

# بيت التراث

ZAATARI HOUSE OF HERITAGE



## Group 4

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## INTRODUCTION

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# Building concept



Bayt alturath

بيت التراث

House of heritage

## Problem Statement

Refugees coming to the Zaatari camp have been displaced from their home country and their **identity** is at stake. By providing them certain **facilities**, their cultural identity could be **preserved**. A **Heritage center** could help to retain their **identity** where one could engage and stay rooted to their **culture and history**.



"The war has largely affected our work because out of 100 professionals ahead of the war, there are now only 15 across Syria," Qarkoush said.

## Design vision

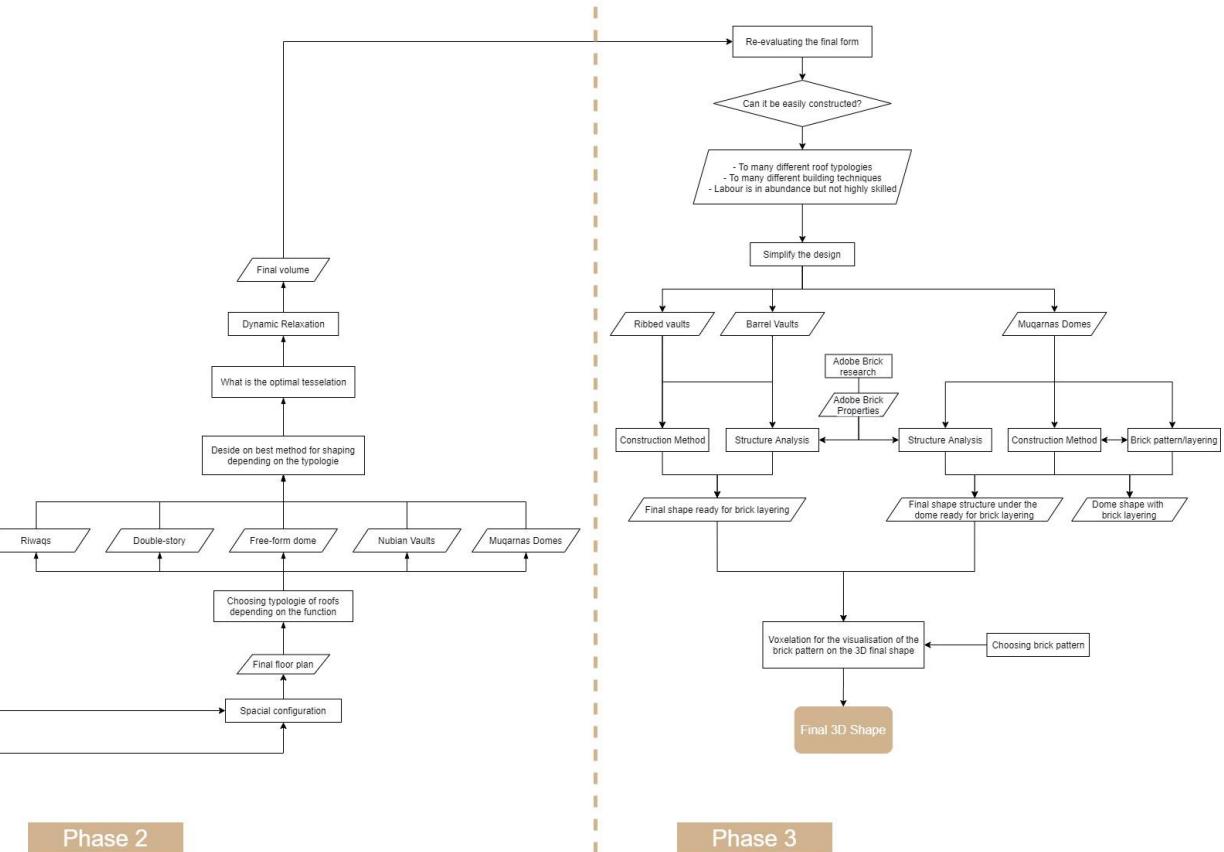
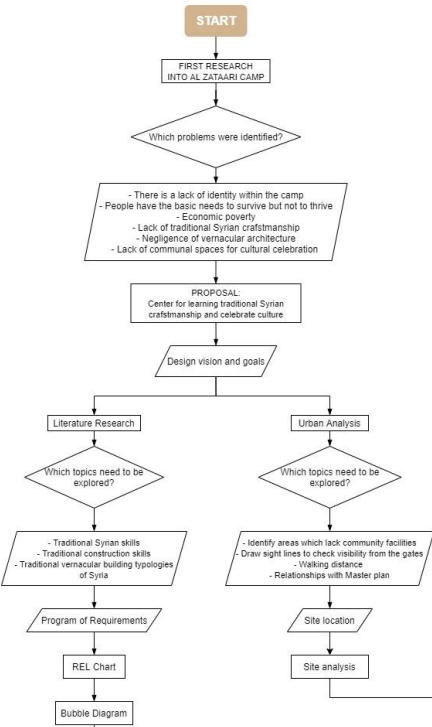
"Our aim is to revive the traditional arts and craftsmanship of Syria while empowering the members of the community with skills that will make them economically self sufficient."

# Goals

- Reviving the Vernacular Syrian architecture
- Reviving traditional Syrian arts and crafts
- Creating jobs for refugees by giving them the means to start their own business
- Providing more communal spaces in the camp



# Flowchart



Phase 1

Phase 2

Phase 3

## RESEARCH

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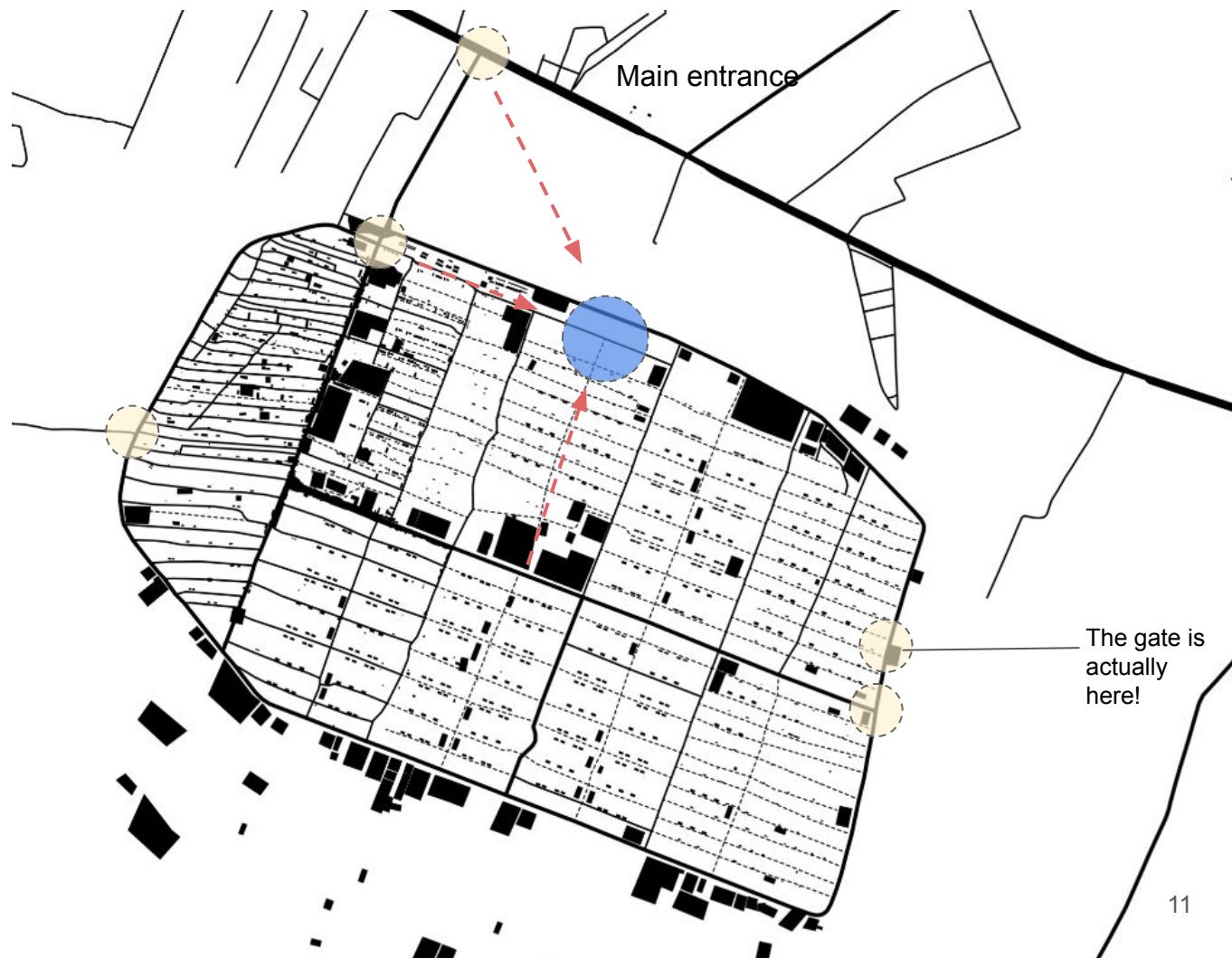
Youth centres and  
community centres

- Community Centres
- Youth Centres
- Recreational Areas
- Possible locations



## Site Location

- Gates
- Heritage center
- Sight lines



## Site Location

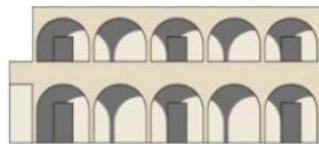


# Traditional Syrian Crafts

TEXTILE WORK	WOOD WORK	CERAMIC WORK
Al Aghabani	Mother of Pearl Marquetry	Pottery
Brocade	Al Ajami	Al Qishani
Oriental rugs	Oud (Musical Instruments)	Mosai



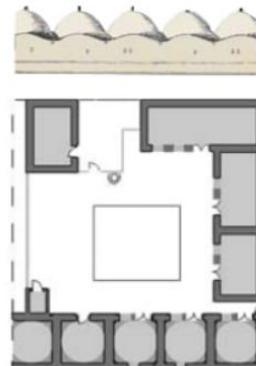
## Vernacular architecture- Spatial Configuration



House with Riwaq



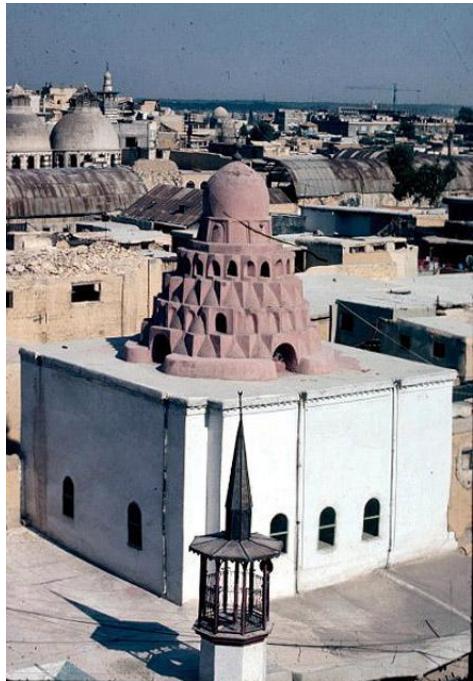
House with Liwan



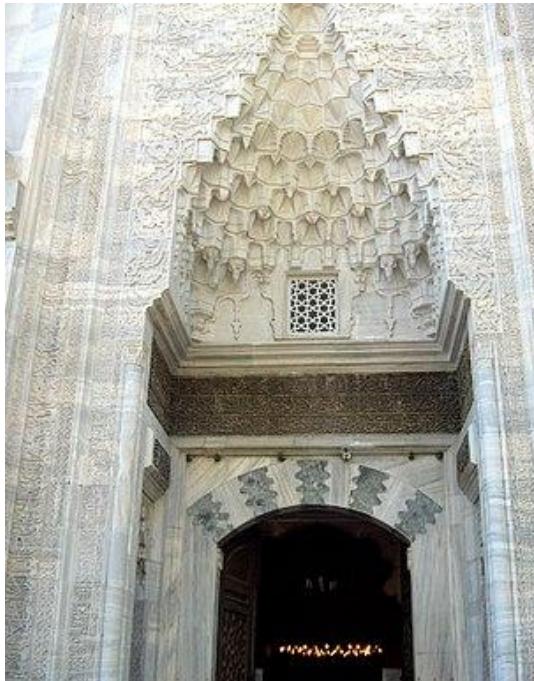
House with courtyard

Source: Traditional Syrian architecture, Corpus Levant

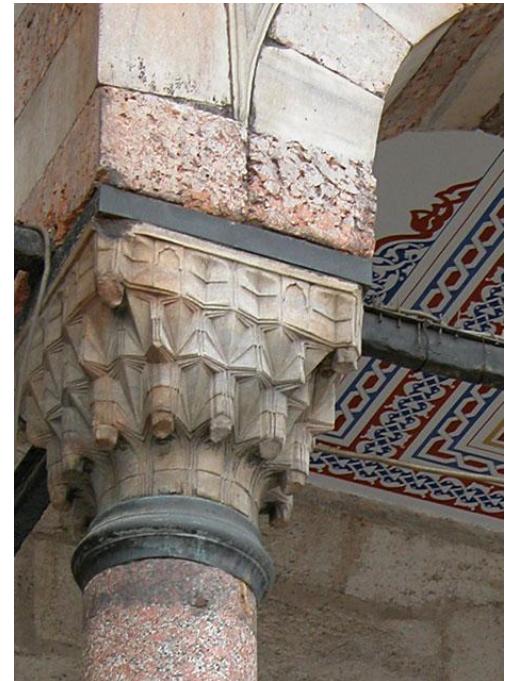
## Vernacular architecture- Muqarnas



Muqarnas as dome



Muqarnas on the wall

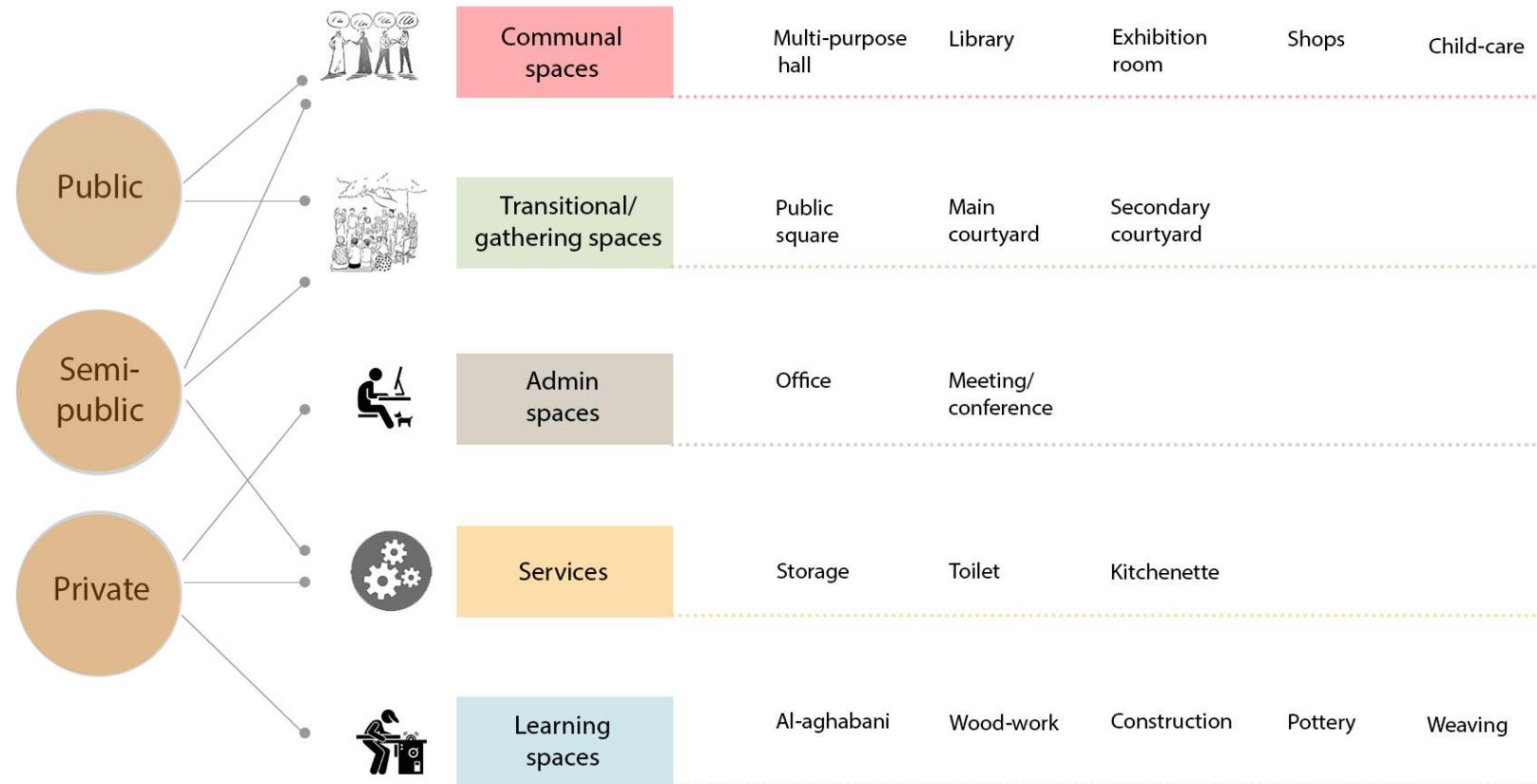


Muqarnas on a column

## Vernacular architecture- Openings



# Program

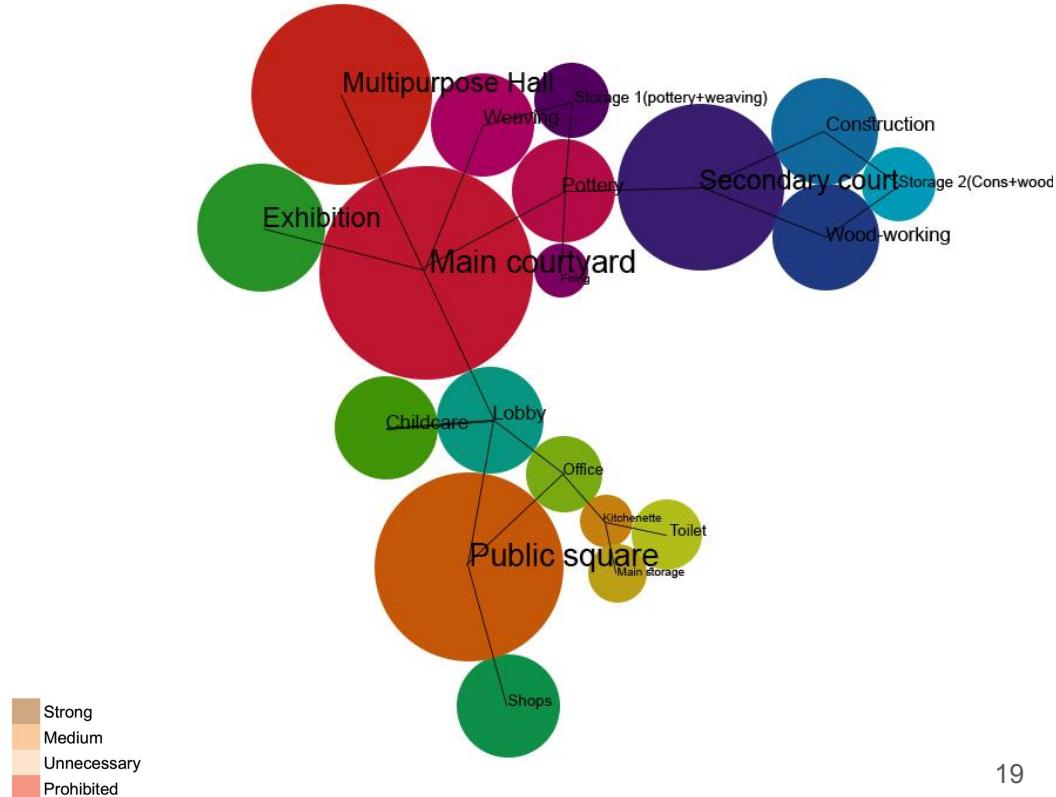
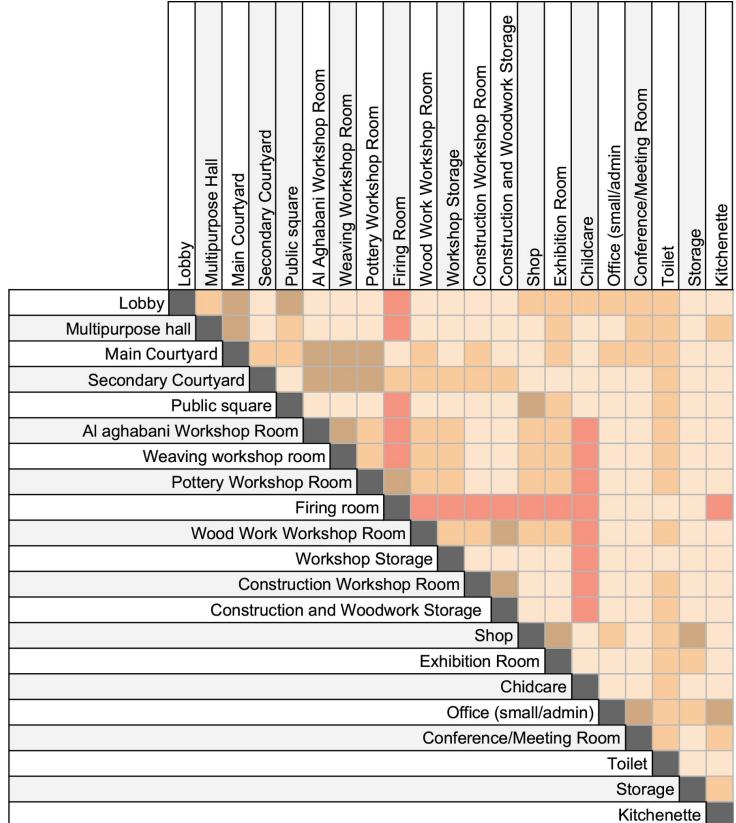


## CONFIGURING

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# Connections and adjacencies



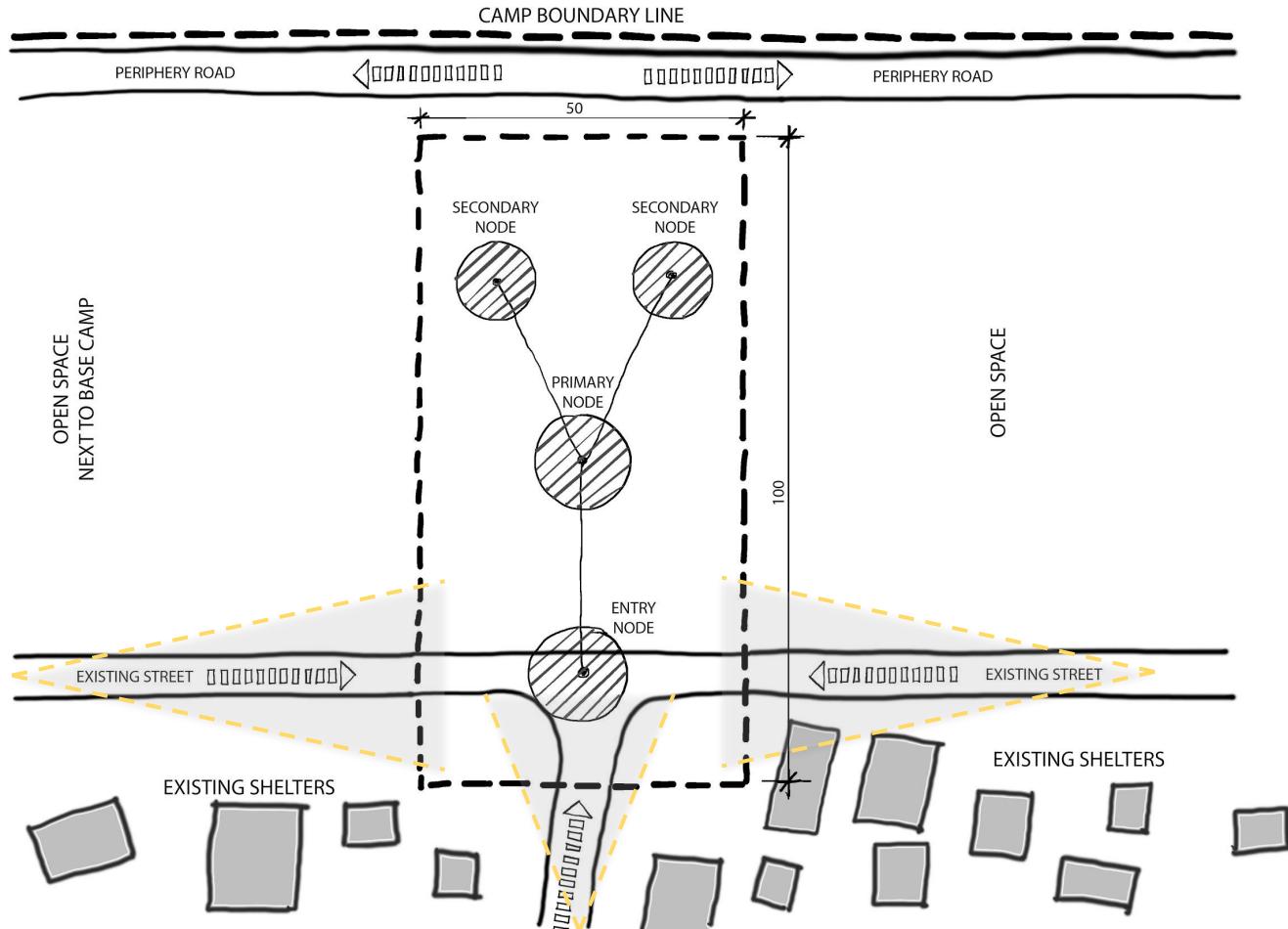
# Site analysis

## Site access and visibility

- Showcasing Syrian architecture
- Visibility from the site

## Site nodes and connectivity

- Helps to identify circulation
- Hierarchy of space
- Nodes as central or spaces for gathering



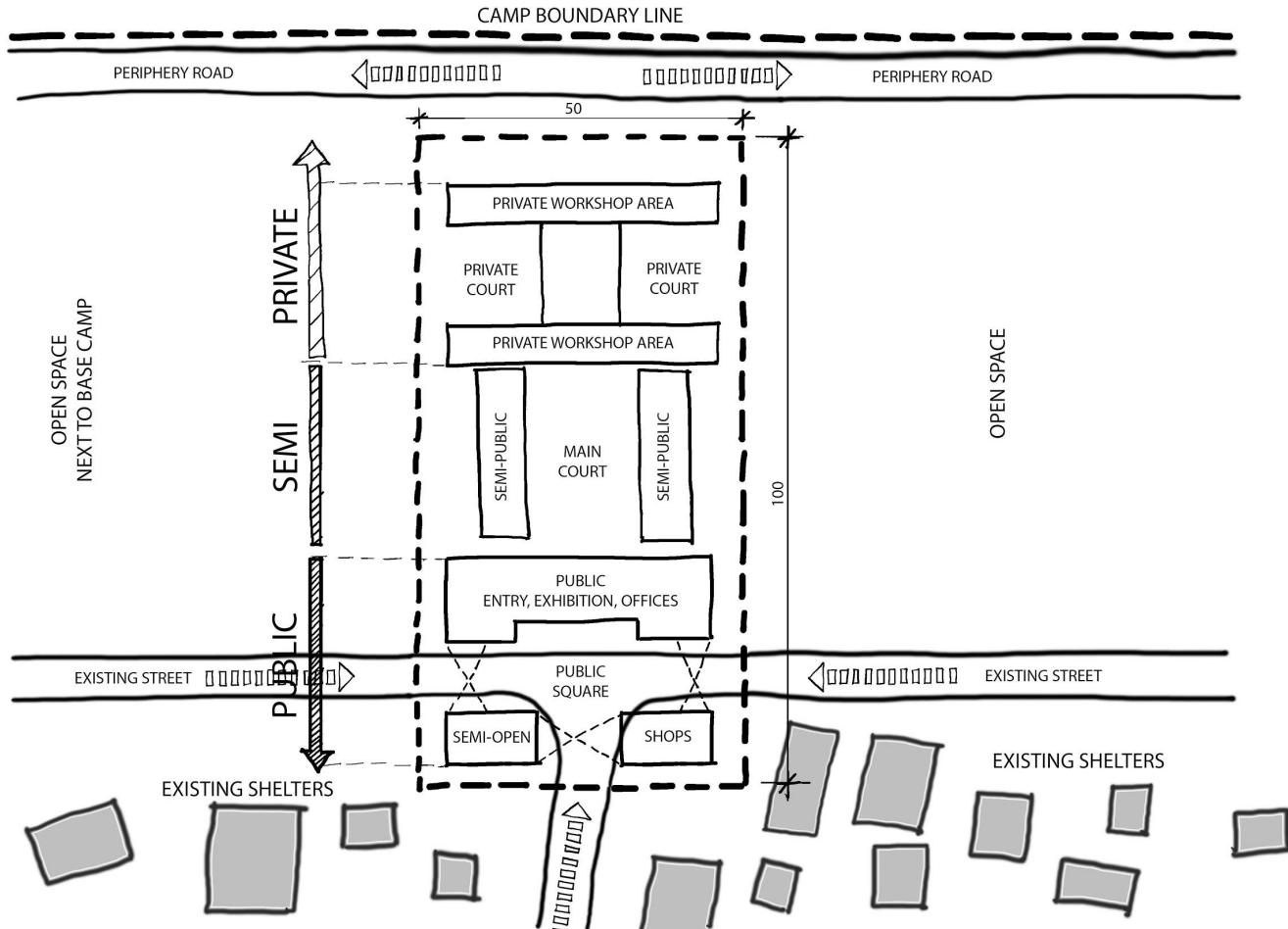
# Site analysis

## Site Zoning

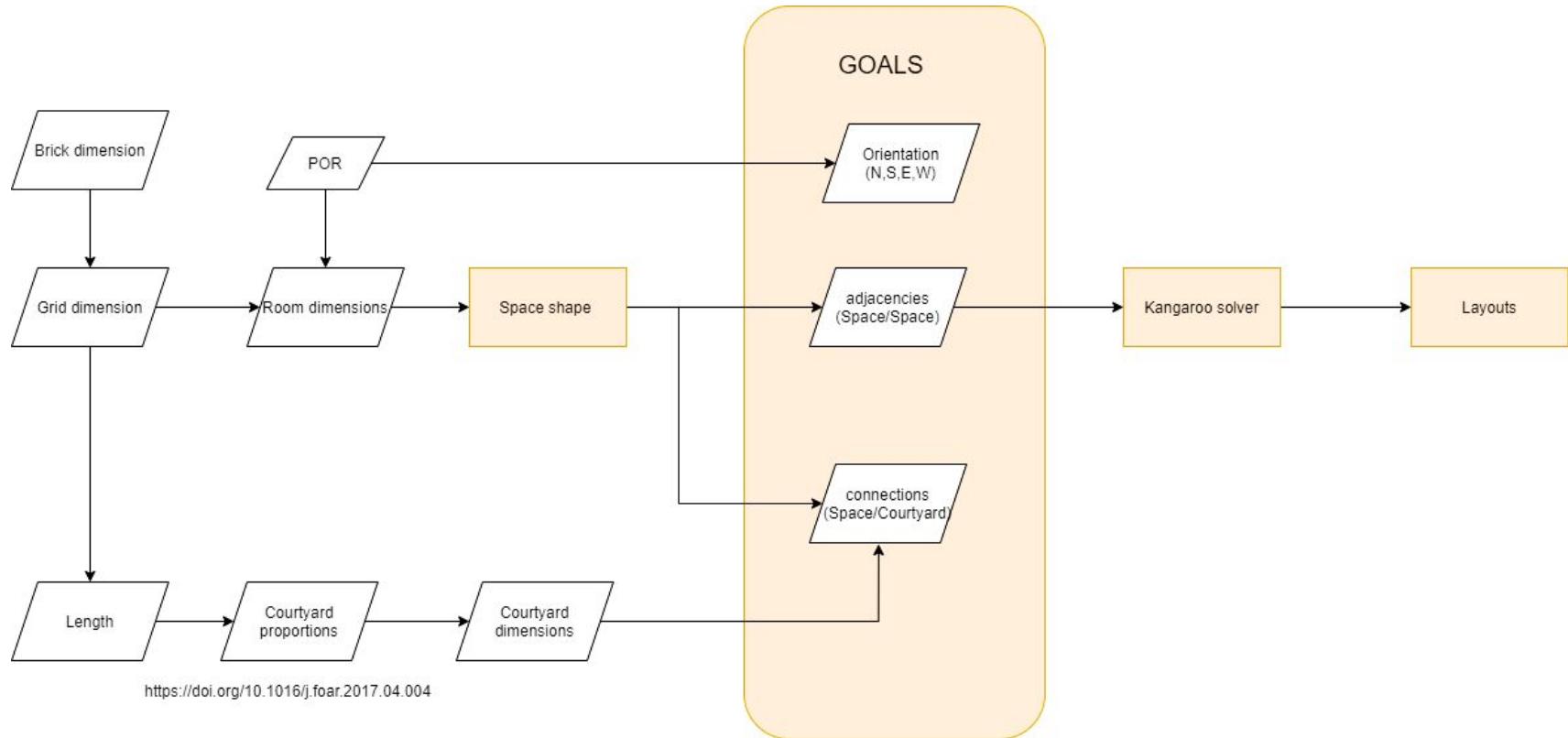
- Hierarchy of zones
- Public to private transition of space
- Security

## Site climate

- Hot and dry summer
- Trees to shade the courtyard
- Higher massing towards the South self-shade.

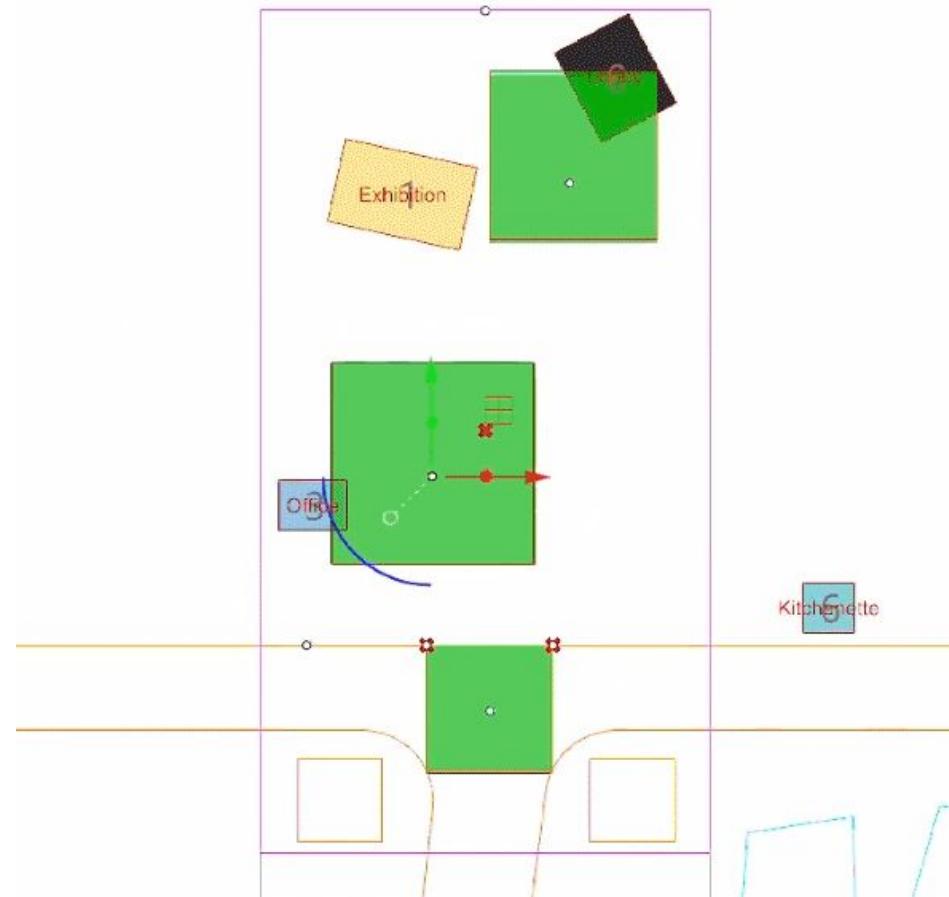


# Configuration flowchart

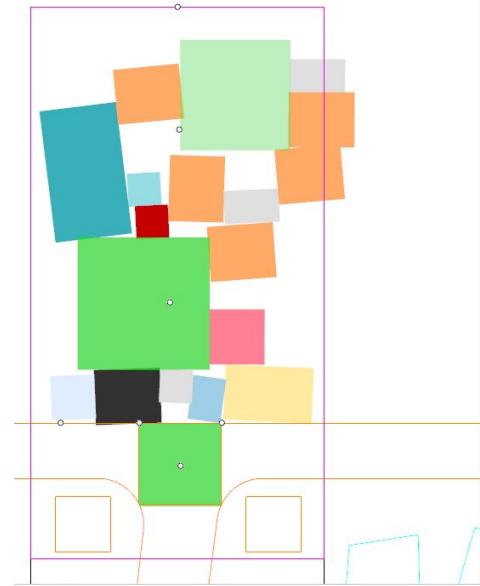
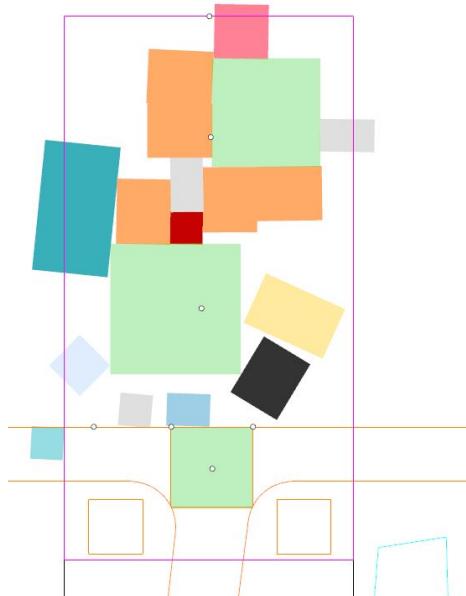
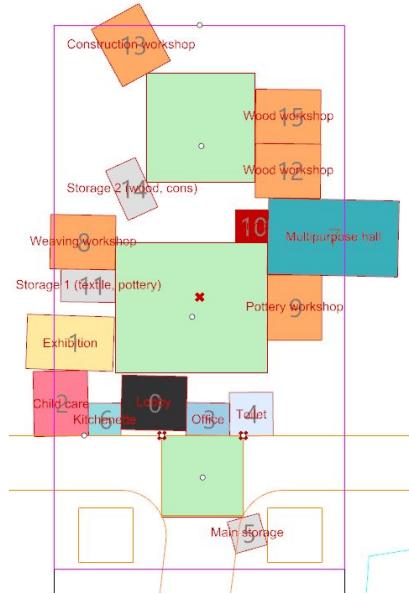


# Layout Configuration

	Lobby
	Exhibition
	Child care
	Office
	Toilet
	Main storage
	Kitchenette
	Multipurpose hall
	Weaving workshop
	Pottery workshop
	Firing
	Storage 1 (textile, pottery)
	Wood workshop
	Construction workshop
	Storage 2 (wood, cons)
	Wood workshop

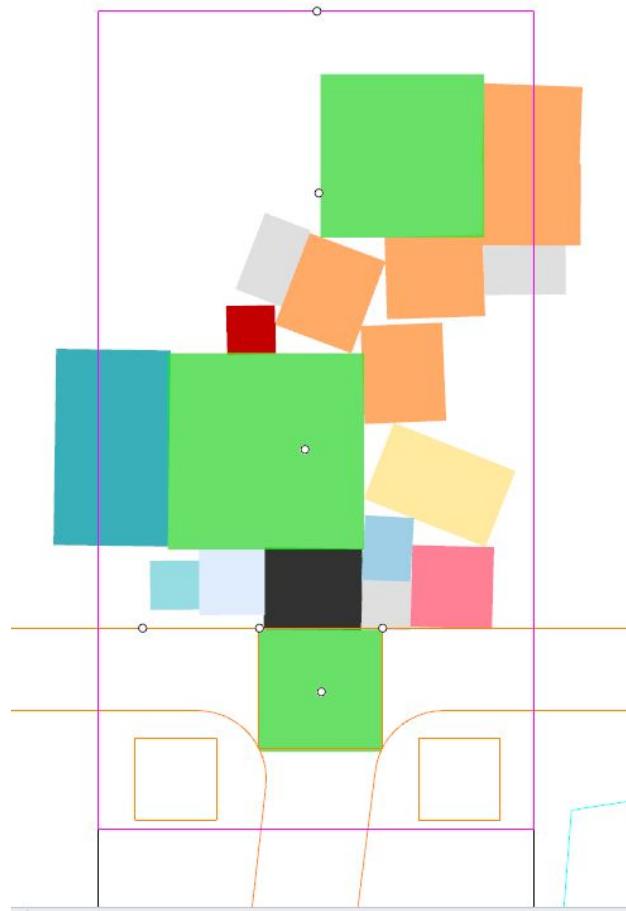


# Layout options



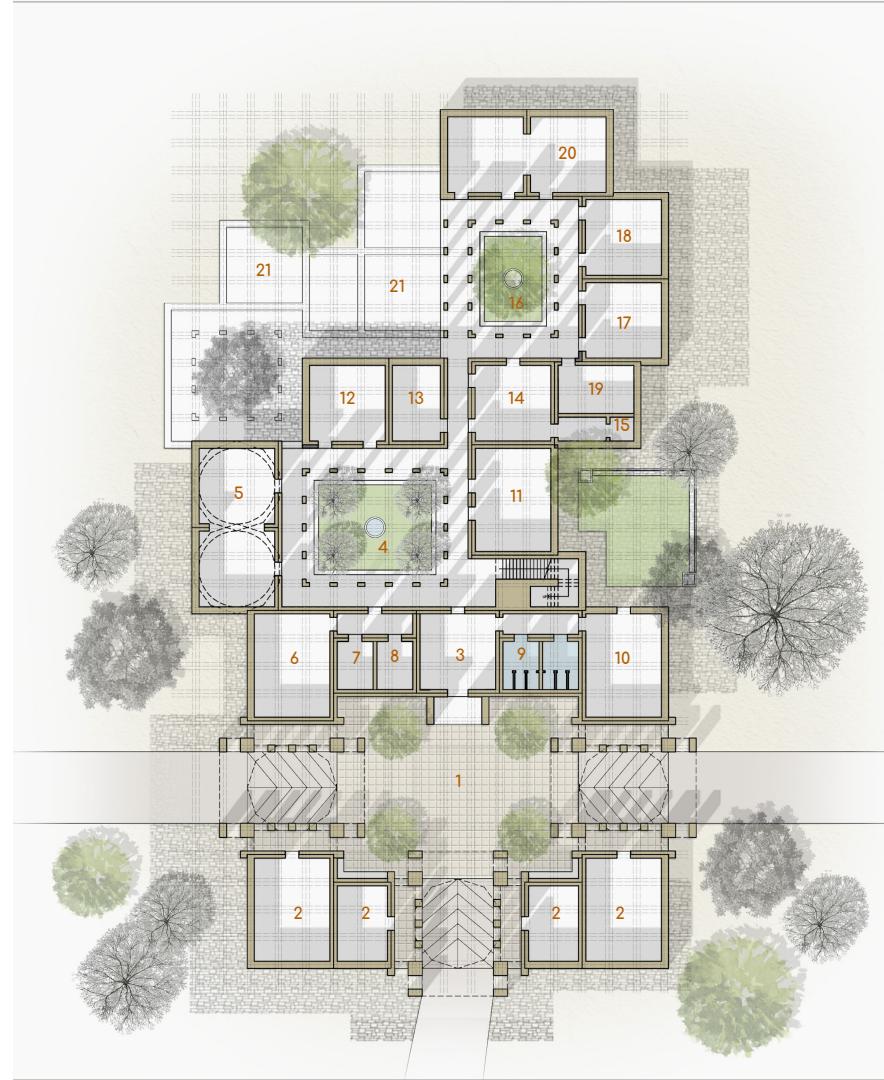
## Chosen layout

	Lobby
	Exhibition
	Child care
	Office
	Toilet
	Main storage
	Kitchenette
	Multipurpose hall
	Weaving workshop
	Pottery workshop
	Firing
	Storage 1 (textile, pottery)
	Wood workshop
	Construction workshop
	Storage 2 (wood, cons)
	Wood workshop



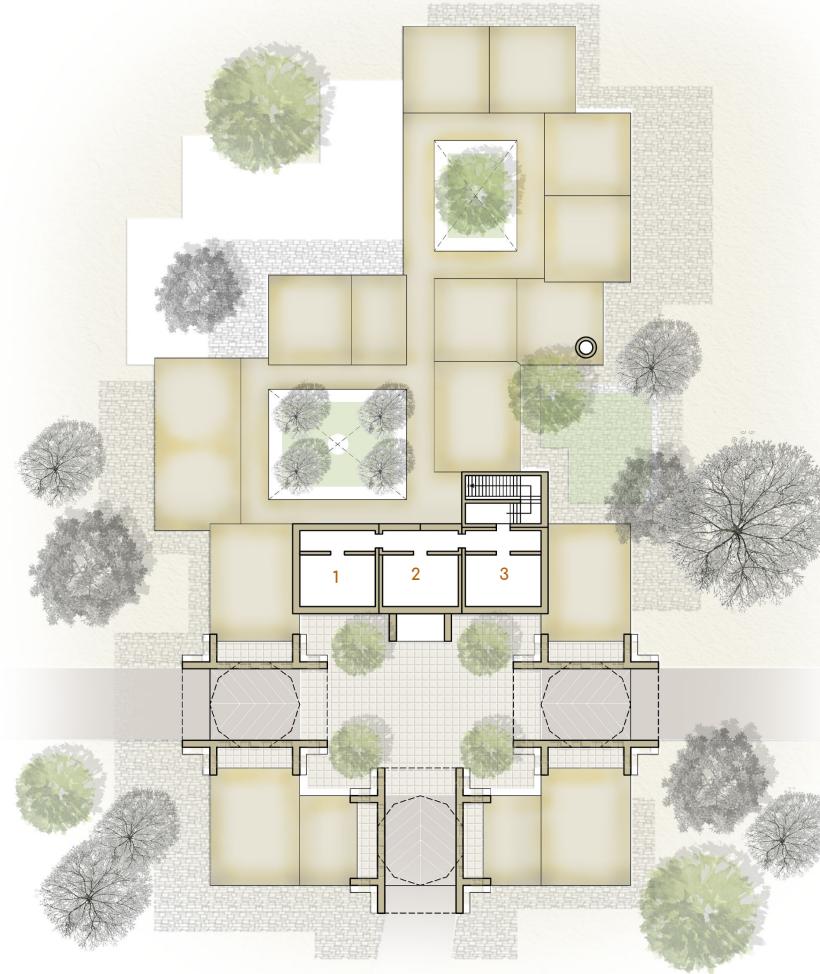
# Ground floor plan

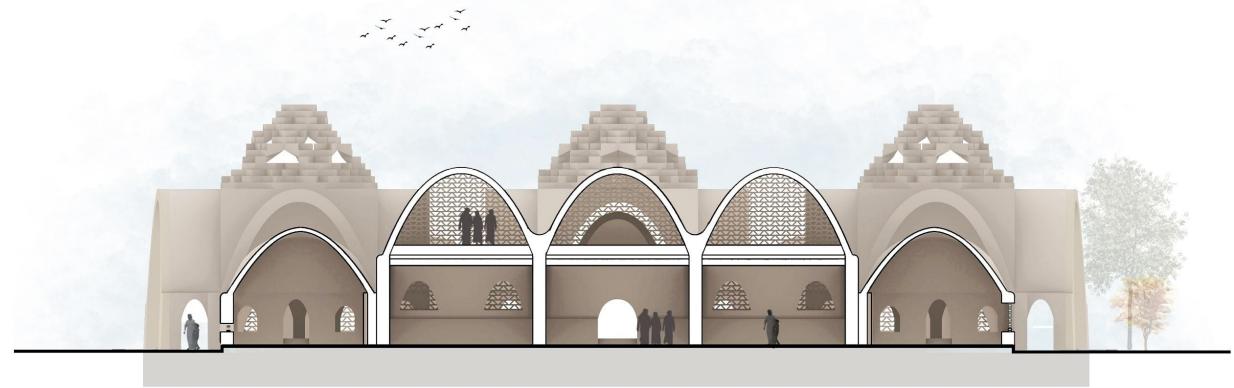
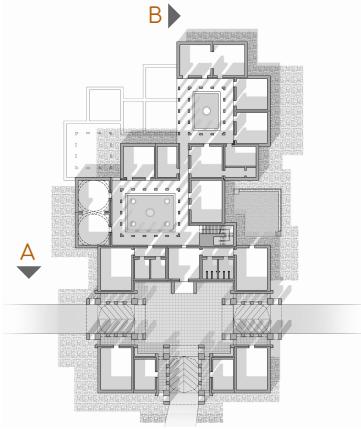
1. Public square
2. Shops
3. Entrance lobby
4. Main courtyard
5. Multipurpose hall
6. Office
7. Kitchen
8. Store
9. Toilets
10. Child-care
11. Exhibition
12. Weaving
13. Store (Weaving & pottery)
14. Pottery
15. Firing
16. Secondary courtyard
17. Construction
18. Woodwork
19. Store (Construction & Woodwork)
20. Prototyping
21. Future expansion



# First floor plan

1. Al aghabani
2. Conference
3. Library





Section A-A



Section B-B

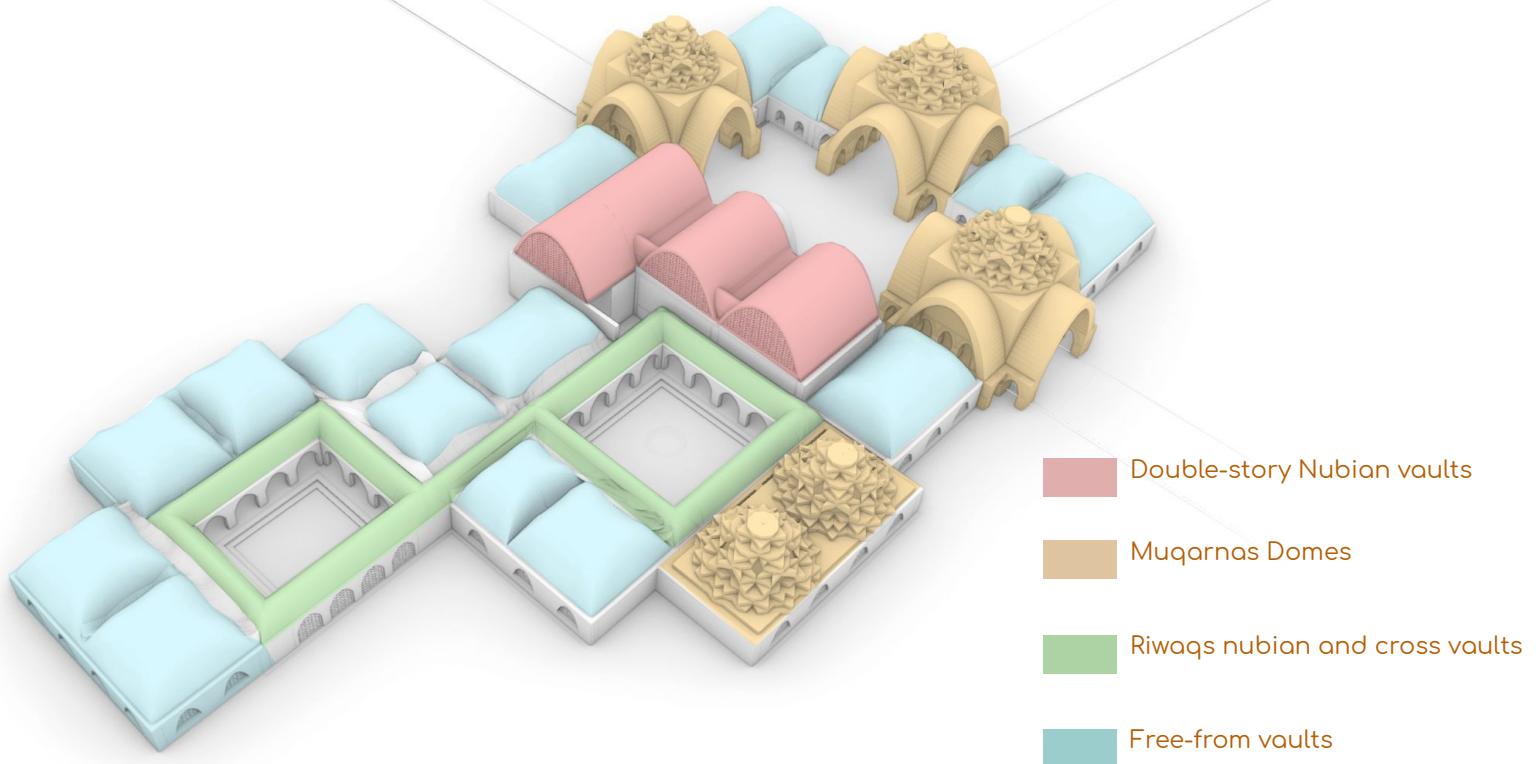


## FORMING AND STRUCTURING

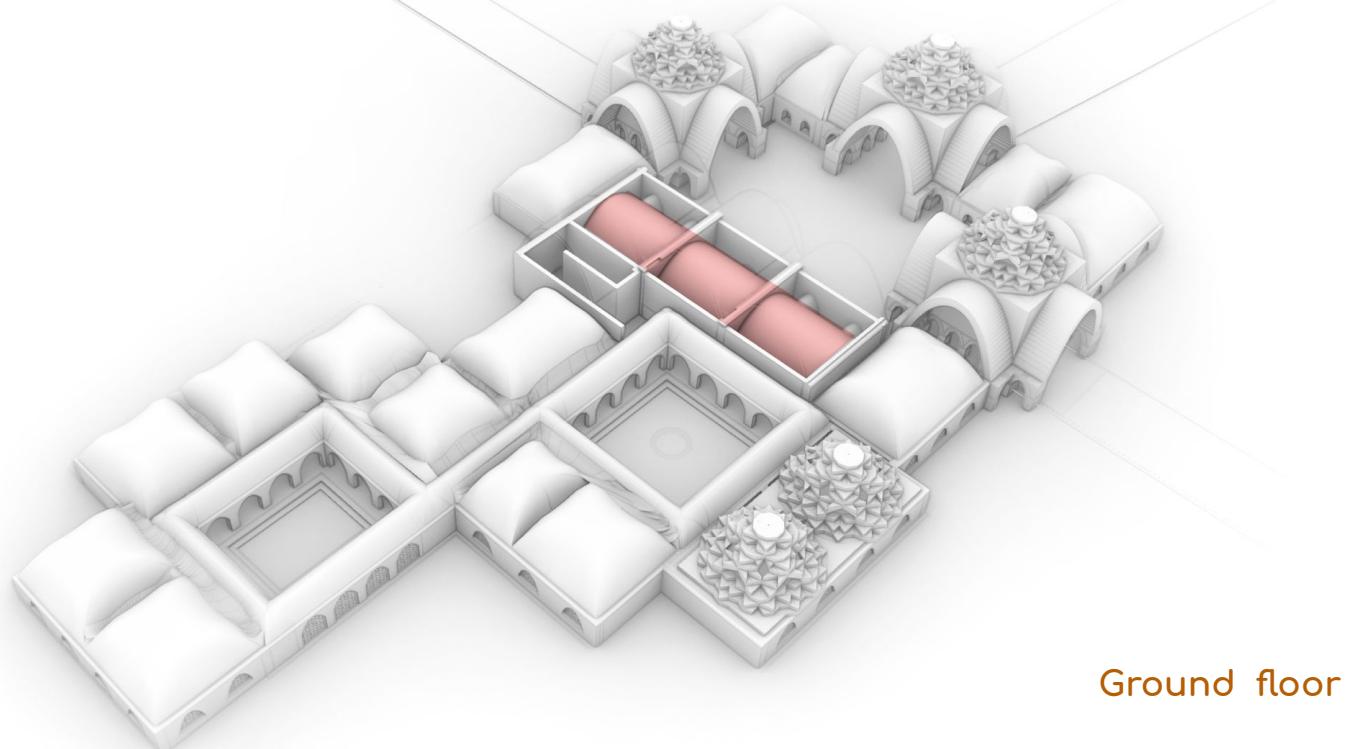
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# Roof Typologies

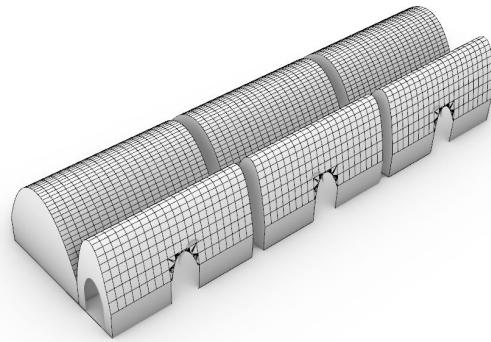
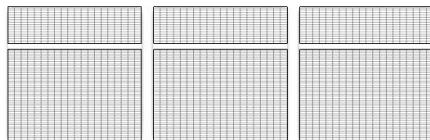
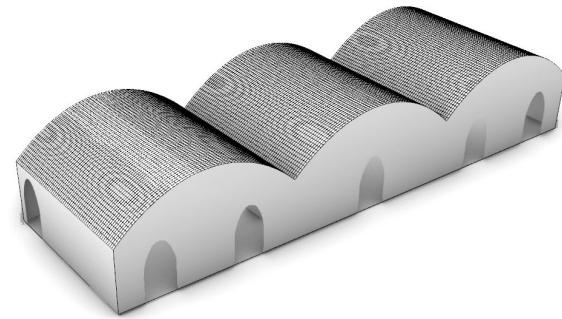
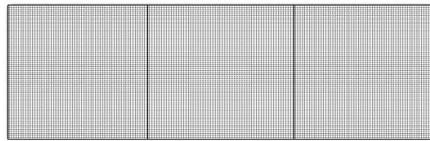


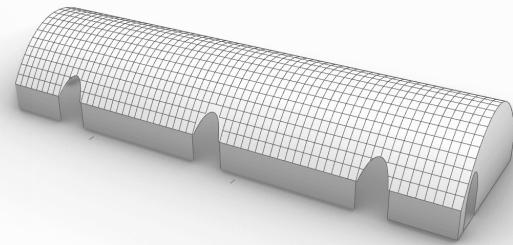
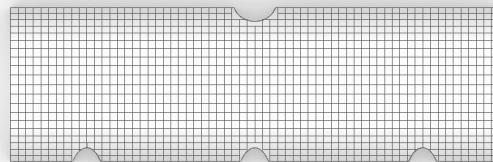
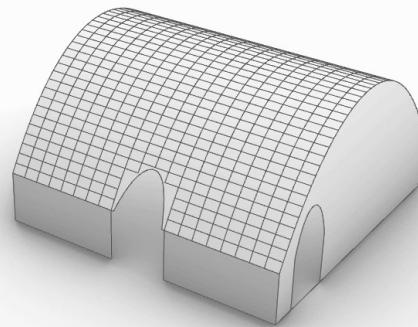
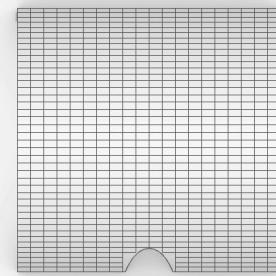
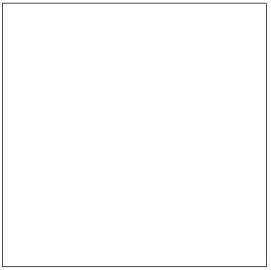
## Double storey nubian vaults



## Ground floor

### Forming

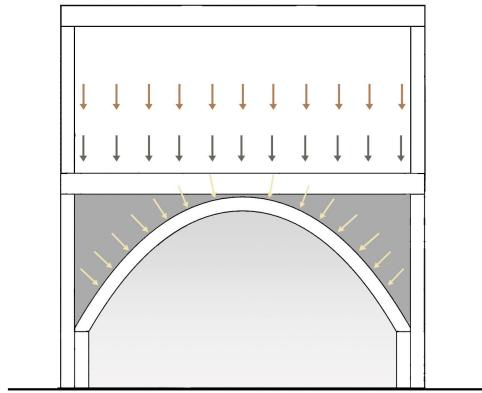




## Structuring

Material Inputs	
Young modulus(N/mm <sup>2</sup> )	150
Compressive strength(N/mm <sup>2</sup> )	3.67
Safety factor for stress	2.5
Safety factor for live load	1.5
Safety factor for dead load	1.2
Allowable compressive strength(N/mm <sup>2</sup> )	1.5
Allowable tensile strength (N/mm <sup>2</sup> )	0.15
Shear modulus(N/mm <sup>2</sup> )	60
Specific weight((kN/m <sup>3</sup> )	15

## Structuring



→ Self-weight

→ Sand load

→ Live load

Ground floor load cases

600mm thick wall  
300mm thick shell

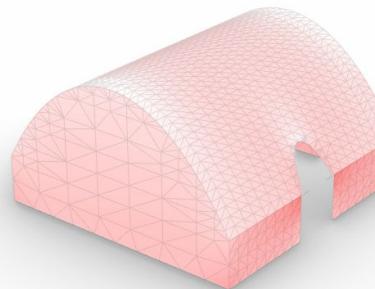
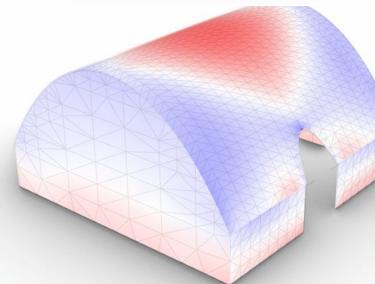
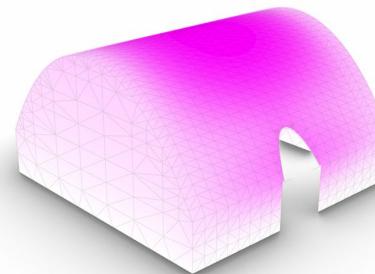
Maximum displacement -  
4.05mm

Peak compressive stress 1  
-  $0.147\text{N/mm}^2$ <sup>22</sup>

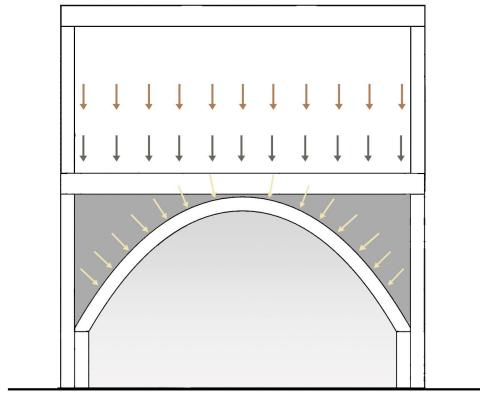
Peak tensile stress 1  
 $0.111\text{N/mm}^2$

Peak compressive stress 2  
-  $0.776\text{N/mm}^2$

Peak tensile stress  
 $0.01\text{N/mm}^2$



## Structuring



- Self-weight
- Sand load
- Live load

Ground floor load cases

600mm thick wall  
300mm thick shell

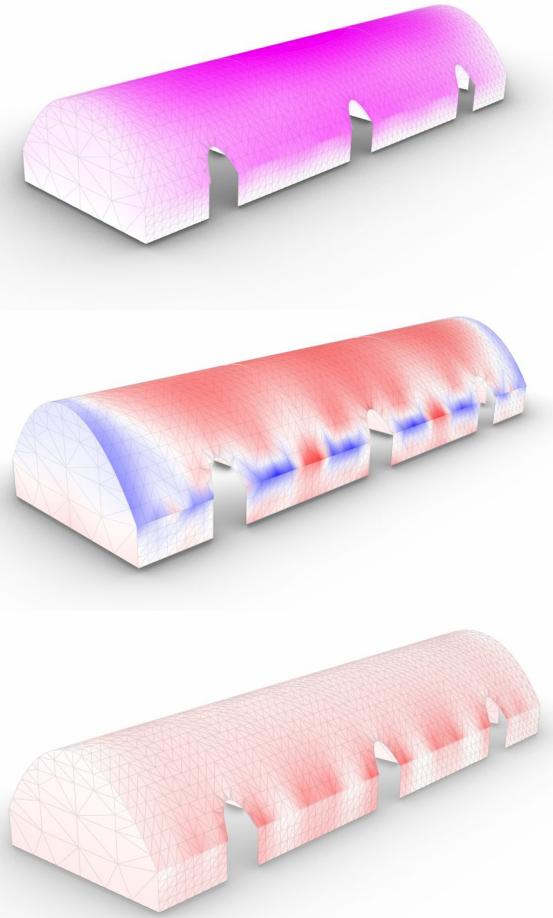
Maximum displacement -  
13.60mm

Peak compressive stress 1  
- 0.266N/mm<sup>2</sup>

Peak tensile stress 1  
0.147N/mm<sup>2</sup>

Peak compressive stress 2  
- 1.15.N/mm<sup>2</sup>

Peak tensile stress  
20.025N/mm<sup>2</sup>



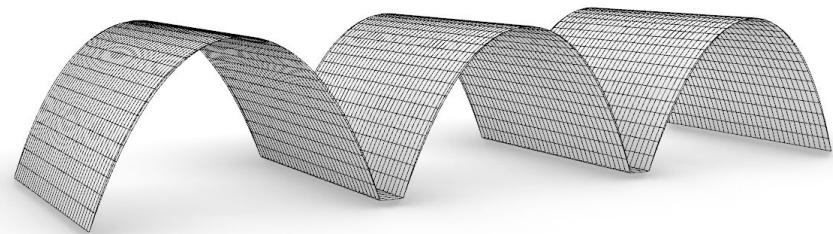
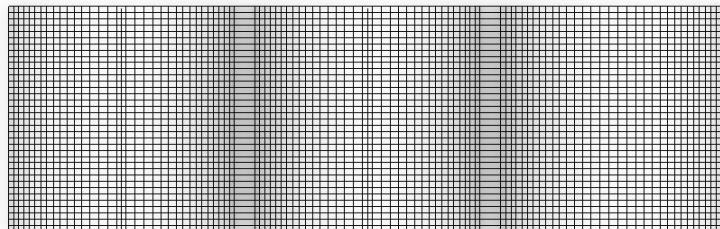
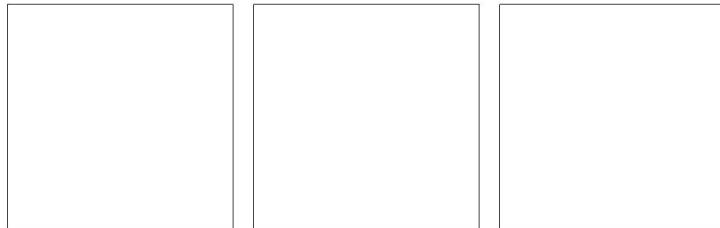
Double storey nubian vaults



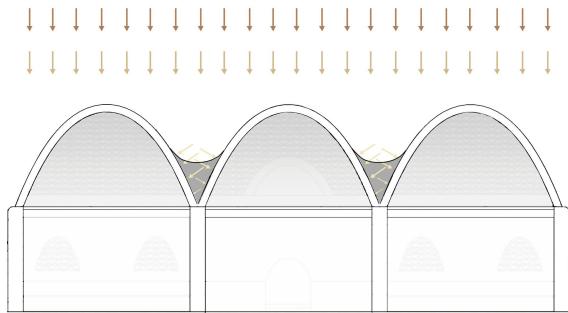
First floor

First floor

Forming



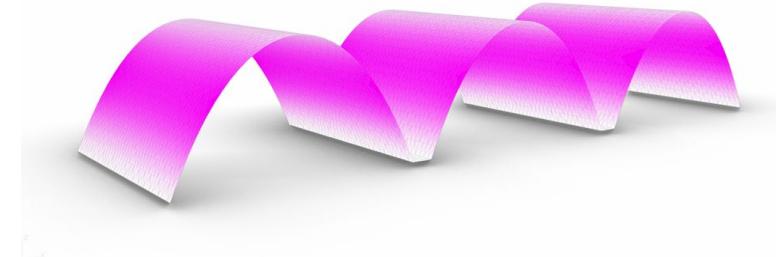
## Structuring



First floor load cases

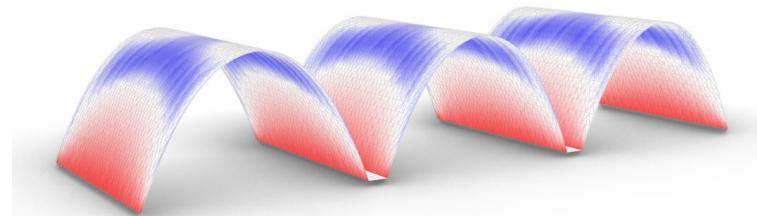
300mm thick shell

Maximum displacement -  
6mm



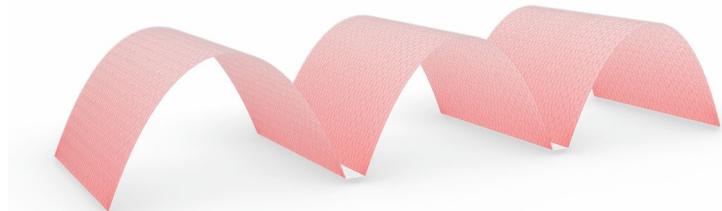
Peak compressive stress 1  
- 0.048N/mm<sup>22</sup>

Peak tensile stress 1  
0.003N/mm<sup>2</sup>



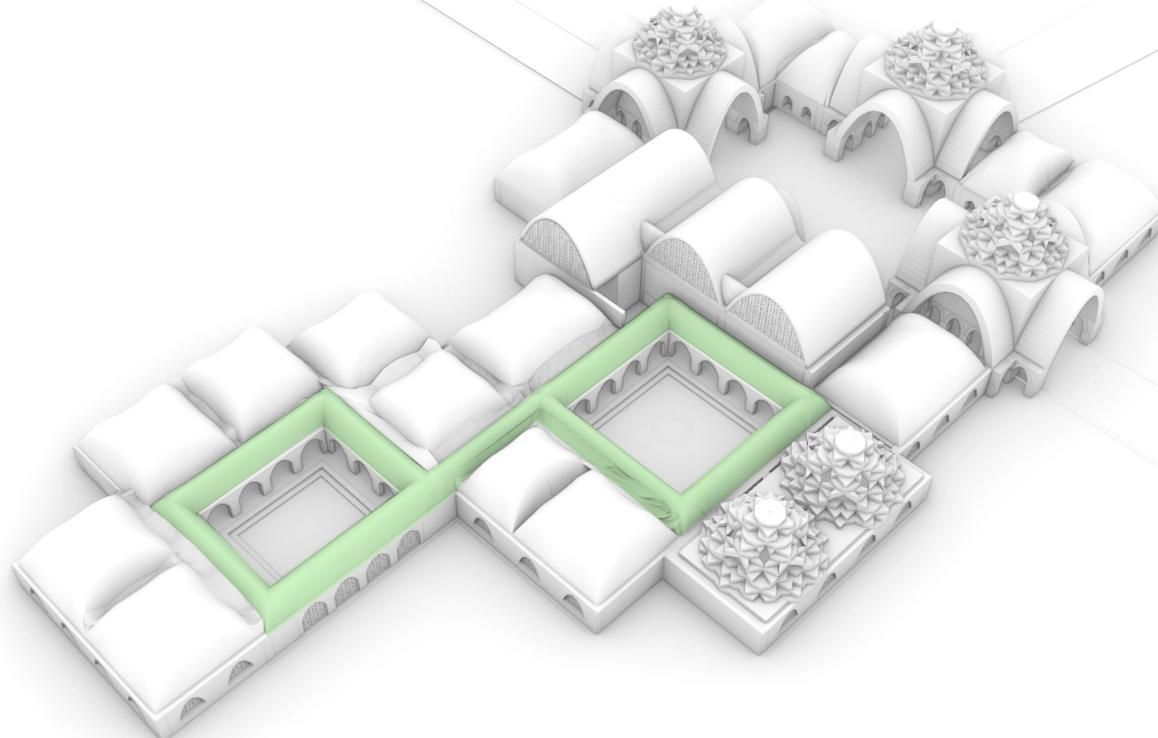
Peak compressive stress 2  
- 0.14N/mm<sup>2</sup>

Peak tensile stress  
0.001/mm<sup>2</sup>

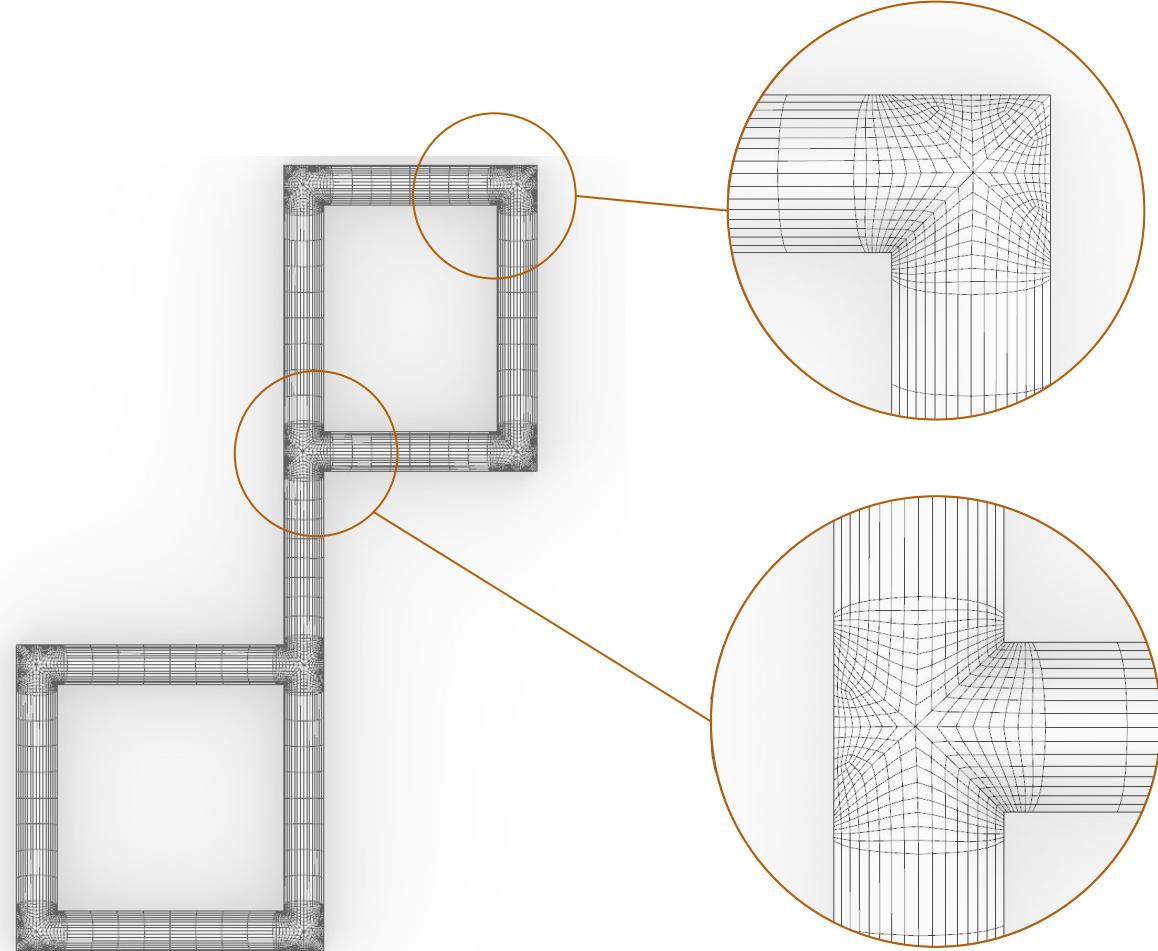
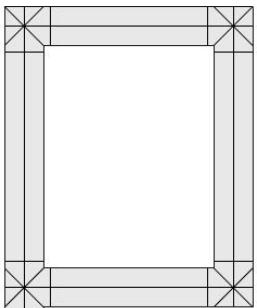
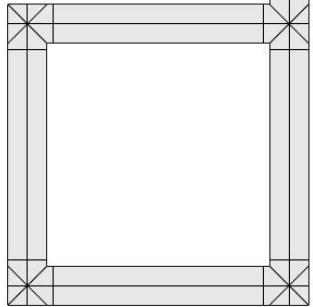


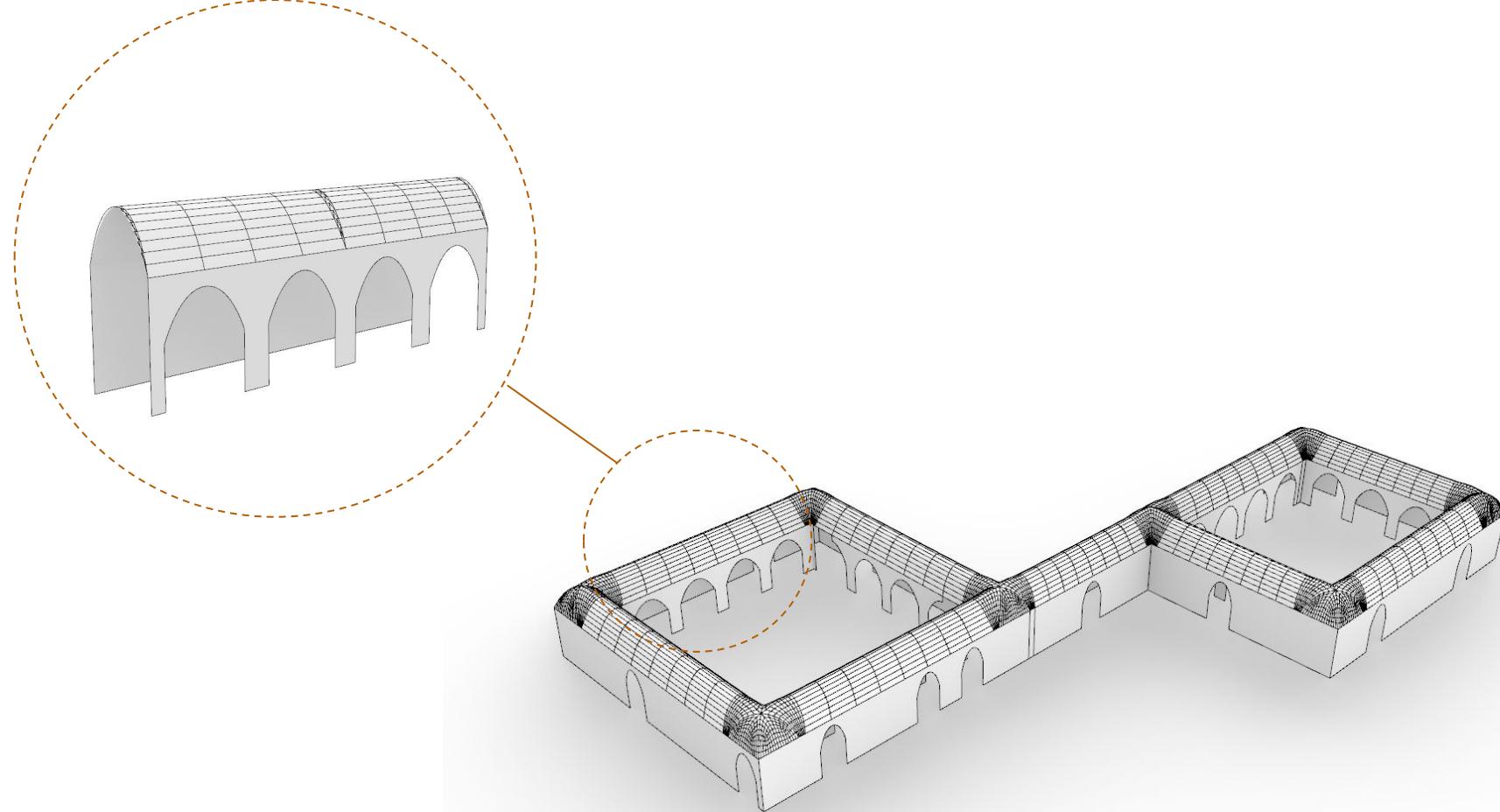


## Riwaqs

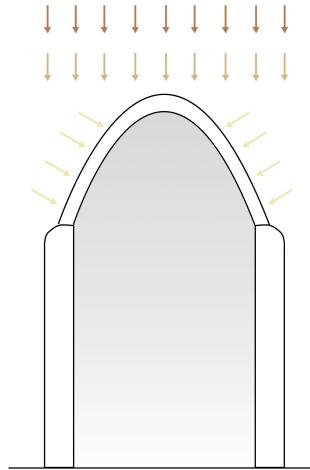


## Forming





## Structuring



First floor load cases

300mm thick wall  
150mm thick shell

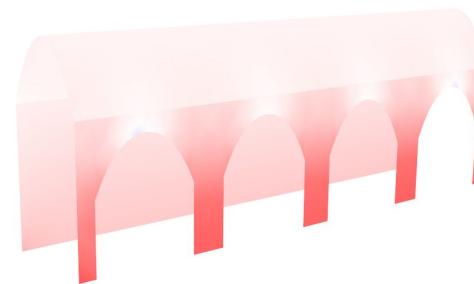
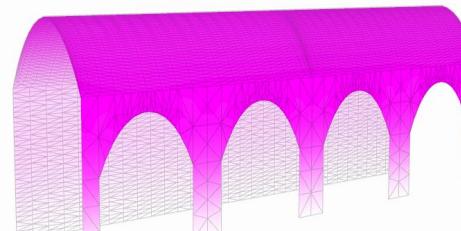
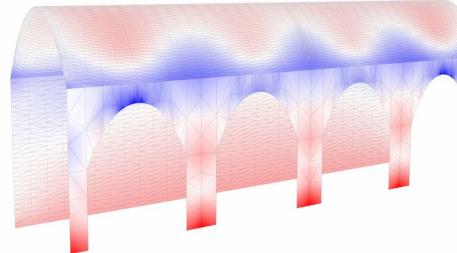
Maximum displacement -  
5.76mm

Peak compressive stress 1  
- 0.086N/mm<sup>2</sup>

Peak tensile stress 1  
0.054N/mm<sup>2</sup>

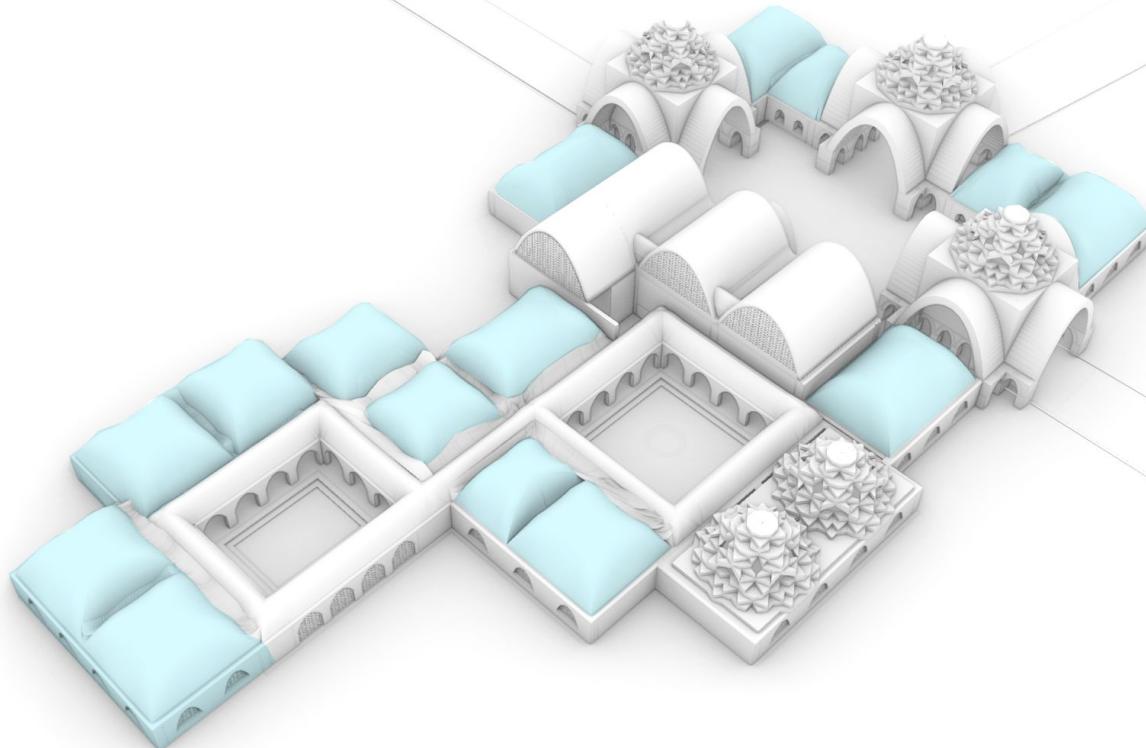
Peak compressive stress 2  
- 0.037N/mm<sup>2</sup>

Peak tensile stress  
0.017N/mm<sup>2</sup>



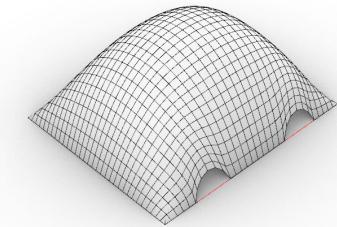
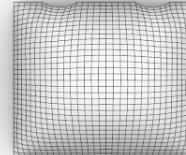
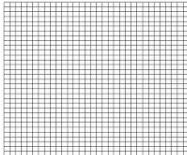
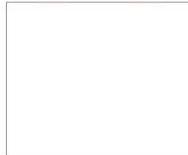


## Workshop spaces- Free-form domes

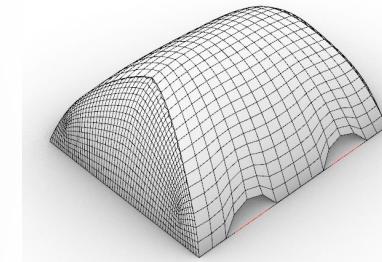
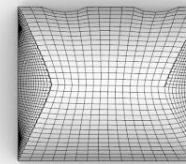
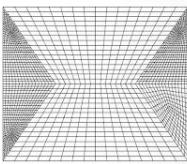
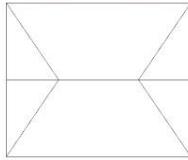


## Forming

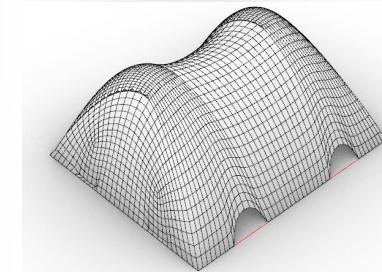
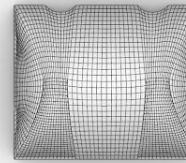
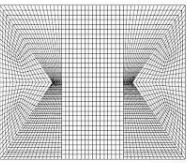
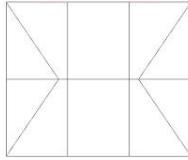
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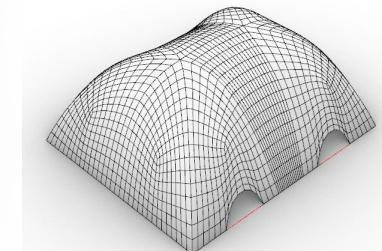
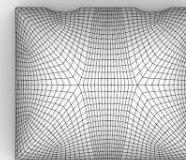
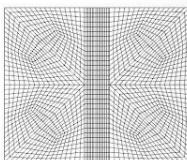
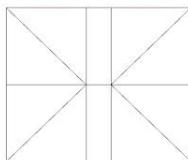
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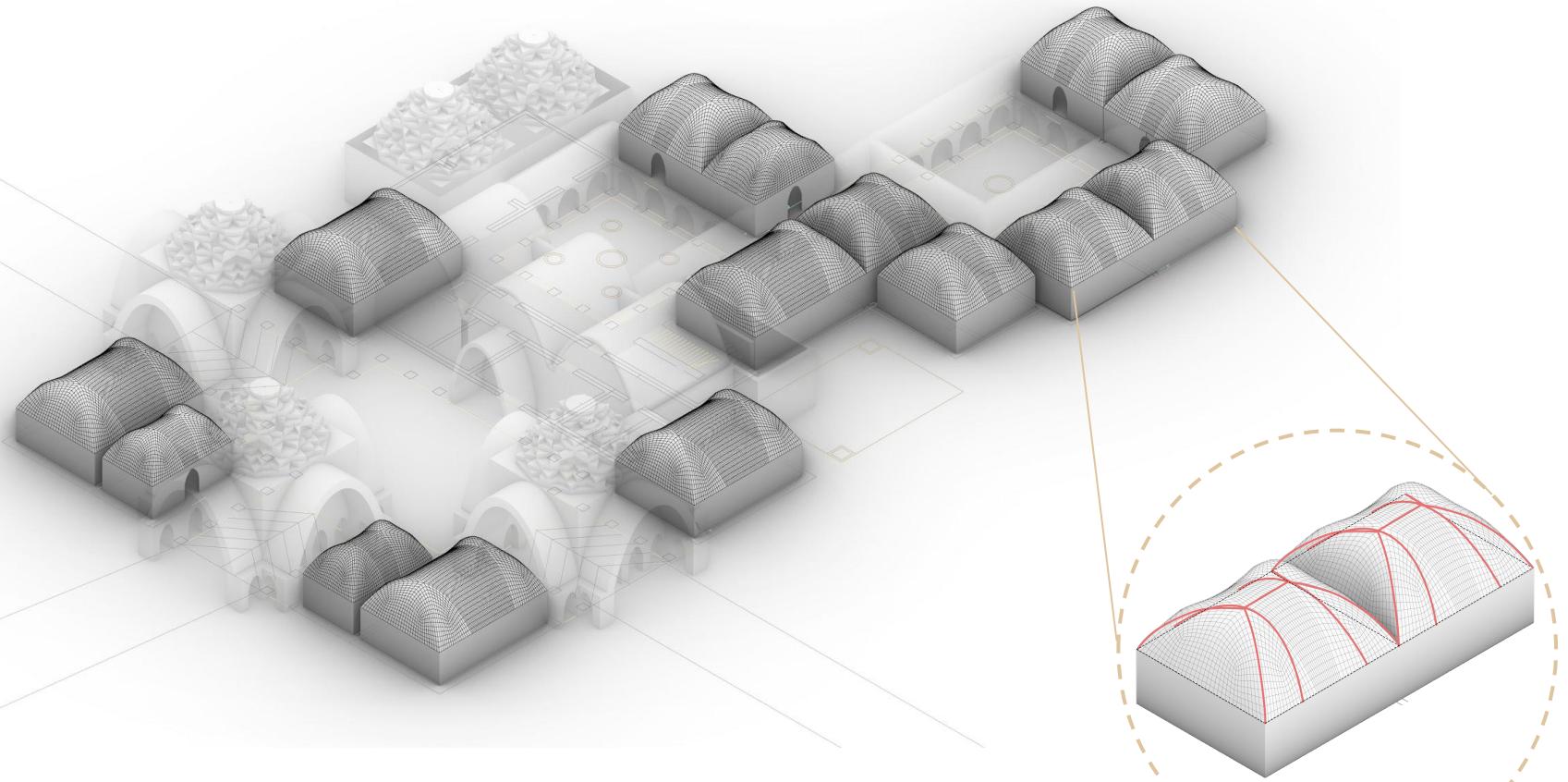


3

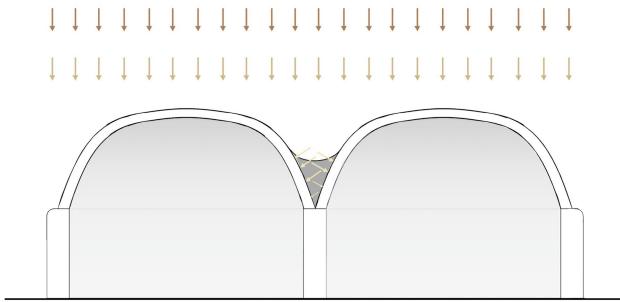


4





## Structuring



- Self-weight
- Sand load
- Filling load

600mm thick wall  
300mm thick shell

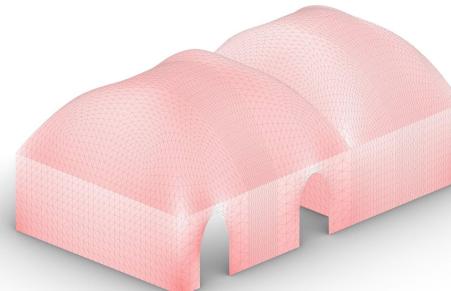
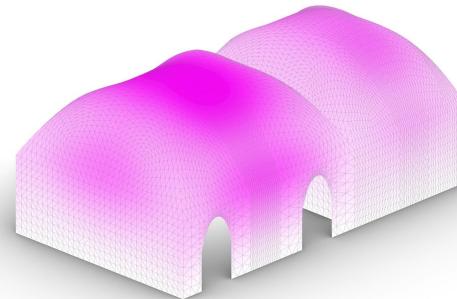
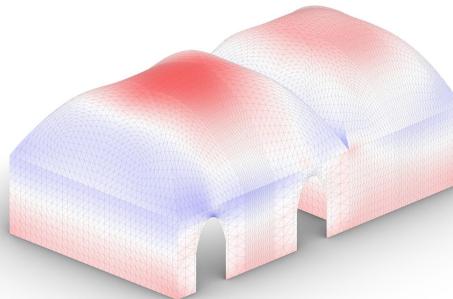
Maximum displacement -  
5.71 mm

Peak compressive stress 1 -  
0.0777 N/mm<sup>2</sup>

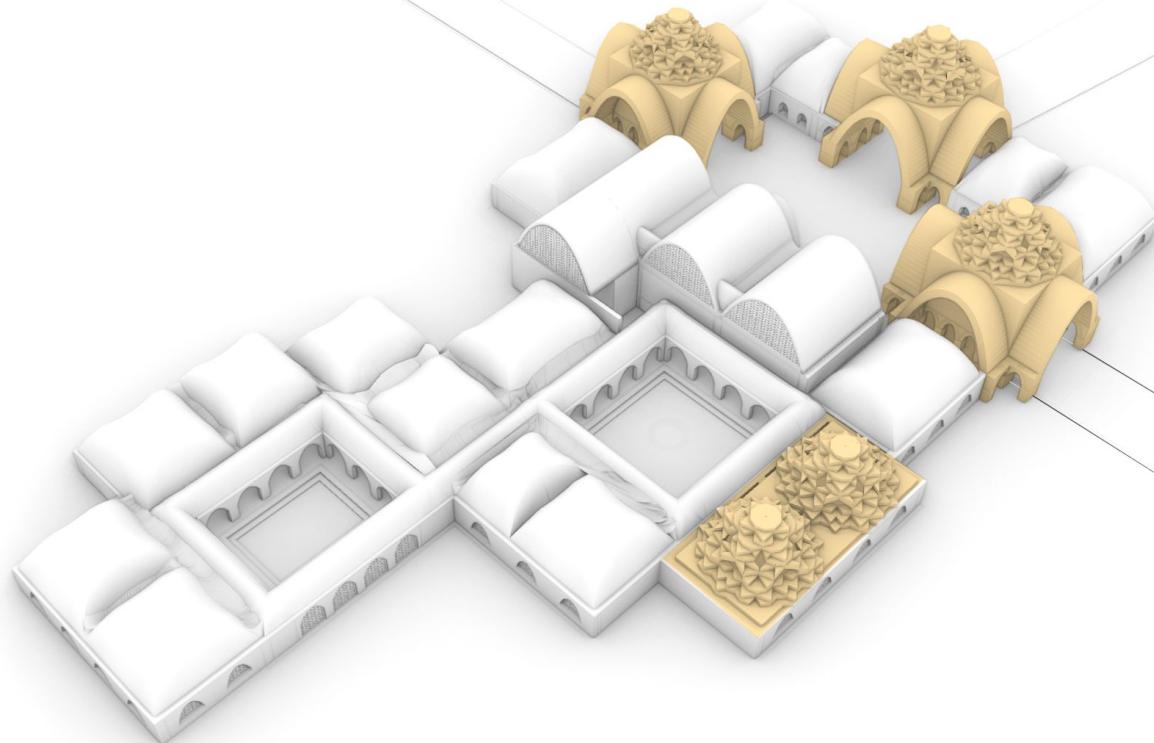
Peak tensile stress 1  
-0.13 N/mm<sup>2</sup>

Peak compressive stress 2 -  
0.239 N/mm<sup>2</sup>

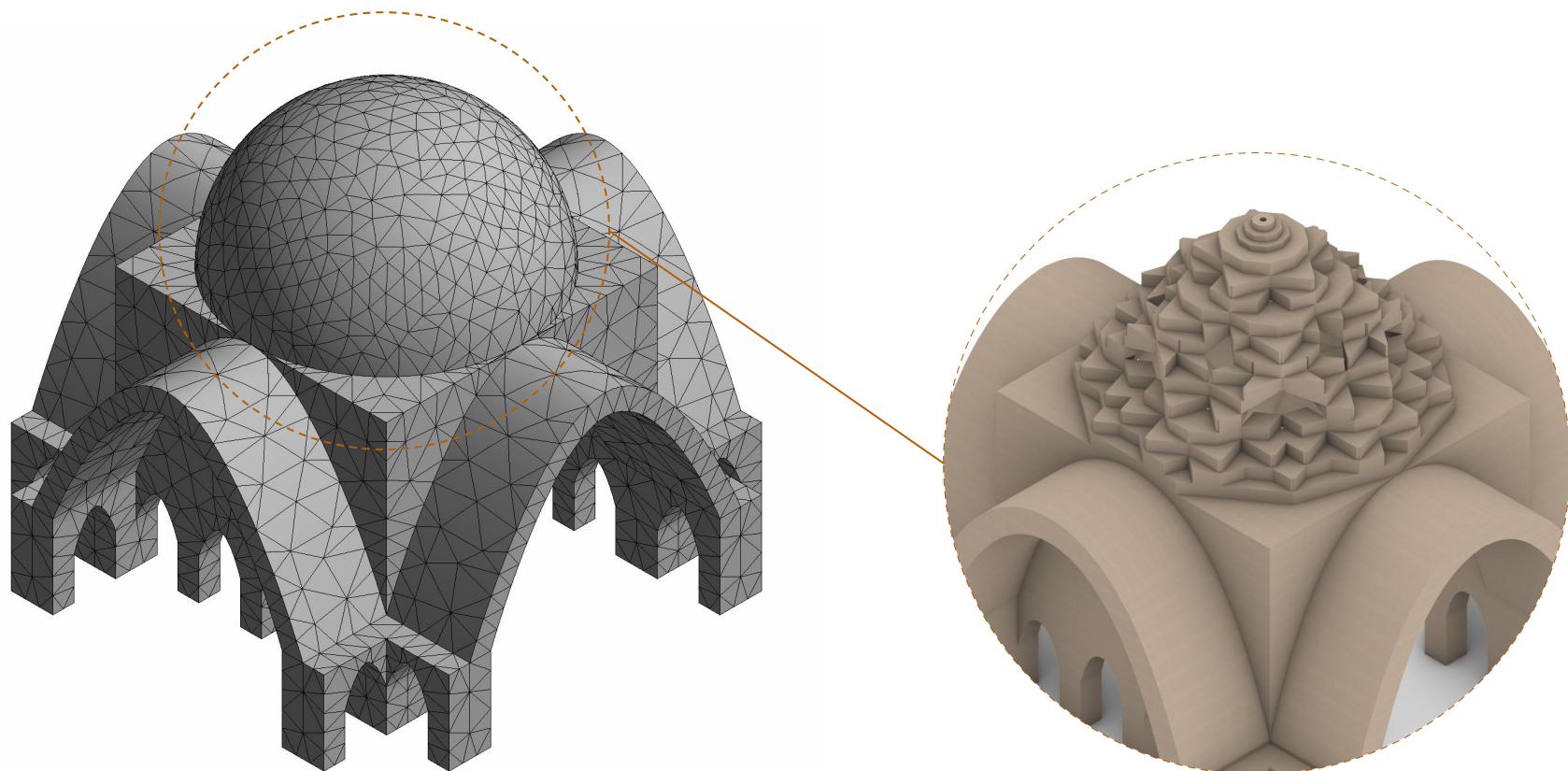
Peak tensile stress  
- 0.0828 N/mm<sup>2</sup>



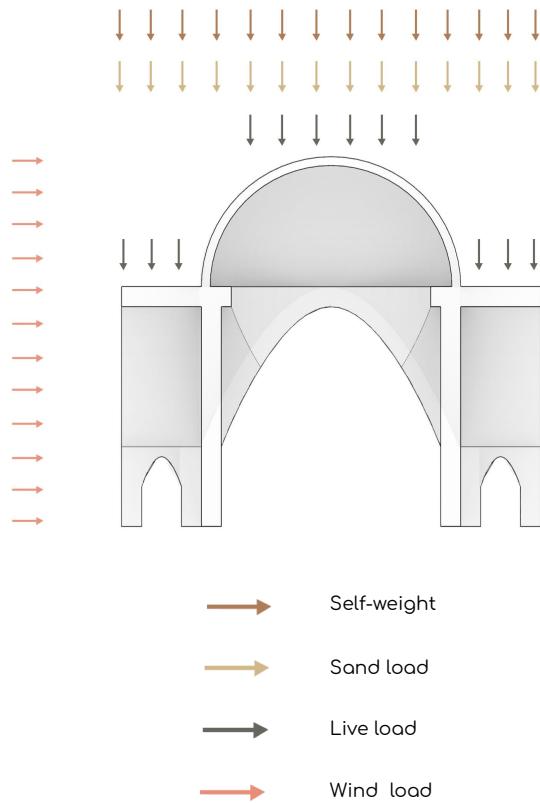
## Muqarnas Domes



## Forming for structural analysis



## Structuring

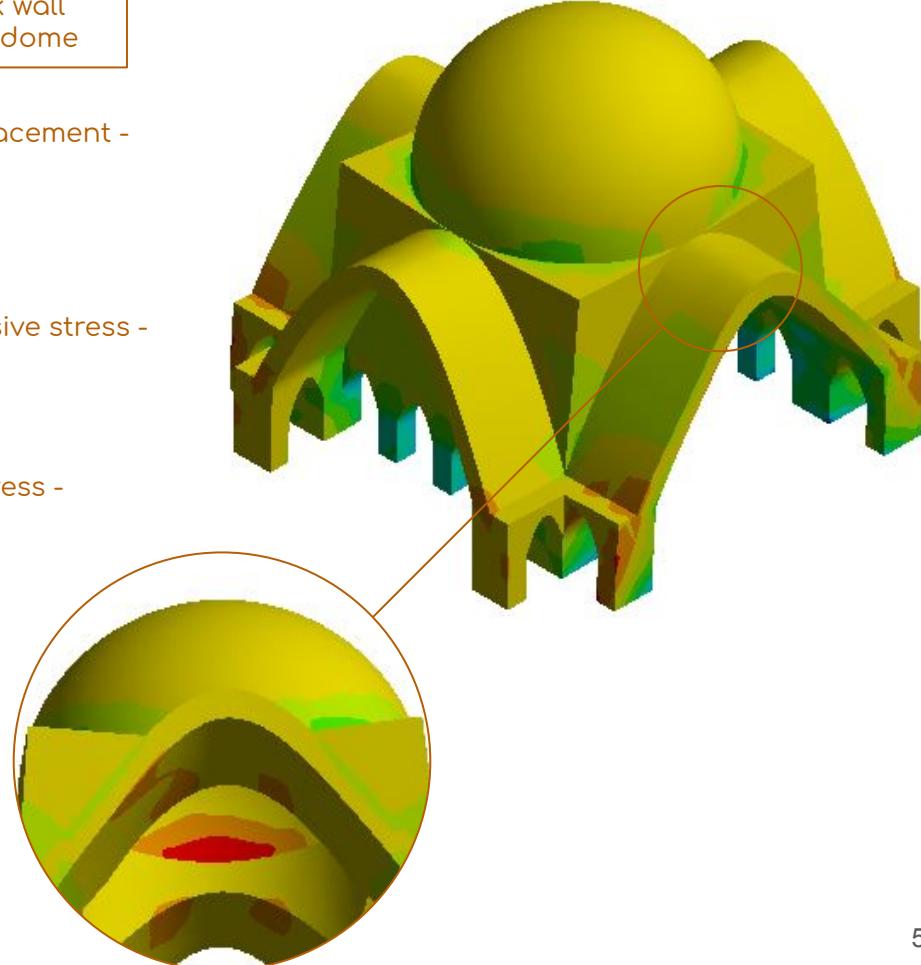


600mm thick wall  
300mm thick dome

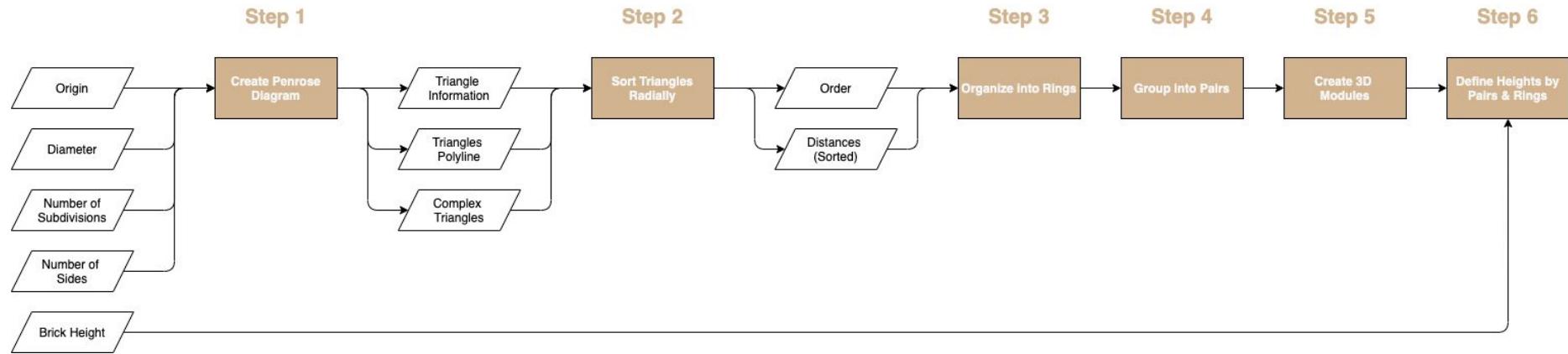
Maximum displacement -  
10.84 mm

Peak compressive stress -  
1.02 N/mm<sup>2</sup>

Peak tensile stress -  
0.31 N/mm<sup>2</sup>

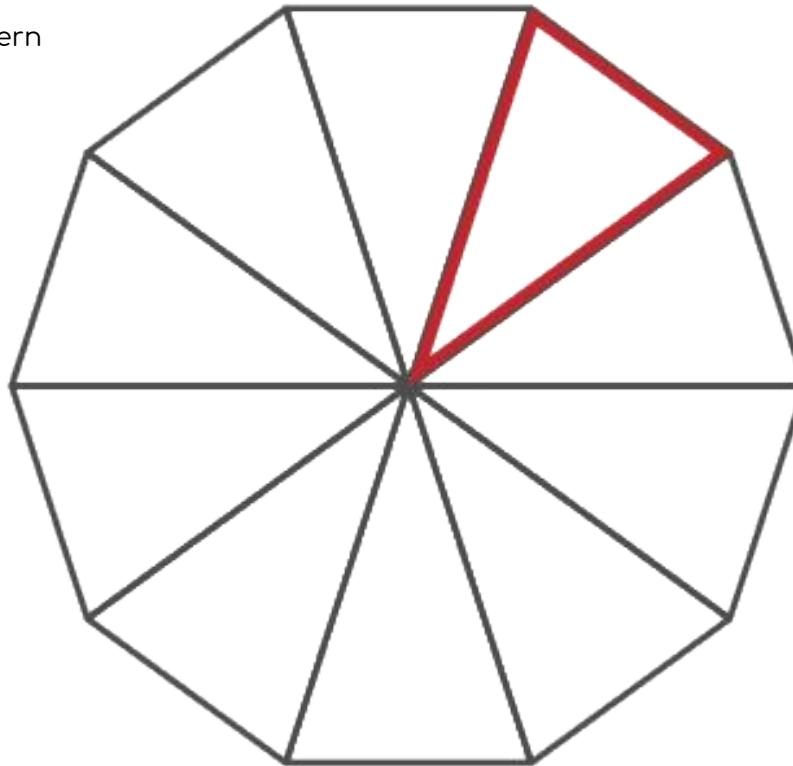


# Muqarnas Domes Forming



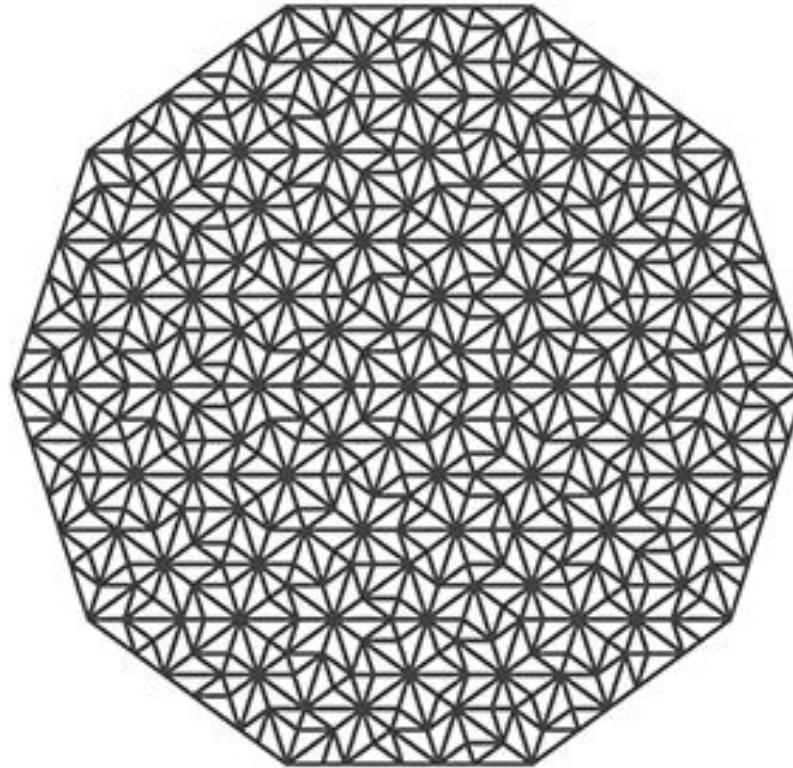
## Muqarnas Domes Forming

Step 1: Generate the Penrose Pattern



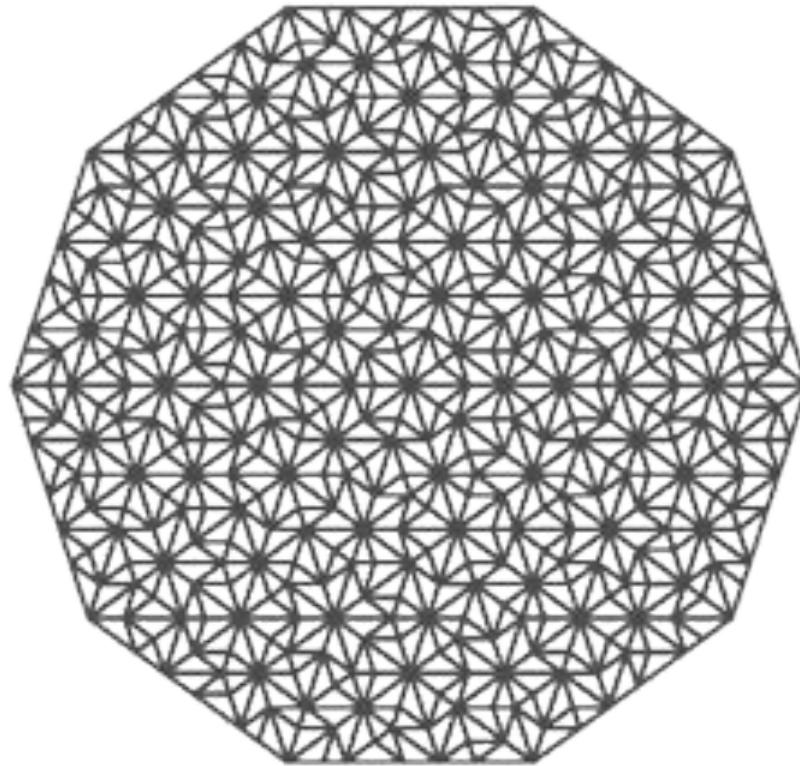
## Muqarnas Domes Forming

Step 2: Order the Triangles



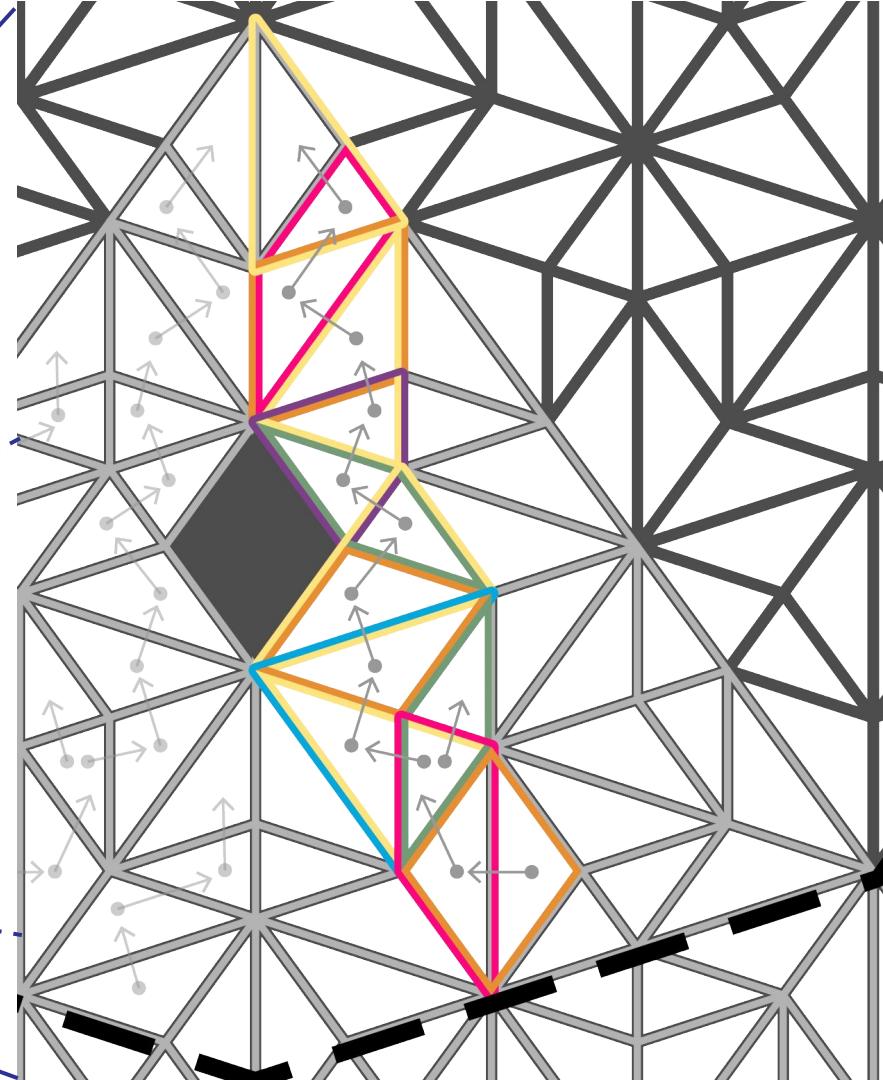
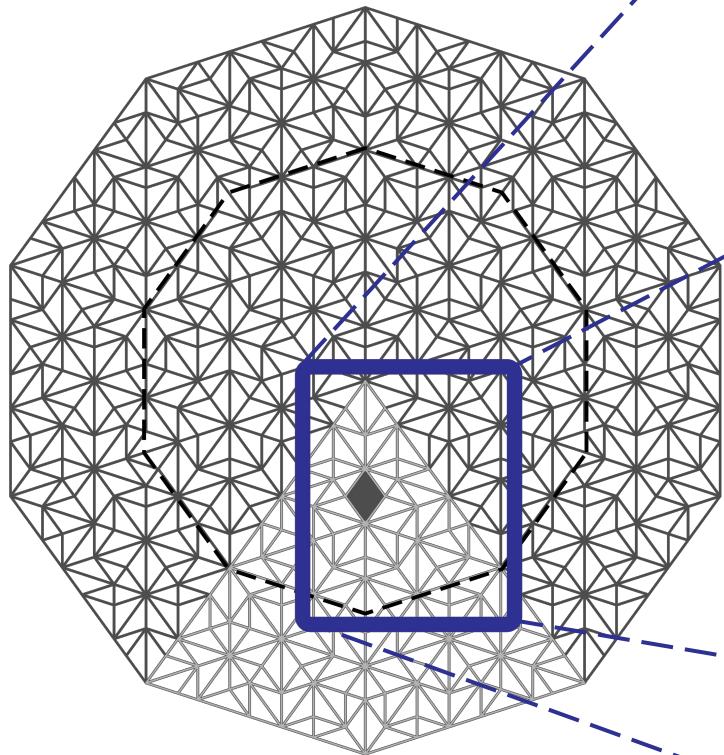
## Muqarnas Domes Forming

Step 3: Group into Rings



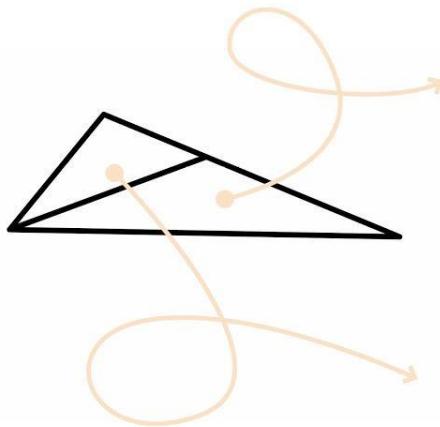
## Muqarnas Domes Forming

Step 4: Define the Pattern

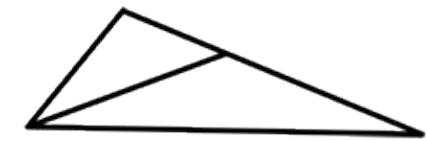


# Muqarnas Domes Forming

## Step 5: Extrusion



- 1) Find all vertices.  
Duplicate set down by  
 $bH$  (brick height)
  - 2) Construct rectangle  
Select rectangle and  
unused point
  - 3) Extrude to Point
- 
- 1) Select points to establish  
direction and magnitude
  - 2) Extrude in that direction
  - 3) Cap geometry



## Muqarnas Domes Forming

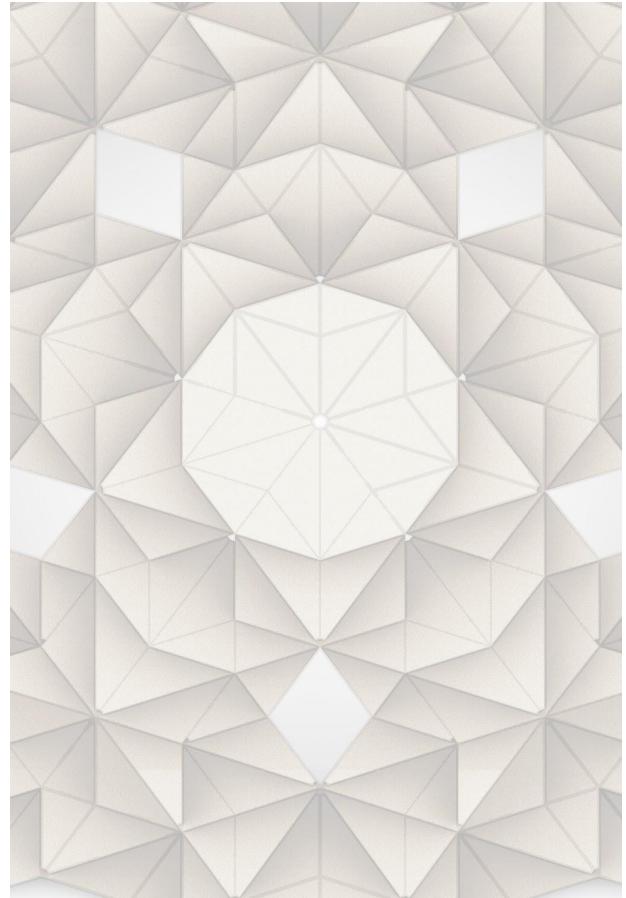
Step 6: Stacking





## CONSTRUCTING

---



# Brick making



# Brick types



Type - A  
For walls and roofs



Type - B  
Queen closer

14 brick modules for Muqarnas



Not to scale | 64

## Construction tools



BASIC CONSTRUCTION TOOLS

## Formwork materials & tools



WASTE CARDBOARD



SCISSORS



ADHESIVE TAPE



METAL CHAIN



GLUE

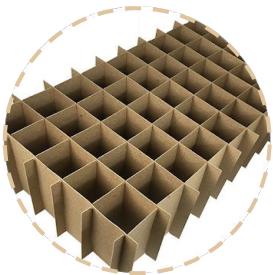


WASTE PLASTIC  
BAGS

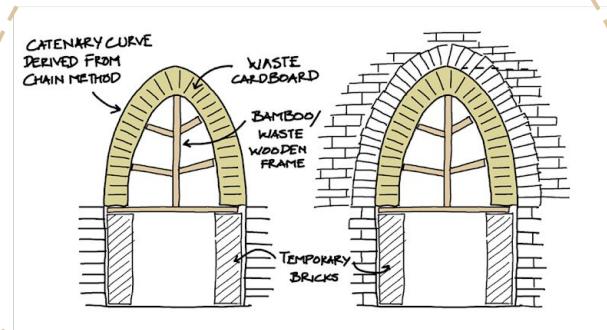


SCRAP WOOD

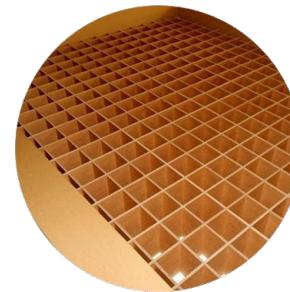
# Formwork concept



GRID BOXES



FORMWORK CONCEPT

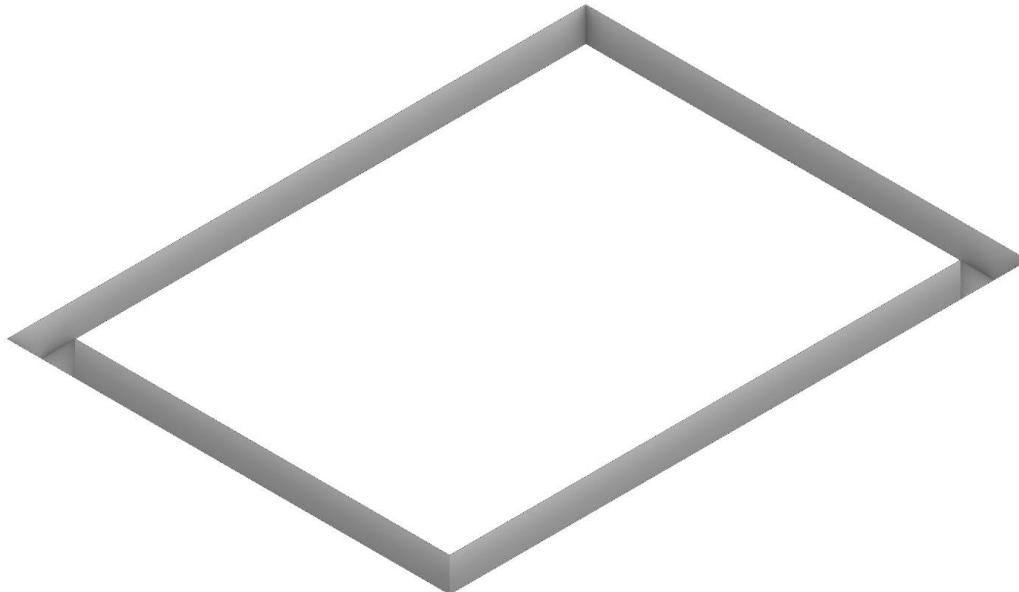


CARDBOARD BED EXAMPLE

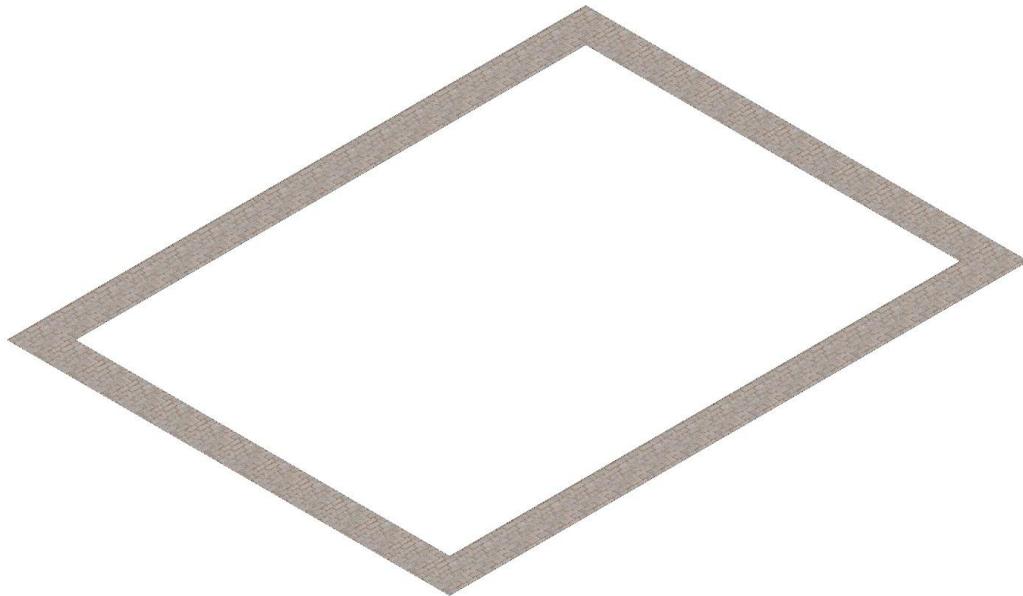


## Ribbed vaults

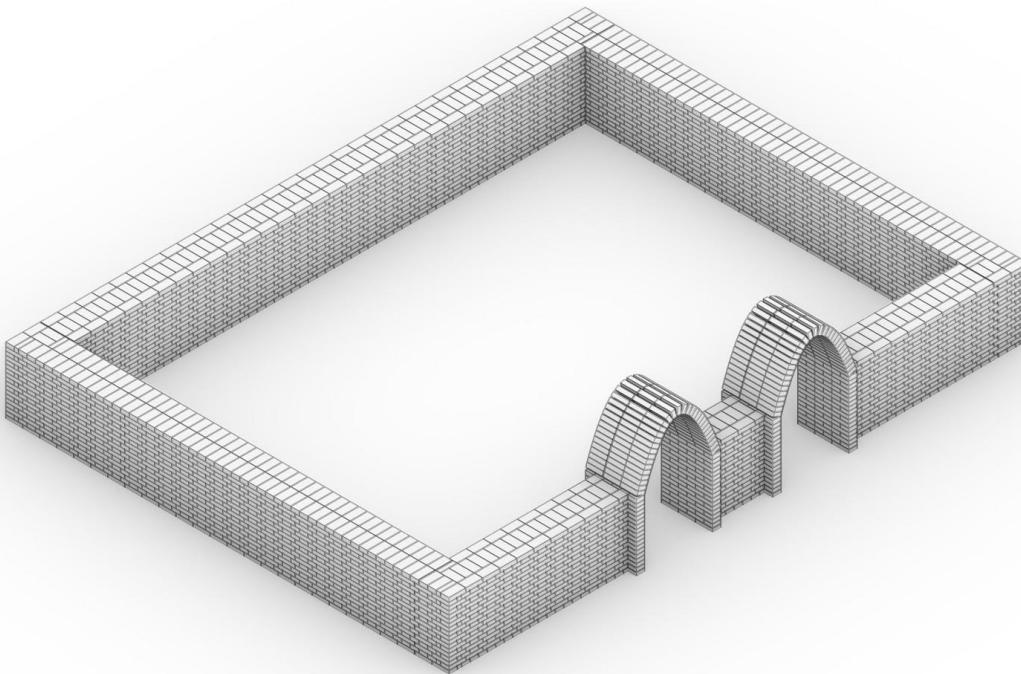
Step 1: Foundation trenches are marked and dug



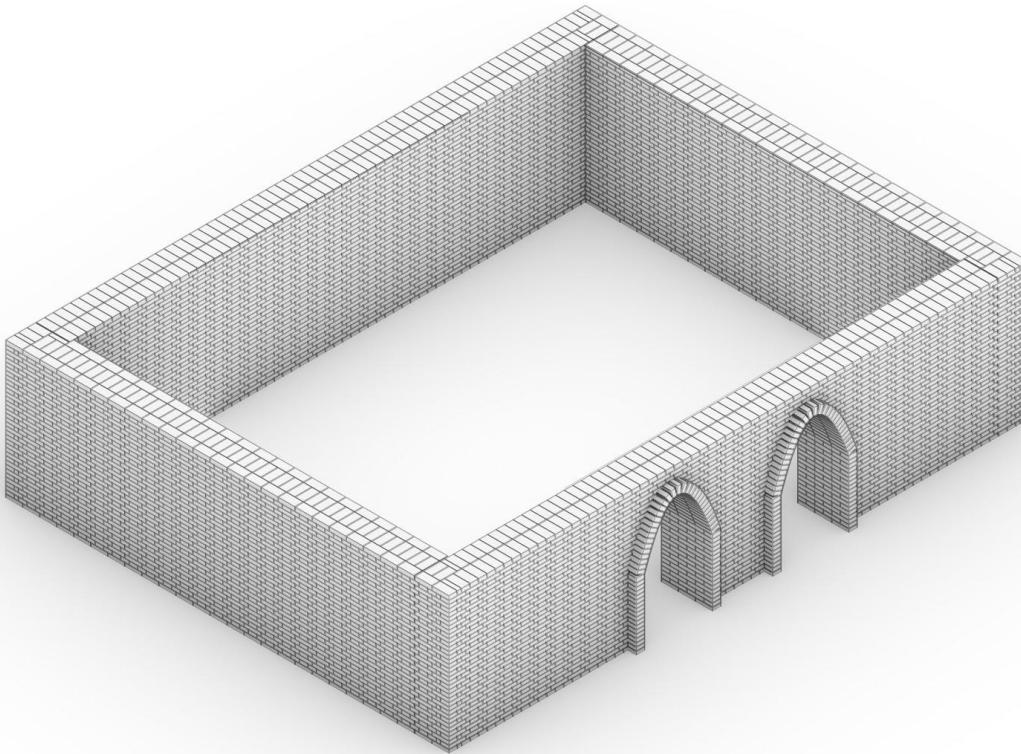
Step 2: Stones are filled in the trench and the site is levelled



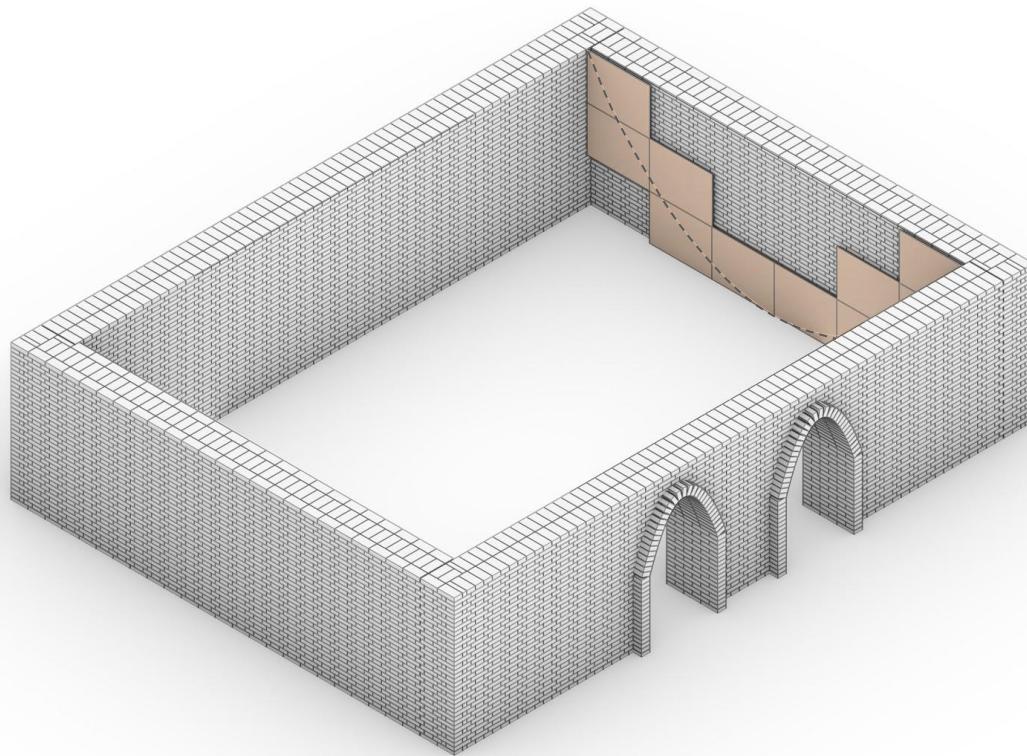
Step 3: Walls are erected with arched door openings



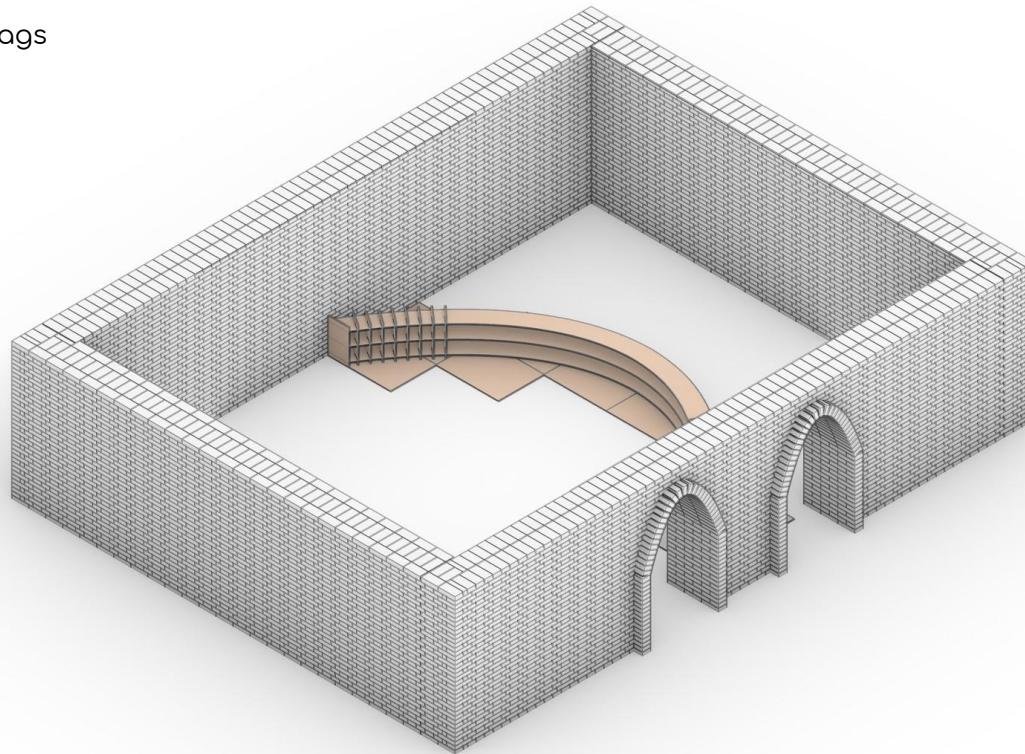
Step 4: Walls are completed up to 2.4 m



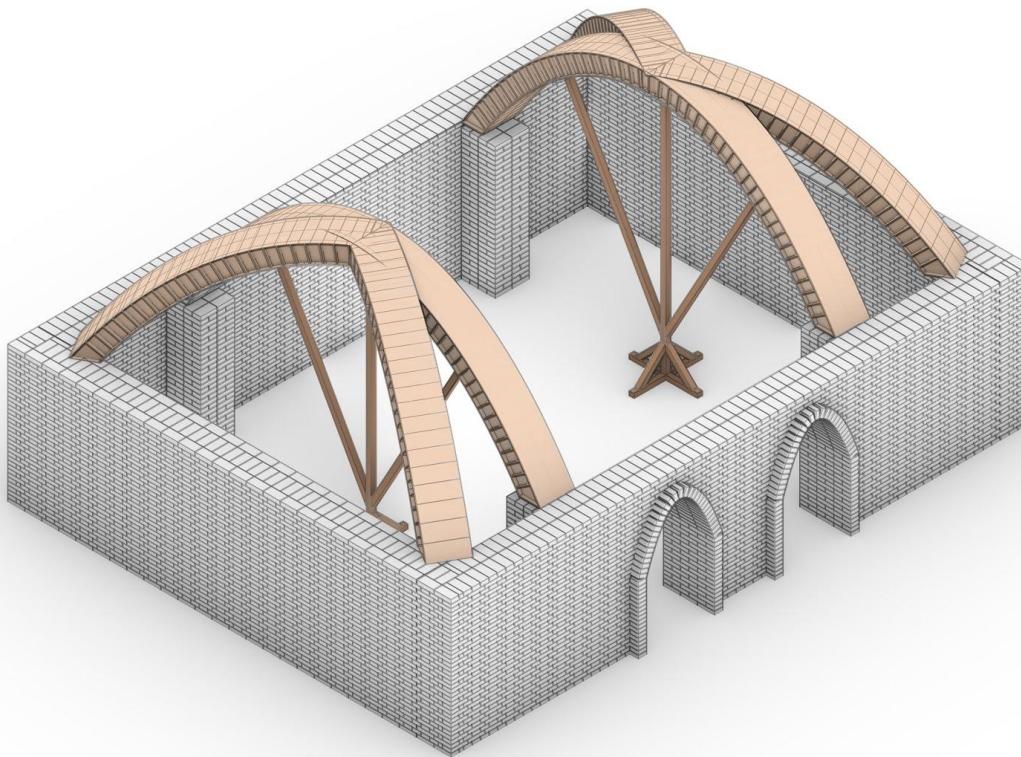
Step 5: Catenary curve is drawn on  
cardboard stuck to the wall



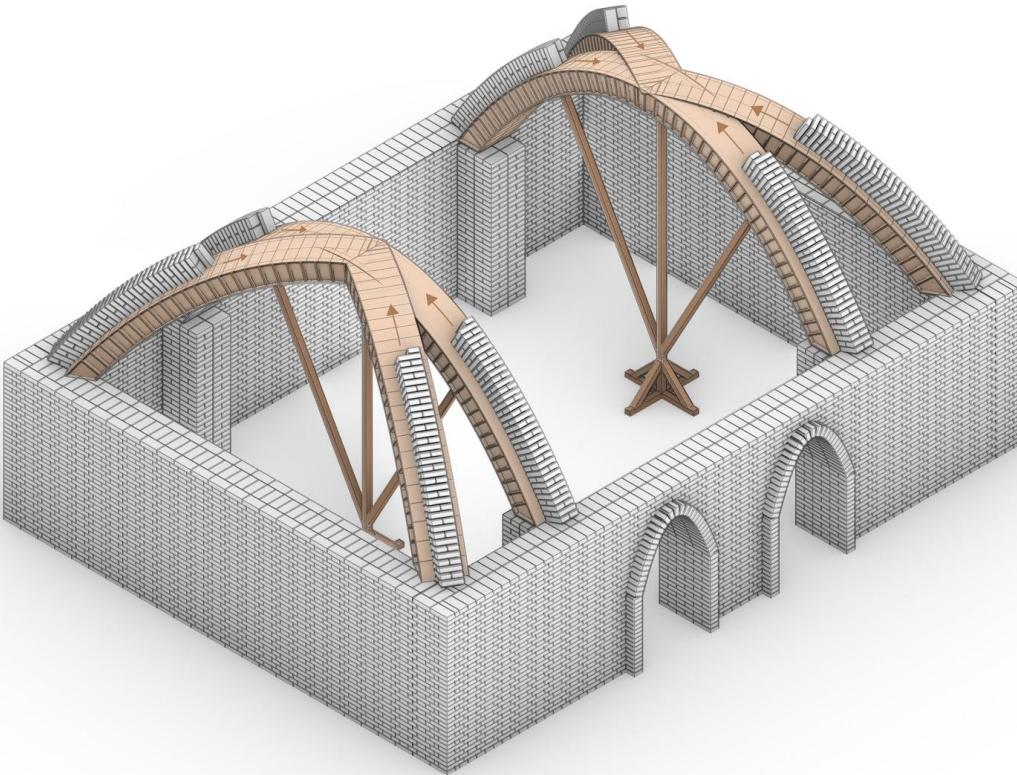
Step 6: Cardboard grid boxes are made along the catenary curve and covered with used plastic bags



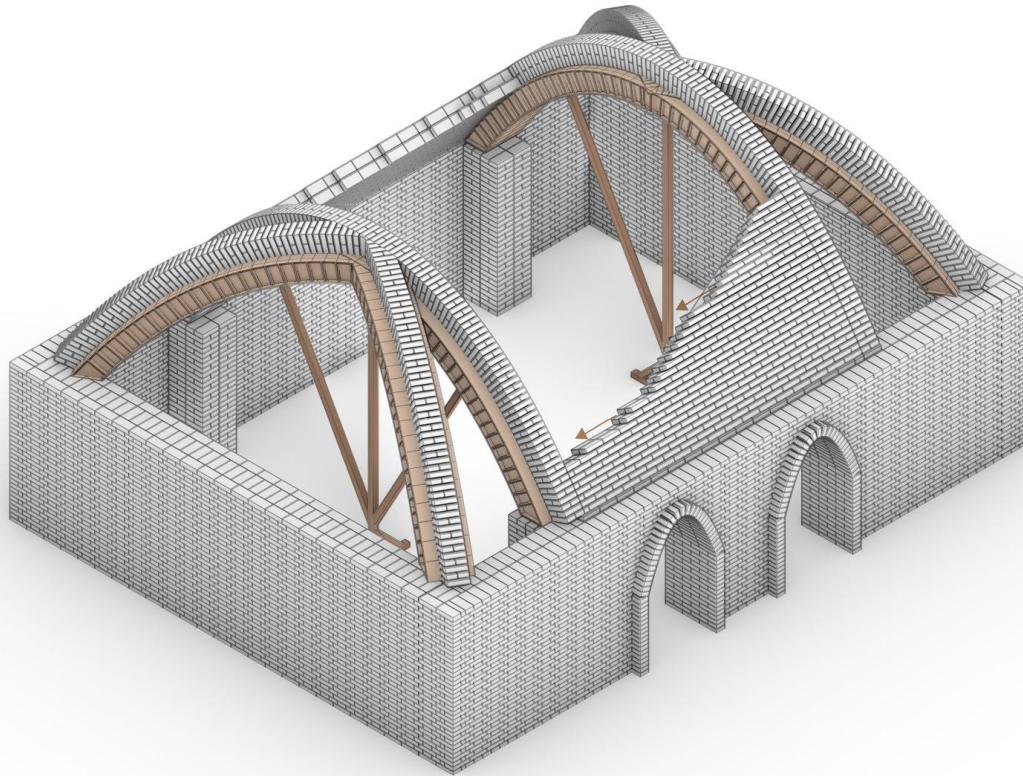
Step 7: Cardboard ribbed arches are hoisted in position with wooden supports



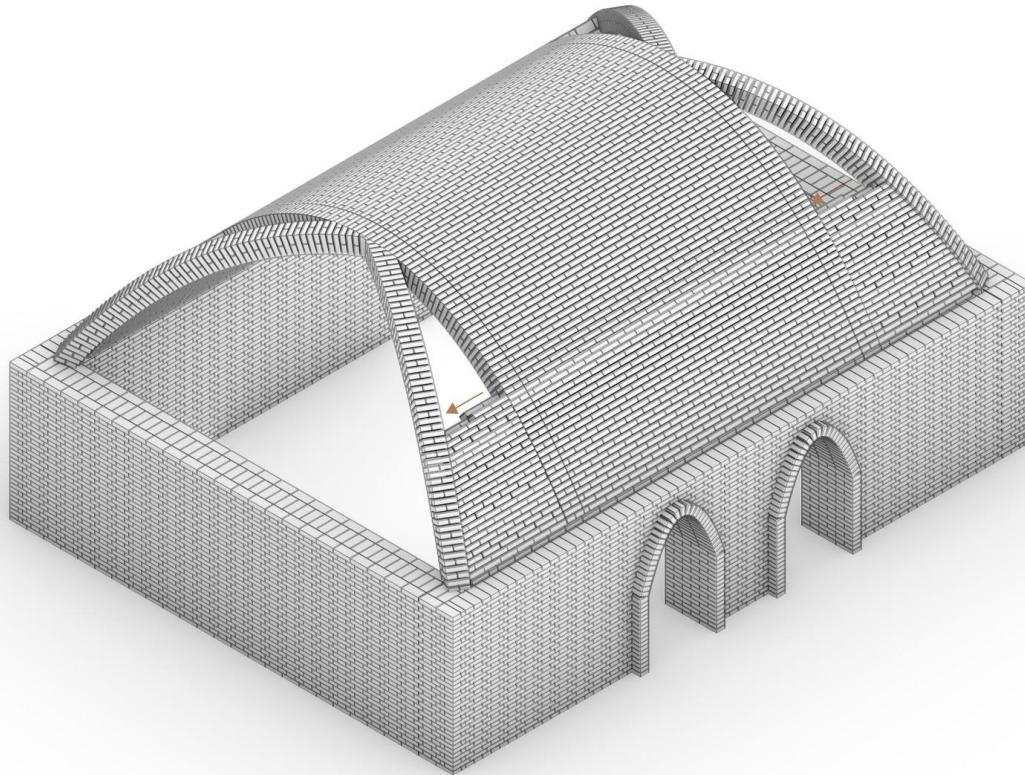
Step 8: Brick arches are laid along the ribs



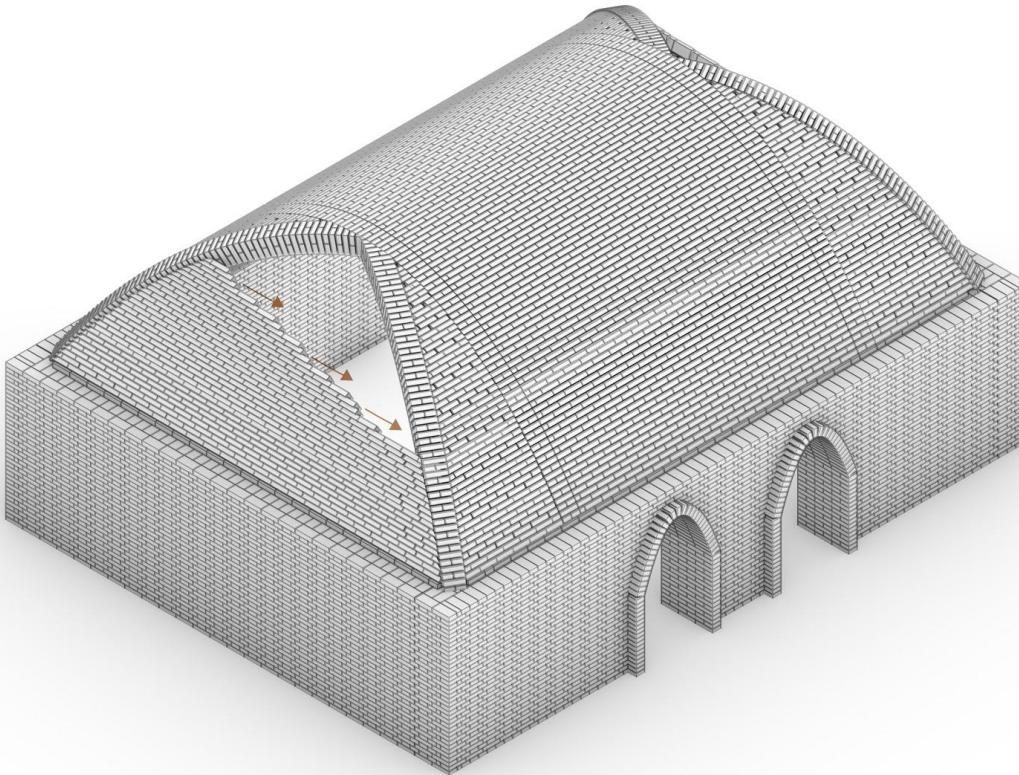
Step 9: Intermediate vault is formed  
between the parallel ribs



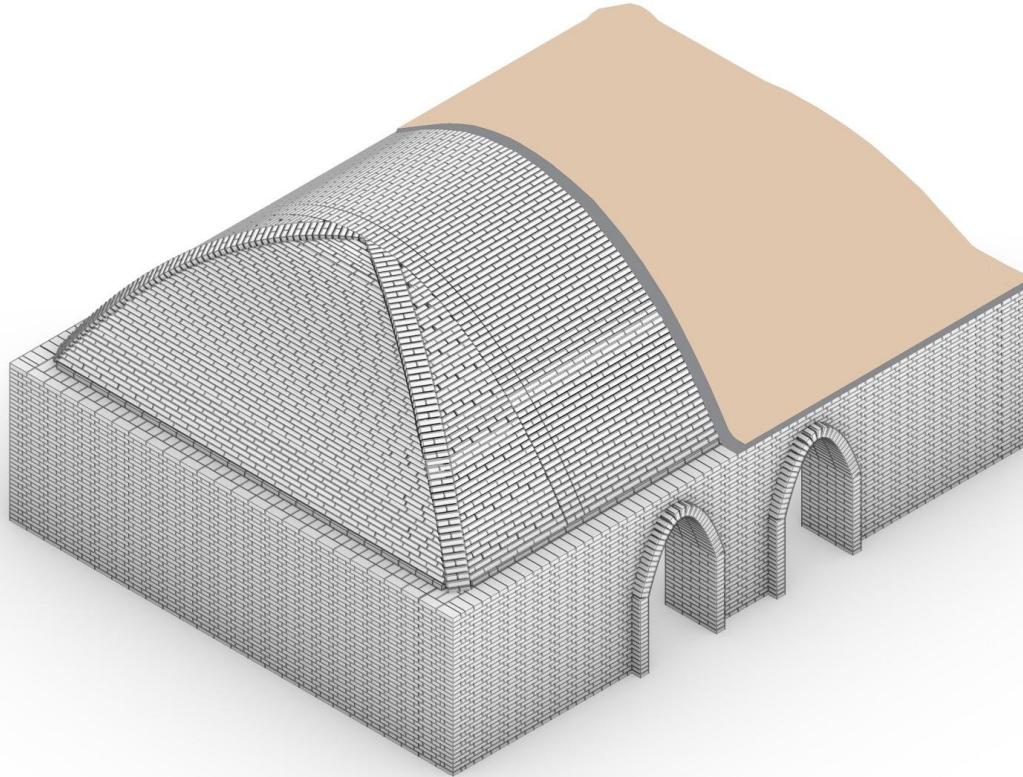
Step 10: Rest of the roof is formed  
along the curved ribs



Step 11: Rest of the roof is formed along  
the curved ribs

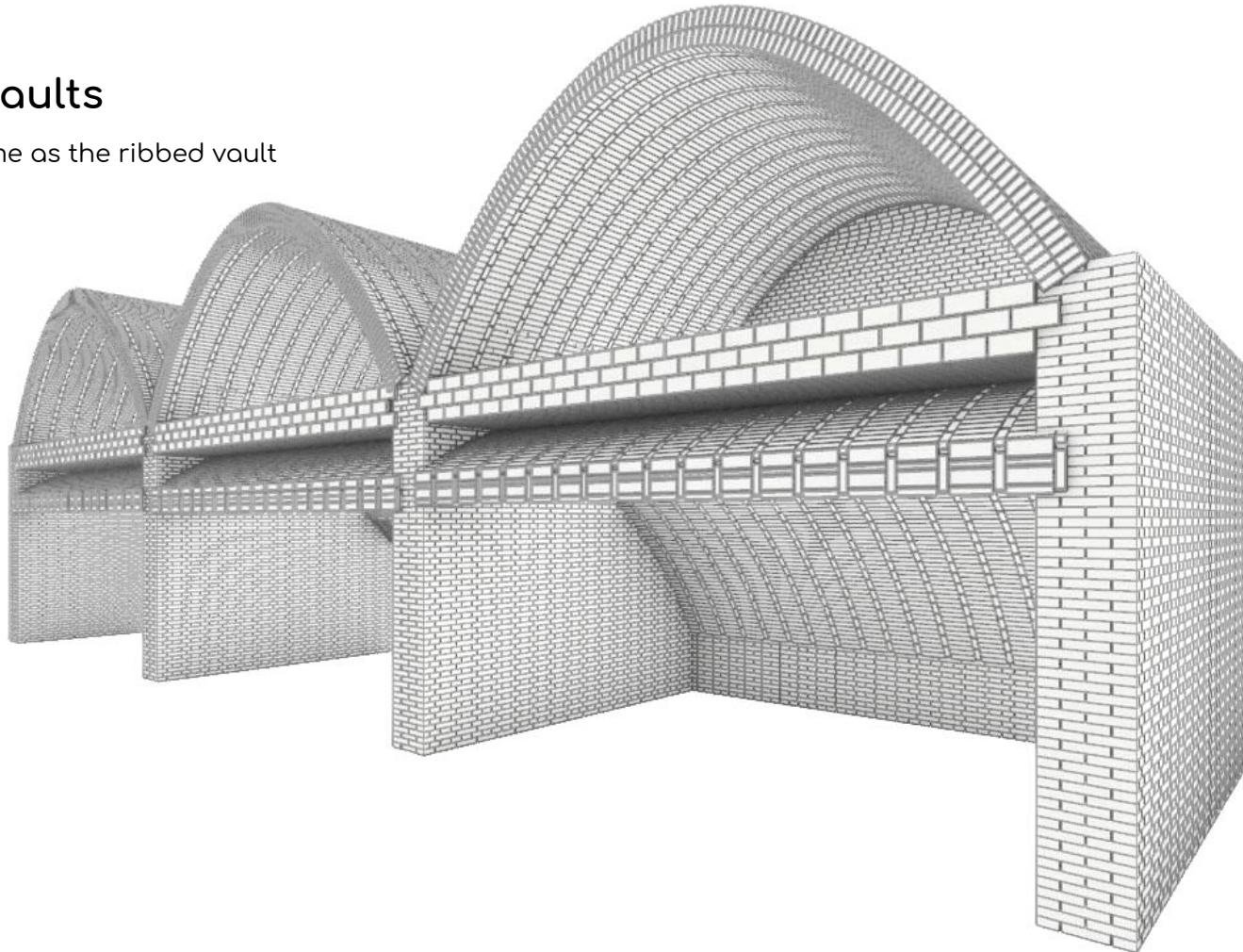


Step 12: Roof is finished with mud  
plaster

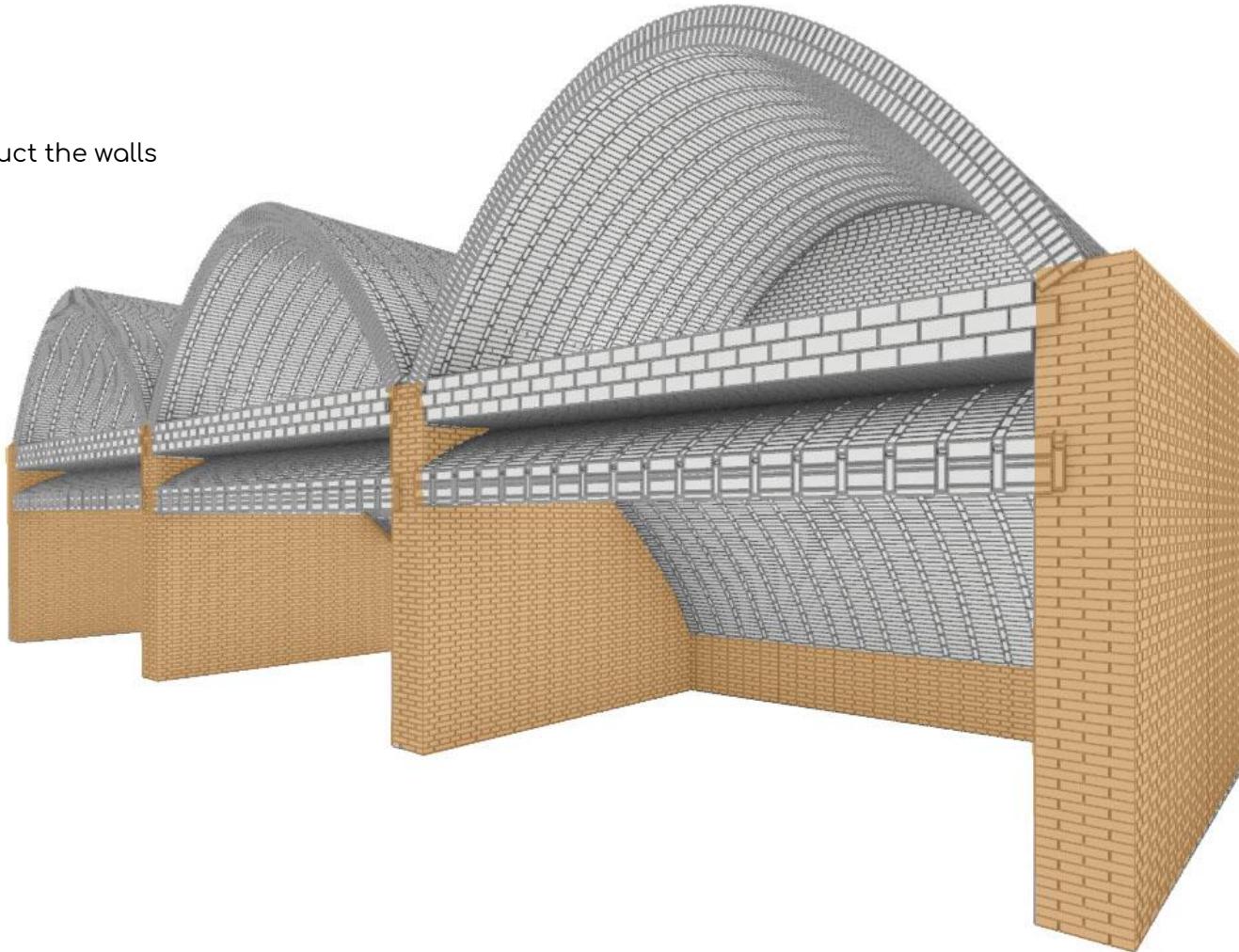


## Nubian vaults

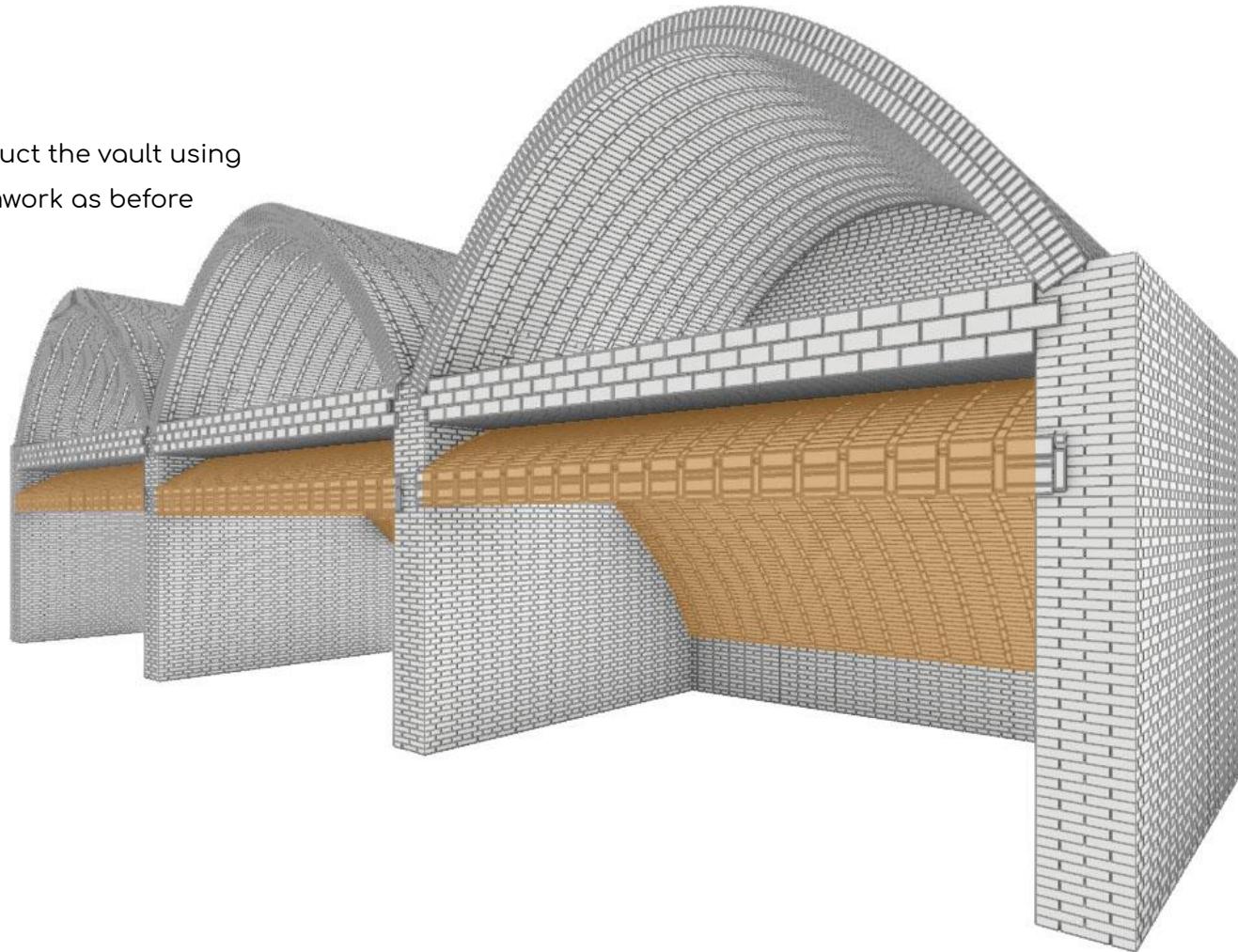
Step 1 & 2: Same as the ribbed vault



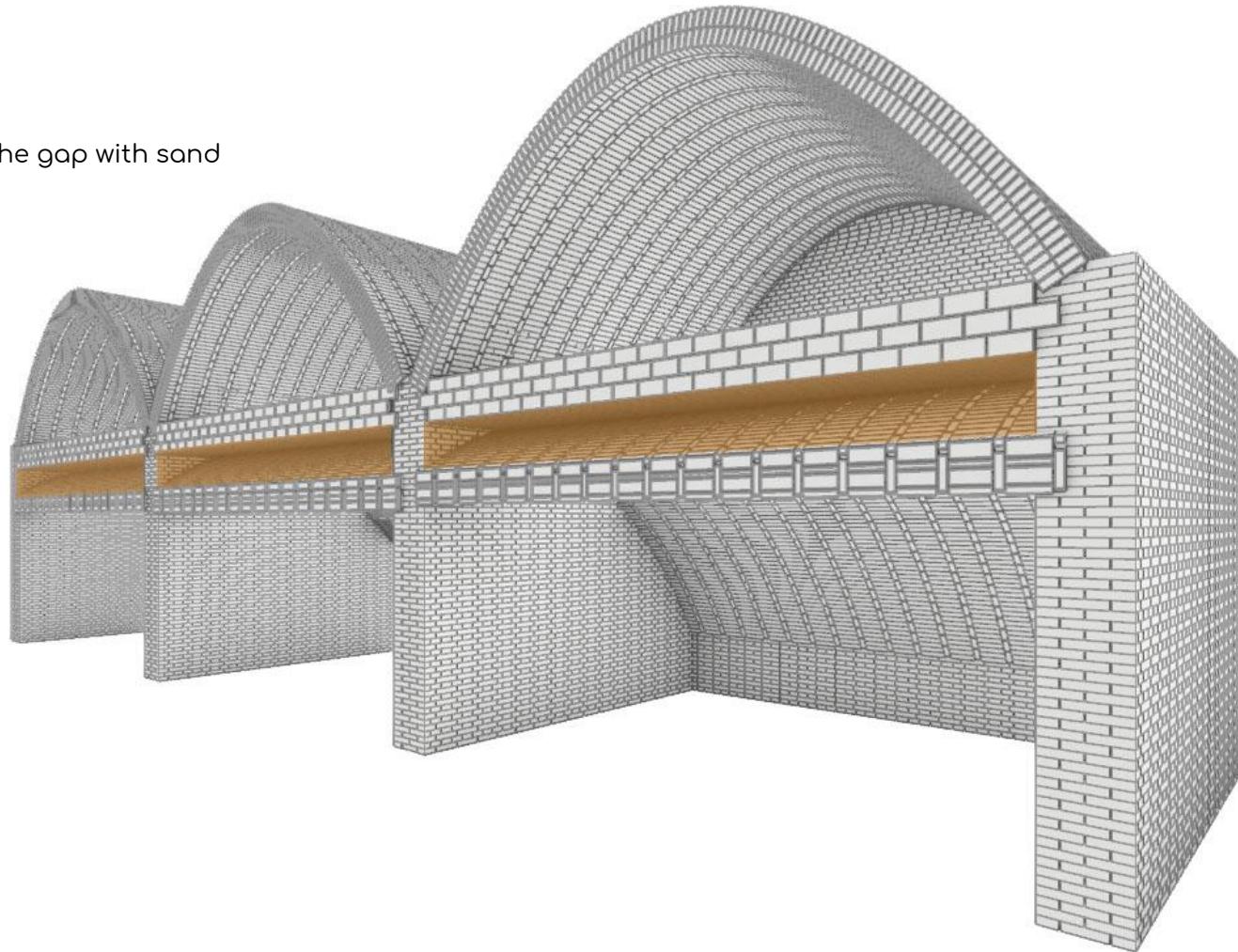
Step 3: Construct the walls



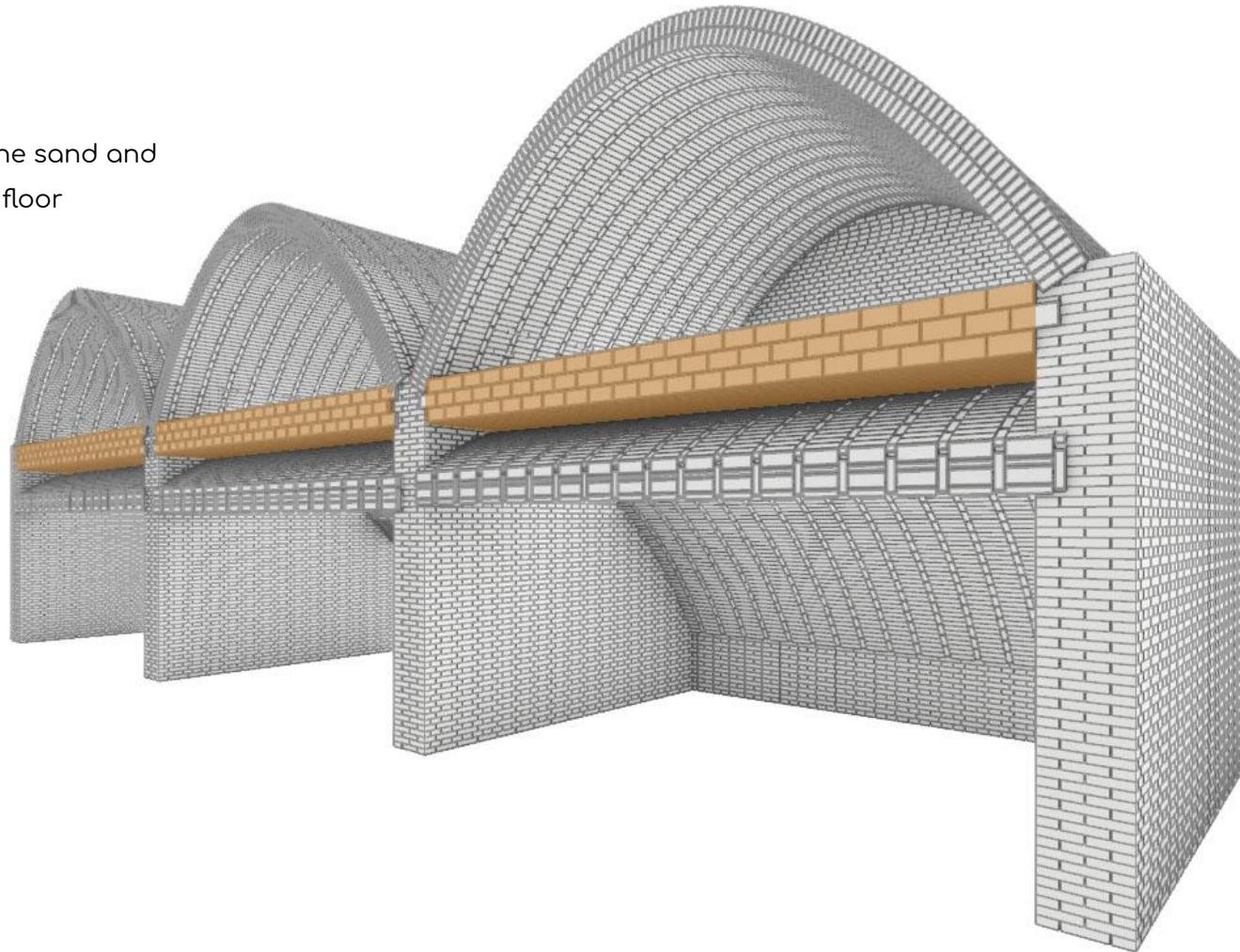
Step 4: Construct the vault using  
the same formwork as before



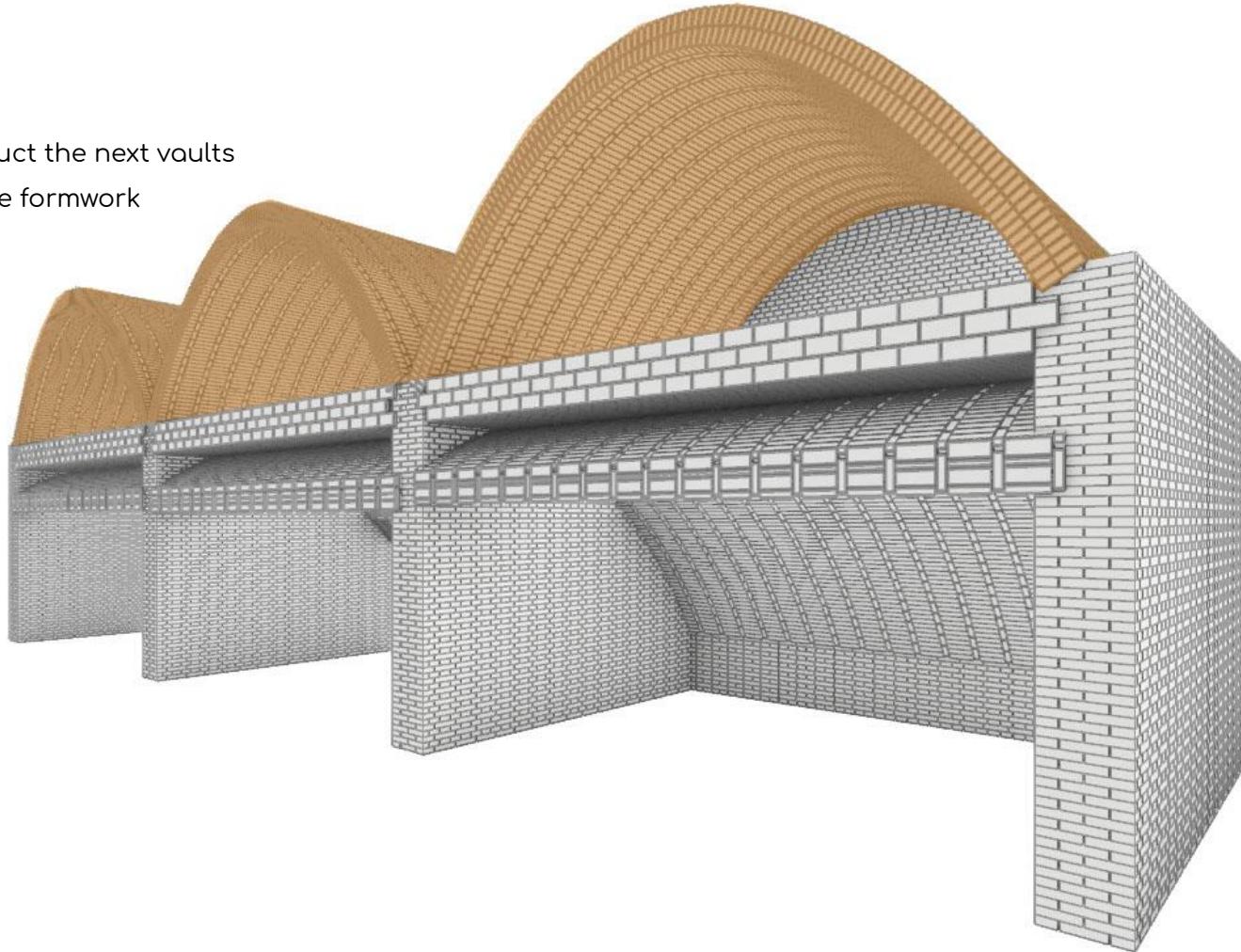
Step 5: Fill in the gap with sand



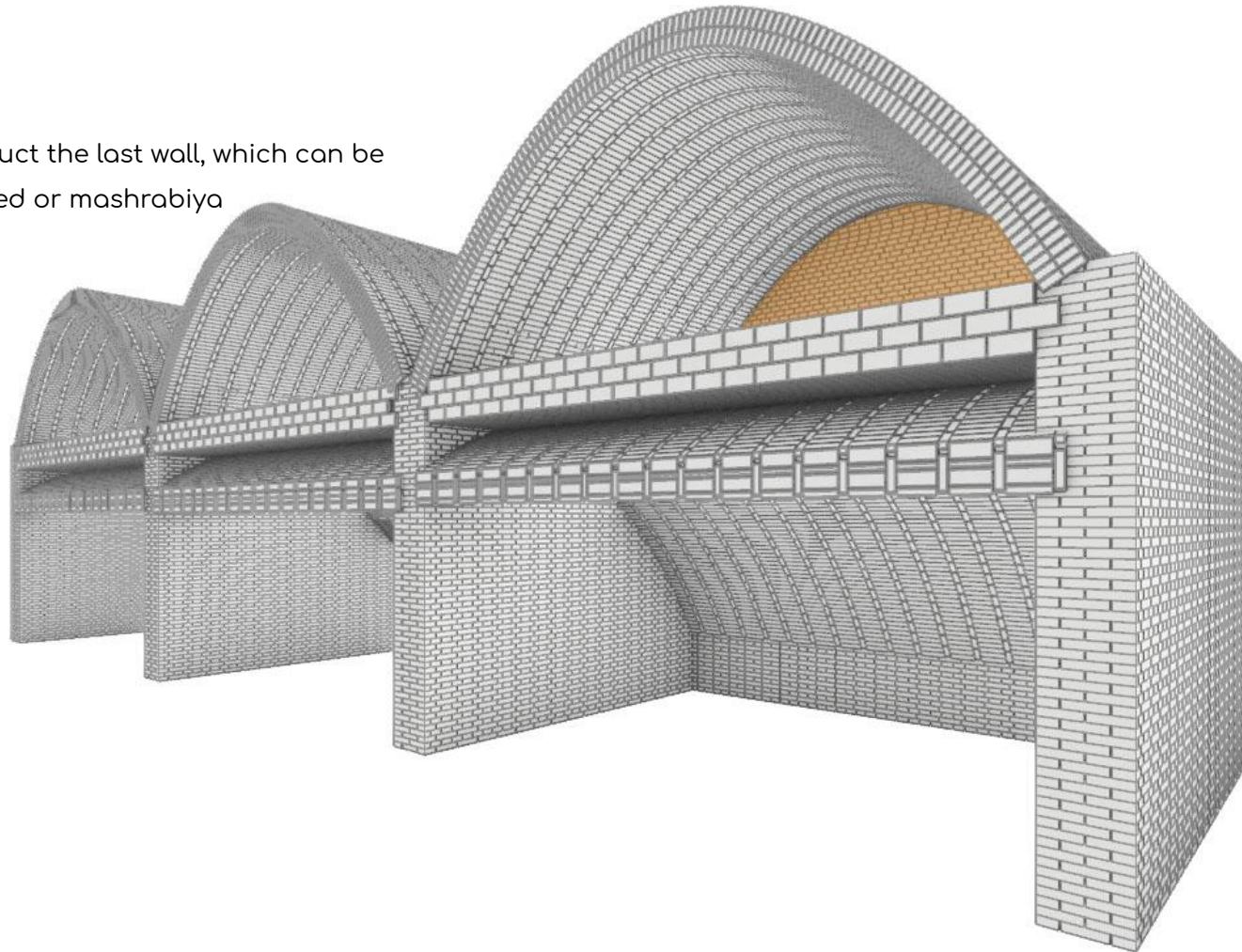
Step 6: Level the sand and  
Construct the floor



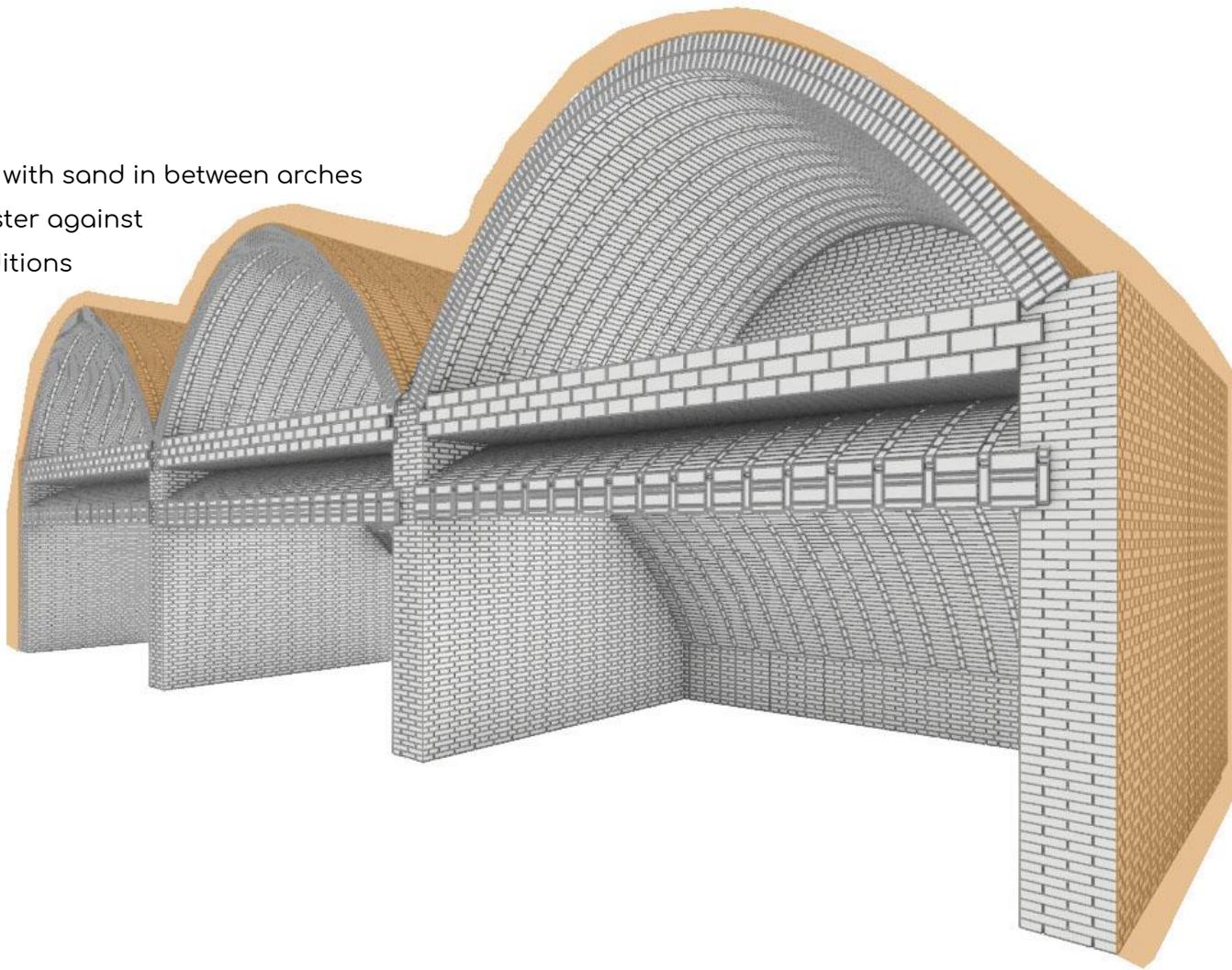
Step 7: Construct the next vaults  
using the same formwork  
as before



Step 8: Construct the last wall, which can be completely filled or mashrabiya

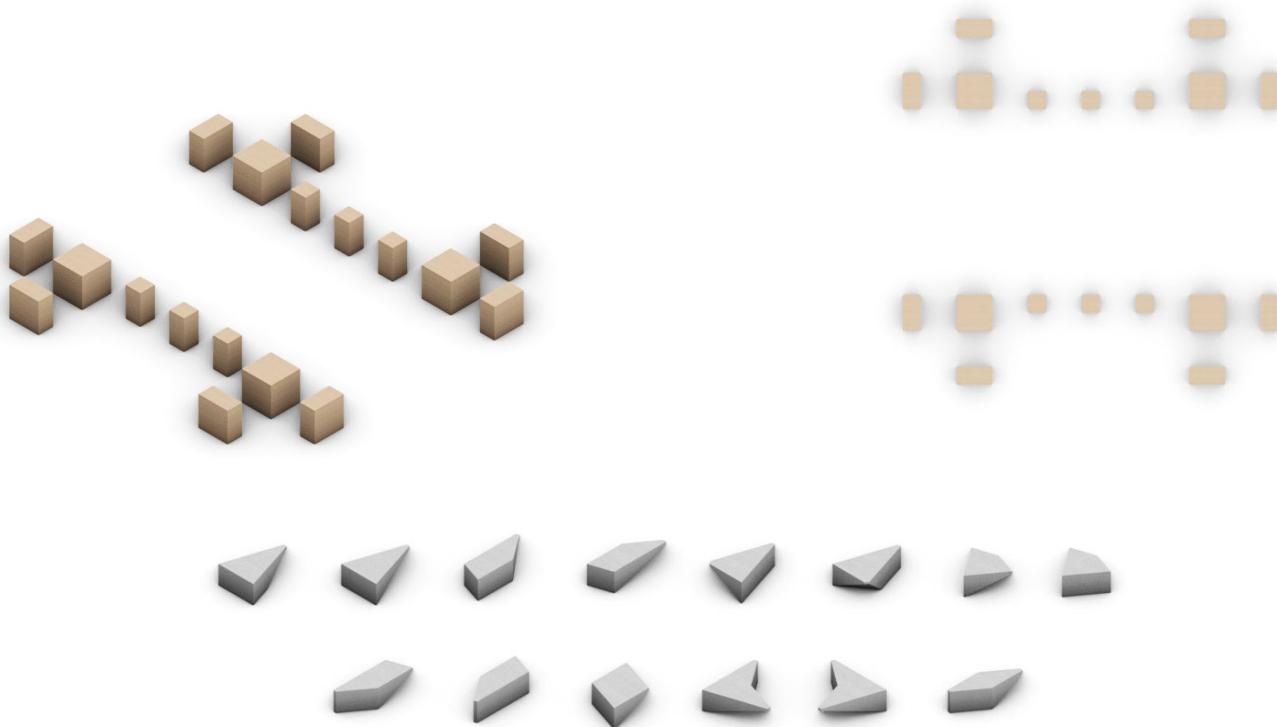


Step 9: Finish with sand in between arches  
and mud plaster against  
weather conditions



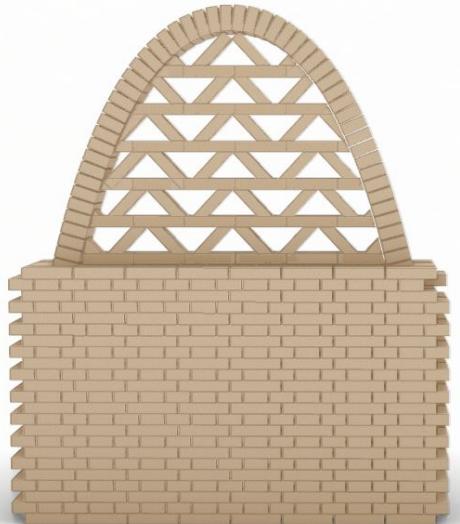
# Muqarnas Domes

Construction sequence

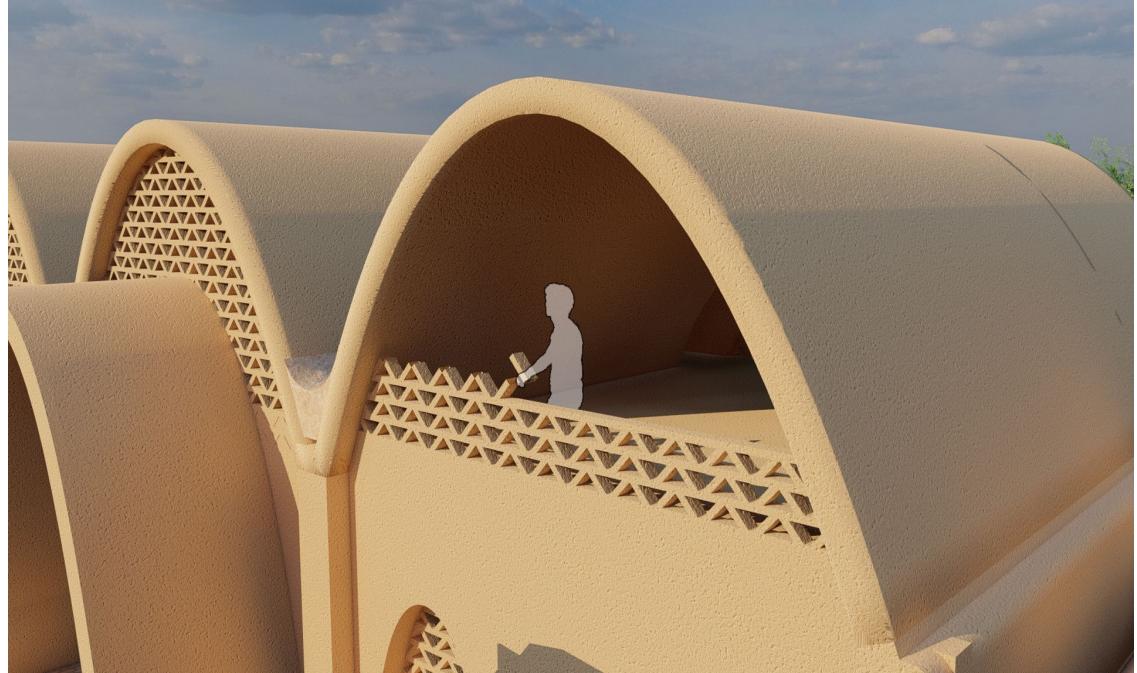




# Openings



Herringbone Jaali screen for privacy





Simple catenary opening





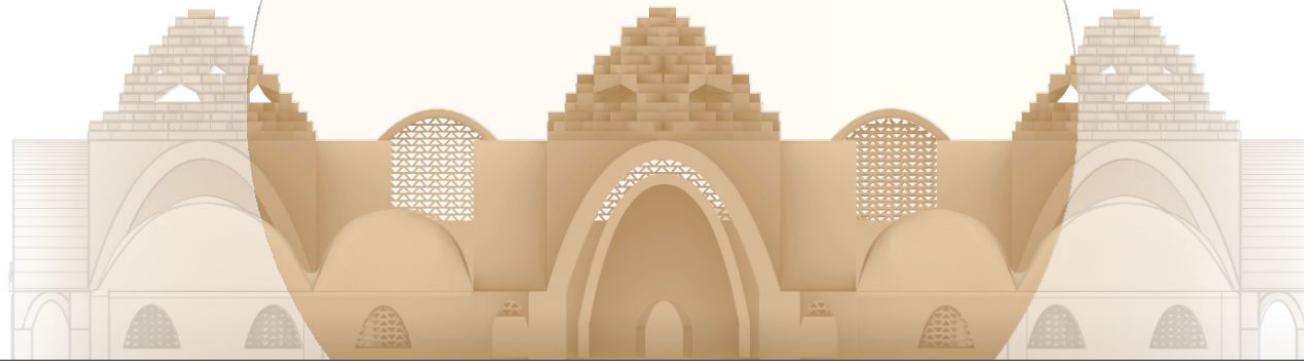


AUSTIN SURGERY  
SALVAGE SURGERY  
LUXURY GARDENS  
...  
AUSTIN SURGERY



## Reflection

# بيت التراث ZAATARI HOUSE OF HERITAGE



Understanding why ancient methods where used initially



Greater insight to the construction methods



Configuration can be improved by making sure the room adjacencies are defined orthogonally to ensure proper room clustering



Human error needs to be taken into account



Muqarnas domes great potential to be developed further