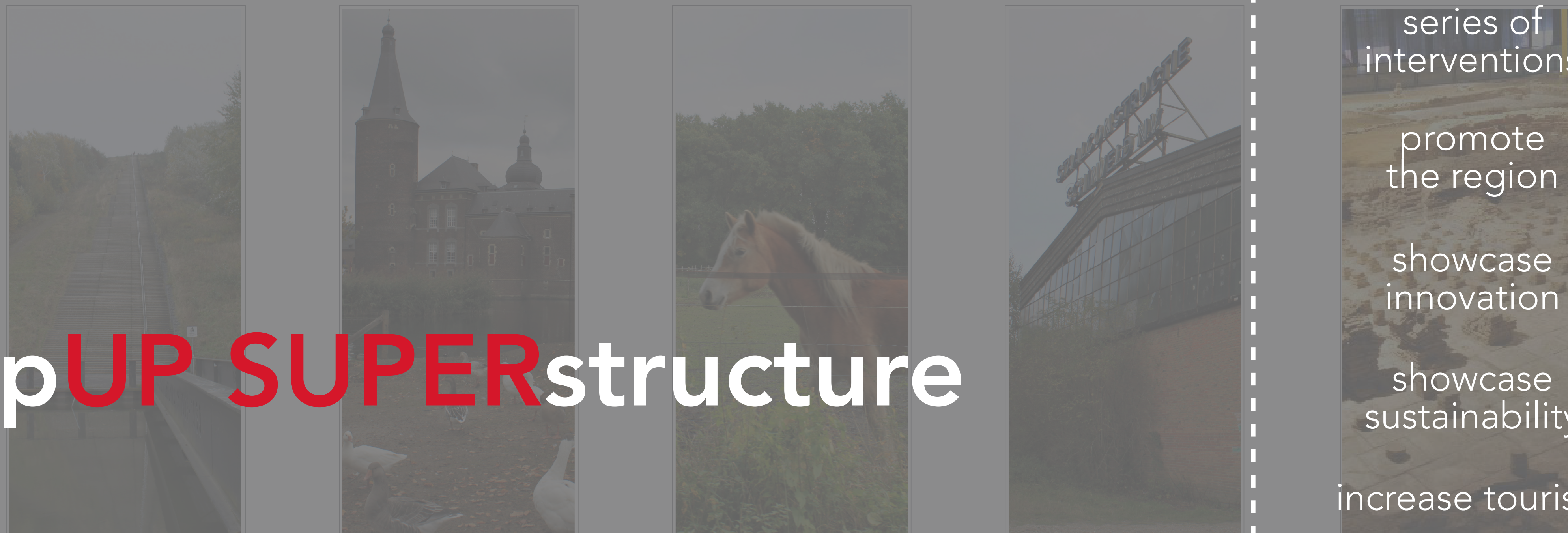




Images: by author

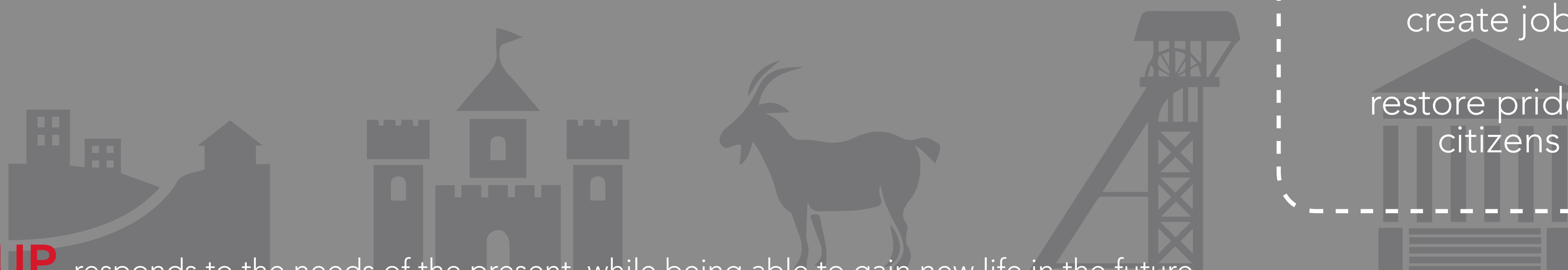


The cultural and historic heritage of the Parkstad Region



popUP SUPERstructure

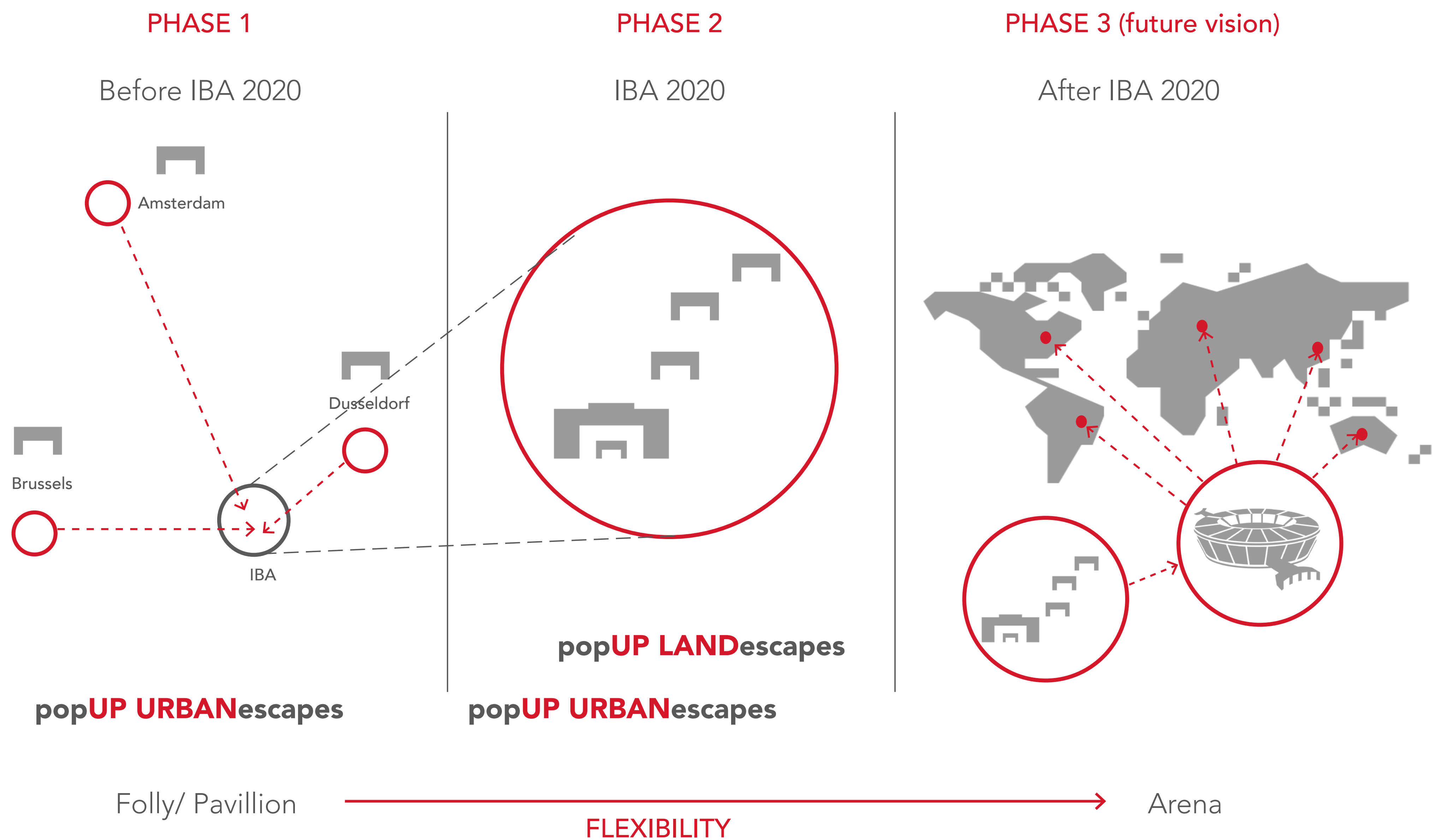
- series of interventions
- promote the region
- showcase innovation
- showcase sustainability
- increase tourism
- create jobs
- restore pride of citizens



popUP responds to the needs of the present, while being able to gain new life in the future

SUPERstructure: capacity of structure to be flexible and adapt to various scales and programs

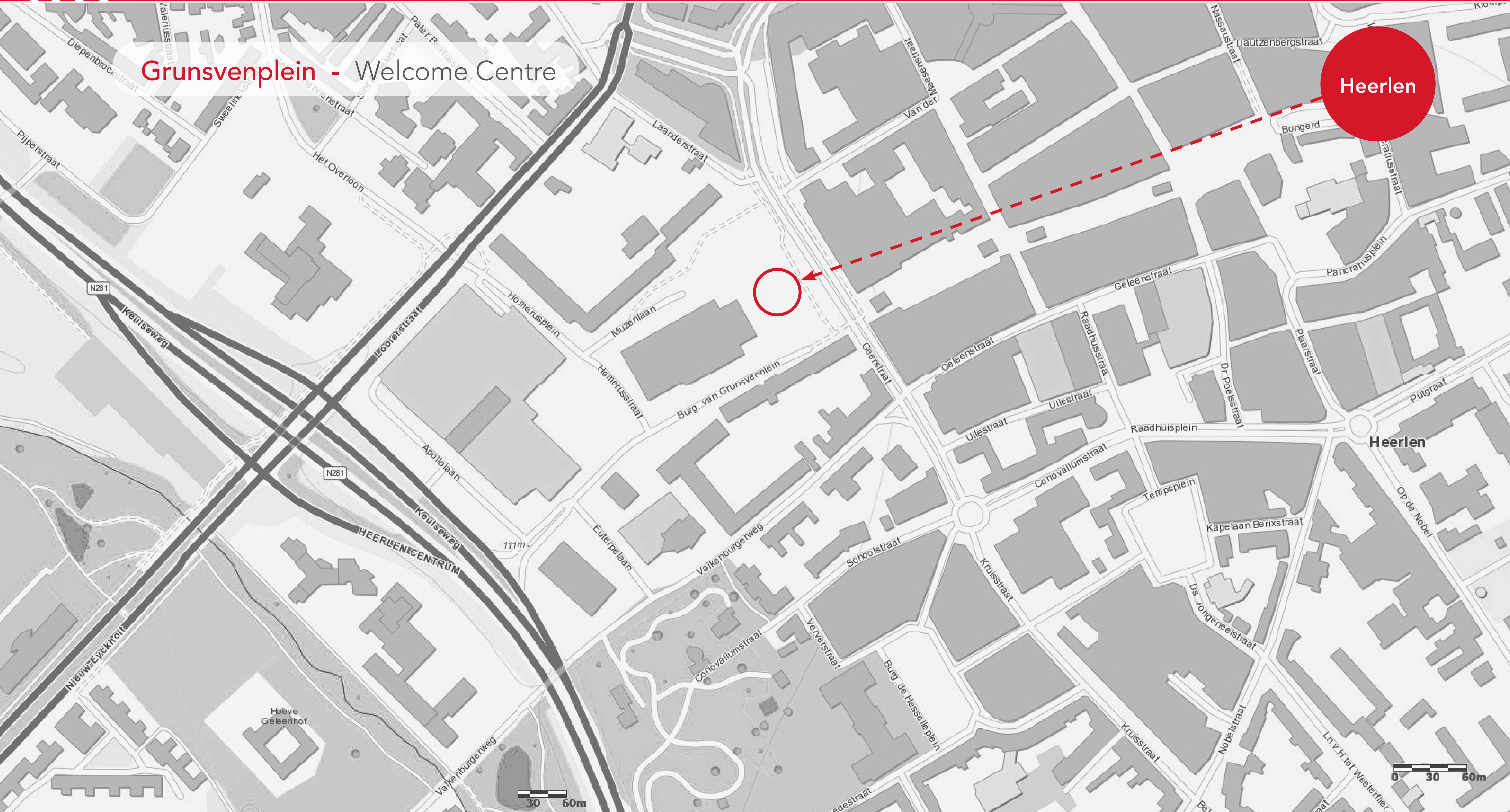
Project Phasing



Masterplan Strategy

IBA 2020 - Meet IBA & Get Connected

Meet IBA	**popUP URBANescapes** Welcome Centre
Get connected	**popUP LANDescapes** Follies to attract people to certain regions


Grunsvenplein - Welcome Centre
Heerlen
Heerlen
Geleenstraat
Geerstraat
Burg. van Grunsvenplein
Homeruslaan
Homerusplein
Muzenlaan
Laanderstraat
Het Overloon
Looierstraat
Keulseweg
HEERLEN CENTRUM
N281
Apollolaan
Euterpelaan
Valkenburgerweg
Coriovallumstraat
Schoolstraat
Uilestraat
Raadhuisplein
Raadhuisstraat
Dr. Poelsstraat
Pancratiusplein
Putgraaf
Bongerd
Dautzenbergstraat
Nassaustraat
Tempsplein
Kapelaan Berixstraat
Kruisstraat
Verversstraat
Burg. de Hesselleplein
Nobelstraat
Op de Nobel
Ds. Jongeneelstraat
Nieuw Eyckholt
Pijperstraat
Hoeve Geleenhof
Plaatsstraat
0 30 60m

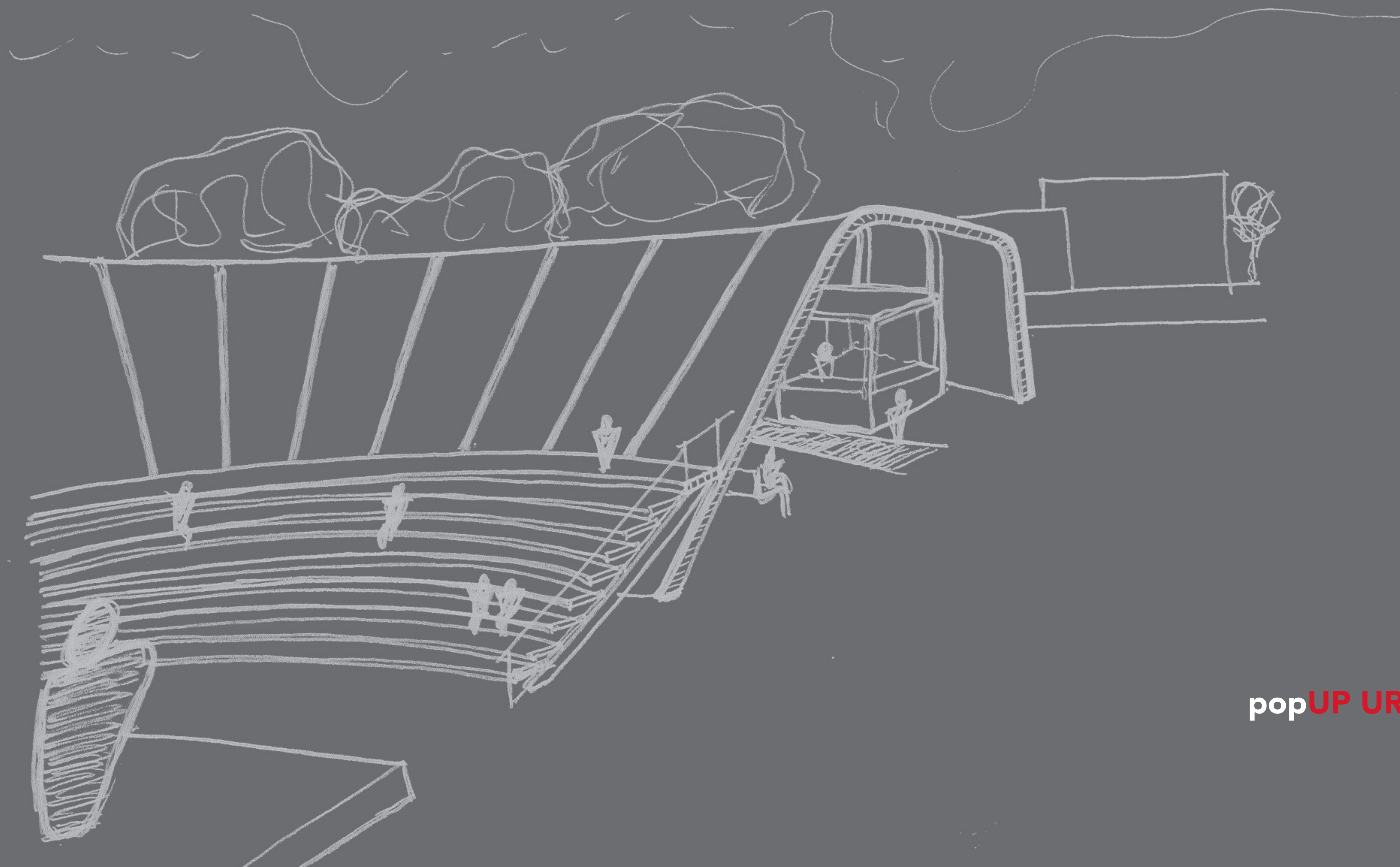
Grunsvenplein - Welcome Centre

Heerlen is considered the Heart of the Parkstad Region. Rich Roman heritage at Via Belgica.
City is situated strategically betweem main roads leading to Belgium and Germany.

Image: Google Earth

Grunsvenplein - Welcome Centre

Heerlen

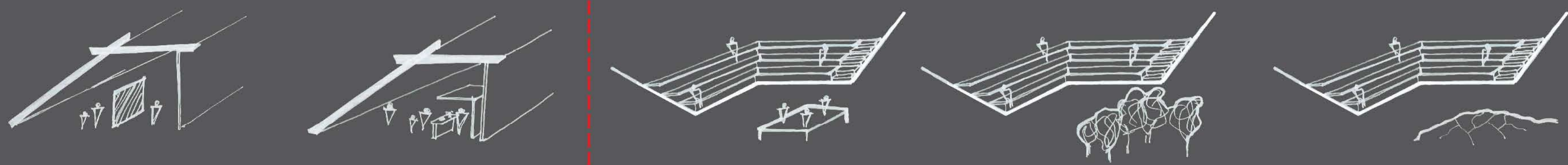


Vision

Heerlen

FLEXIBLE INDOOR SPACES

FLEXIBLE OUTDOOR SPACES



Cultural
Mining & Industrial Heritage
EXHIBITIONS

Social & Sustainable
Local Produce
MARKET

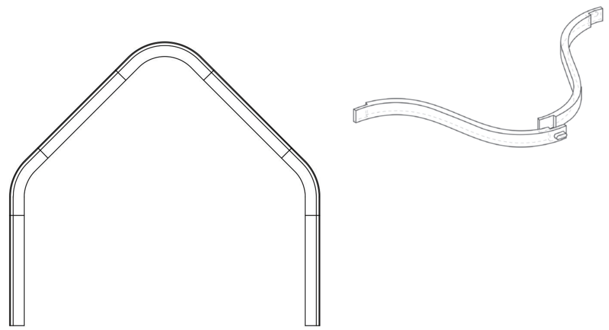
Leisure
Recreational Gatherings
FESTIVAL & CONCERT

Nature
Interaction with Landscape
BARE NATURE

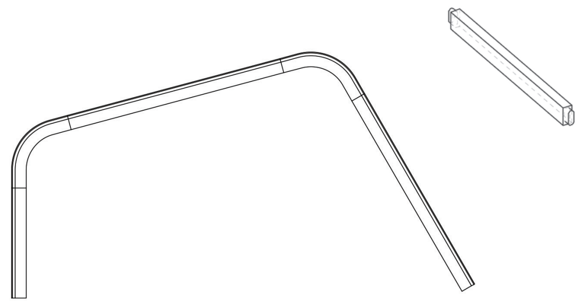
Historic
Interaction with Site History
INSTALLATION

Toolbox use for modules creation

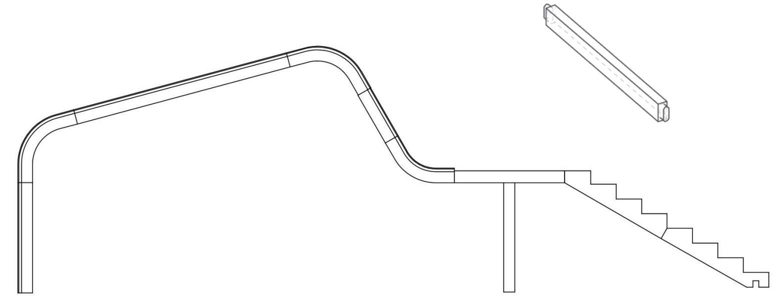
Heerlen



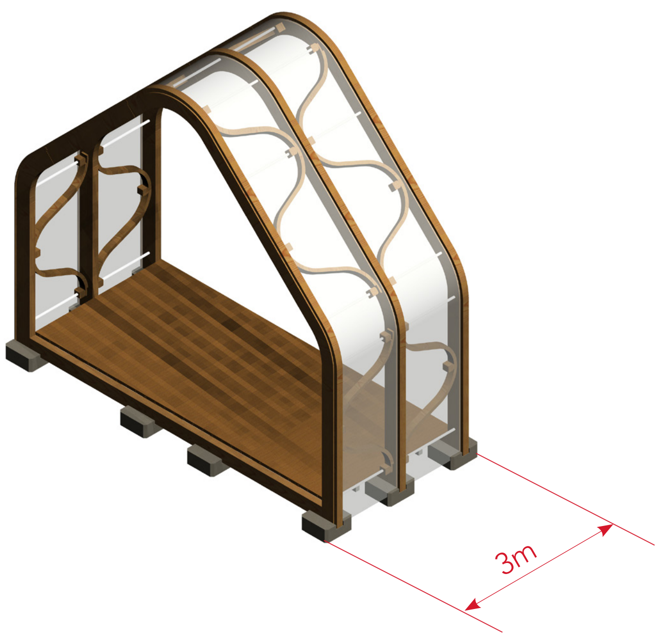
Frame A4-1 + Bracing Type III



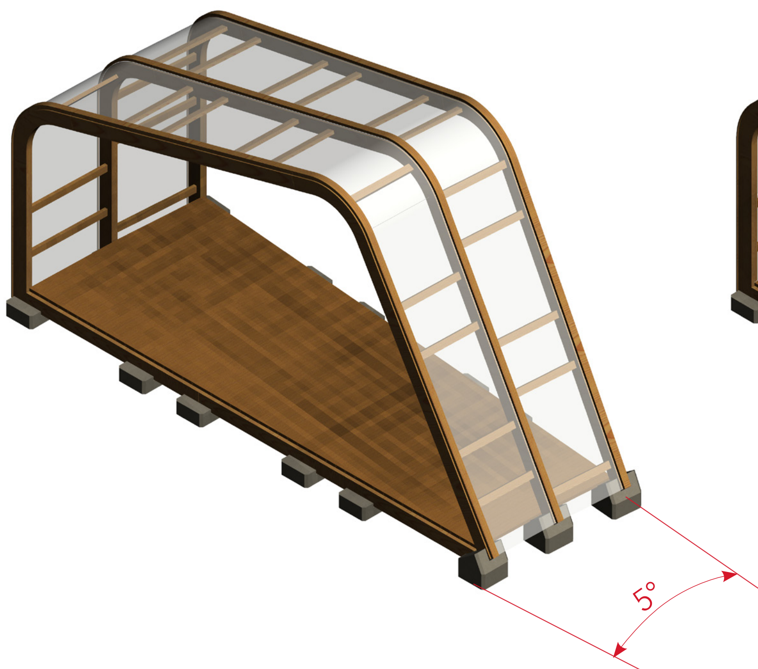
Frame C3-2 + Bracing Type I



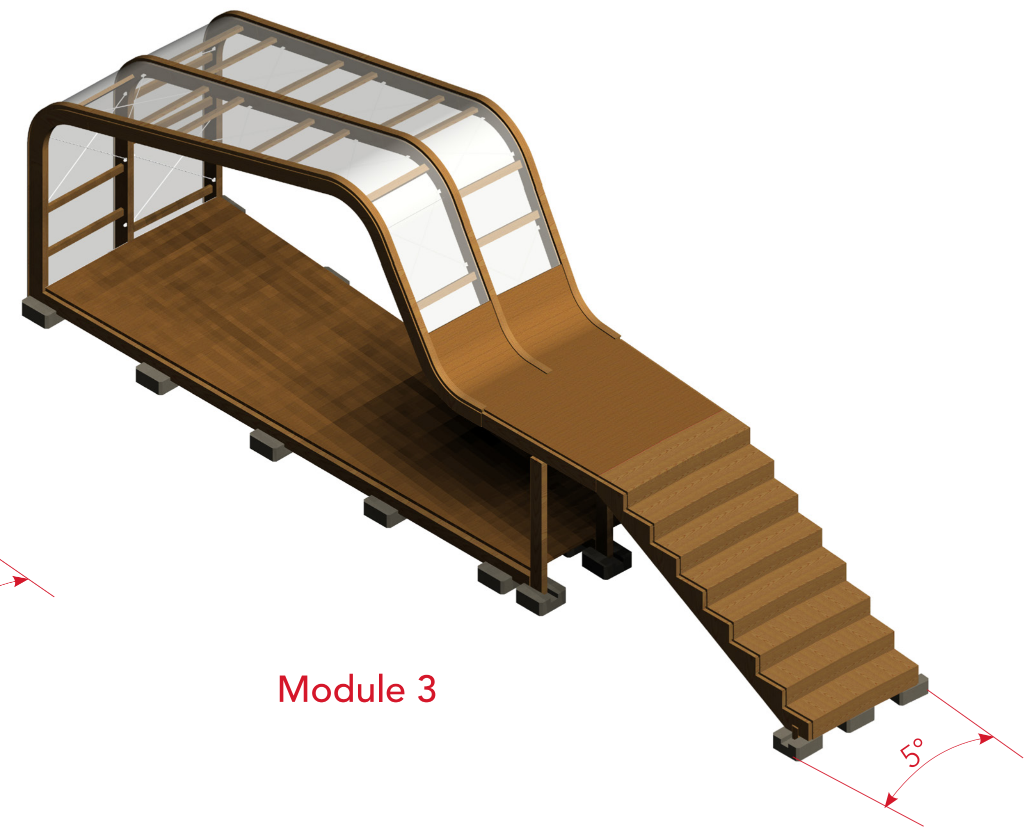
Frame C3-2 + Stairs + Bracing Type I



Module 1



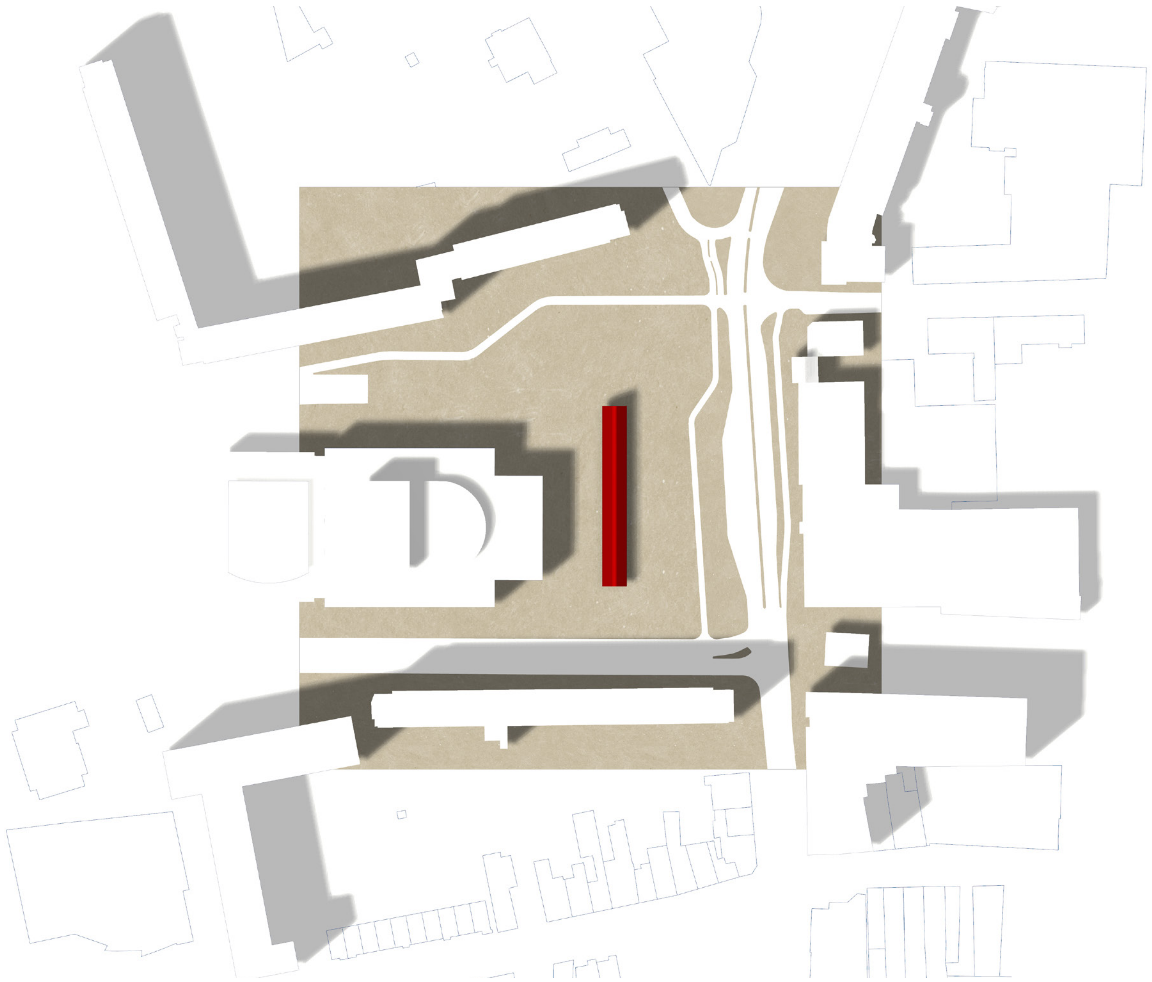
Module 2

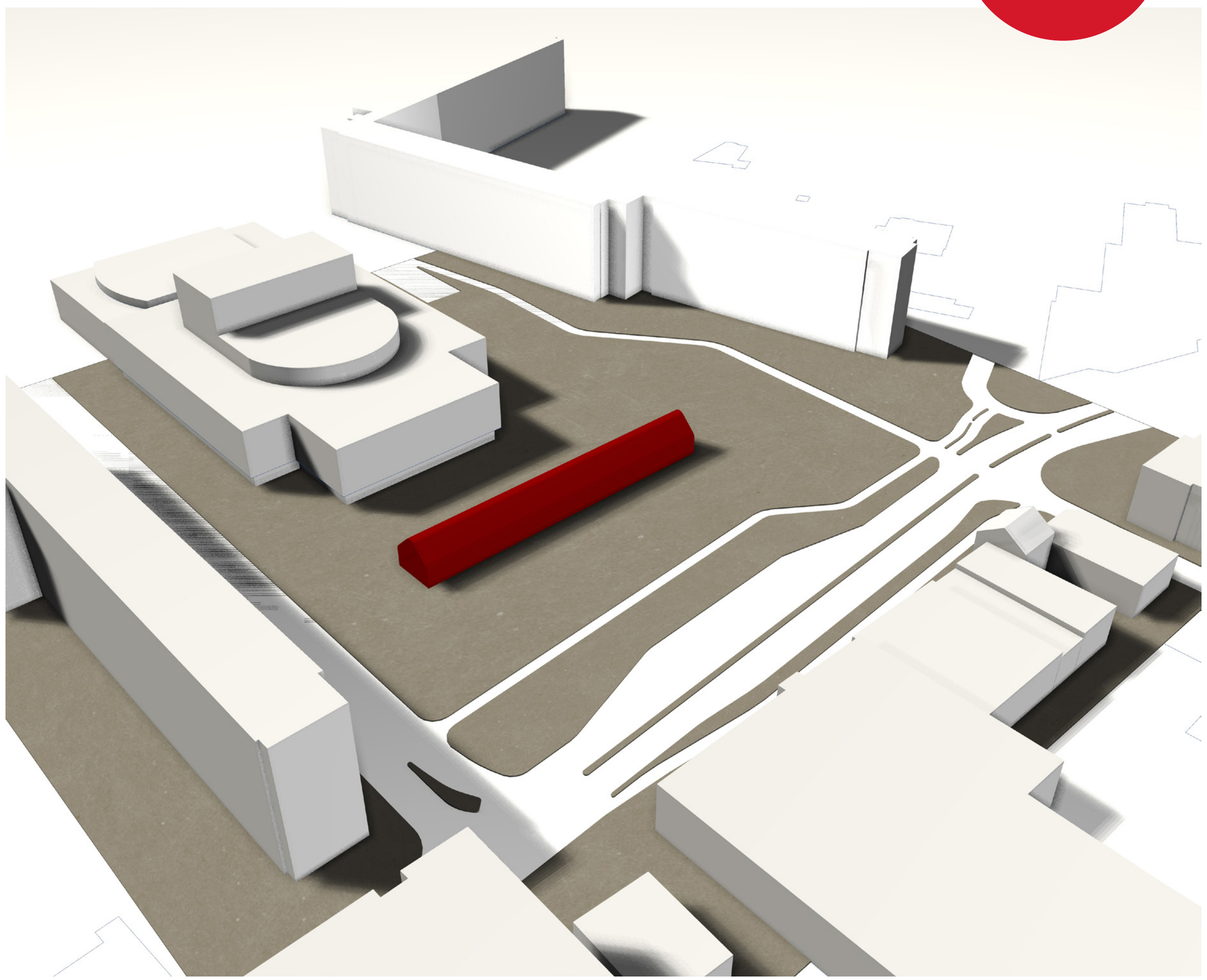


Module 3

Massing and Urban Study

Heerlen



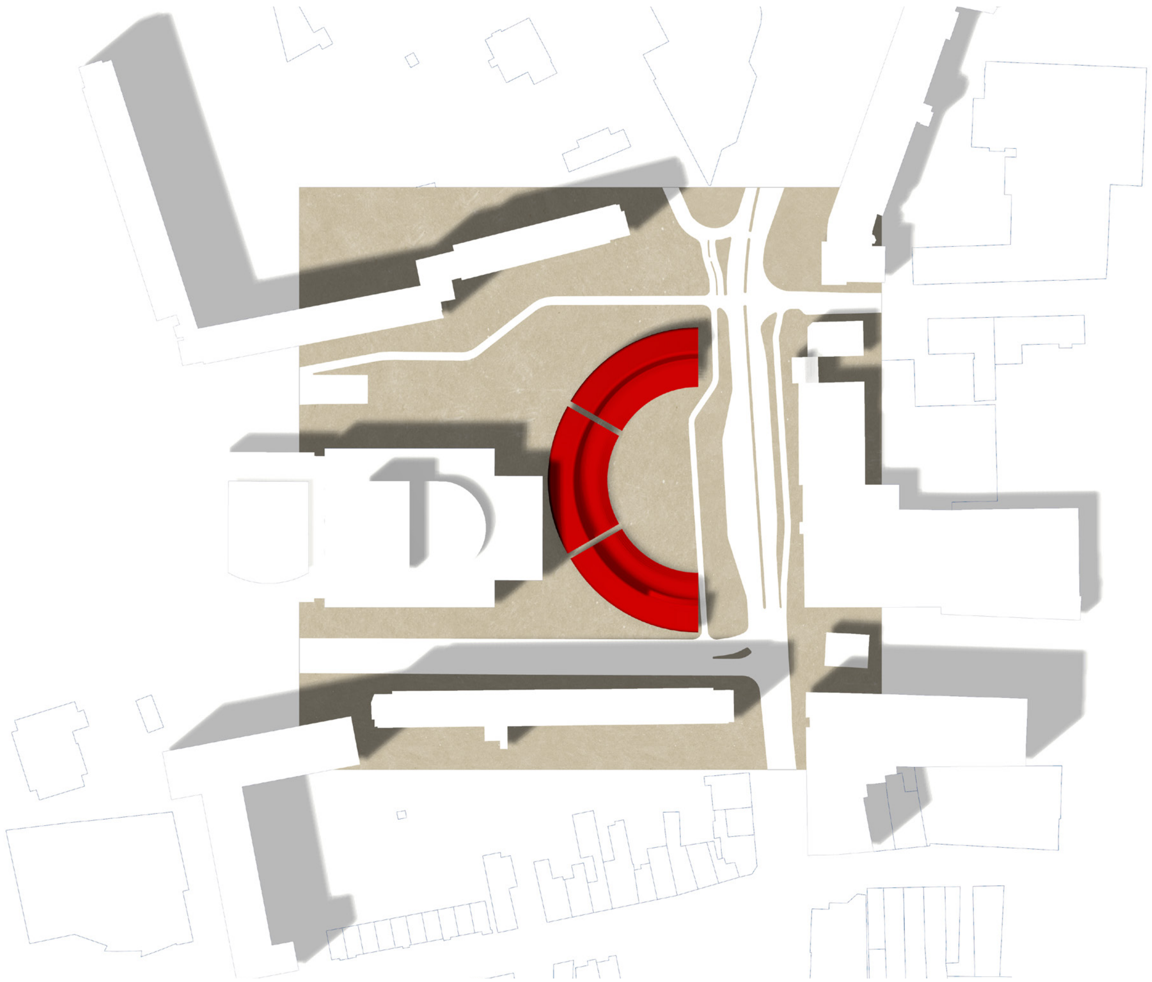


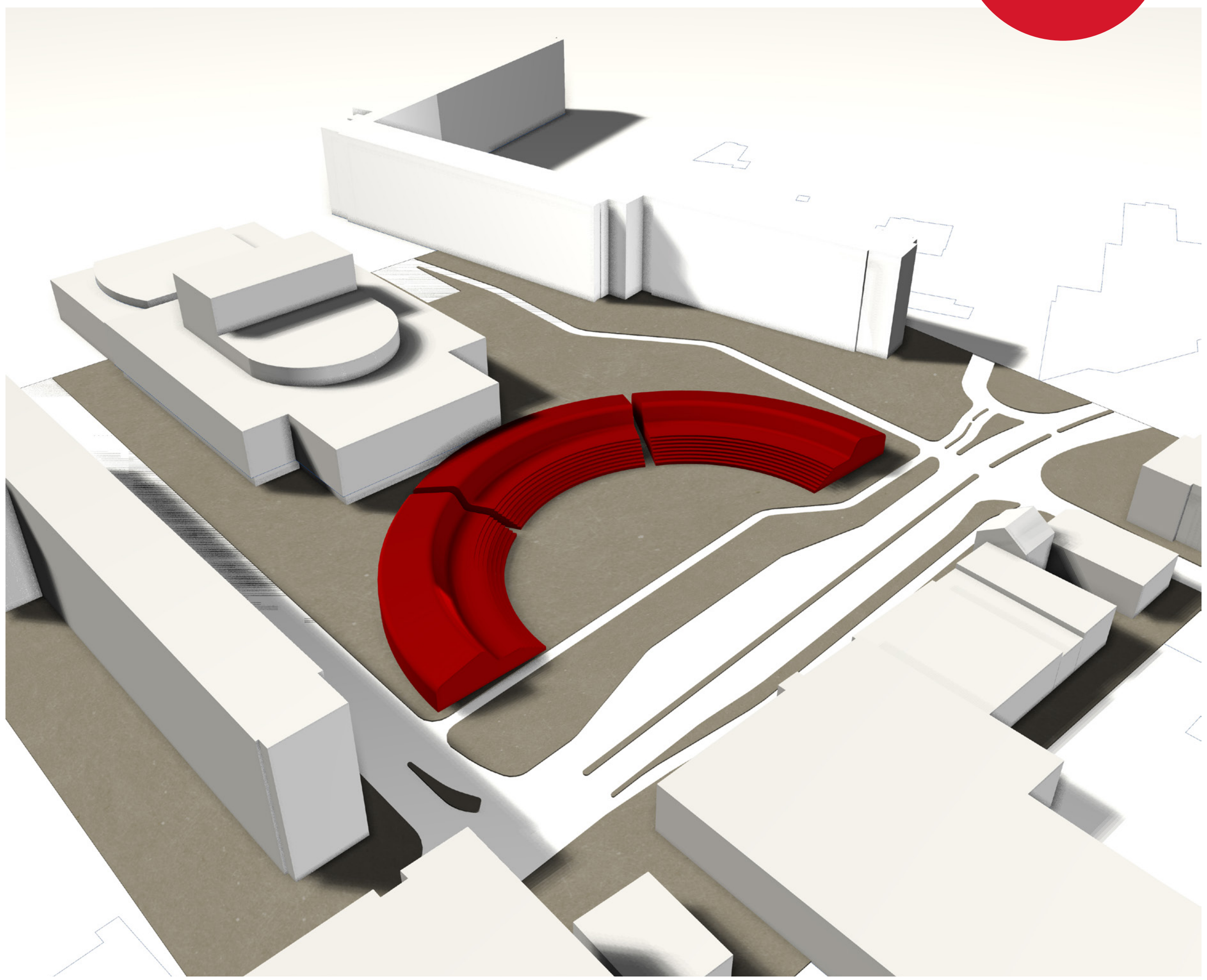
Module 1

Combined single module into a long shape.
Not a strong presence on site.
Blocking view of the main theatre

Massing and Urban Study

Heerlen



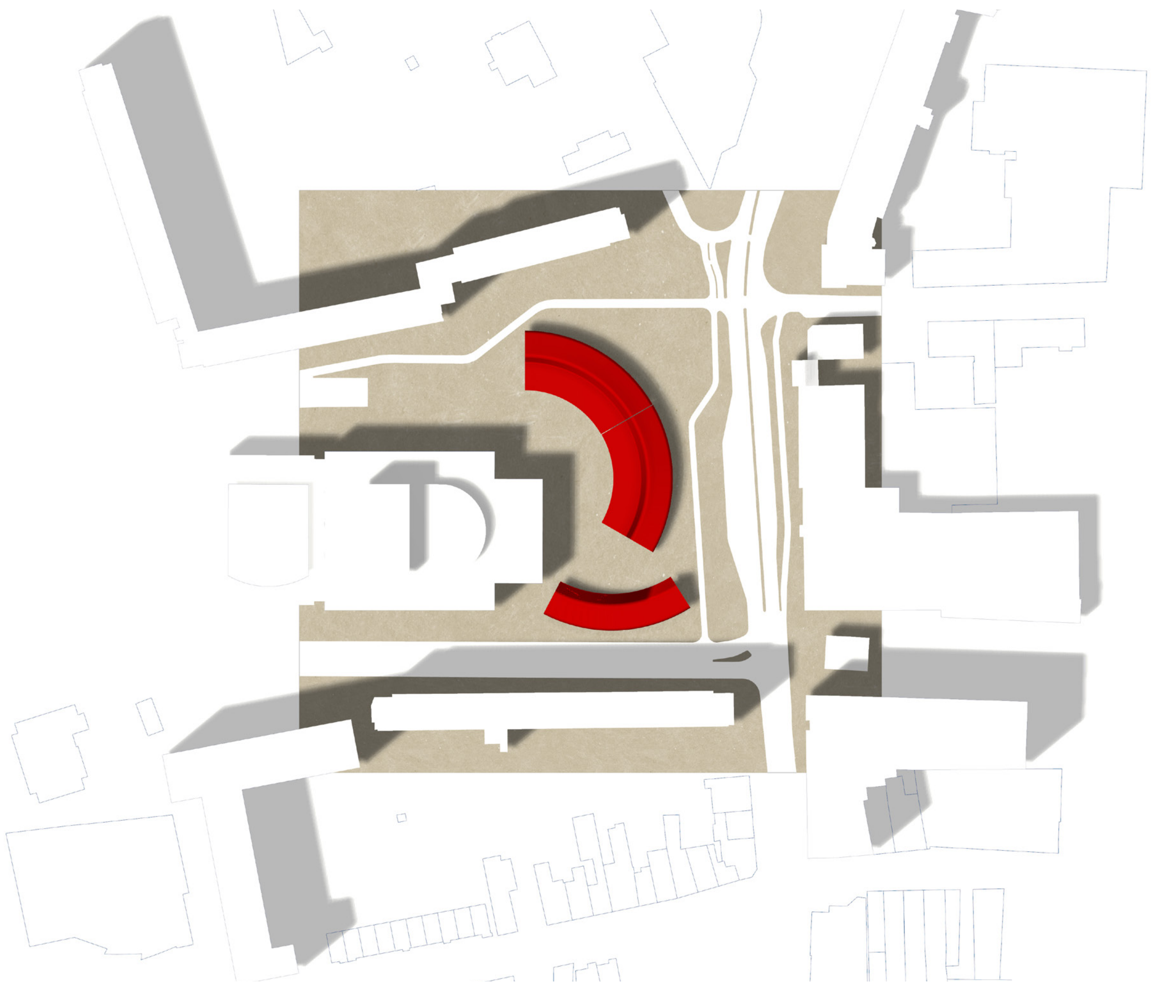


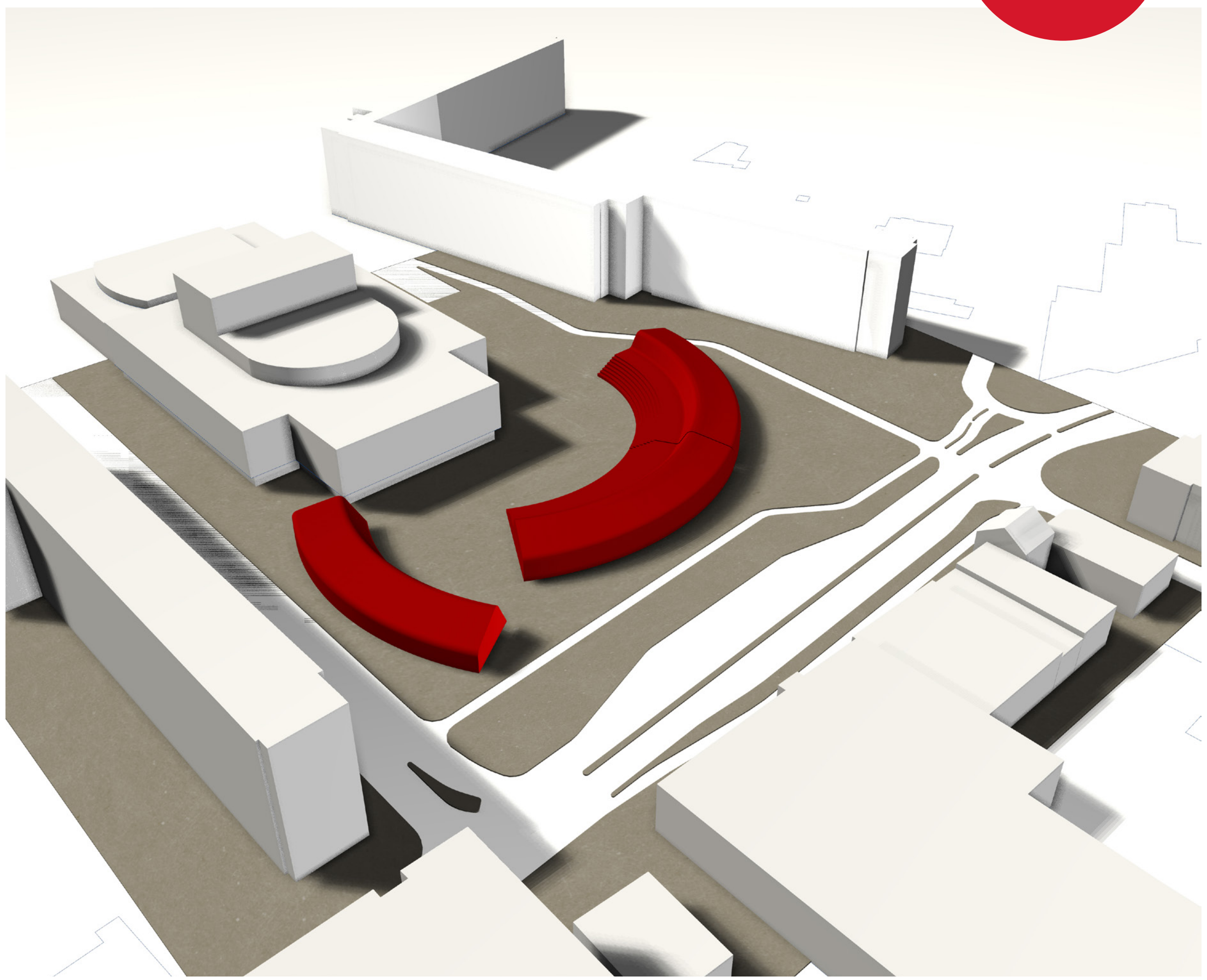
Module 3

Combined single module type.
Strong presence on site.
Blocking view of the main theatre. Street as backdrop

Massing and Urban Study

Heerlen



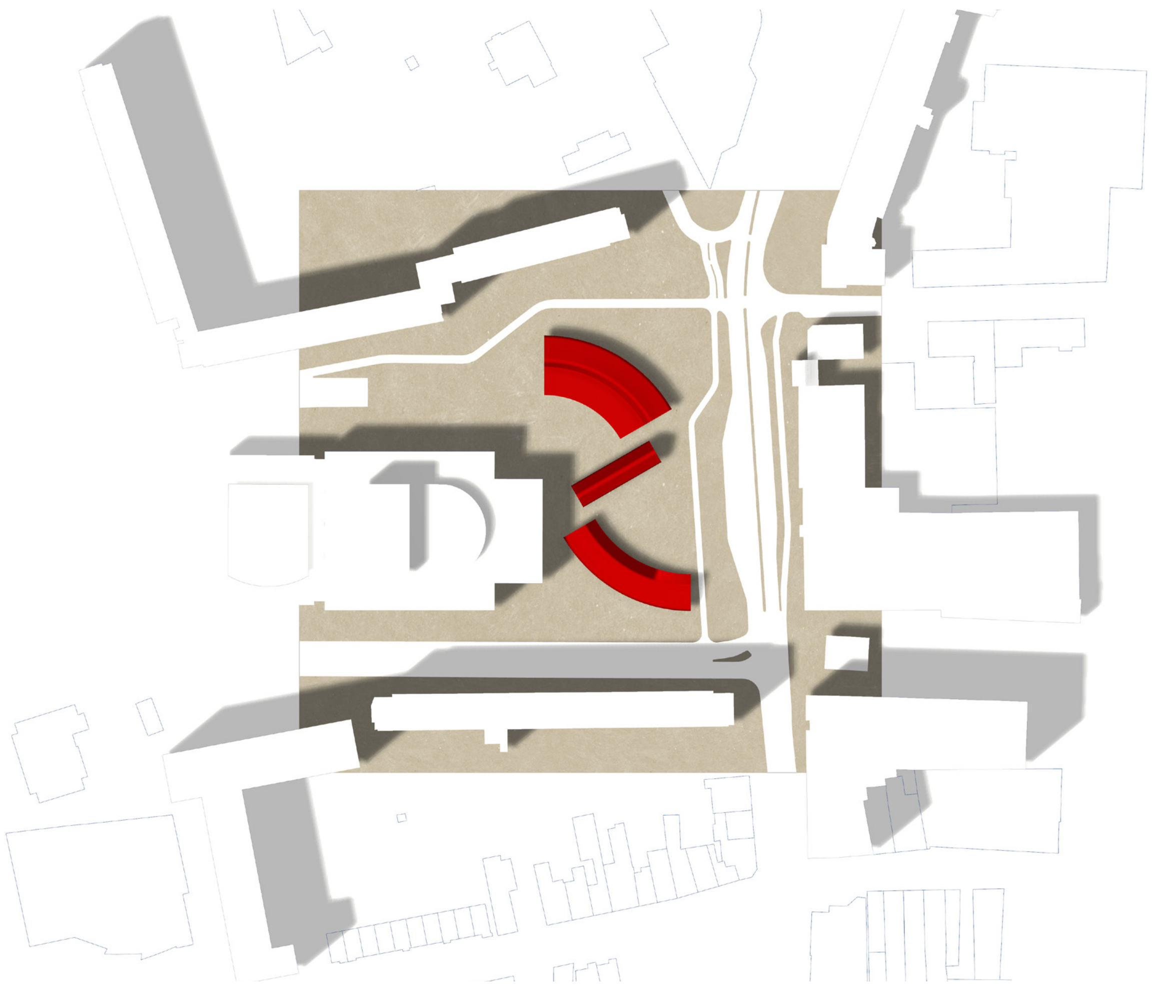


Module 2 + 3

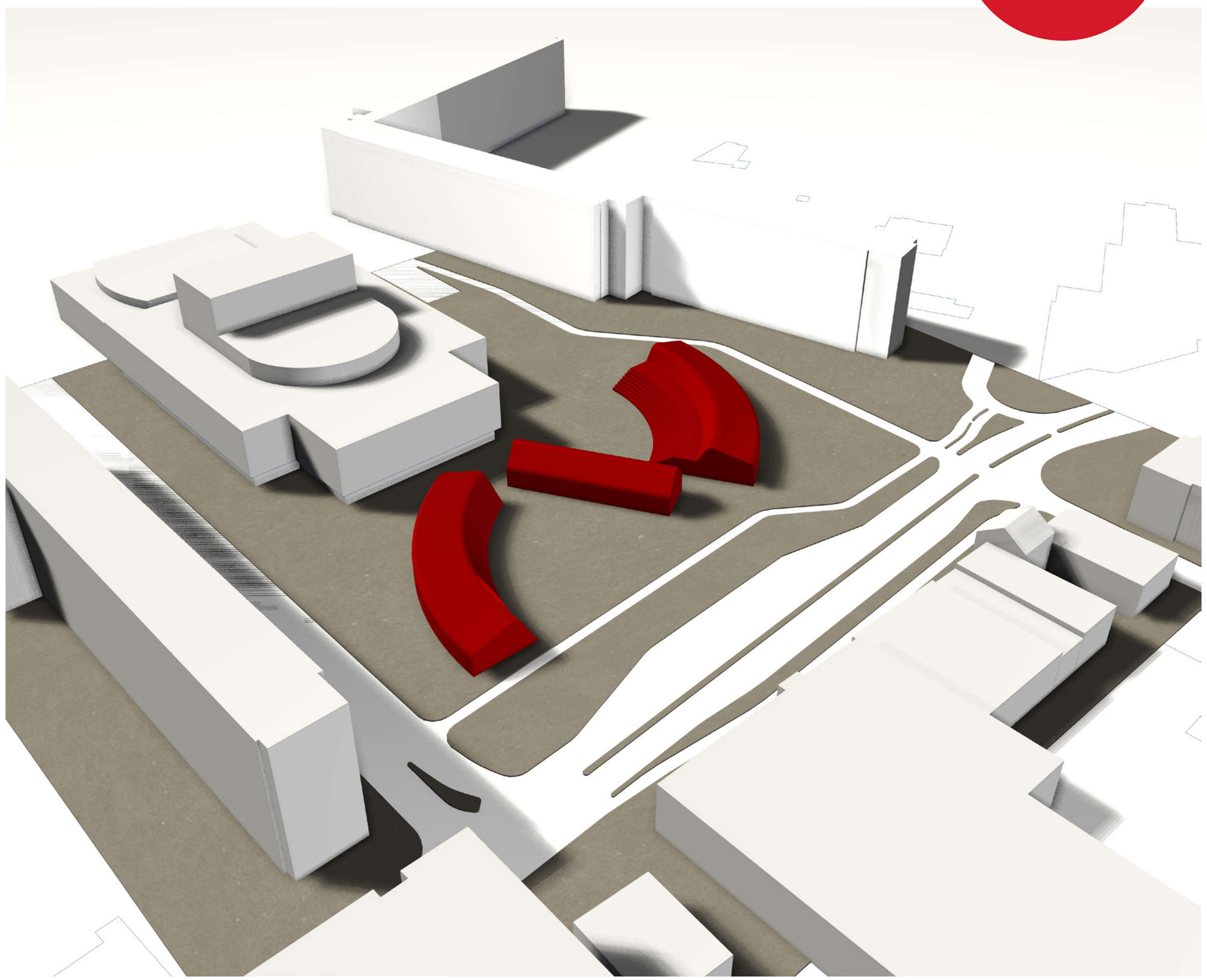
Combined different module types for different programs.
Strong presence on site.
Partial blocking view of the main theatre

Massing and Urban Study

Heerlen

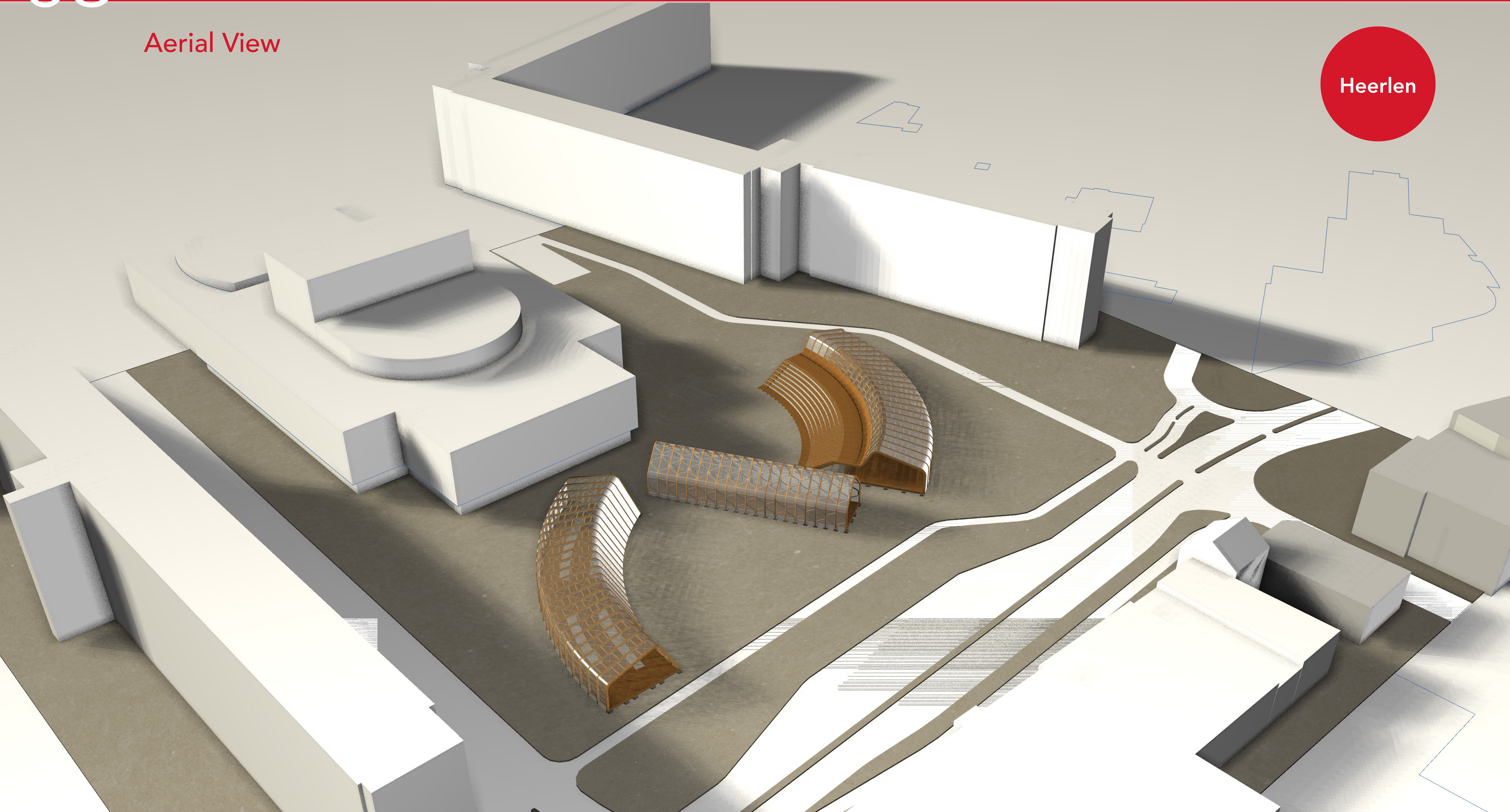


Module 1+ 2 + 3

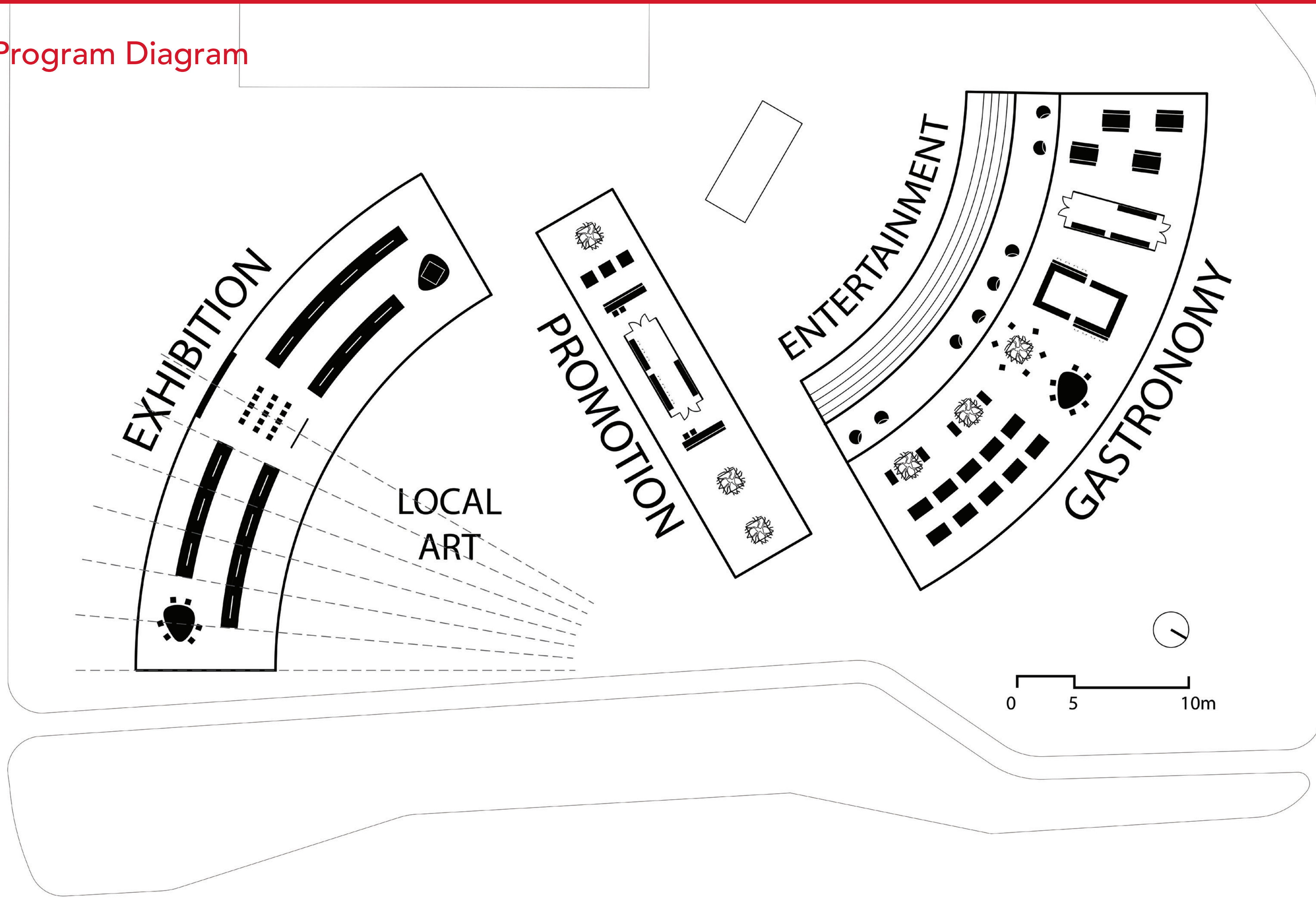


Combined different module types for different programs.
Strong presence on site. Street aproach guided by fluid form.
Direct access to main theatre.

Aerial View



Program Diagram

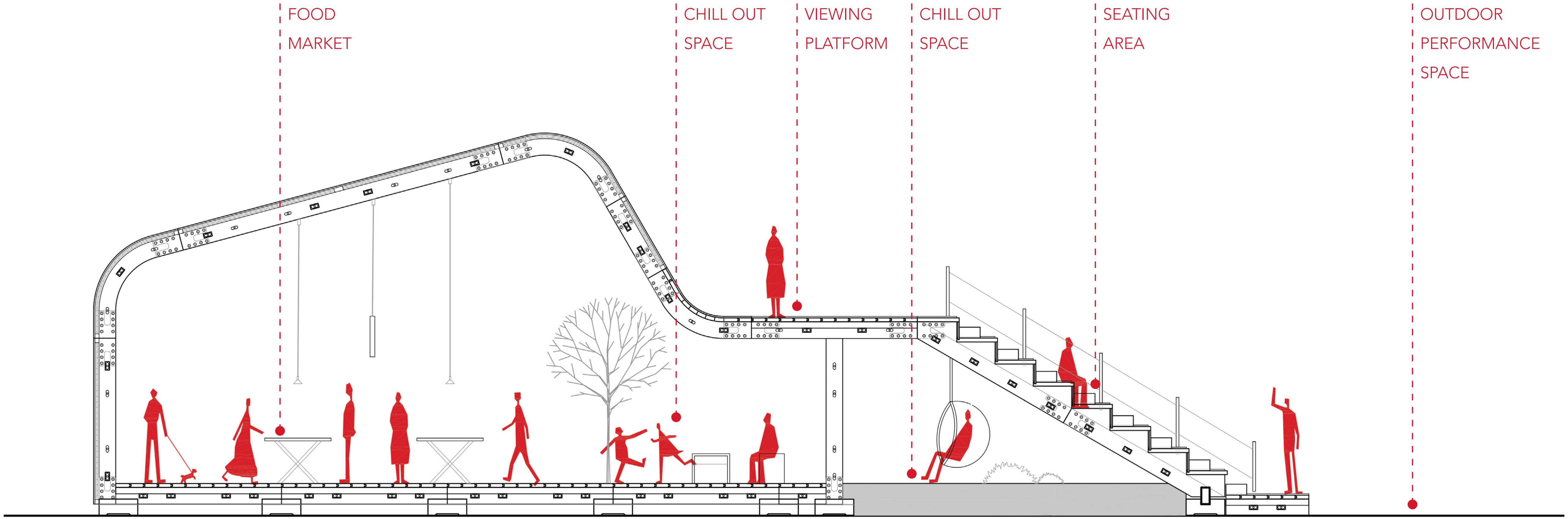


Floor Plan

Heerlen

Building Sections

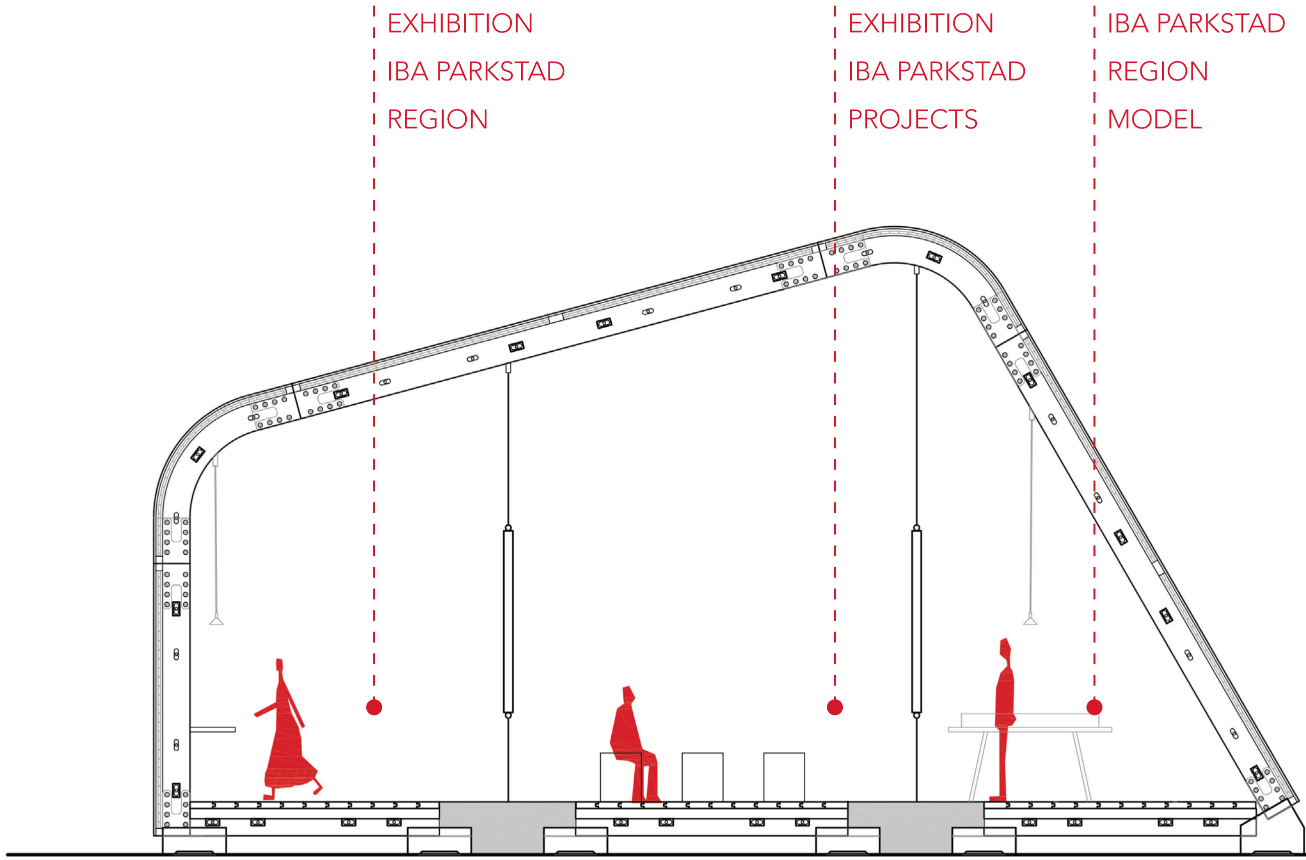
Heerlen



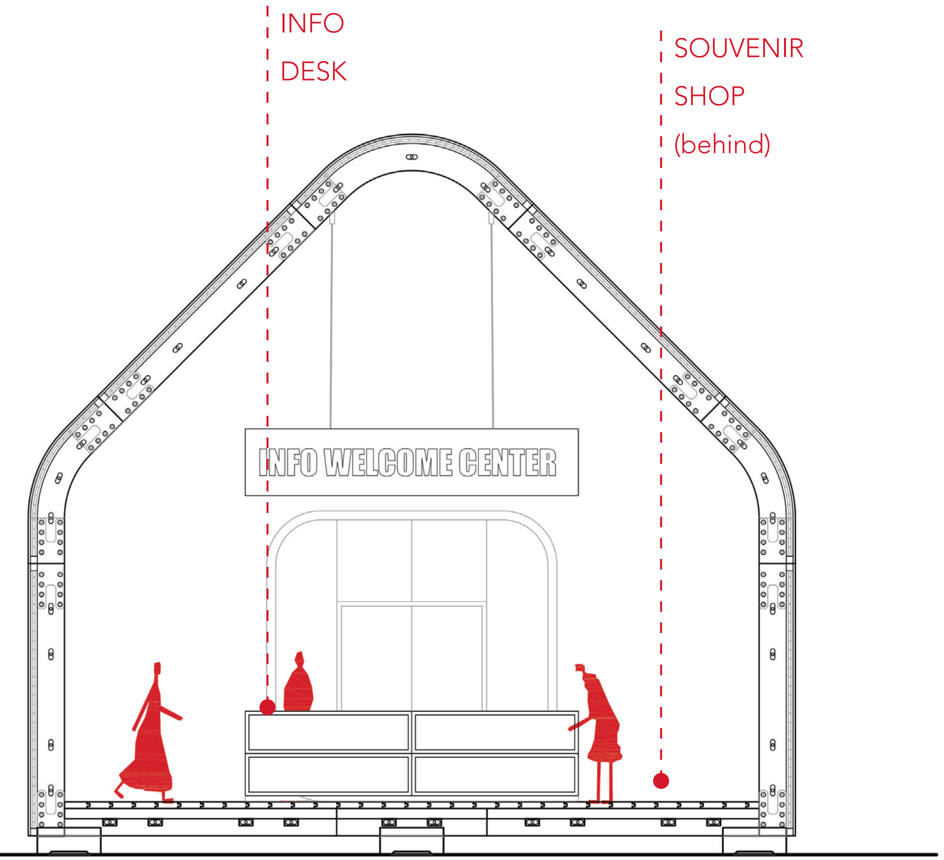
Section A

Building Sections

Heerlen

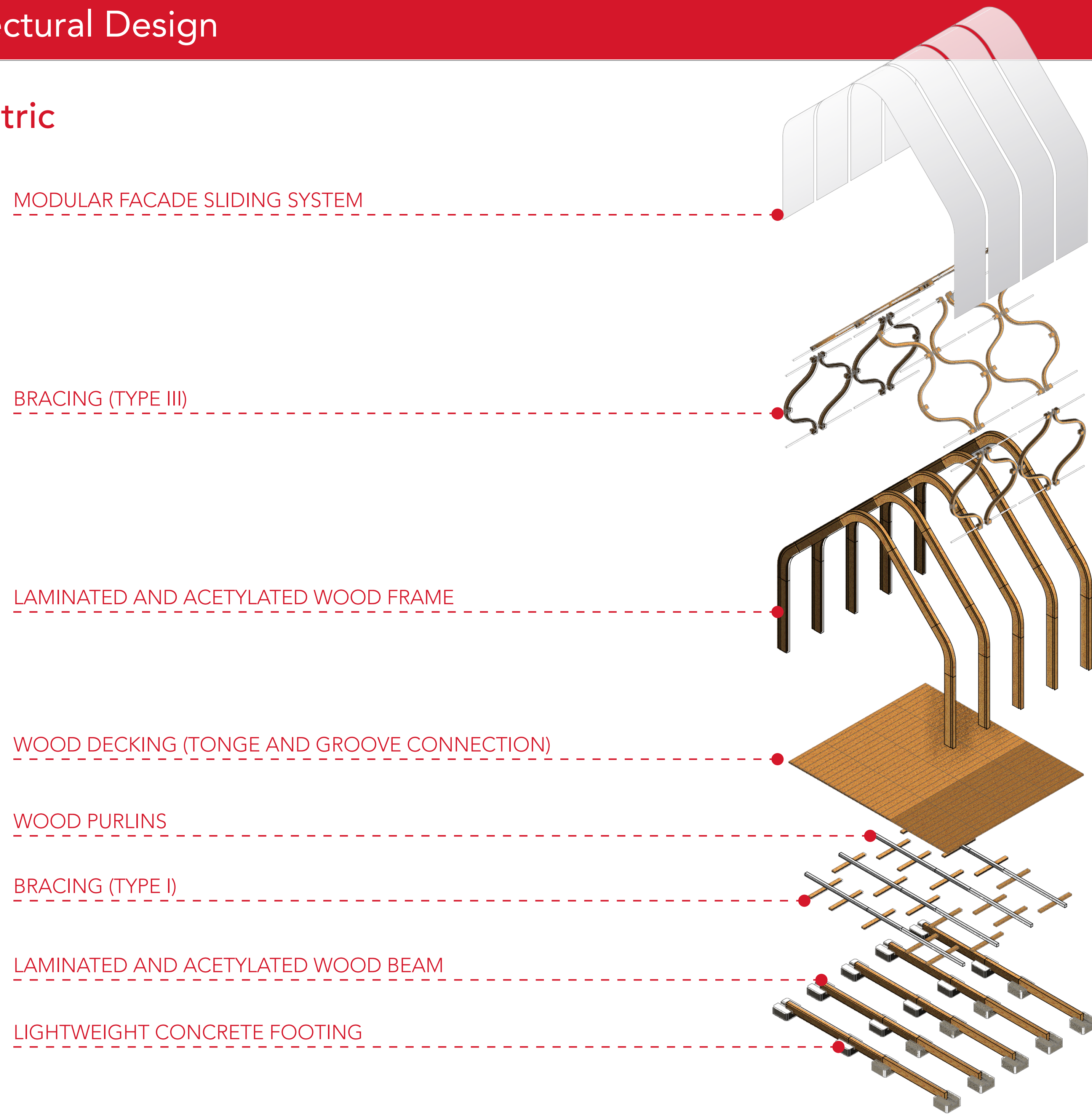


Section B

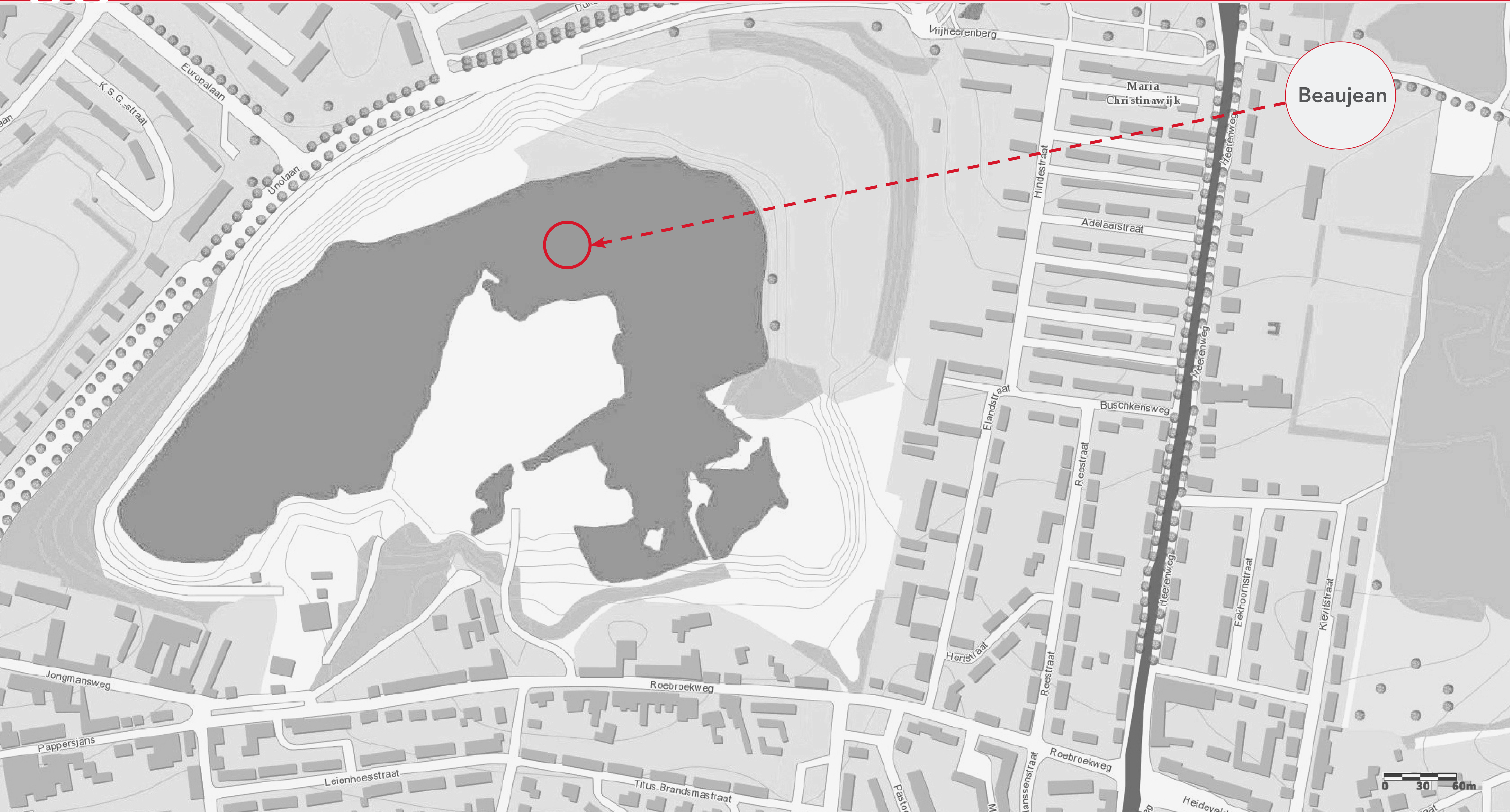


Section C

Exploded Axonometric




Heerlen
iba
parkstad
2013-2020
PH-IBA
www.iba-parkstad.nl
THEATER HEERLEN
iba
parkstad
WELCOME CENTER


Beaujean
Maria Christinawijk
Vrijheerenberg
Europalaan
K.S.G.-straat
Unolaan
Hindestraat
Adelaarstraat
Heerenweg
Buschkensweg
Elandstraat
Reestraat
Eekhoornstraat
Kievitstraat
Hertstraat
Jongmansweg
Roebroekweg
Pappersjans
Leienhoesstraat
Titus Brandsmastraat
0 30 60m

Beaujean Quarry - Folly (Floating Platform)

Beaujean

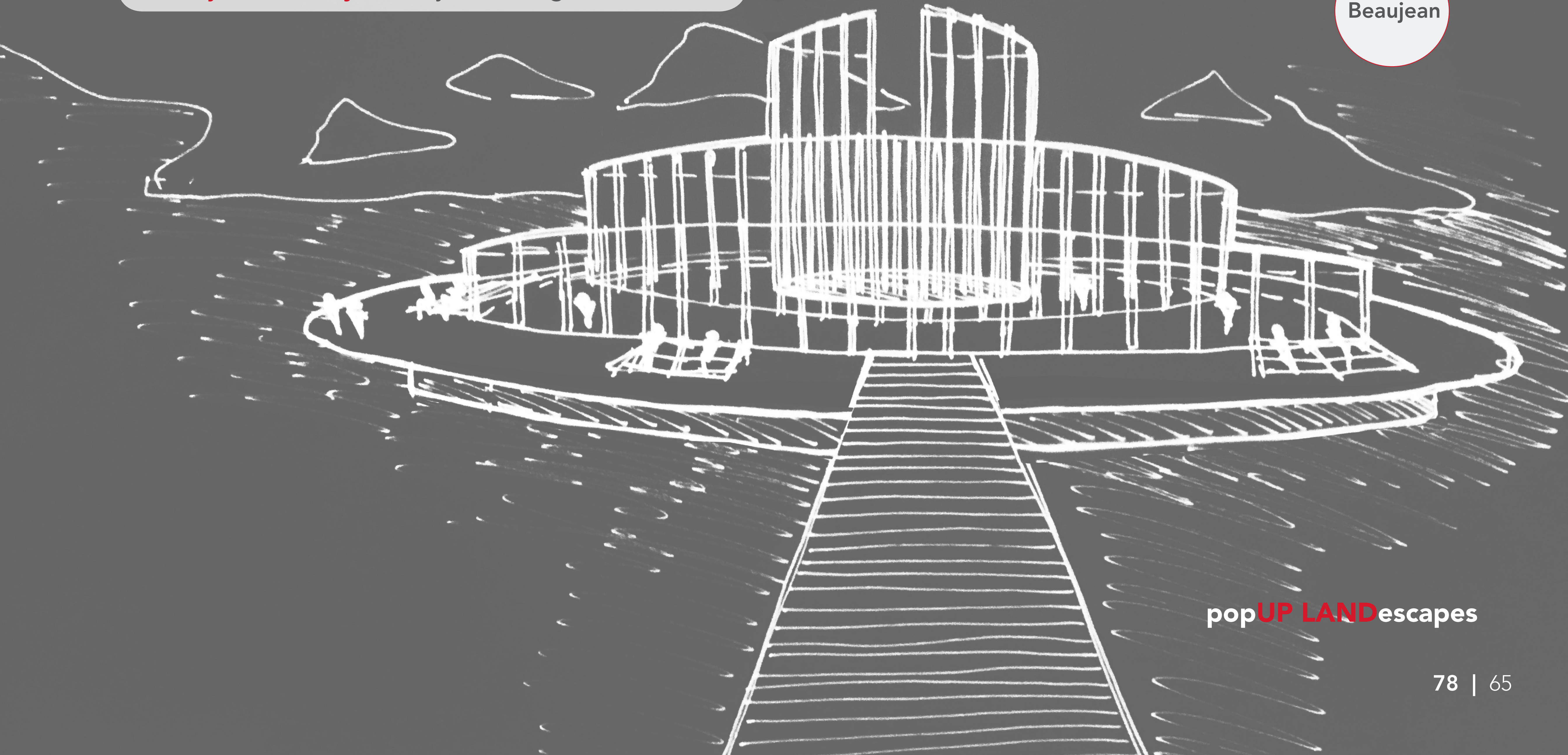
popUP LANDescapes

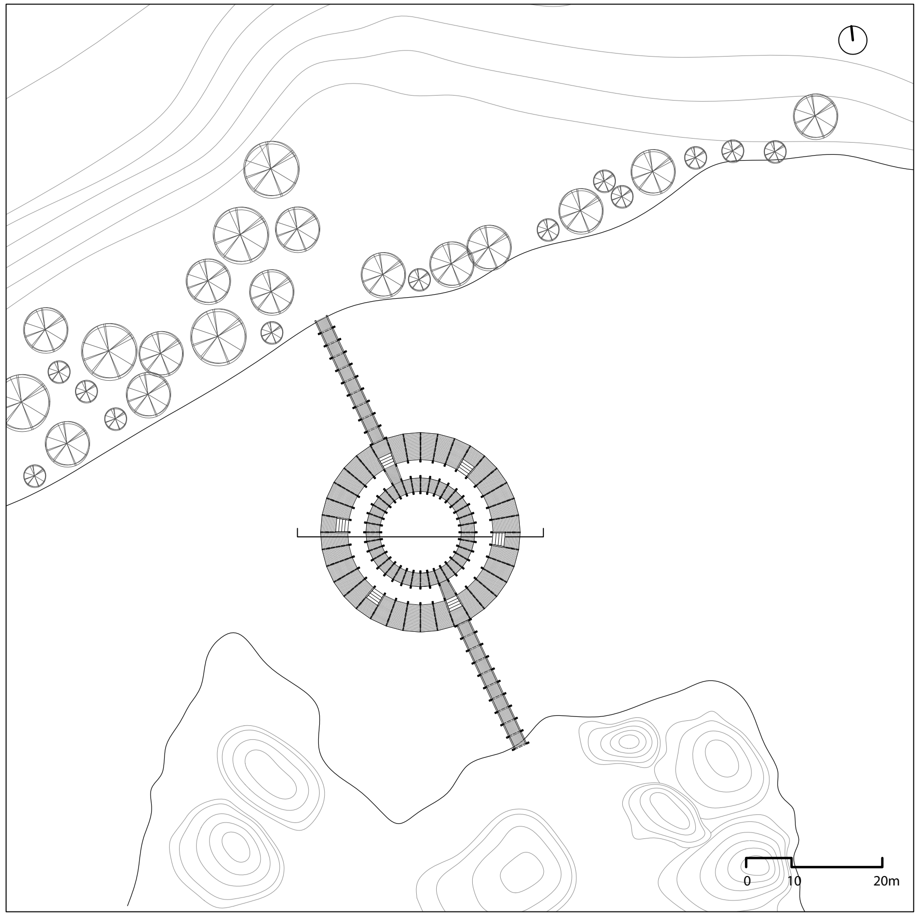
Crystal (or silver) sand used for the manufacture of glass since 1914. The sand is known for its mineral and chemical purity. The quarry landscape was closed to the public and is now being transformed into a public park.

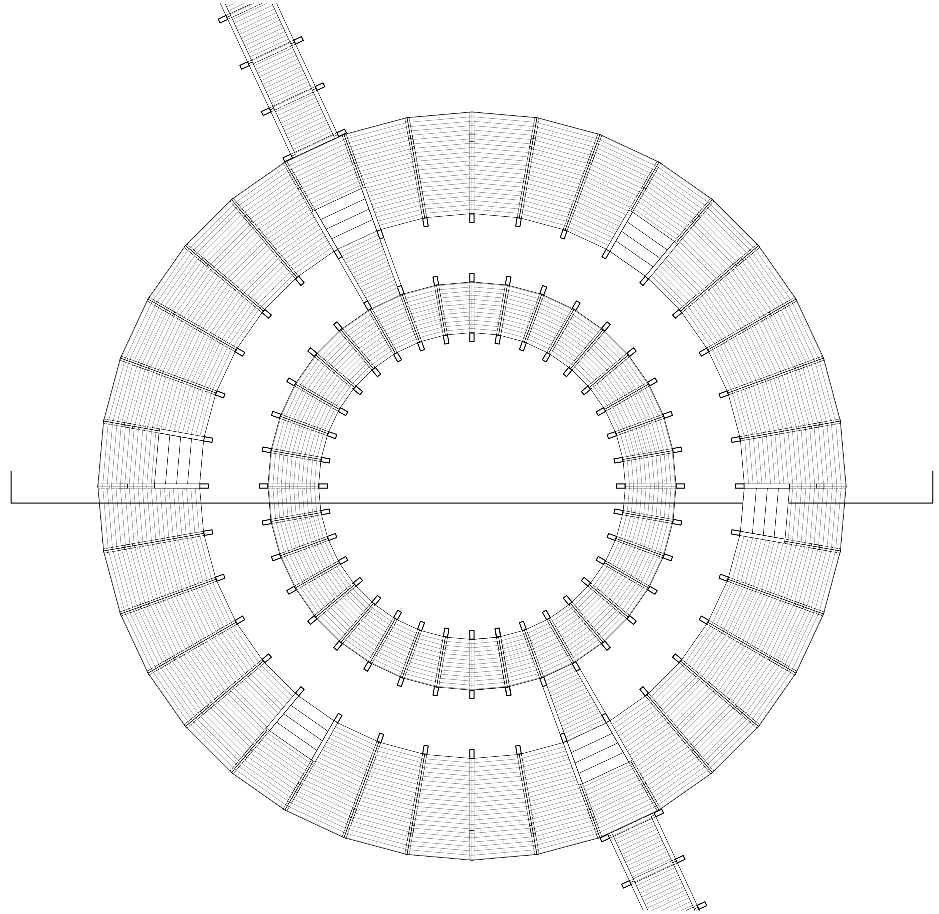
Image: Image: online

Beaujean Quarry - Folly (Floating Platform)

Beaujean

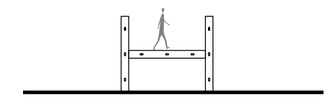


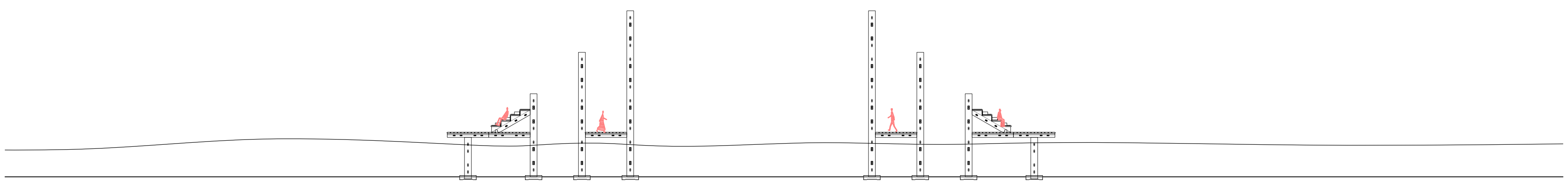


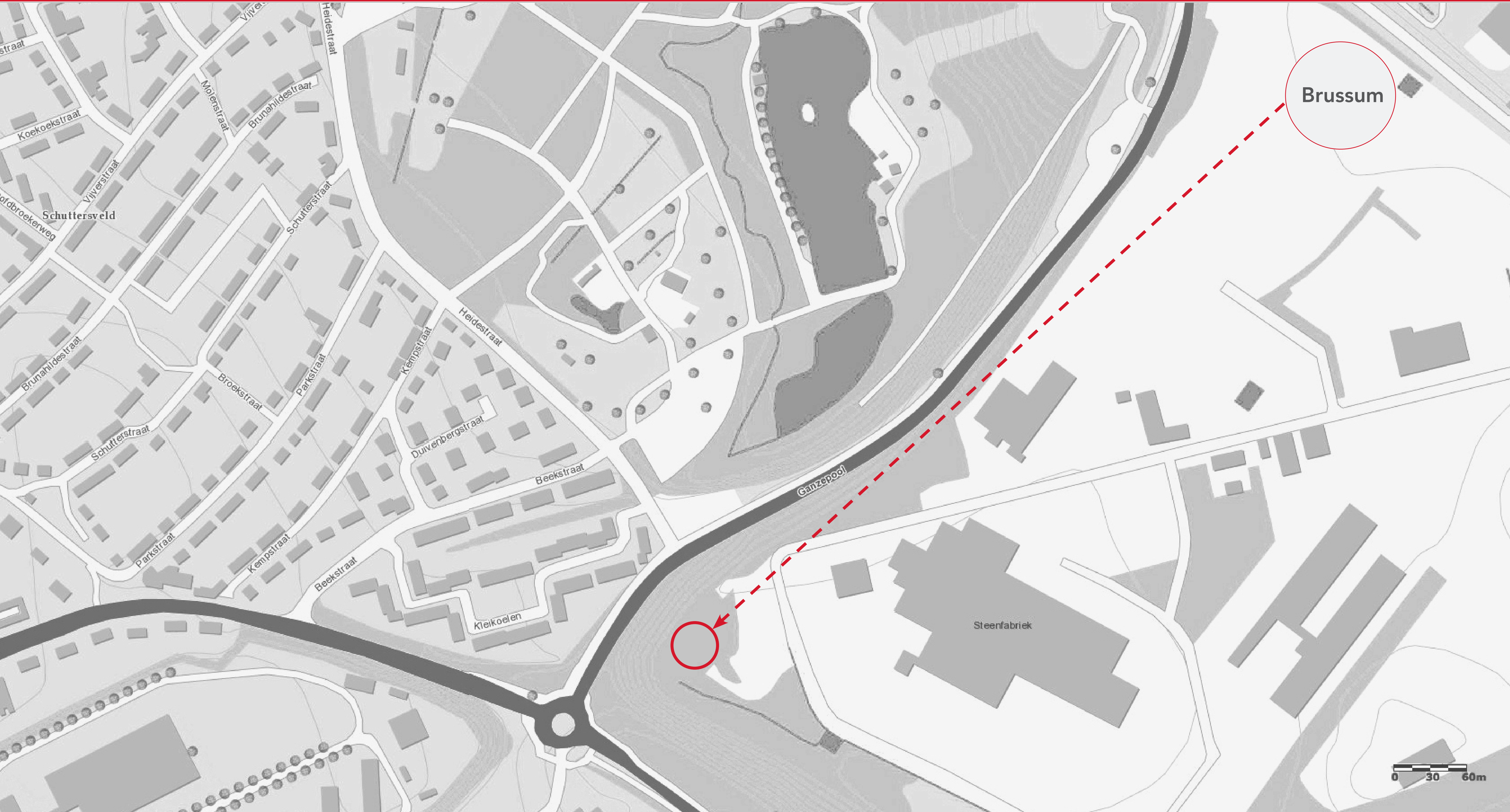


Beaujean

FRAME USED:






Brussum
Schuttersveld
Koekoekstraat
Vijverstraat
Molenstraat
Brunahildestraat
Heidestraat
Schuttersstraat
Parkstraat
Broekstraat
Kempstraat
Duivenbergstraat
Beekstraat
Kleikoelen
Ganzepool
Steenfabriek
0 30 60m

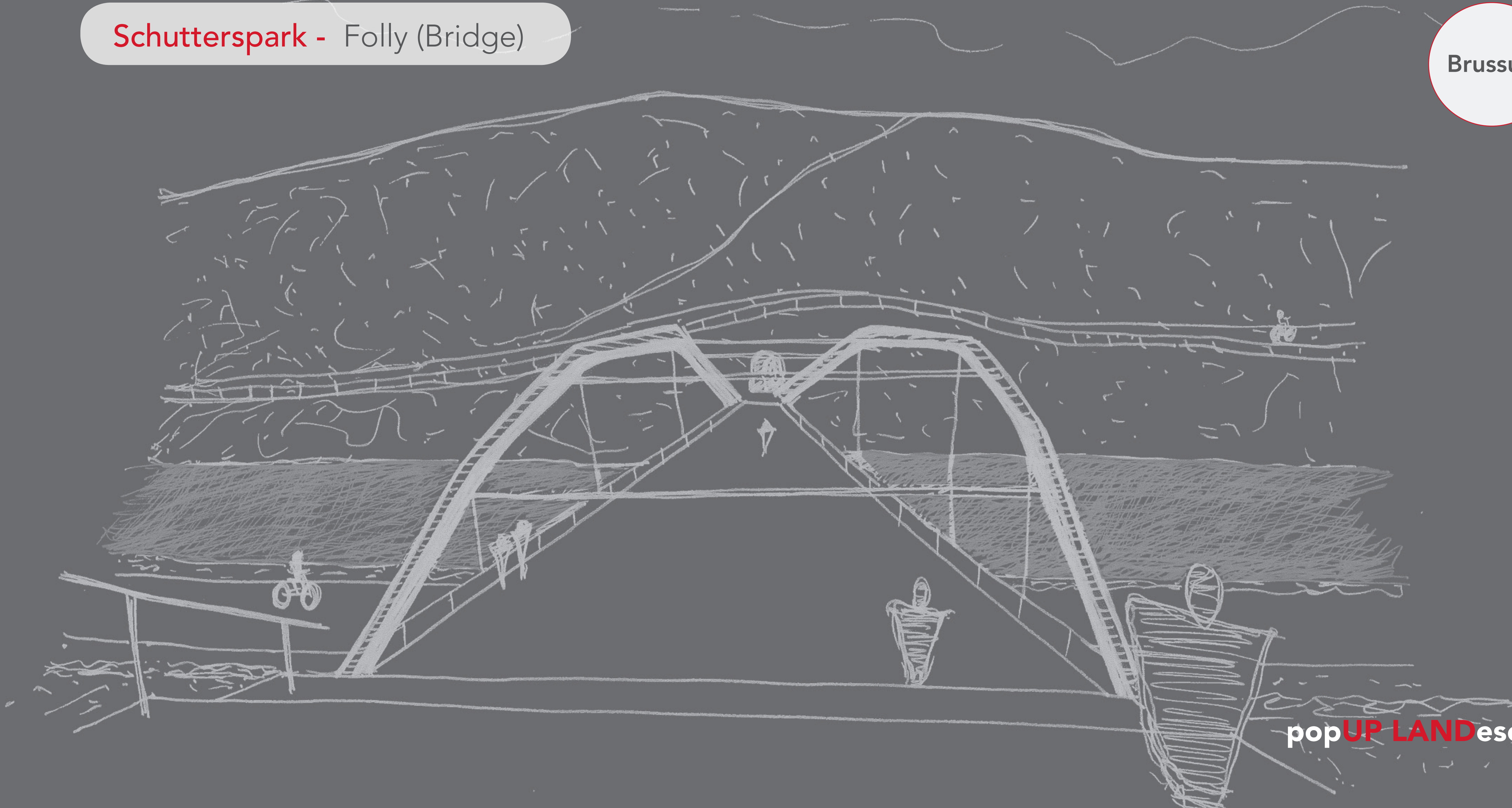
Schutterspark - Folly (Bridge)

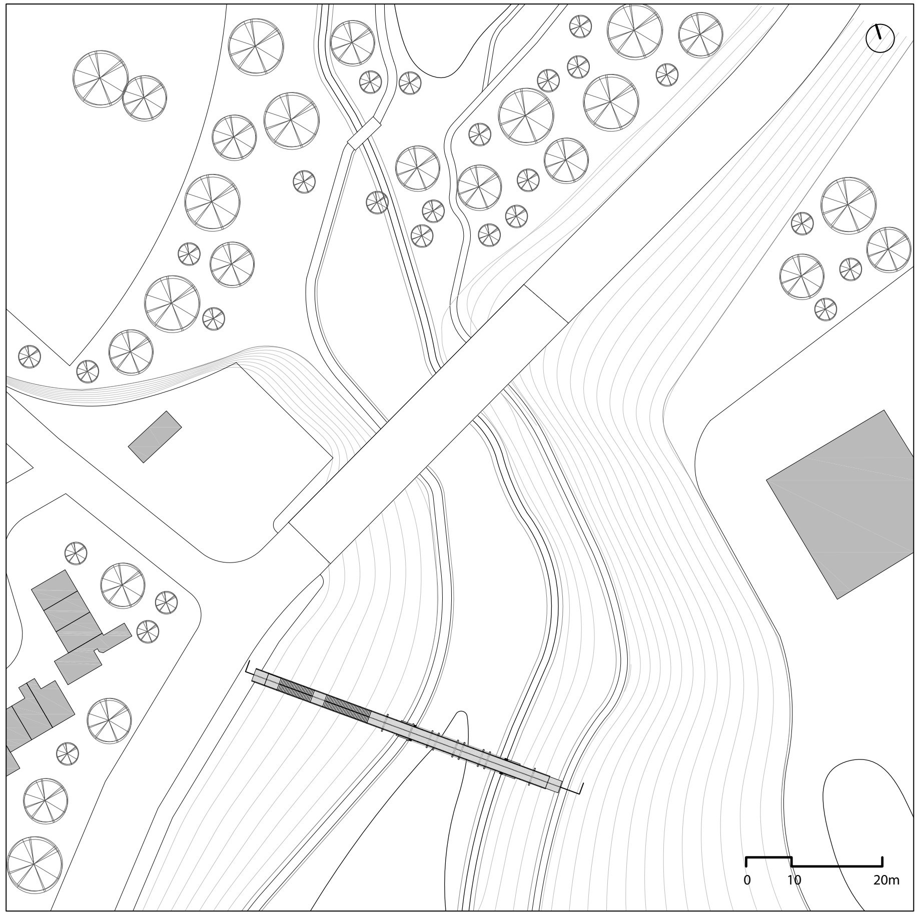
"From Black to Green": project at the intersection between the Park and the waste left behind by the mining industry now aims to bring back to surface the Rode Beek stream and create a green corridor.

Image: by author

Schutterspark - Folly (Bridge)

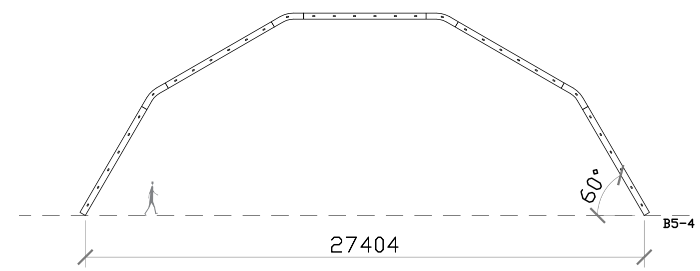
Brussum

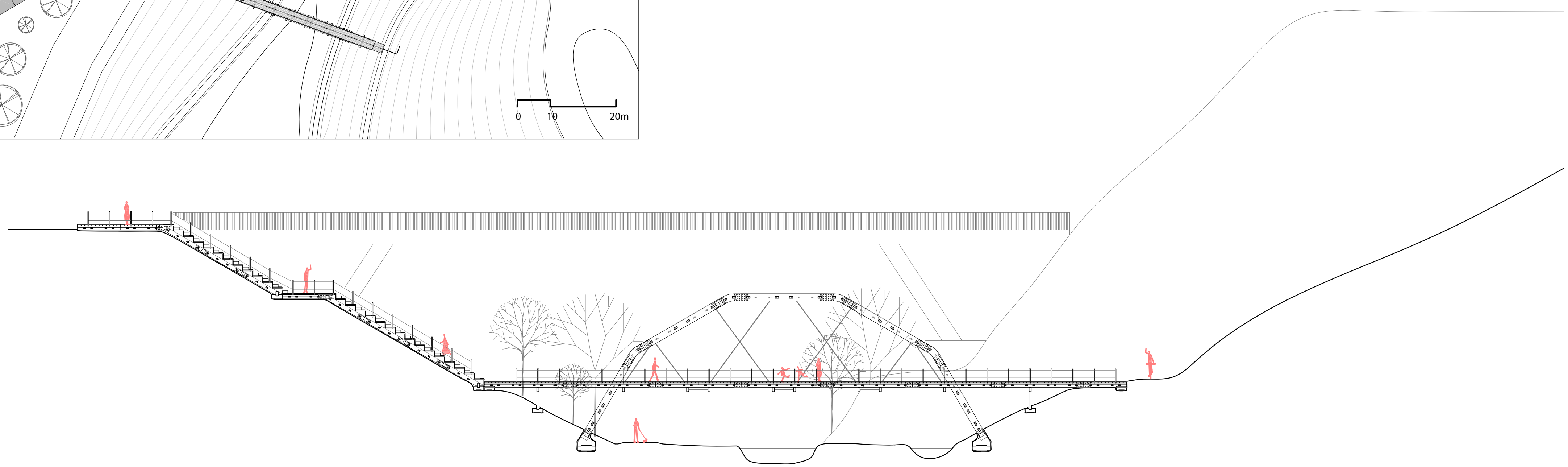




Brussum

FRAME USED:






Schinveld
De Lier
Leiffenderhof
Leiffenderhofweg
Leiffenderhofweg
Leiffenderhofweg
Beemderweg
55 m
Heringsweg
Heringsweg
Kinkeweg
Kinkeweg
1E KOEWEG
Koeweg
Nonke Buusjke
0
30
60m

Schinveldse Bossen - Folly (Observatory)

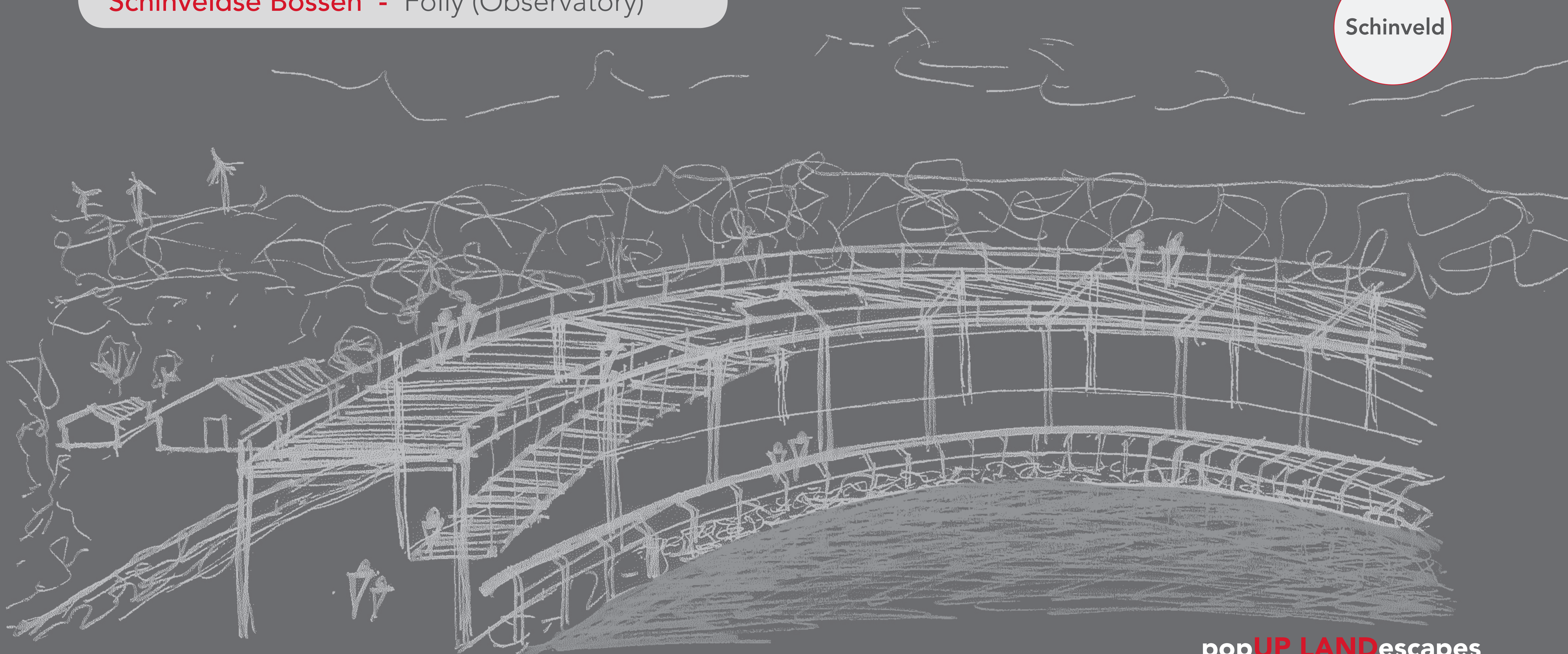
Schinveld

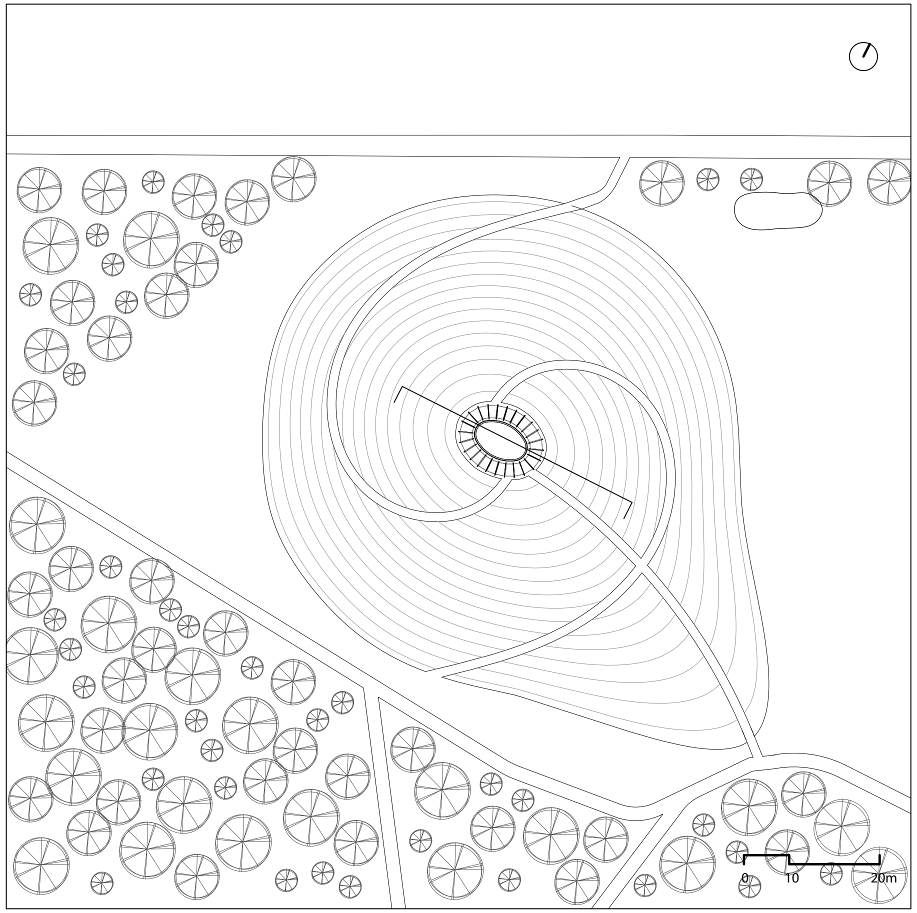
Clay pits excavated during Roman times for production of pottery.
Elevated pond location is a viewing point for surrounding landscape.

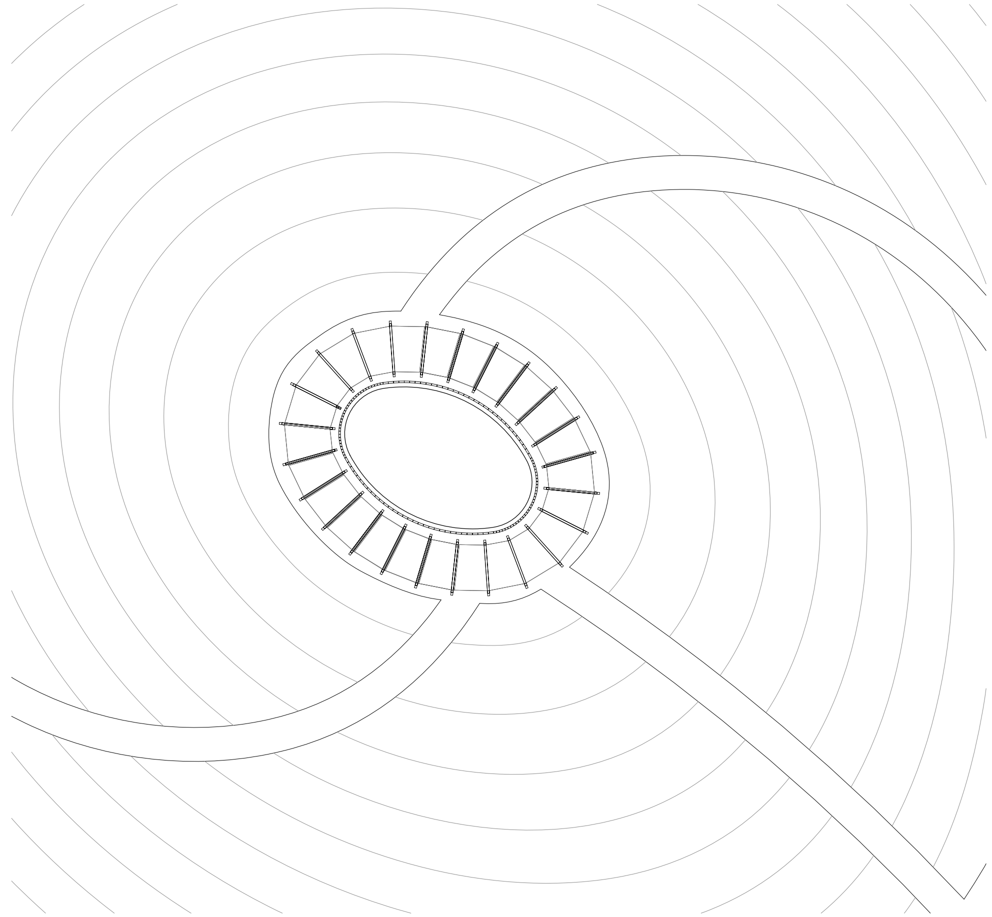
Image: Image: online

Schinveldse Bossen - Folly (Observatory)

Schinveld

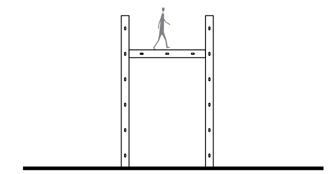


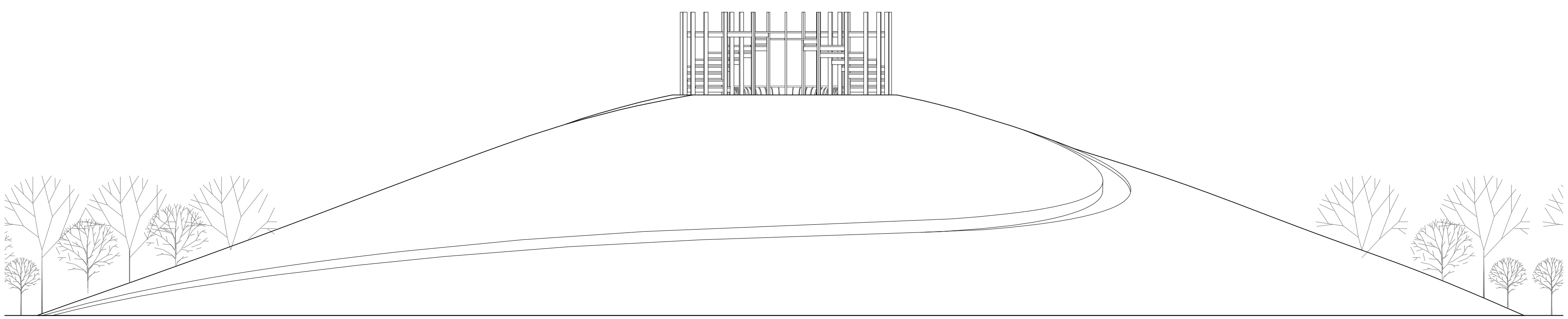




Brussum

FRAME USED:





Content

VIDEO

Content

Next Steps

* Compile all structural analysis information into a booklet
* Showcase 3 additional design better
* Produce 1:20 Sectional model of Heerlen design
* Adjust details to incorporate more tolerances when needed

05 Questions