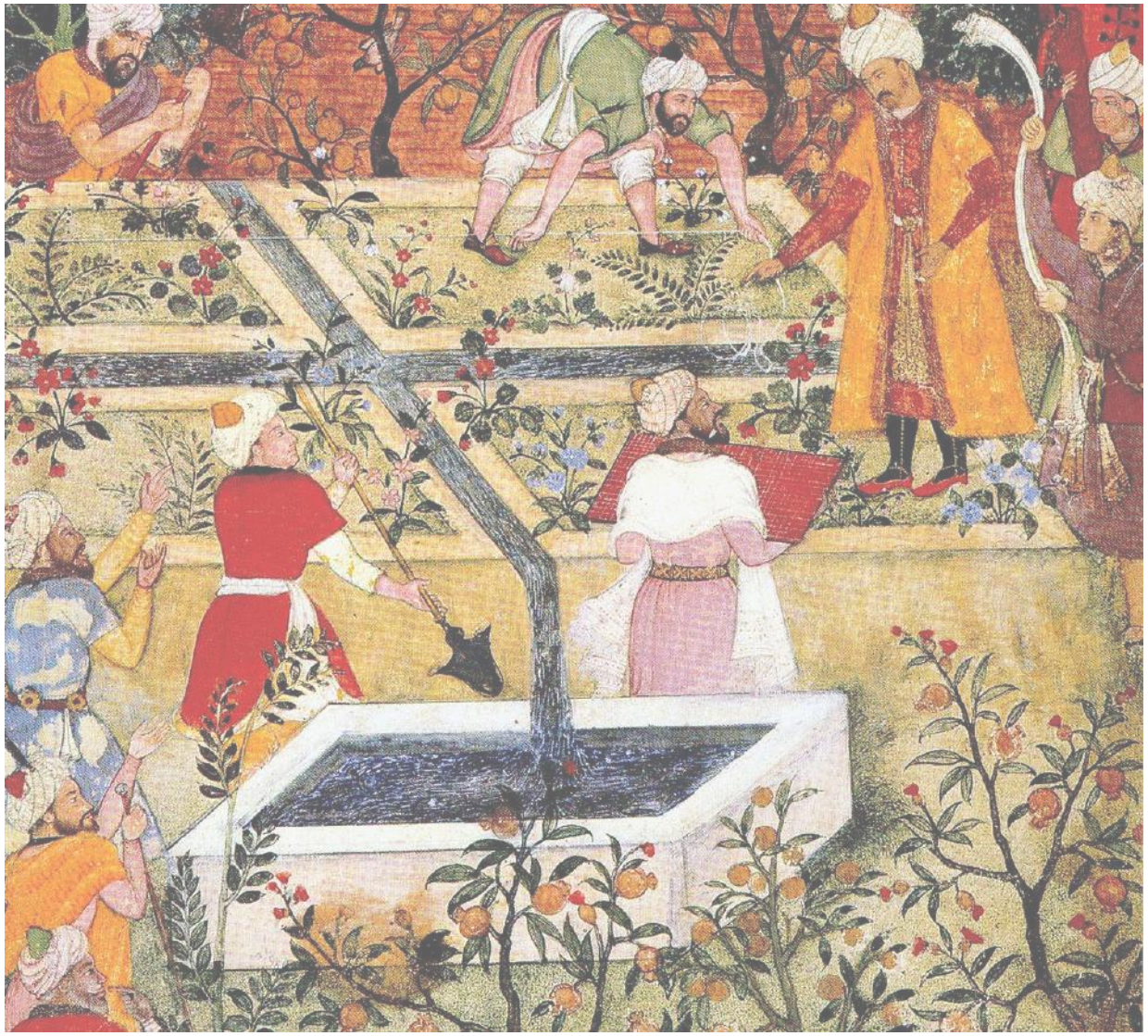
Jannat Al-Tohr

A retreat from everyday life



Content

Students:

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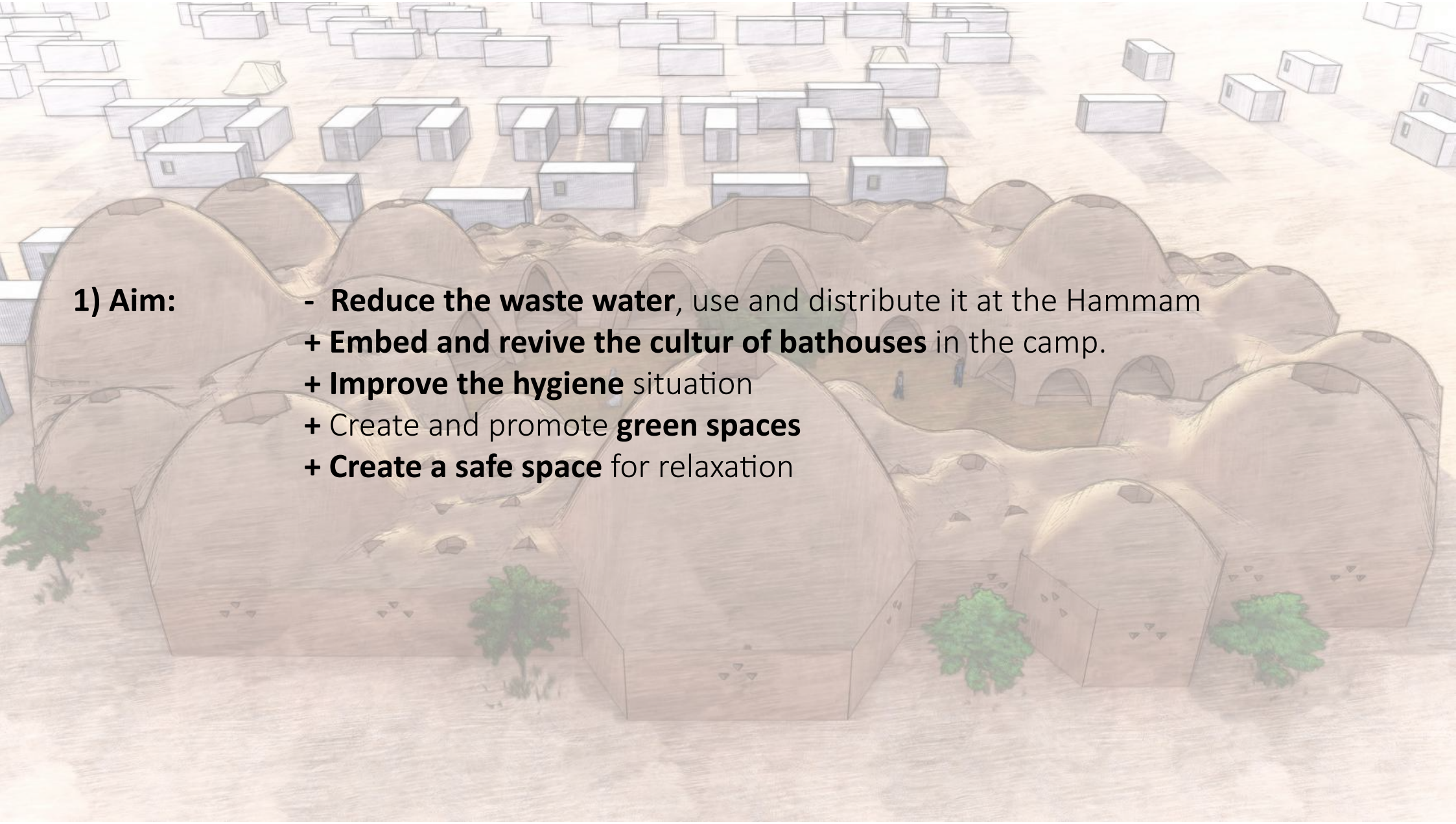
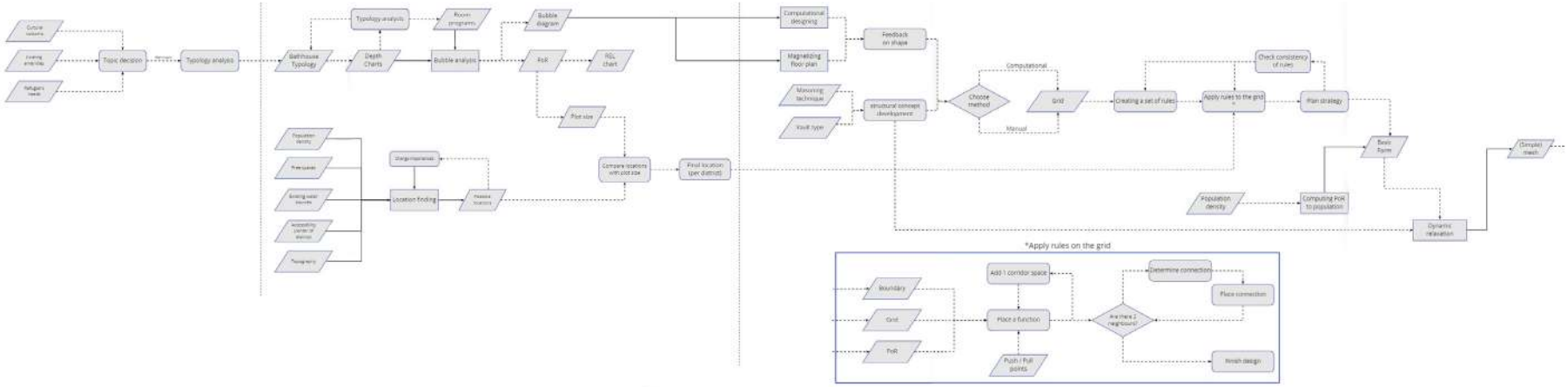
1) Vision: "Our aim is to create a recreational space in which washing facilities will be available to residents. A way of escaping the camp towards a calming environment."

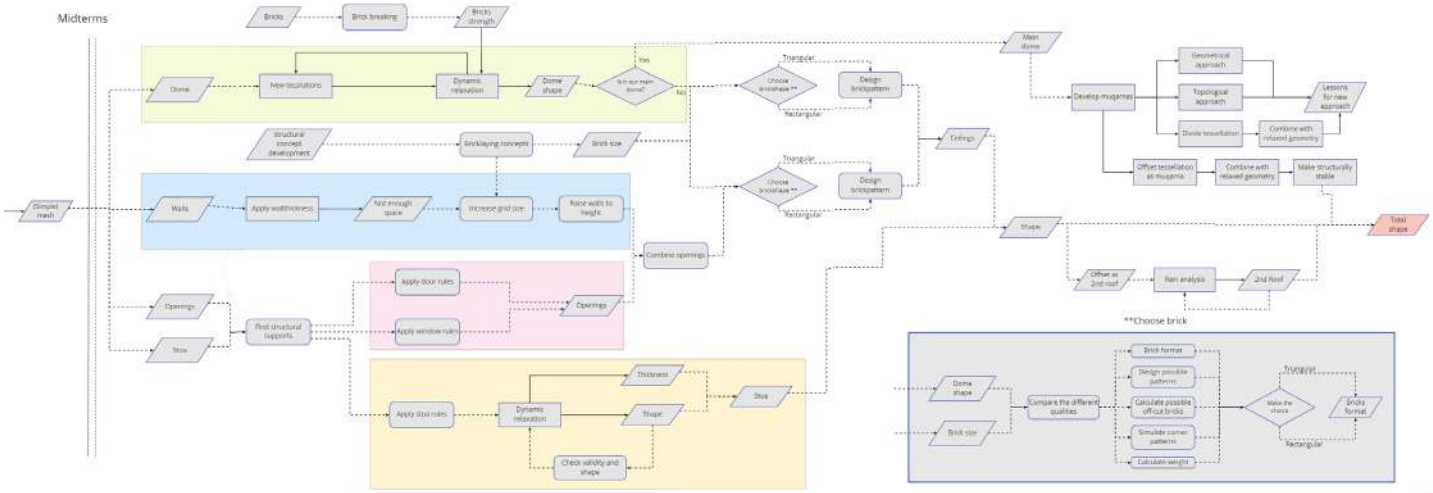


1) Aim:

- **Reduce the waste water**, use and distribute it at the Hammam
- **+ Embed and revive the cultur of bathouses** in the camp.
- **+ Improve the hygiene** situation
- **+** Create and promote **green spaces**
- **+ Create a safe space** for relaxation

Flowchart:


Topic decision
Typology analysis
Bathhouse Typology
Typology analysis
Room programs
Depth Charts
Bubble diagram
Bubble analysis
PoR
FGL chart
Plot size
Compare locations with plot size
Final location (per district)
Location finding
Computational designing
Magnetizing floor plan
Feedback on shape
Structural concept development
Choose method
Computational
Manual
Grid
Creating a set of rules
Apply rules to the grid
Check consistency of rules
Plan strategy
Basic form
(Simple) mesh
Computing PoR to population
Dynamic relaxation
*Apply rules on the grid
Boundary
Grid
PoR
Add 1 corridor space
Place a function
Push / Pull points
Are there 2 neighbours?
Determine connection
Place connection
Finish design

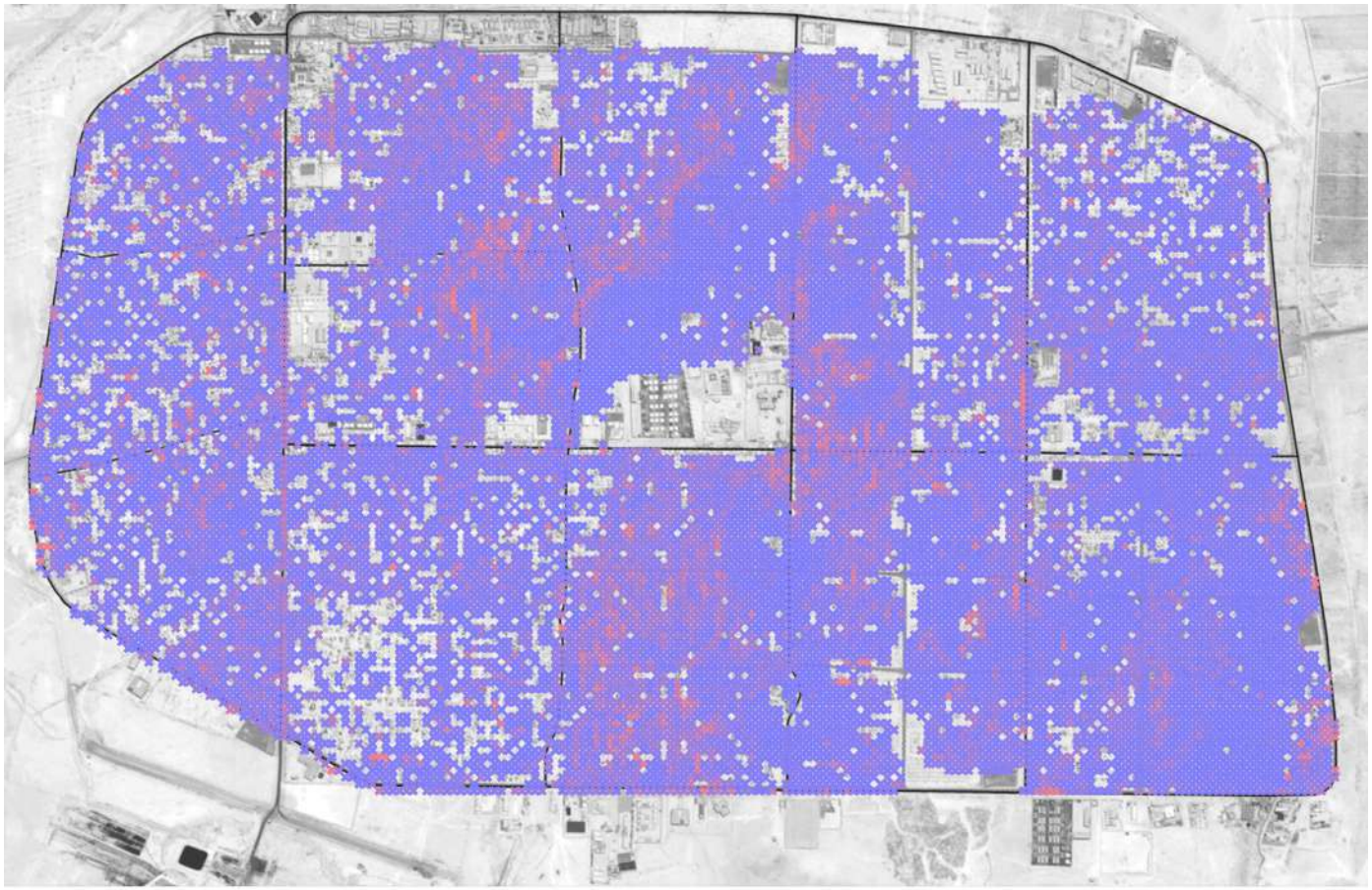

Midterms
Bricks
Brick breaking
Bricks strength
Dome
New iterations
Dynamic relaxation
Dome shape
Is it our main dome?
Yes
No
Triangular
Rectangular
Design brickpattern
Main dome
Develop muqarnas
Geometrical approach
Topological approach
Lessons for new approach
Divide tessellation
Combine with relaxed geometry
Offset tessellation as muqarnas
Combine with relaxed geometry
Make structurally stable
Structural concept development
Bricklaying concepts
Brick size
Walls
Apply wallthickness
Not enough space
Increase grid size
Raise walls to height
Combine openings
Ceilings
Shape
Total shape
Offset as 2nd roof
Rain analysis
2nd Roof
Openings
Stair
Find structural supports
Apply door rules
Apply window rules
Openings
Apply stair rules
Dynamic relaxation
Thickness
Shape
Stair
Check validity and shape
**Choose brick
Dome shape
Brick size
Compare the different qualities
Brick format
Design possible patterns
Calculate possible official bricks
Simulate corner patterns
Calculate weight
Make the choice
Brick format

1) Placing: Selection of location based on:

- Density

- Walking distance

- Water
- Other recreation
- Topology

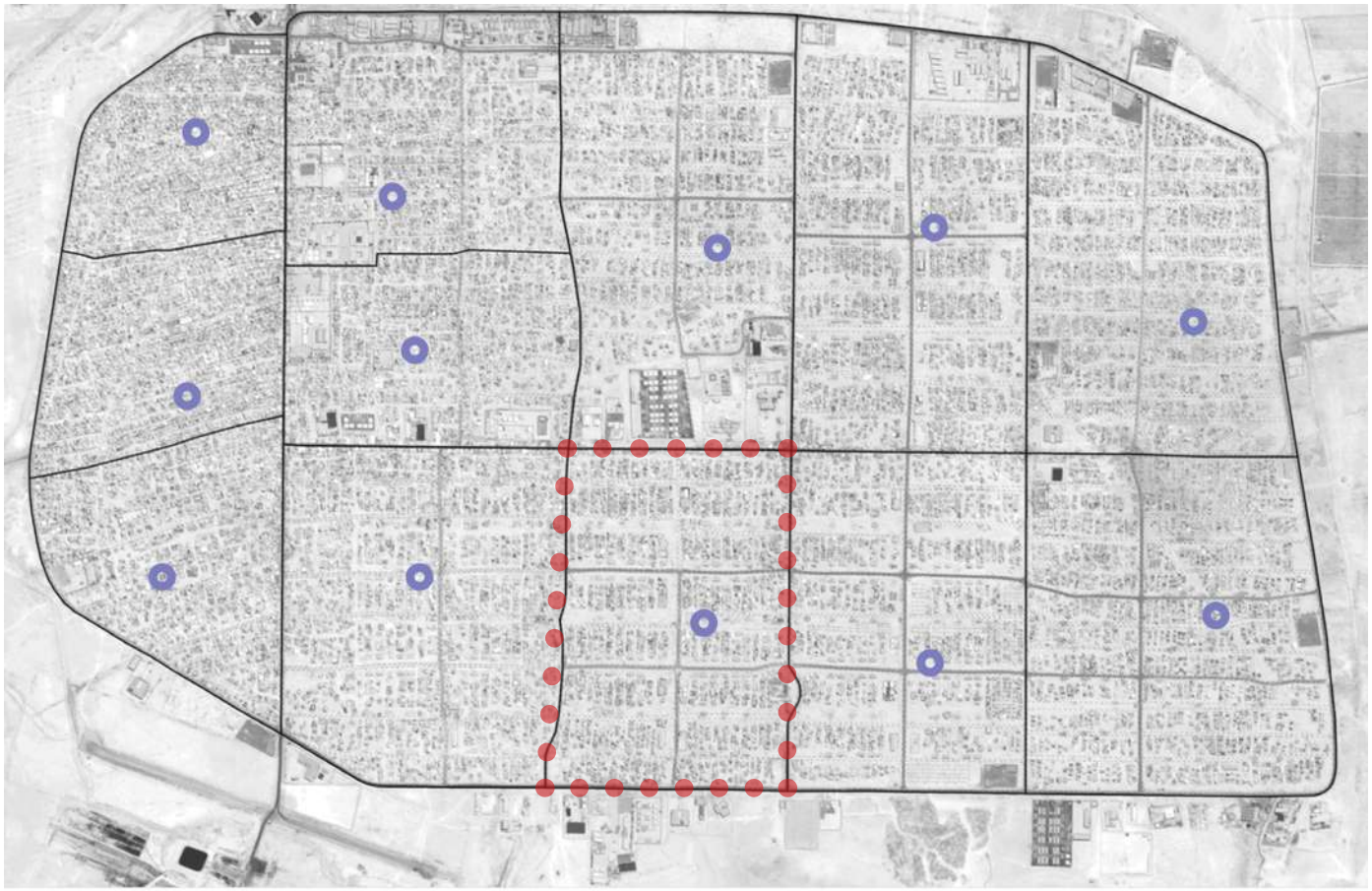


1) Placing: most suitable location for a bathhouse per district

1) Placing:

- Selected locations per district (different hammam size)
- Selected district

(population is close to the avarage population per distrcit)



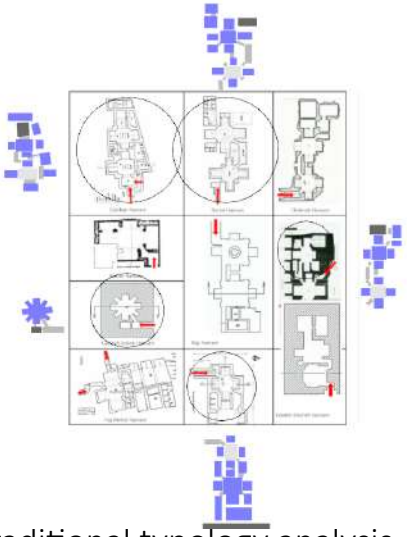
1) Placing: - The plot is located at a crossing. This allows a better urban integration and approachability
- Entrence at the corner

1) Plot size: 40*60 meter

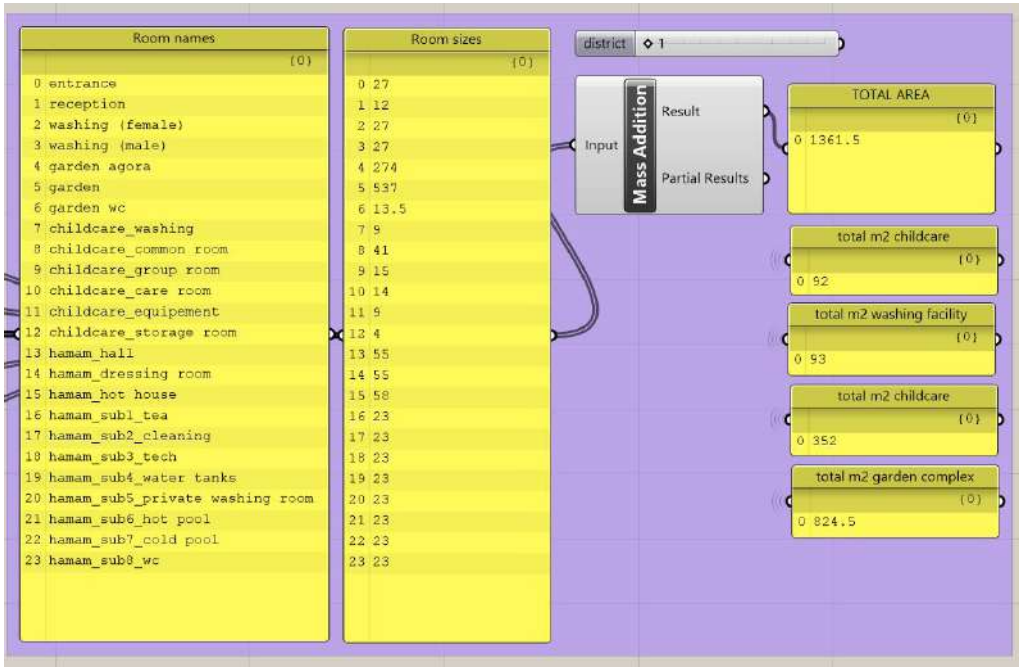
2) Configuration

traditionalism vs. modernism- or both ?
Required space was derived from the population anylysis and the analysis of traditional Hamams

population density

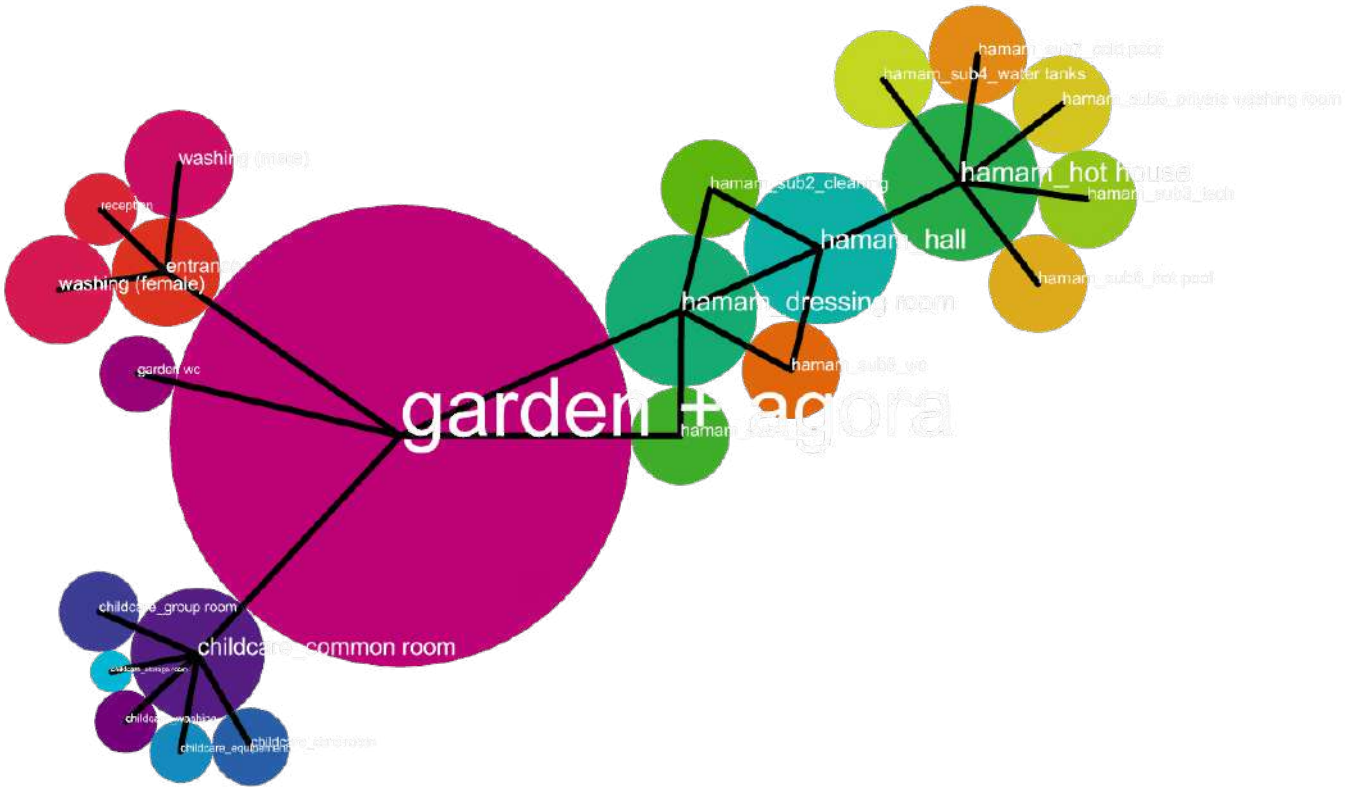


traditional typology analysis



2) Configuration

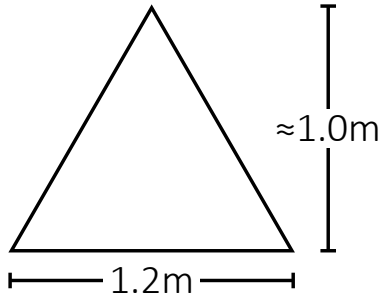
traditionalism vs. modernism- or both ?
Required space was derived from the population anylysis and the analysis of traditional Hamams

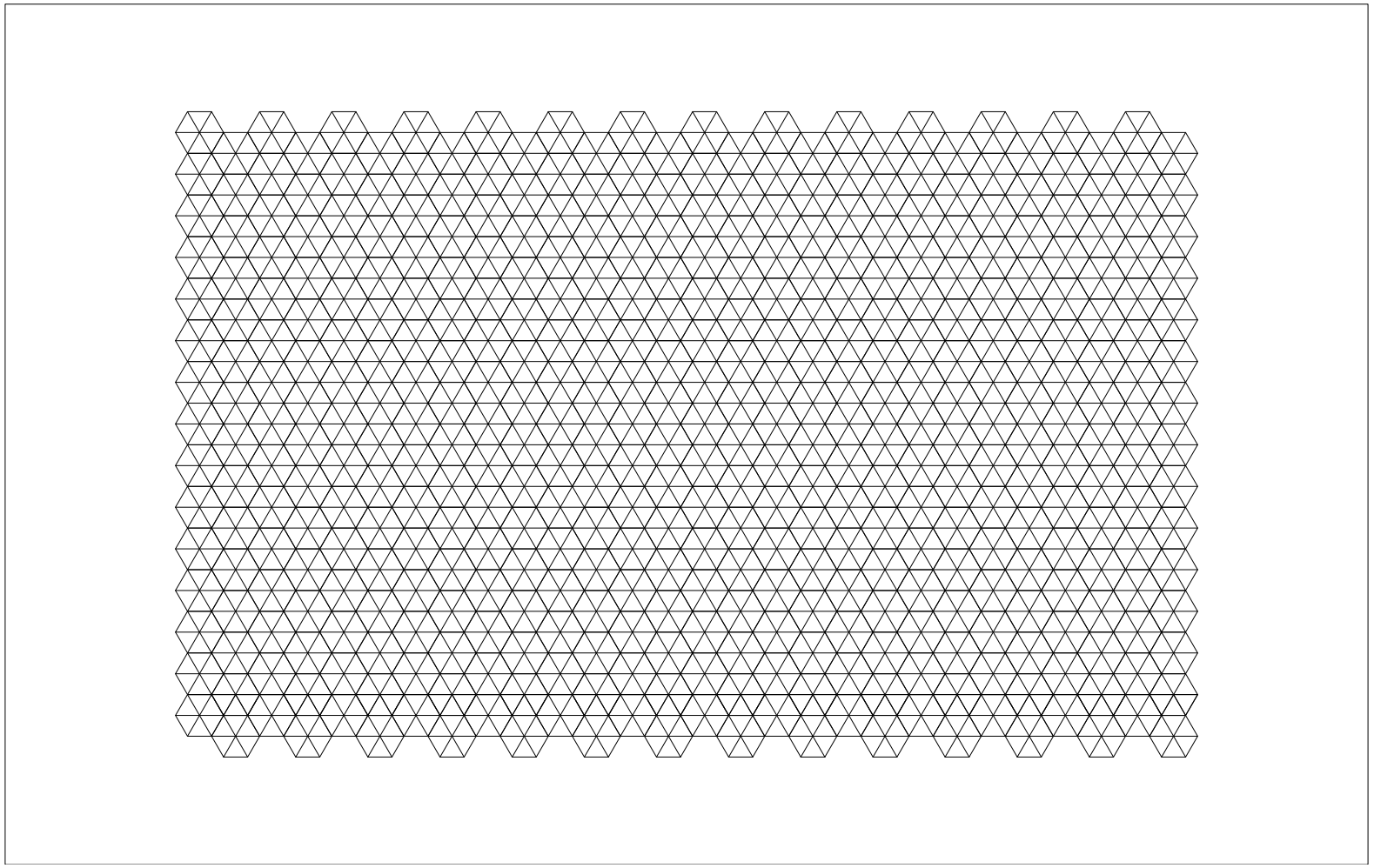


2) Triangular Grid

Rooms => Hexagons

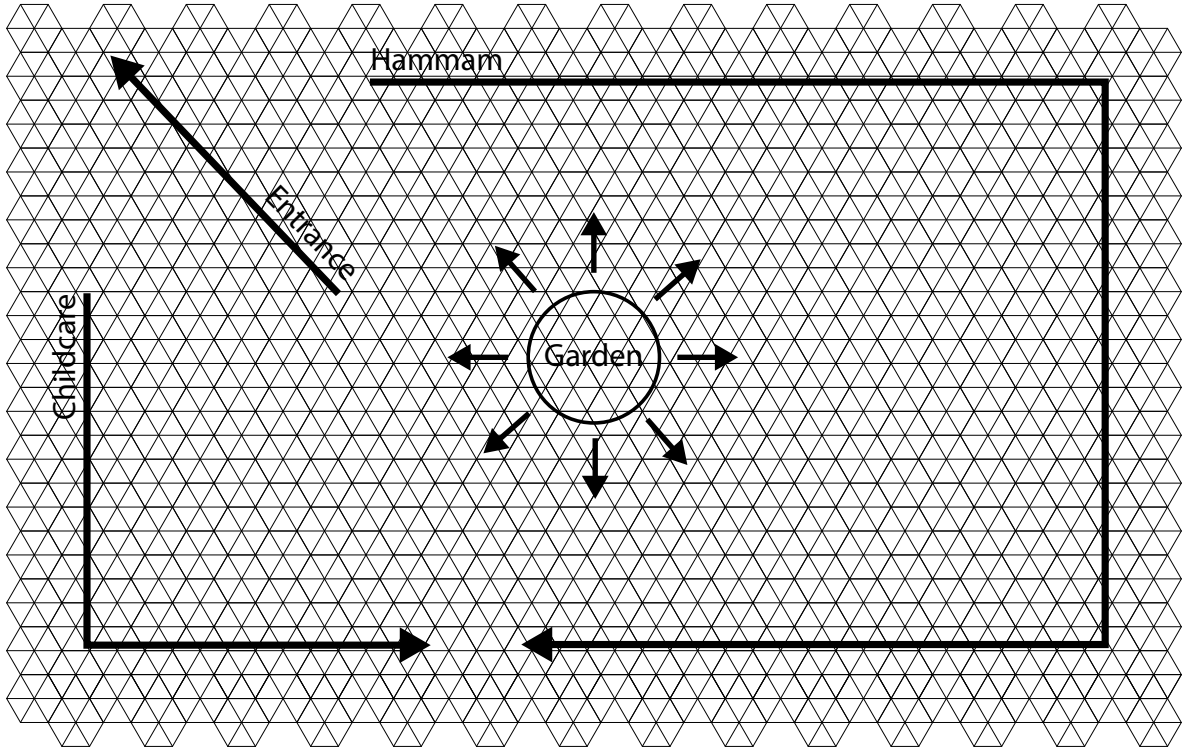
+ Compatible with domes shapes
+Topology of Hammam





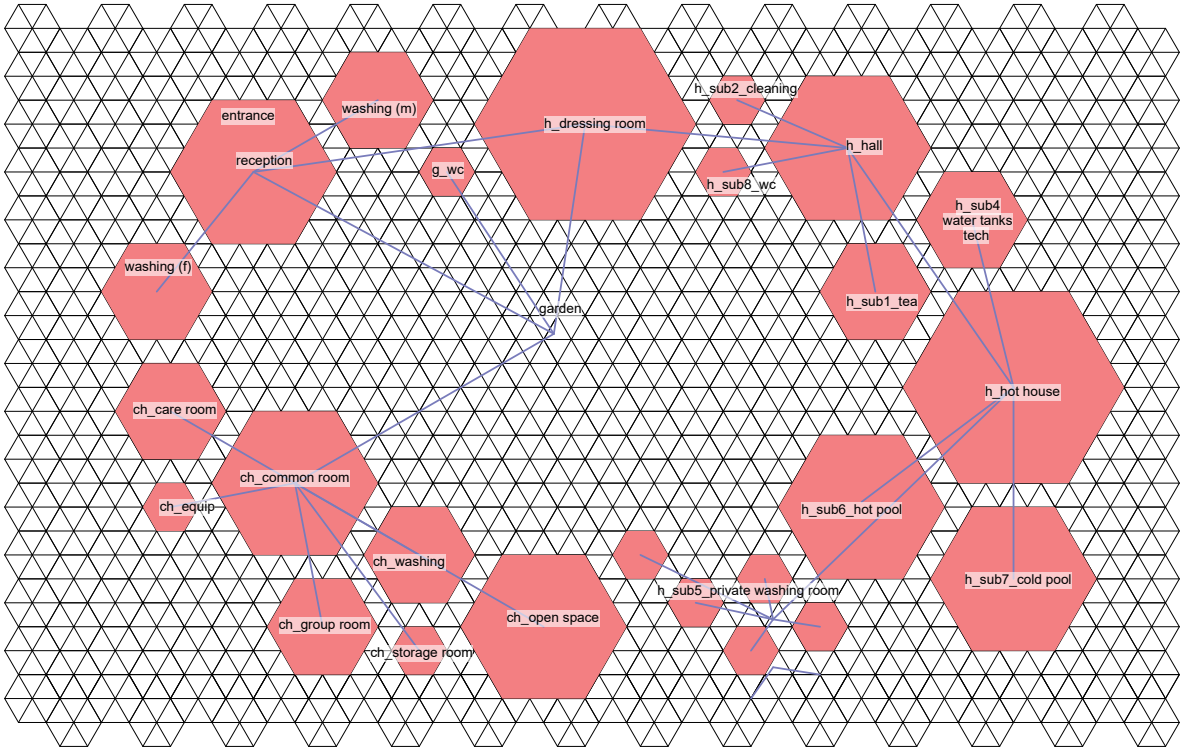
2) Placing Functions

- Define attraction point of entrance
- Hammam and childcare are placed in opposite directions from the entrance
- The center point of the plot acts as push point to achieve the biggest garden possible



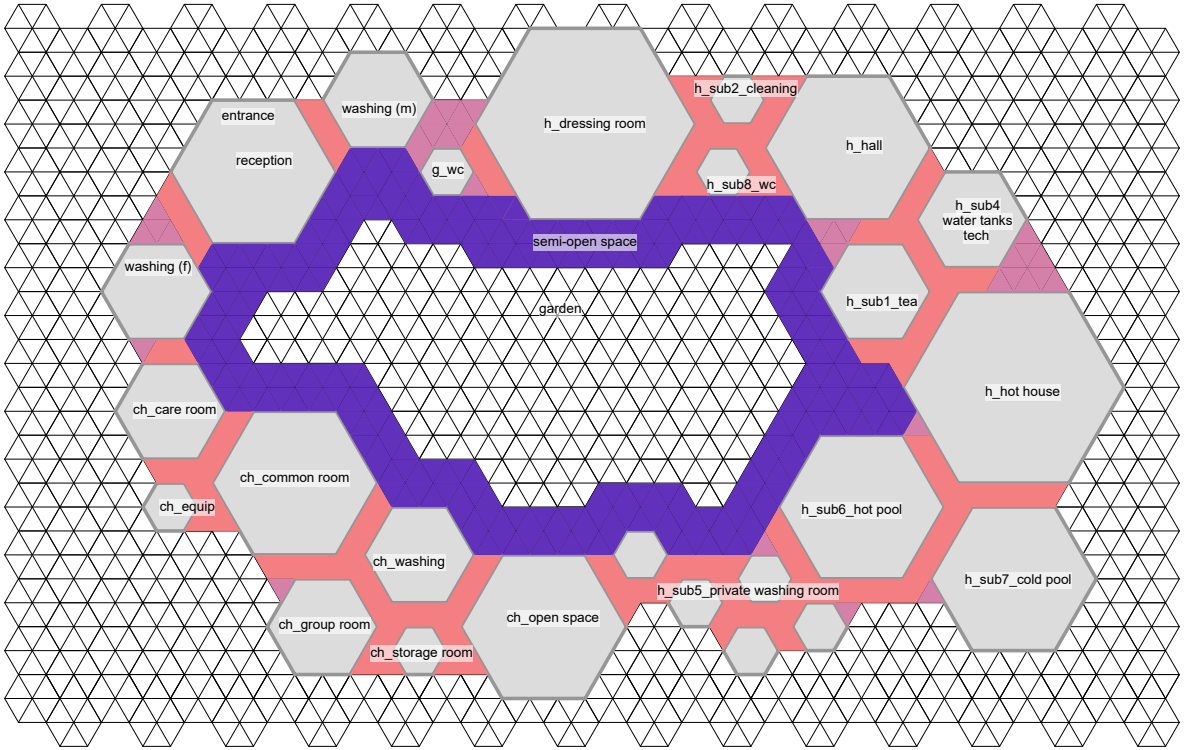
2) Functions & Connections

- The functions are hosted in hexagonal rooms, placed on the grid
- The rooms have distance of one corridor, which is one row of triangles
- The connections of the functions from the bubble diagram is take into consideration

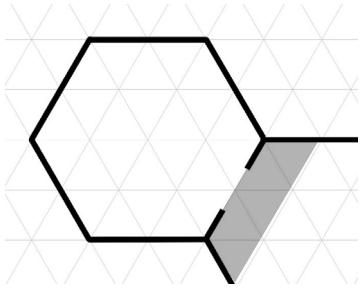


2) Corridor System

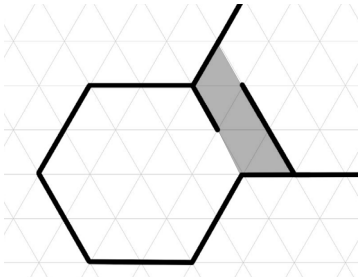
- A corridor system is developed between the faces of the Hexagon
- The system is extended further to remove the dead corners
- A semi-open space is added around the garden



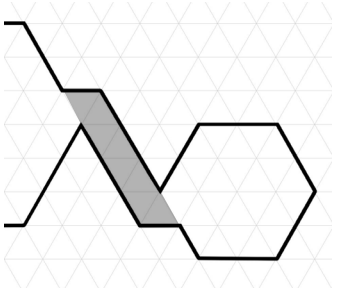
2) Corridor Rules



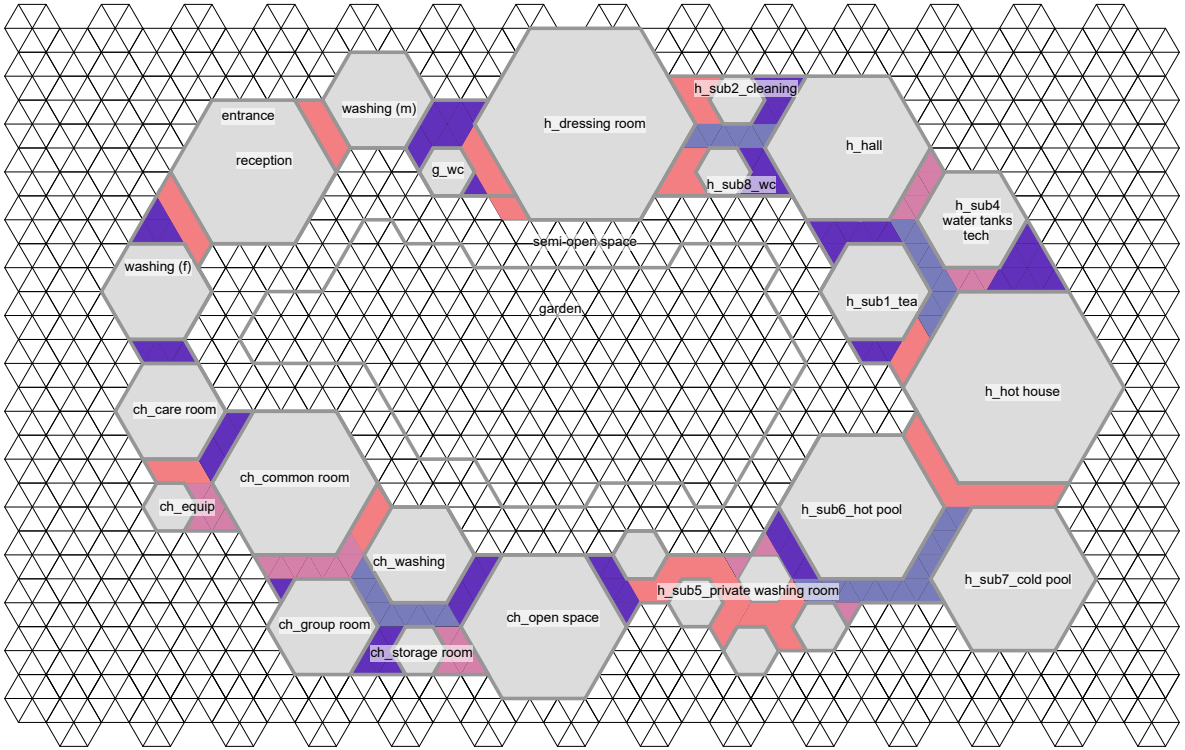
direct



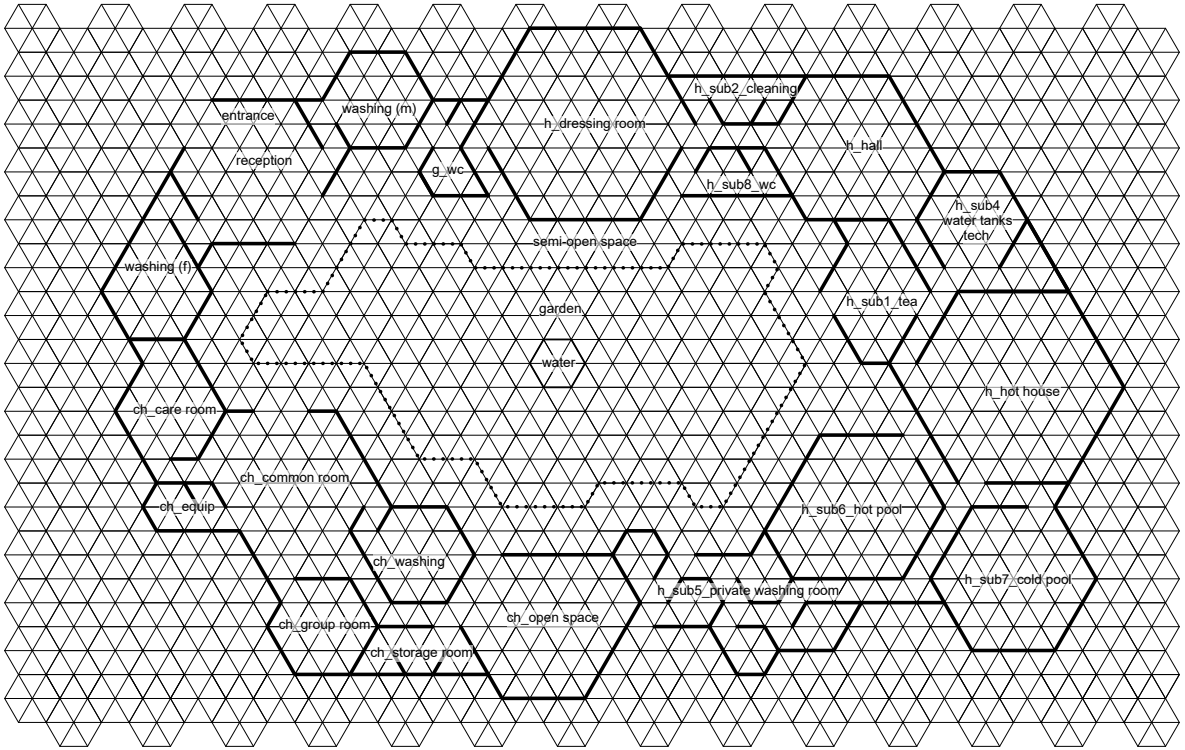
indirect



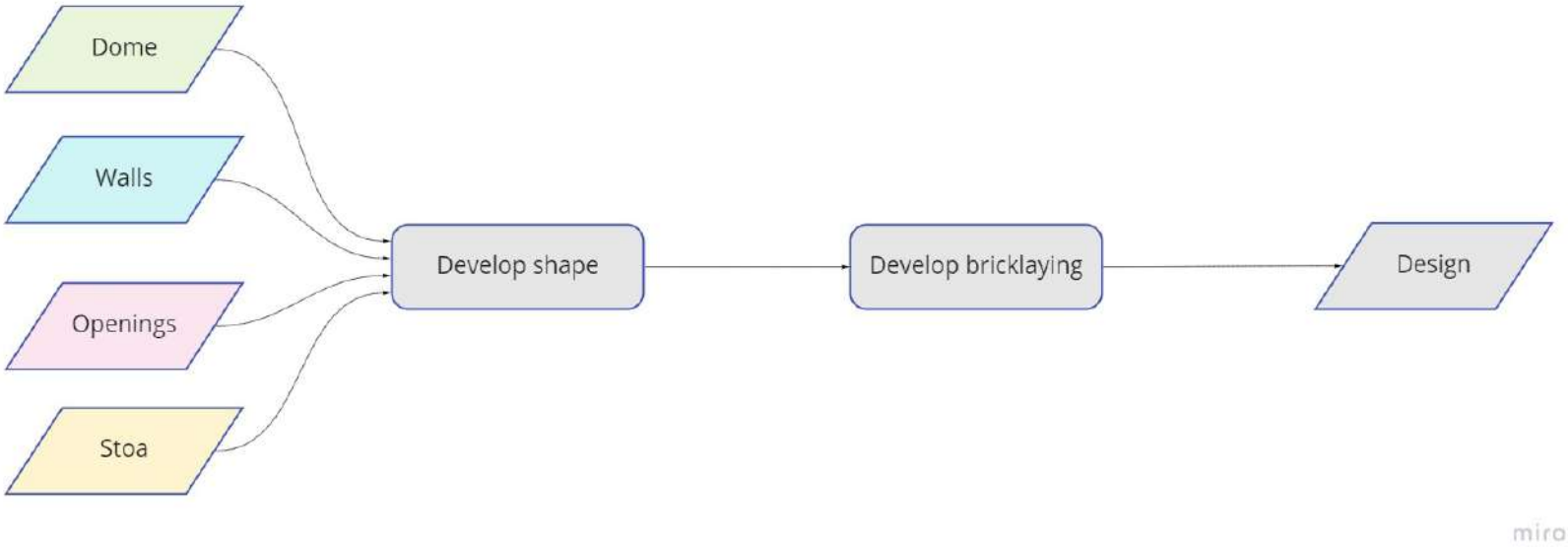
long distance



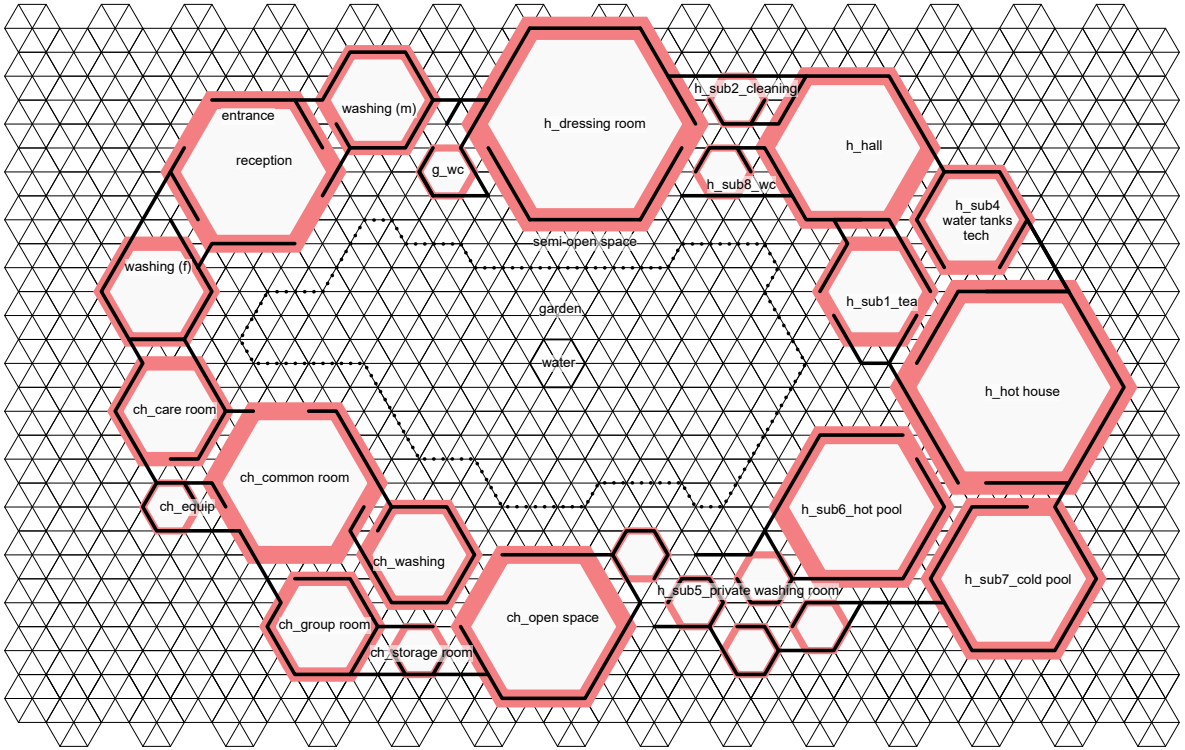
2) Configuration!



2) Flowchart

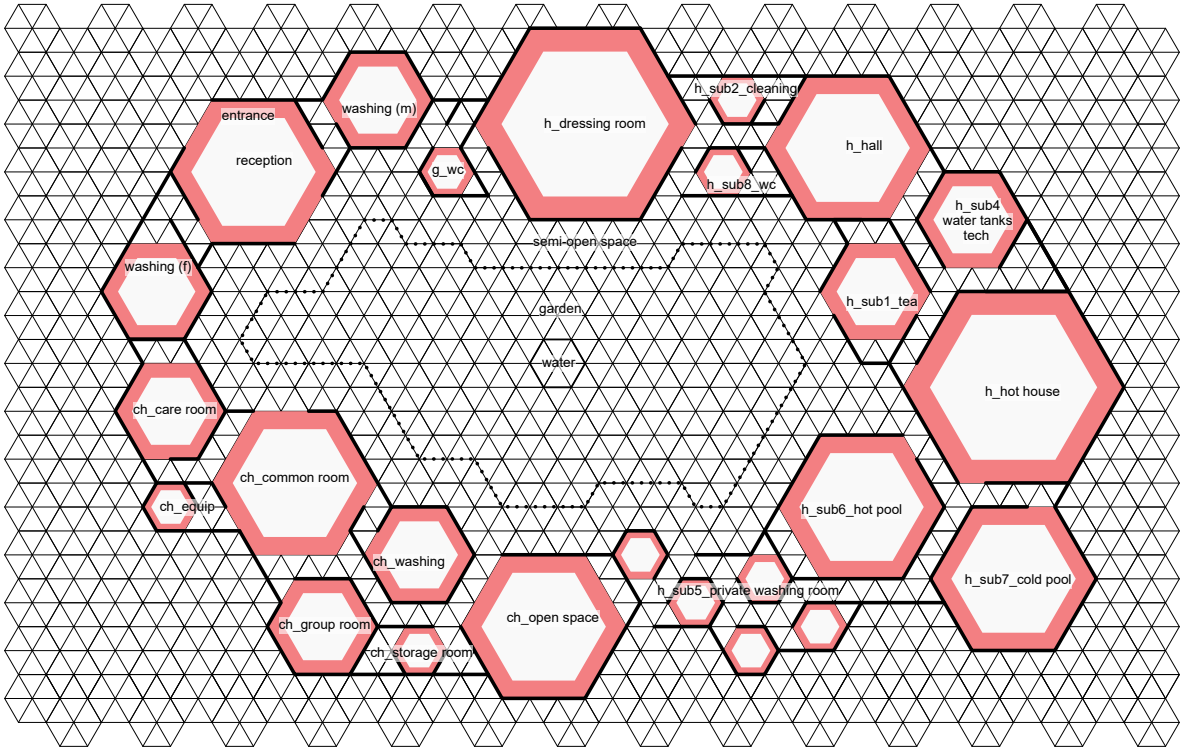

Dome
Walls
Openings
Stoa
Develop shape
Develop bricklaying
Design
miro

2) Wall thickness - Both sides => no space left for corridors :(



2) Wall thickness

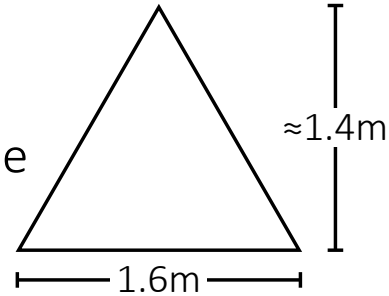
- both sides => no space left for corridors :(
- inside => rooms' areas are reduced a lot :(

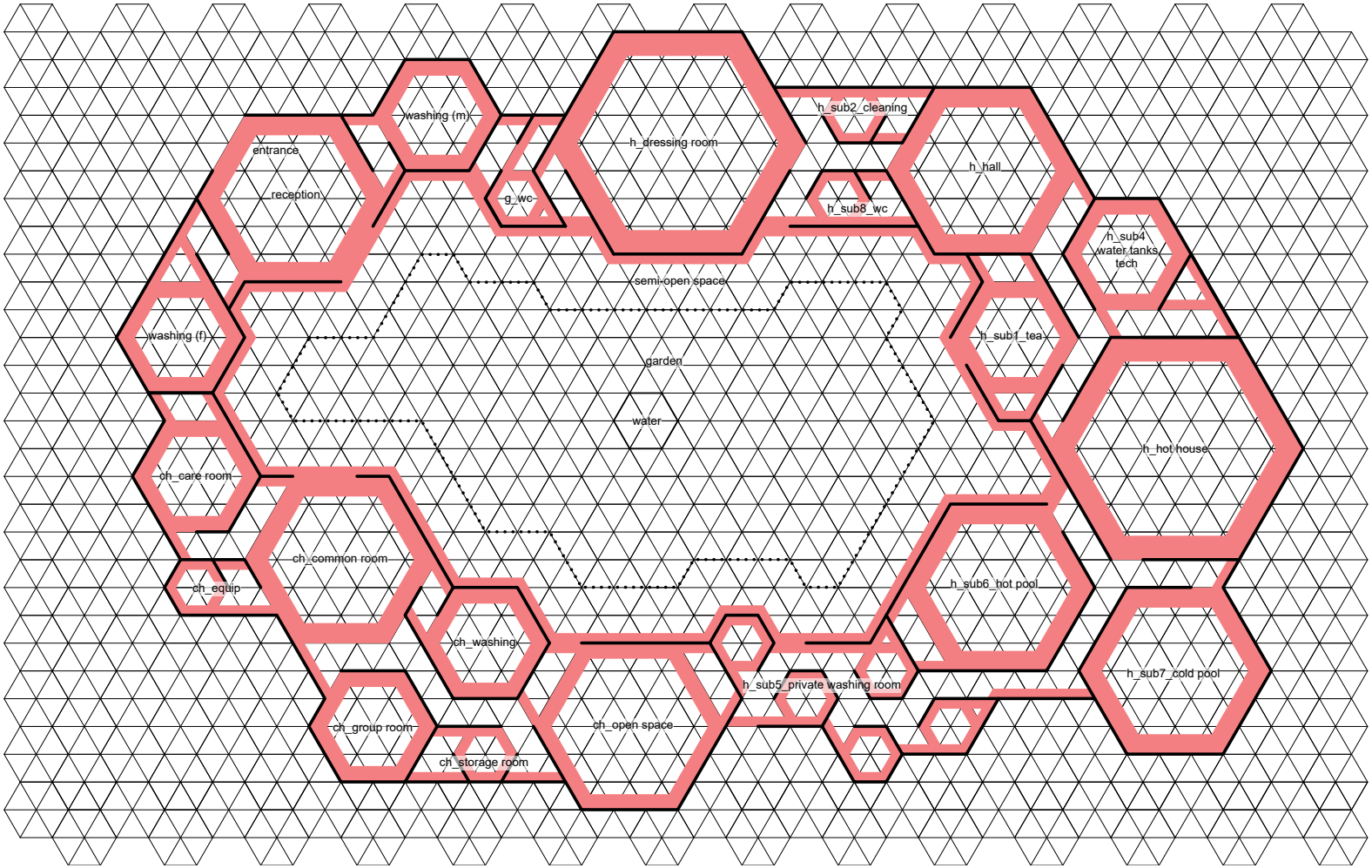


2) Wall thickness

! ! ! Increase grid only by to ≈1.6m ! ! !

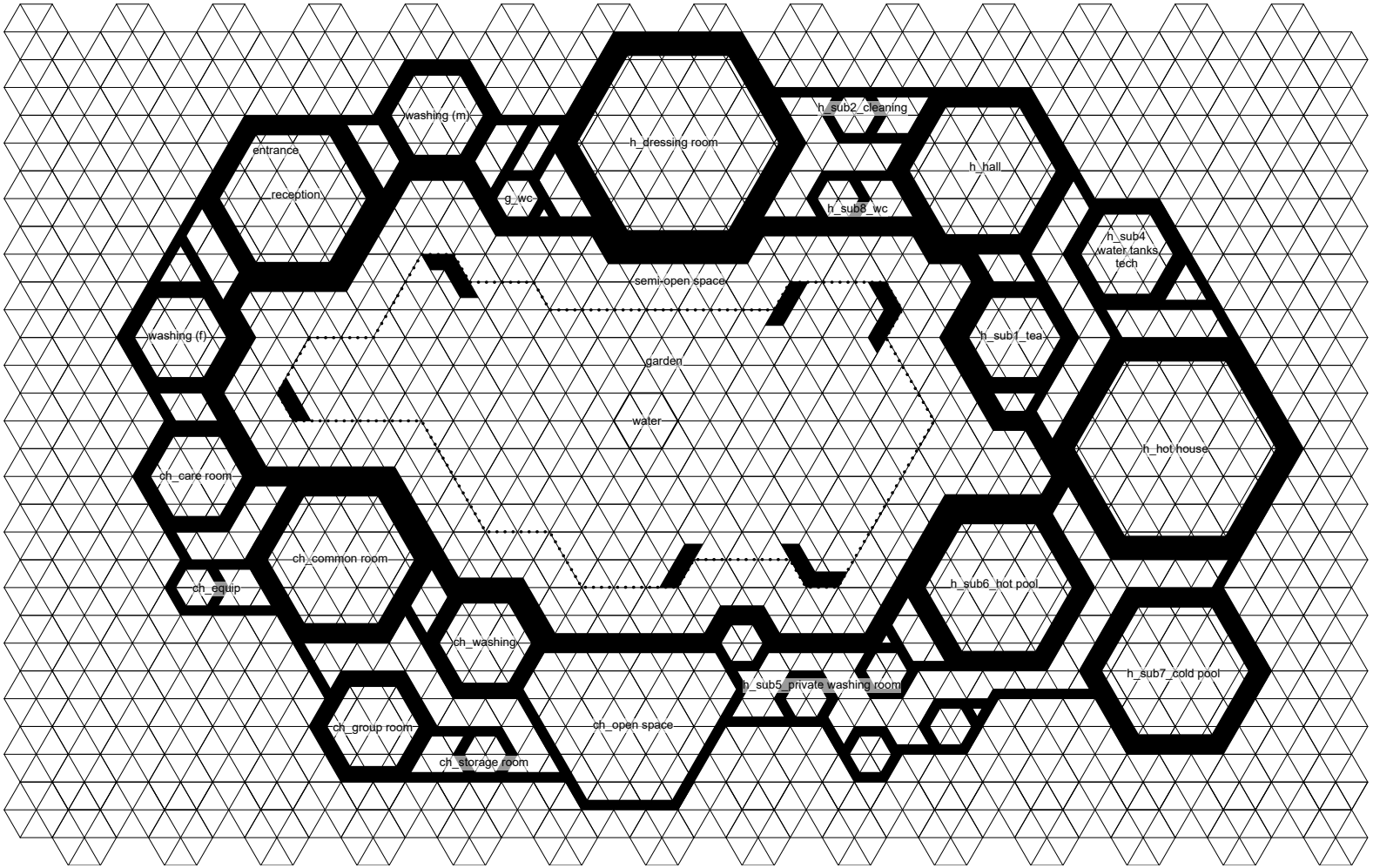
- both sides => room becomes too big :(
- inside => room-sizes remains almost the same
  corridors are ≈1.4m wide :)
- inside => corridor walls





2) Semi-open space supports

- both sides => semi-open space wall (structural reason)
- semi-open space structural support:
  length_segm == grid_size => wall_grs



2) Semi-open space supports

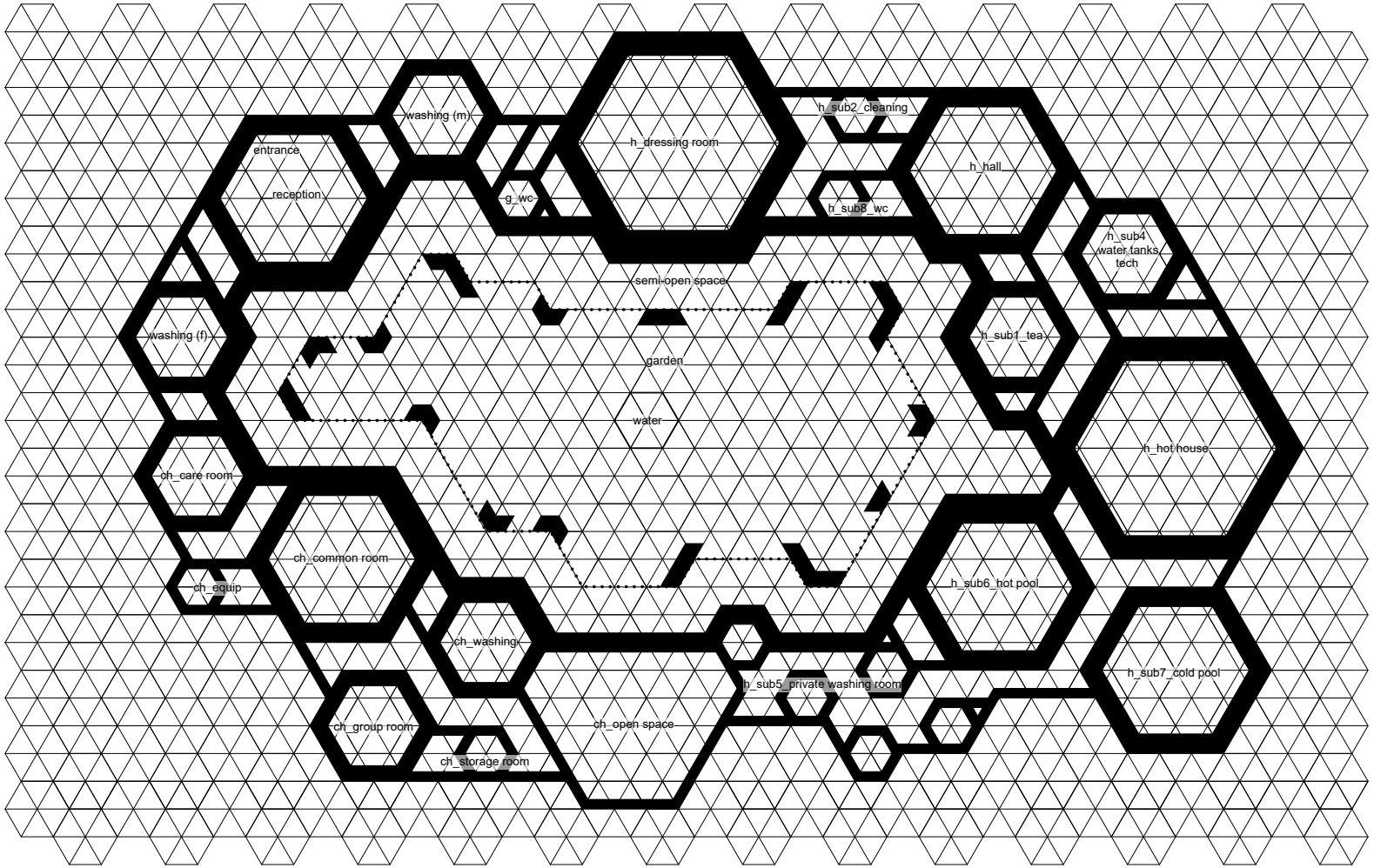
corners: column

grid_size < length_segm ≤ 3 * grid_size => no support

3 * grid_size < length_segm

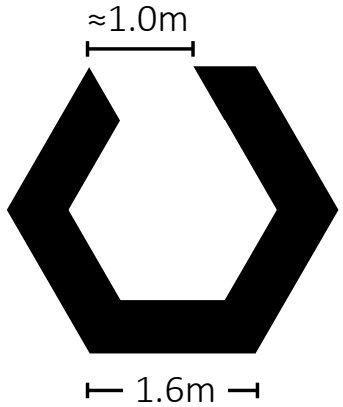
length_segm == n_even * grid_size => wall_grs

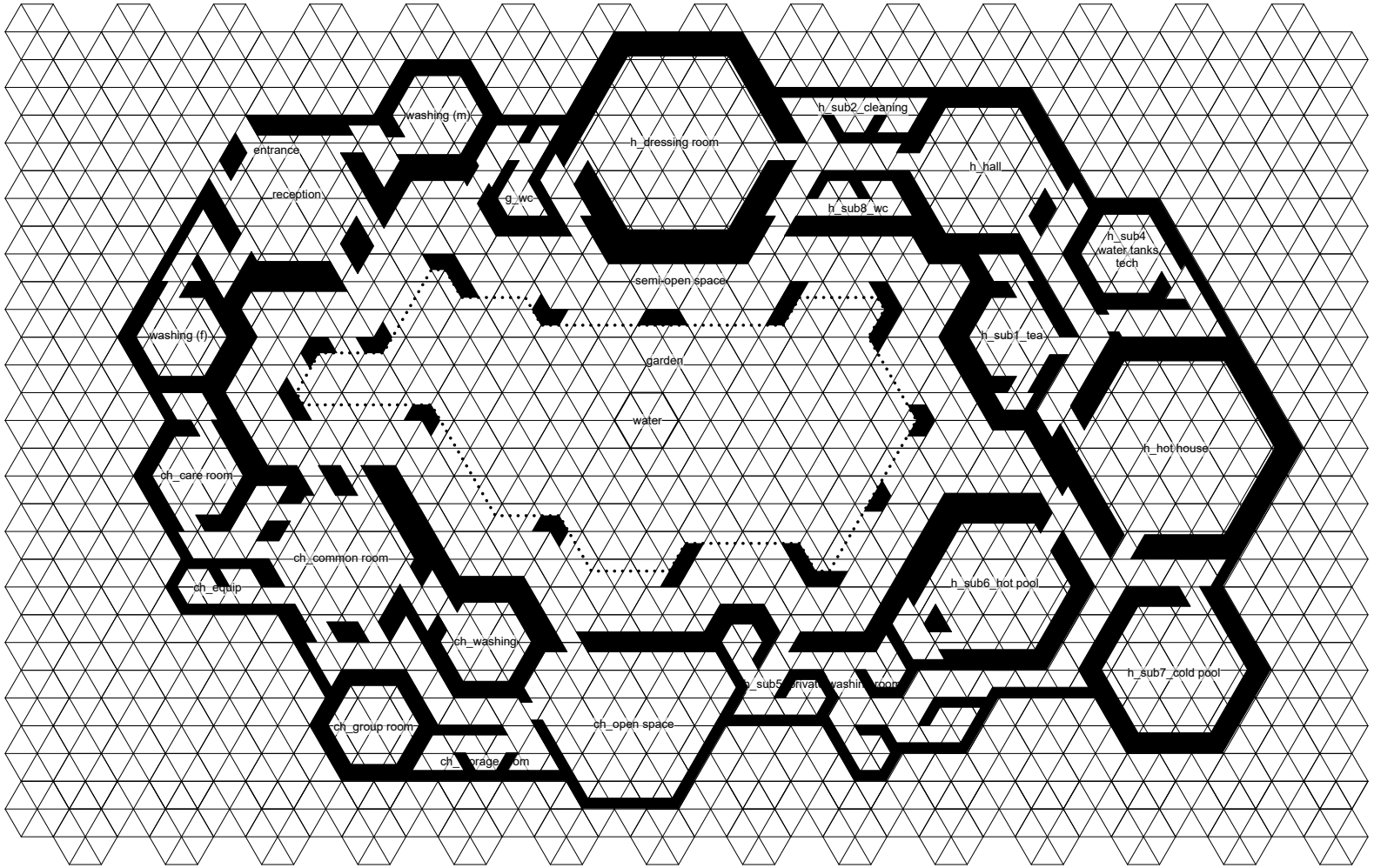
length_segm == n_odd * grid_size => column



2) Openings

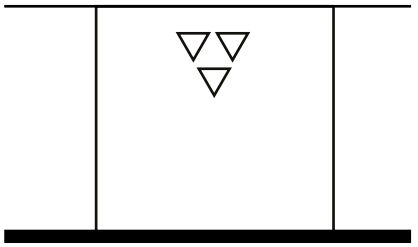
- door openings:
  - diagonal extrusion in the wall
  - ensures privacy
  - placing: configuration

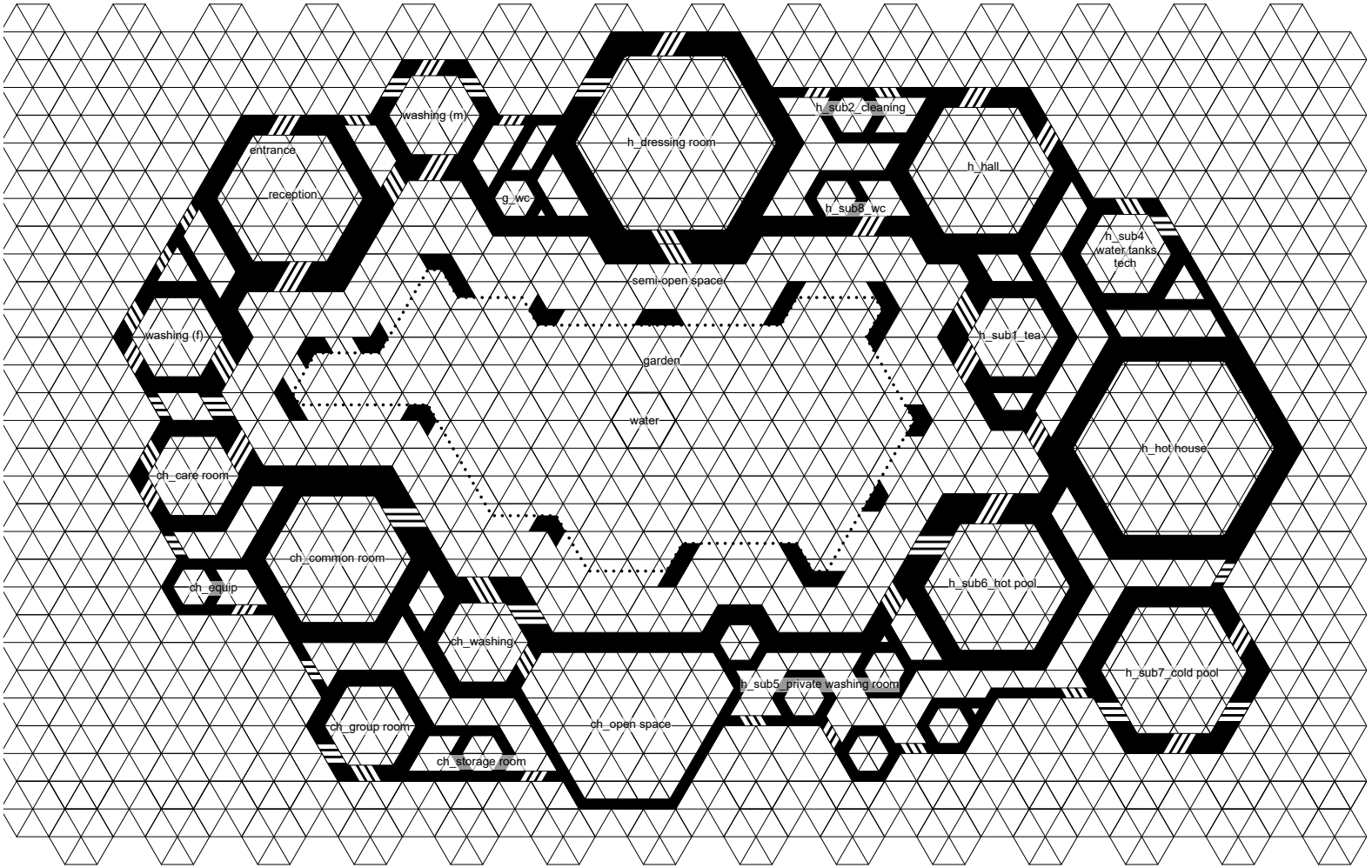




2) Openings

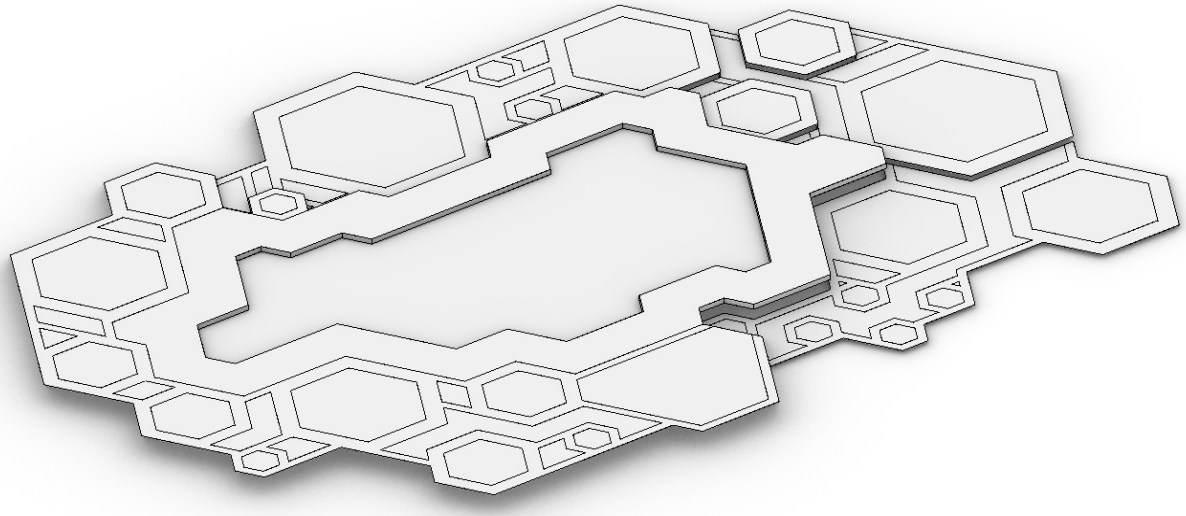
- small ventilation openings
  in the center of each hexagonal face
  that is looking outdoor
  corridors' dead end



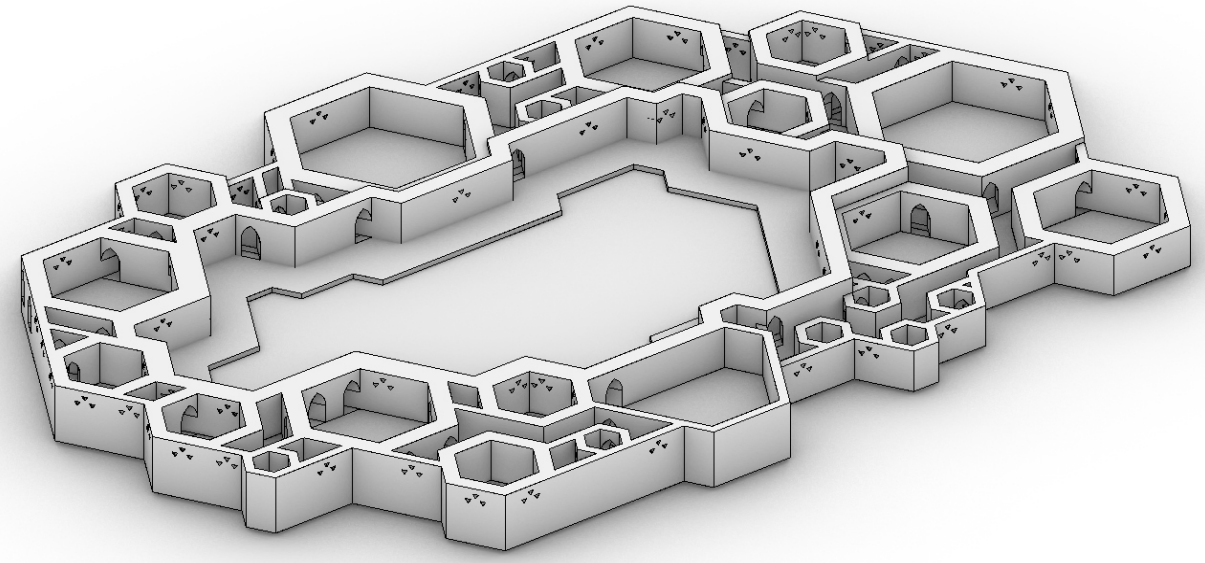


2) 2D => 3D

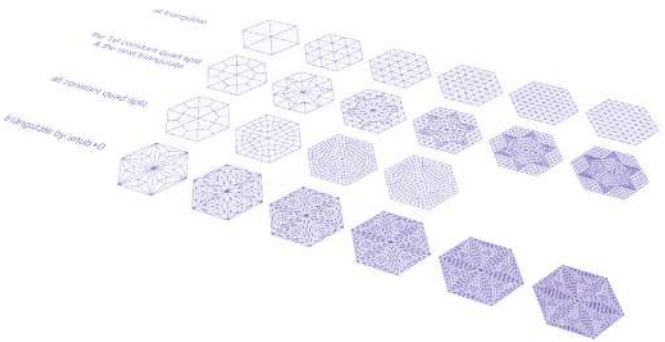
- Different floor-heights according to the function requirements

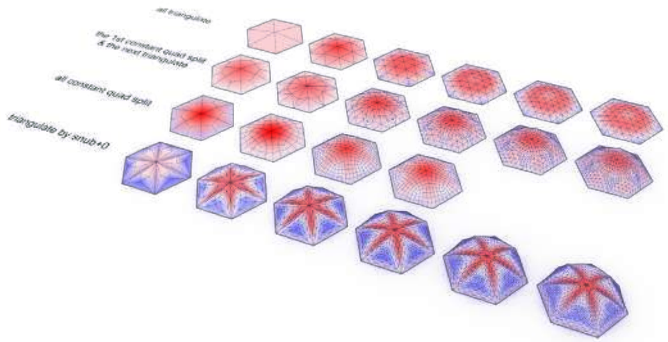


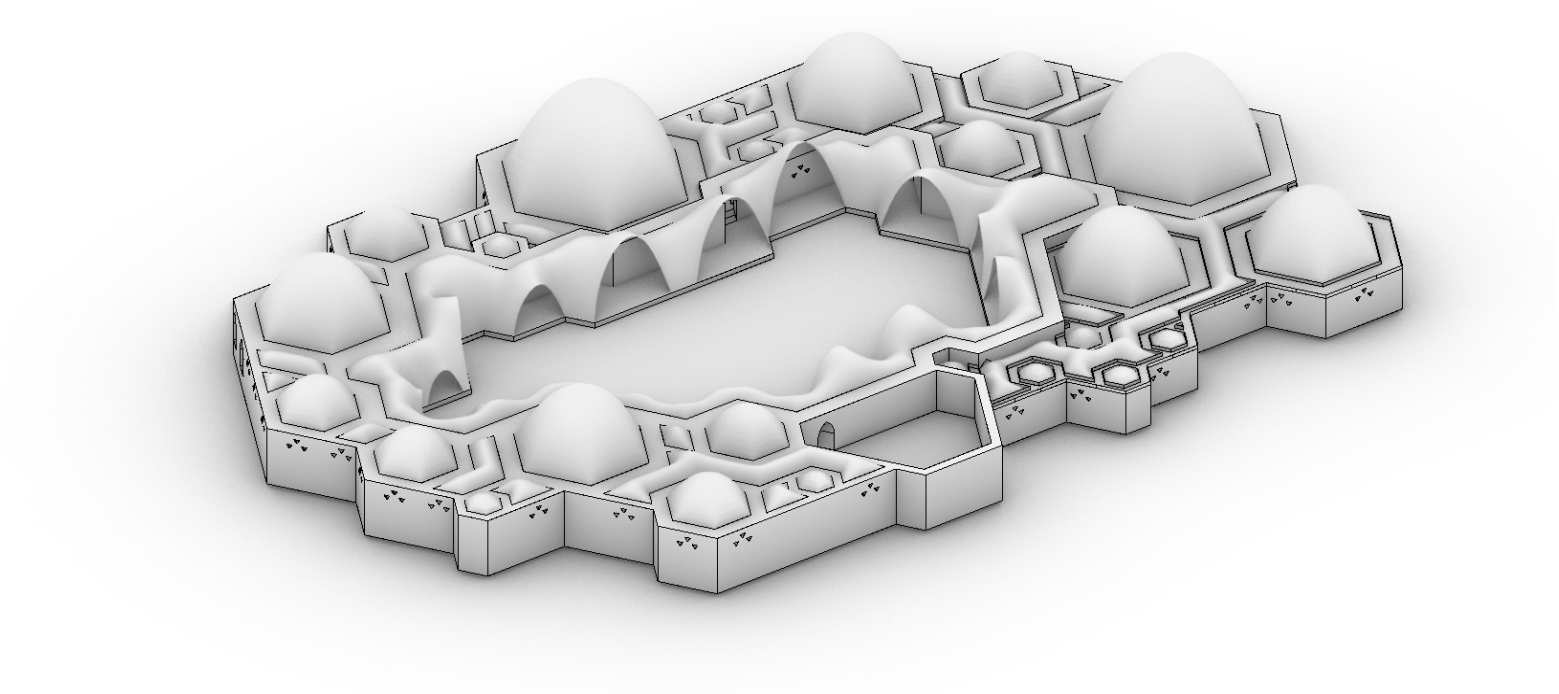
2) 2D => 3D



2) Ceiling - Tessellation and structural evaluation



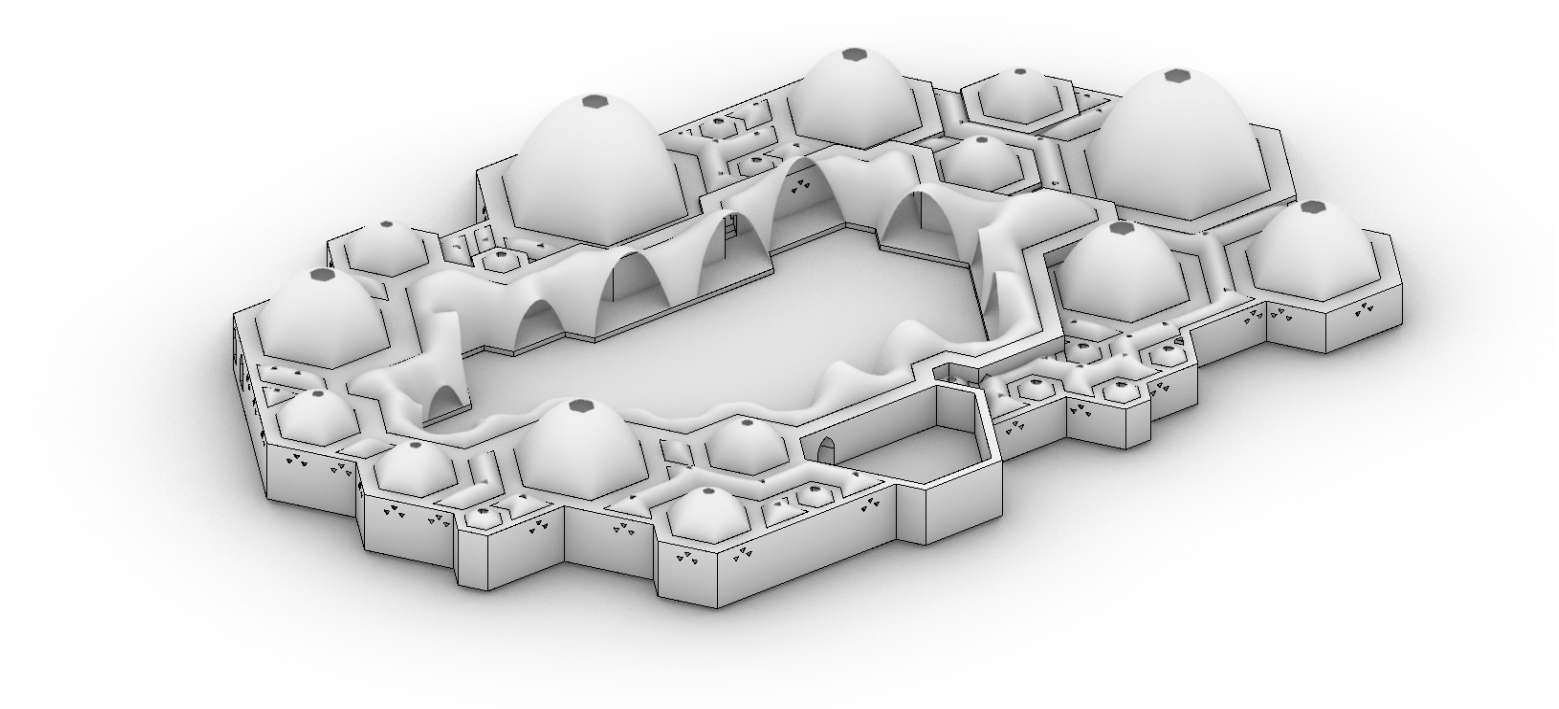




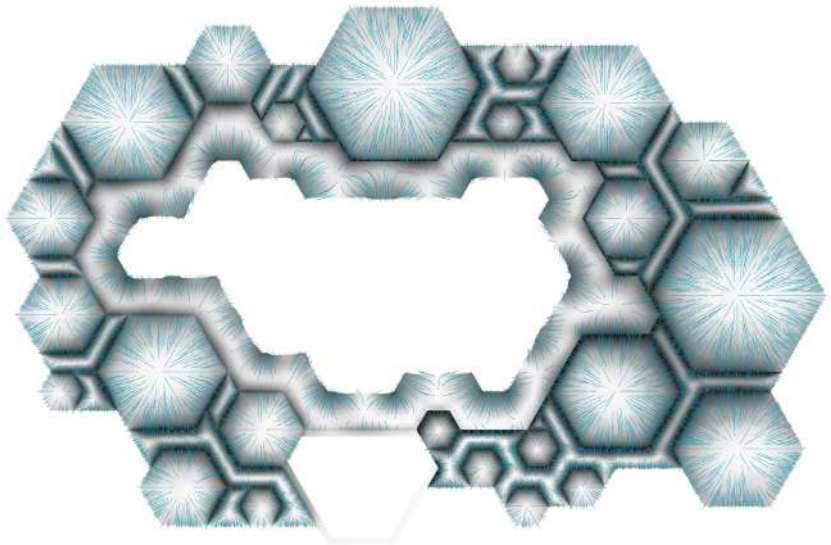
2) Lighting & Ventilation

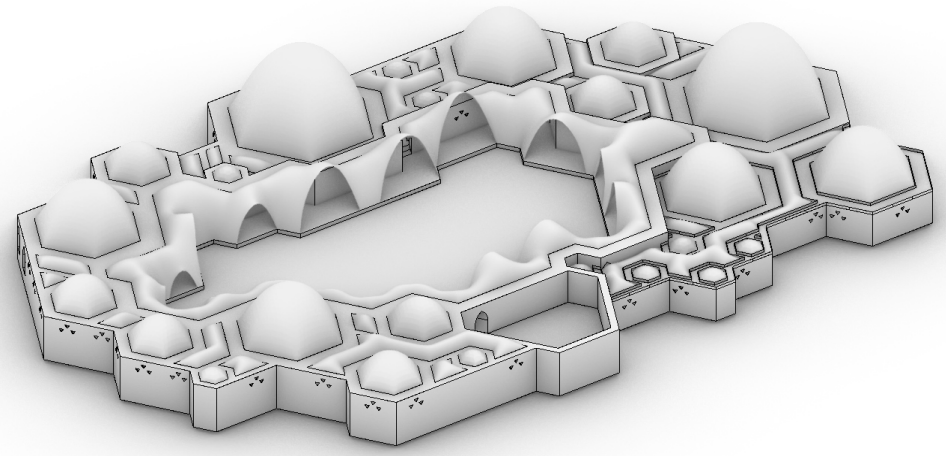
Placing:

- Doms: in the heighest point, the middle of th dom
- Corridors: Crossections and before dead-end

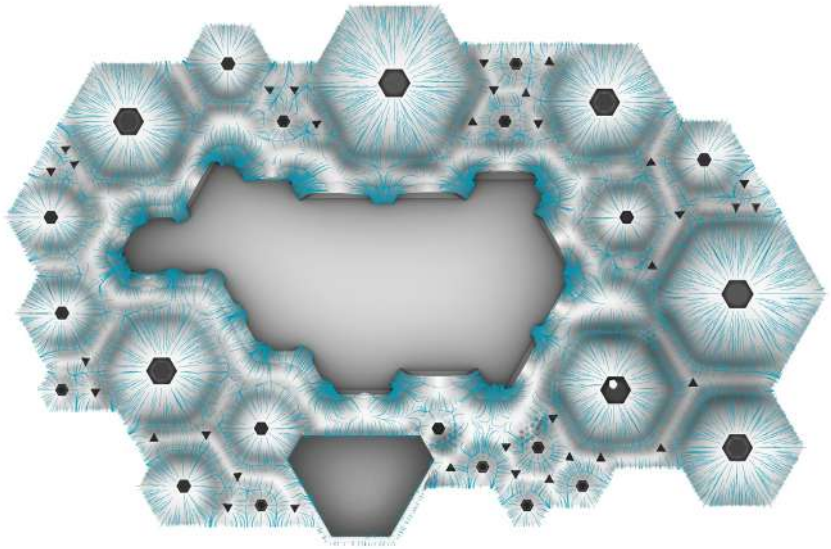


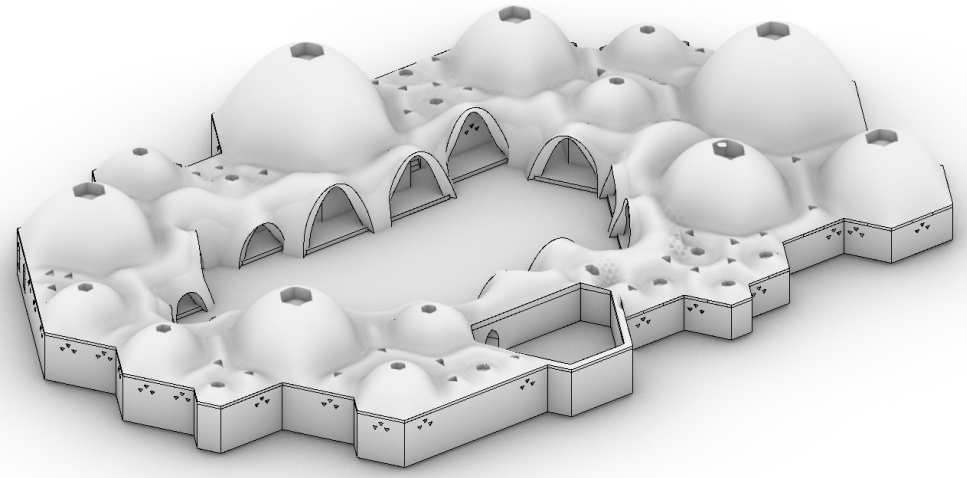
2) Roofing - Rain-water flow in the ceiling shape



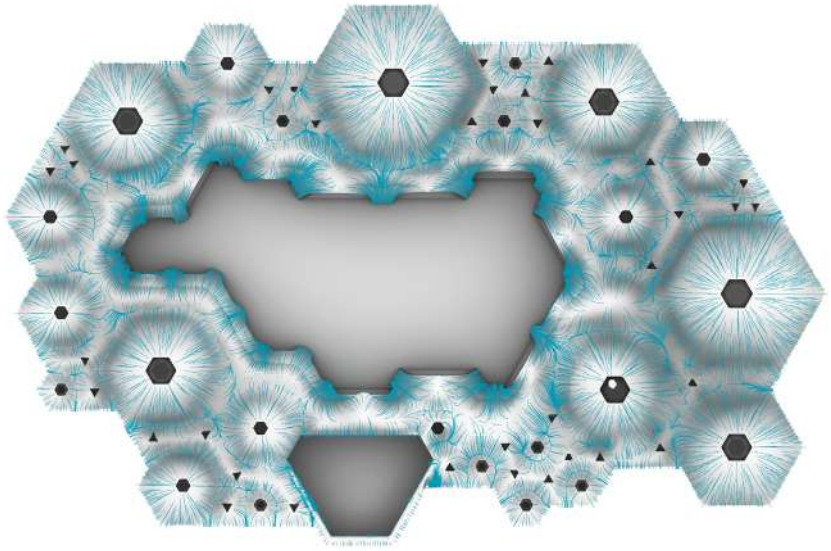


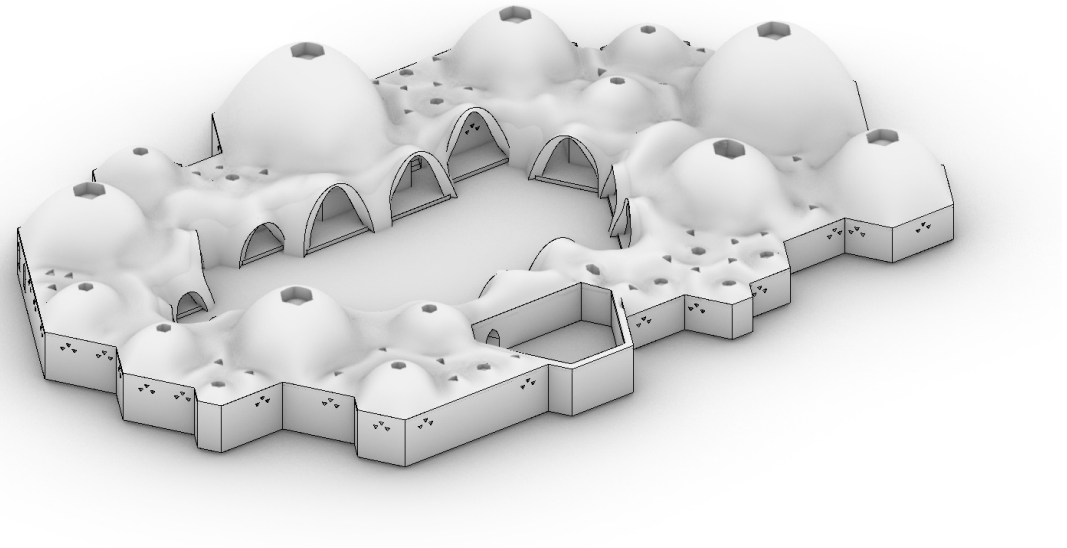
2) Roofing - Rain-water flow in the grasshopper roofing mesh



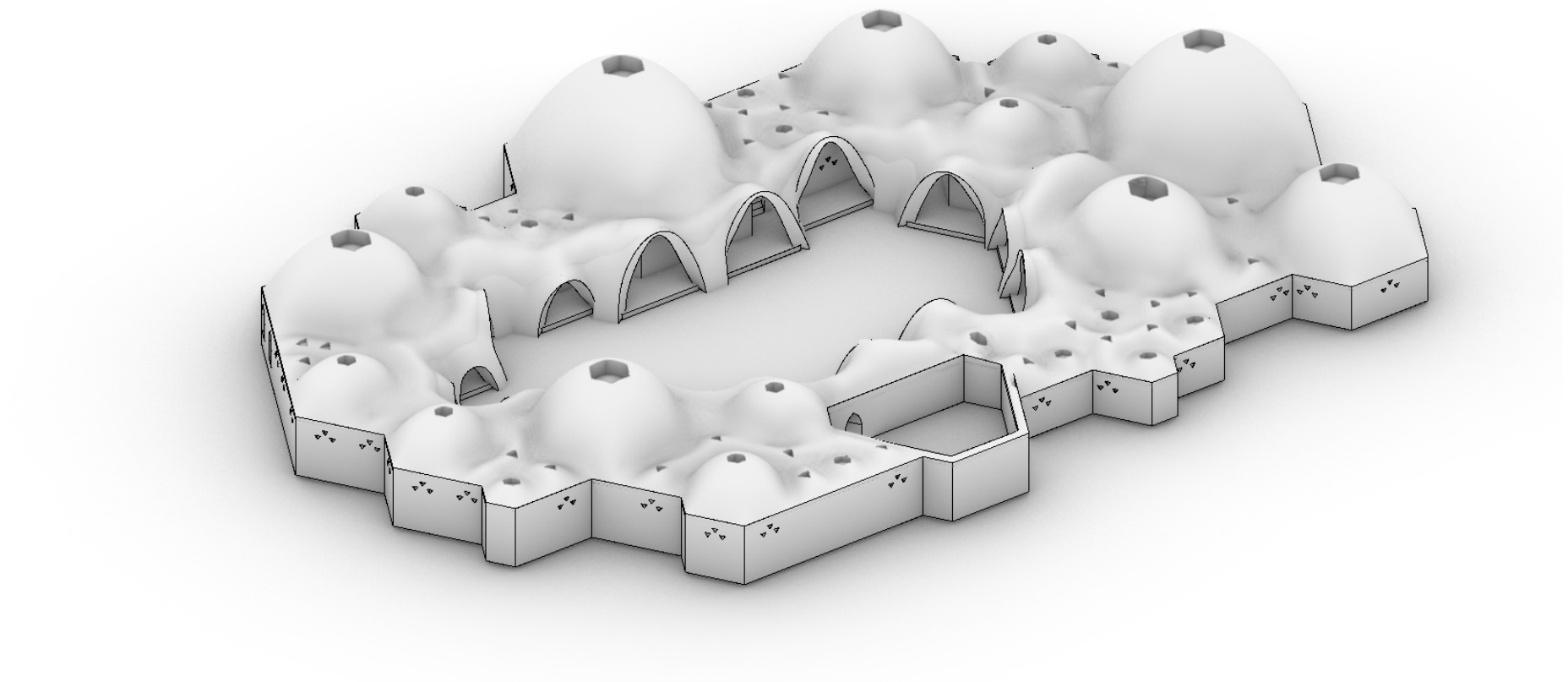


2) Roofing - Rain-water flow in the improved grasshopper roofing mesh

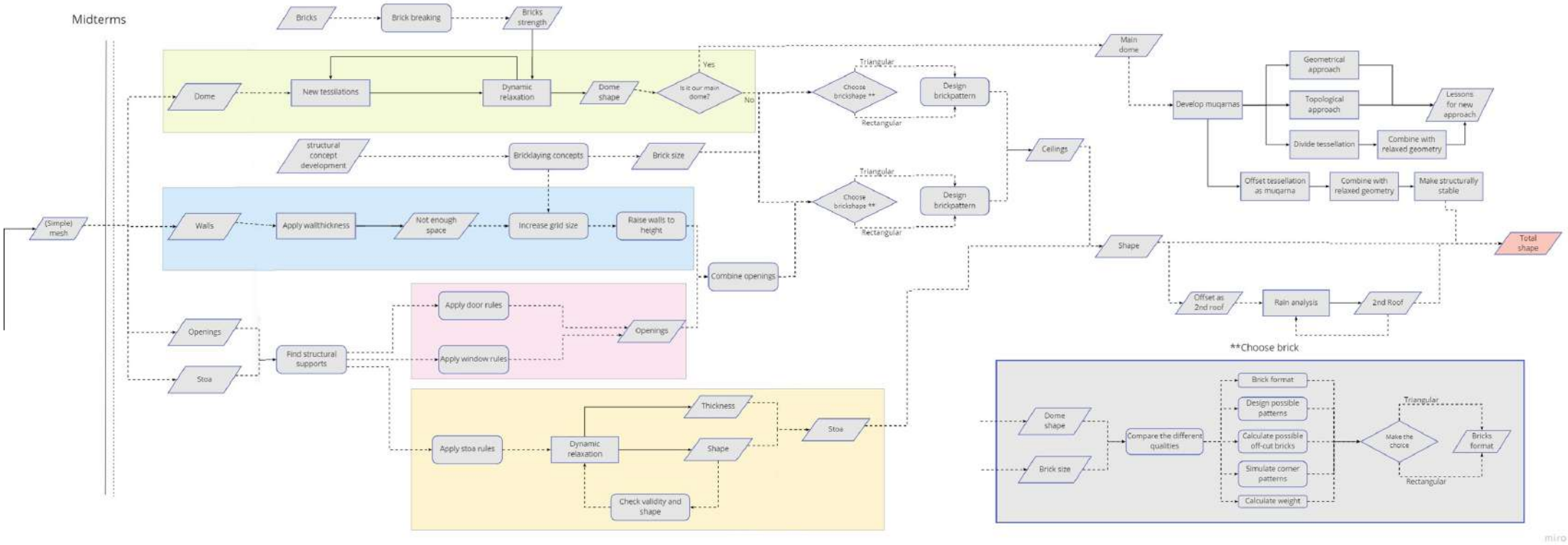




2) Form



3) Flowchart


Midterms
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Ceilings
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Raise walls to height
Combine openings
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Total shape
Offset as 2nd roof
Rain analysis
2nd Roof
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Stoa
Find structural supports
Apply door rules
Apply window rules
Openings
Apply stoa rules
Dynamic relaxation
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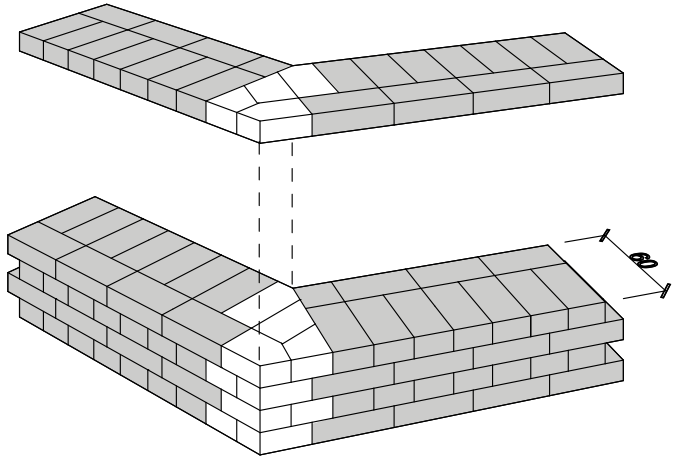
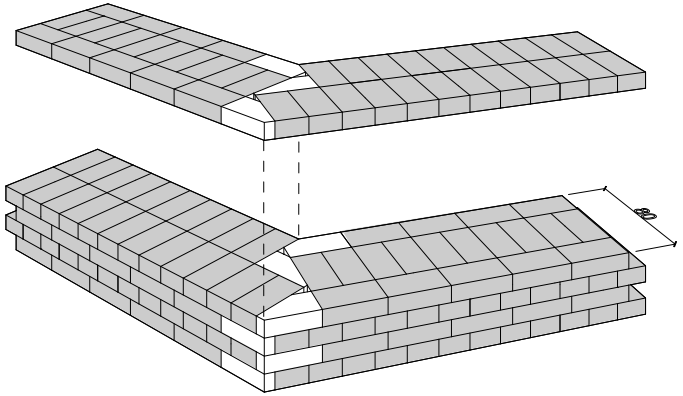
Shape
Stoa
Check validity and shape
**Choose brick
Dome shape
Brick size
Compare the different qualities
Brick format
Design possible patterns
Calculate possible off-cut bricks
Simulate corner patterns
Calculate weight
Make the choice
Triangular
Rectangular
Bricks format
miro

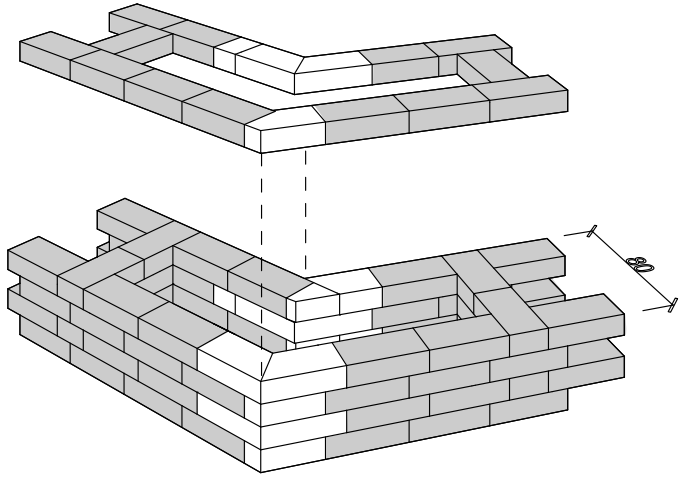
3) Construction aspects: rectangular bricks



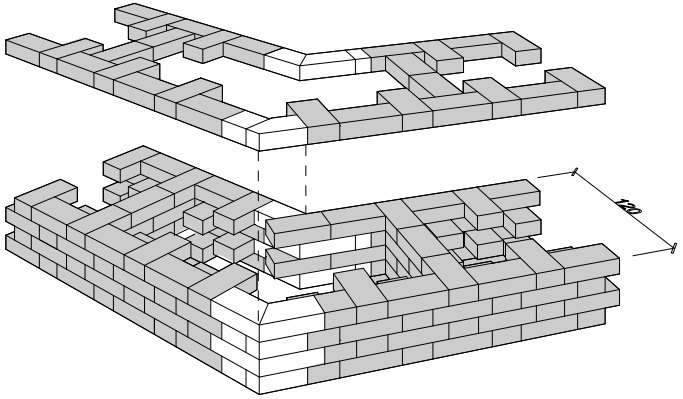
1) 60cm wide cross bond



2) 80cm wide cross bond

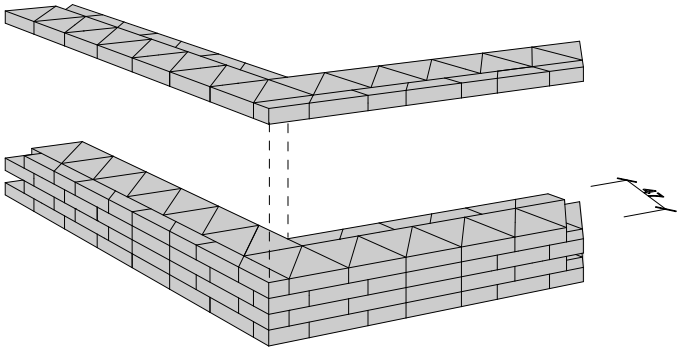


3) 80cm wide half bond with earth infill

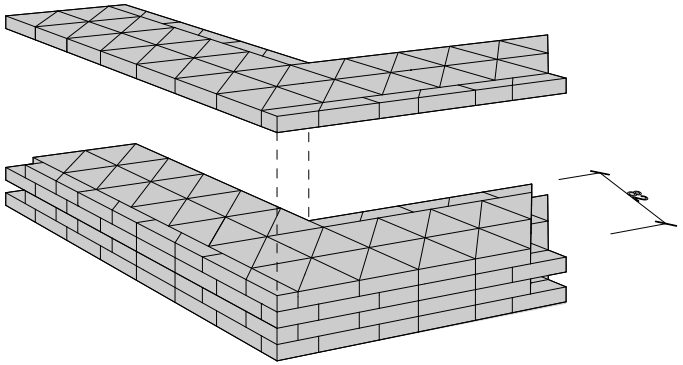


4) 120cm wide Flemish bond with earth infill

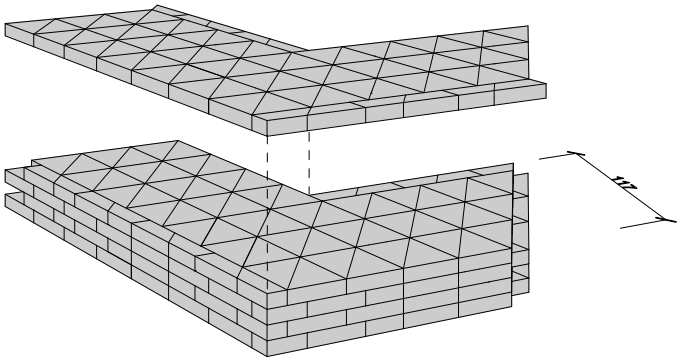
3) Construction aspects: triangular bricks



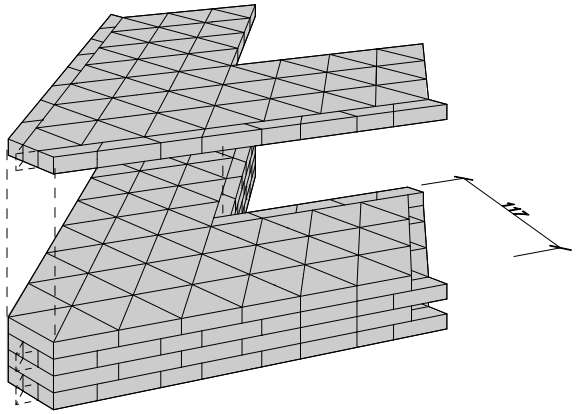
1) 47cm wide bond 120 degree corner



2) 82cm wide bond 120 degree corner

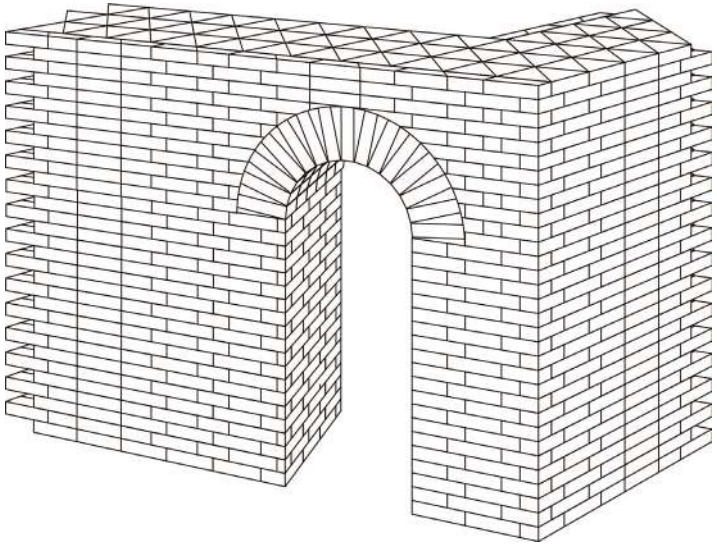


3) 117cm wide bond 120 degree corner

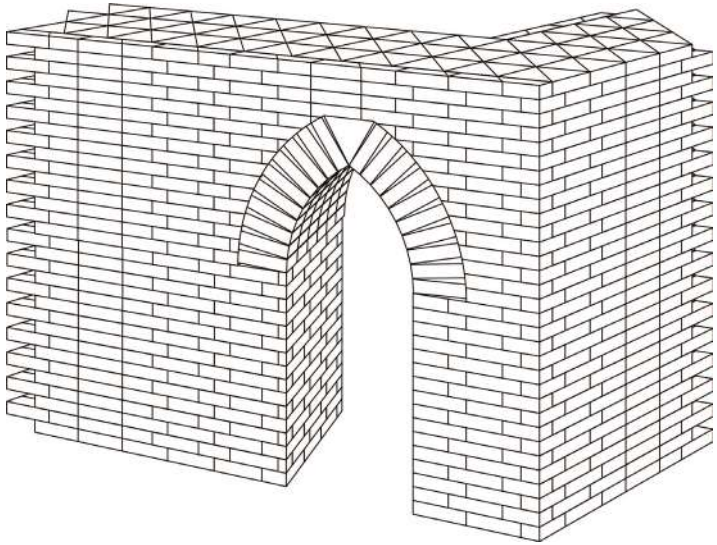


4) 117cm wide bond 60 degree corner

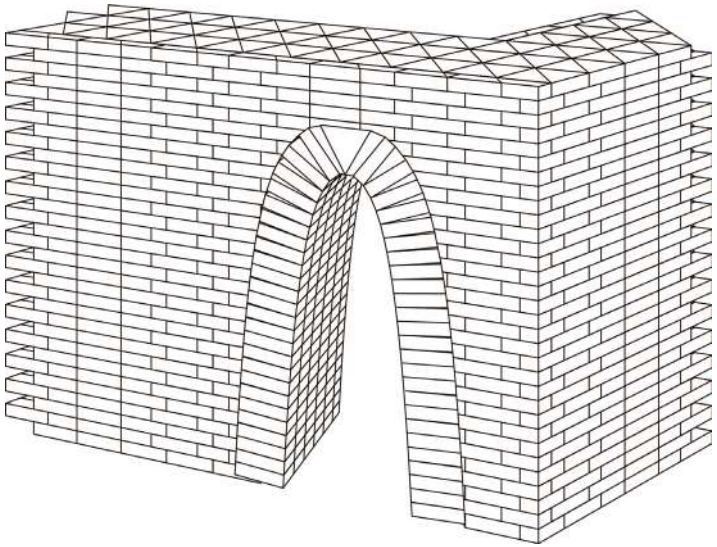
3) Construction aspects: rectangular bricks



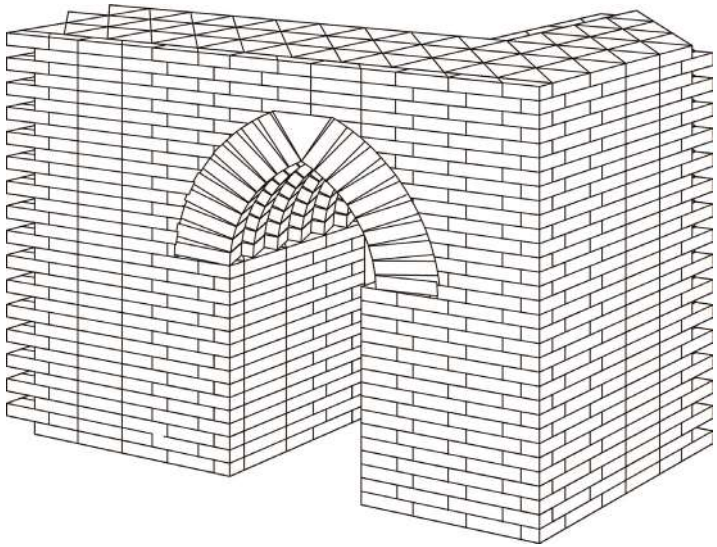
1) Semi-circular arch with stretcher layer



2) Two-pointed arch with keystone

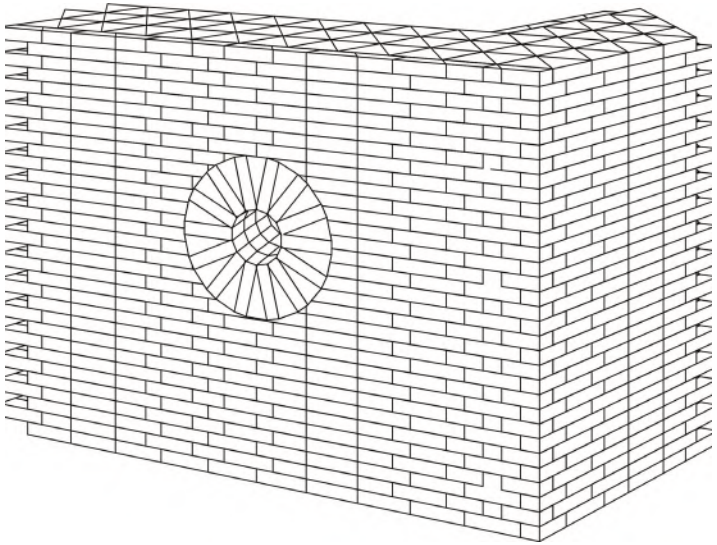


3) Inverted catenary arch with keystone

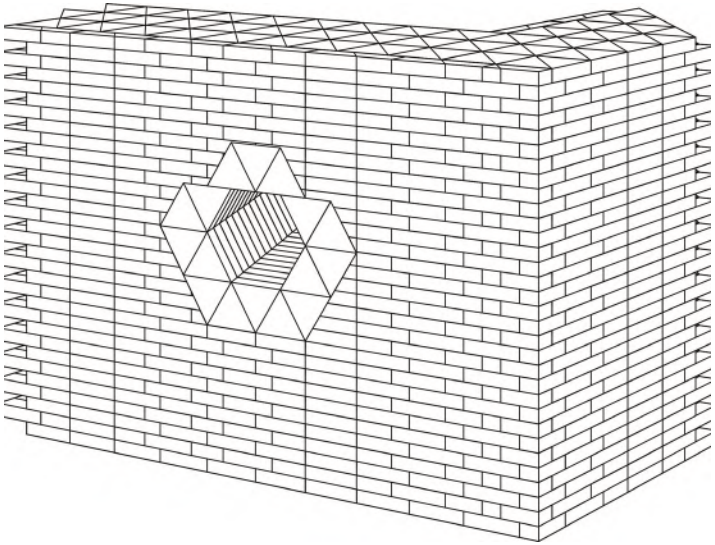


4) Shifted two-pointed arch with keystone

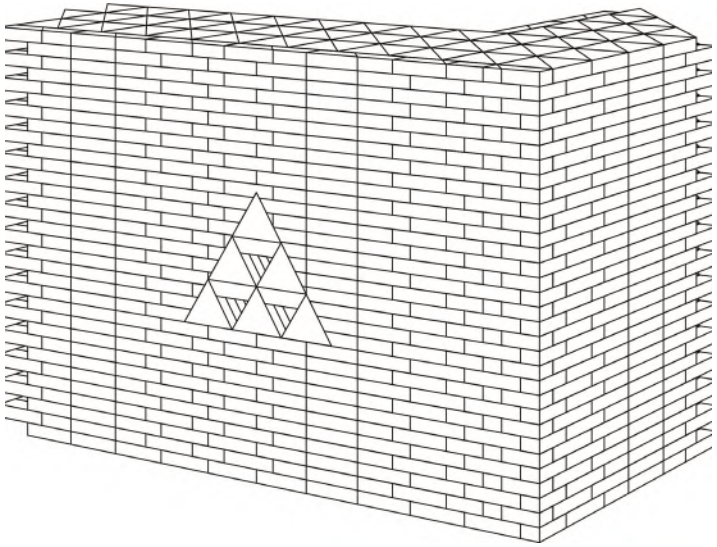
3) Construction aspects: Windows



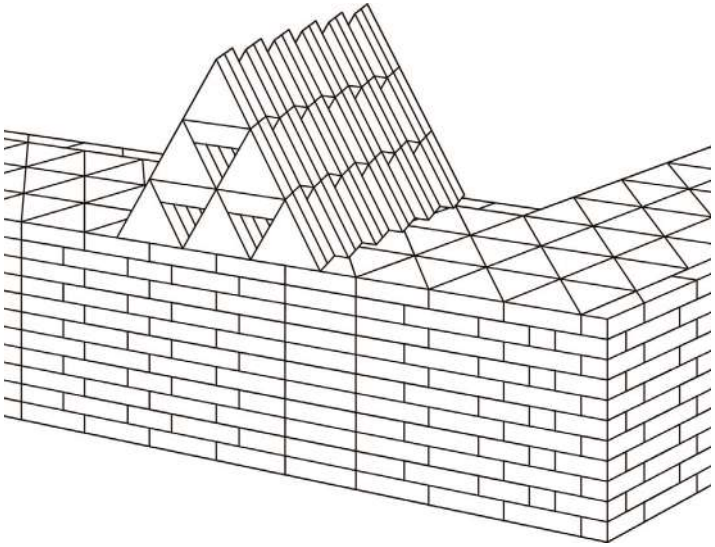
1) Circular window with stretcher layer



2) Hexagonal window with stretcher layer of

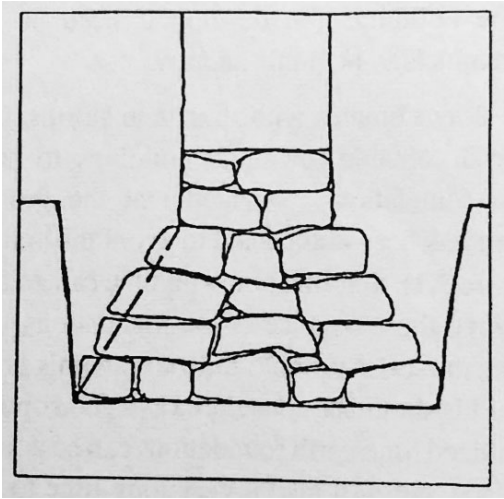


3) Triangular window with stretcher layer

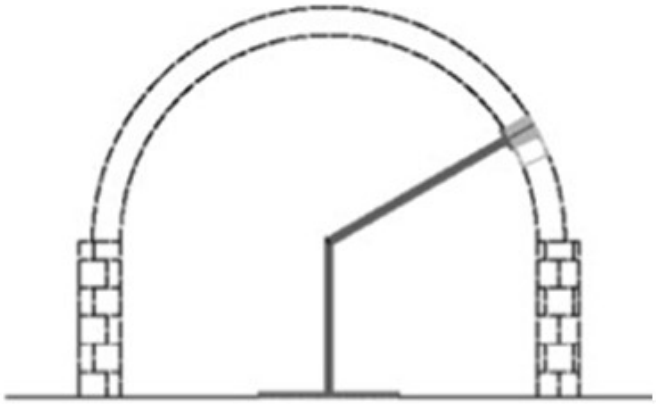


4) Shifted Triangular window

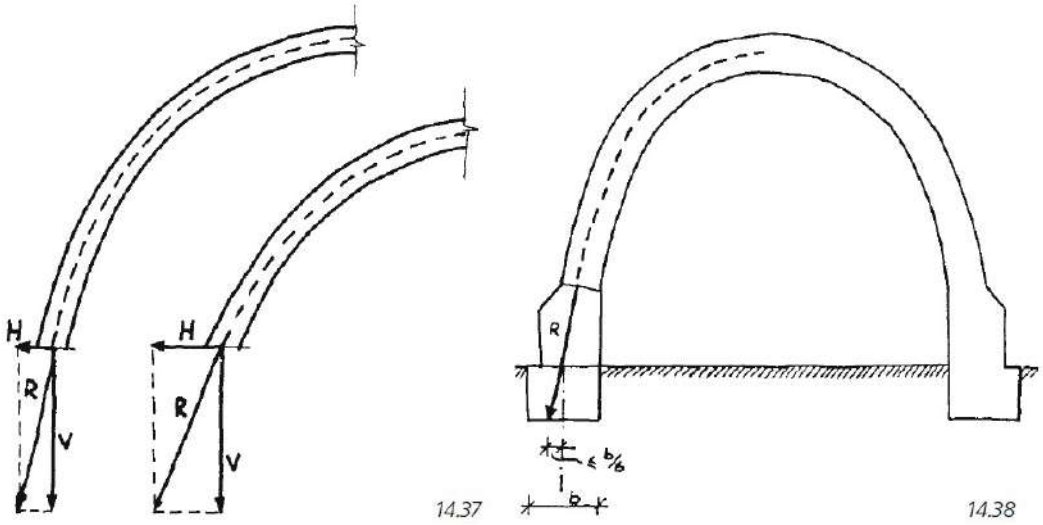
3) Construction aspects



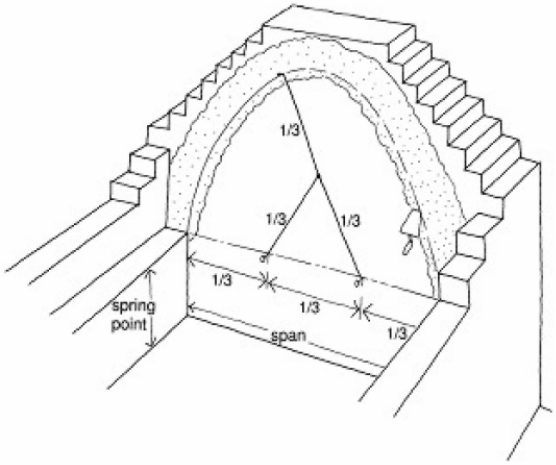
Stone foundation

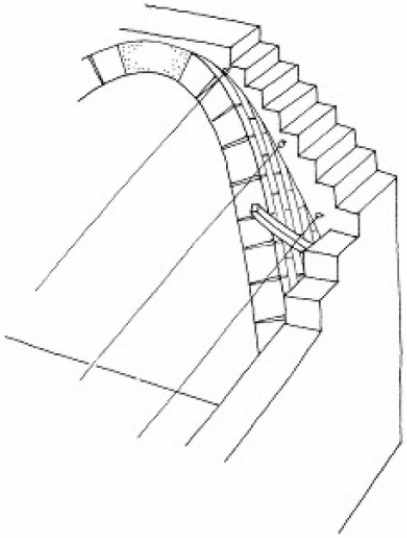


'Fathy compass' aka radial arm



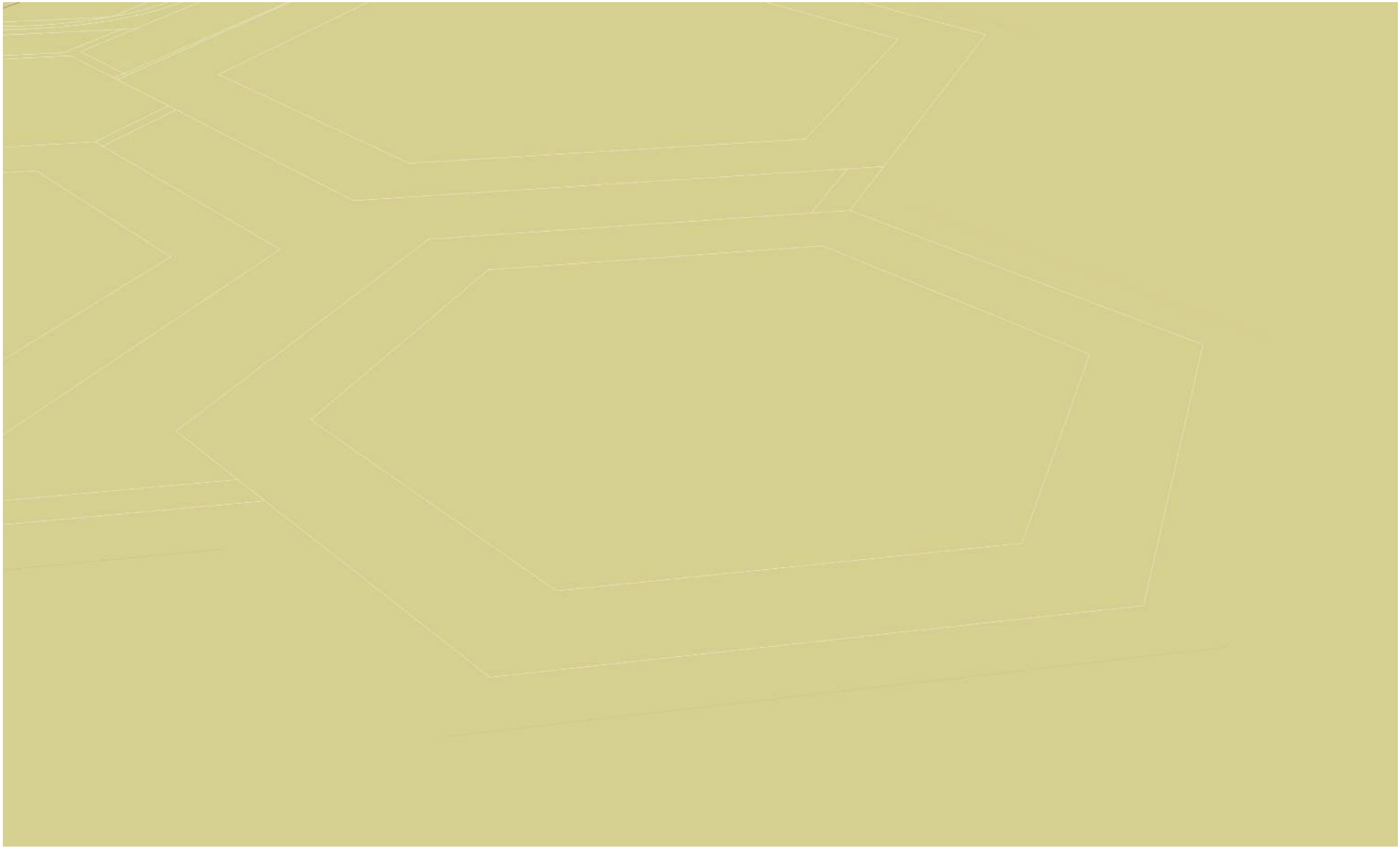
Resulting force lines





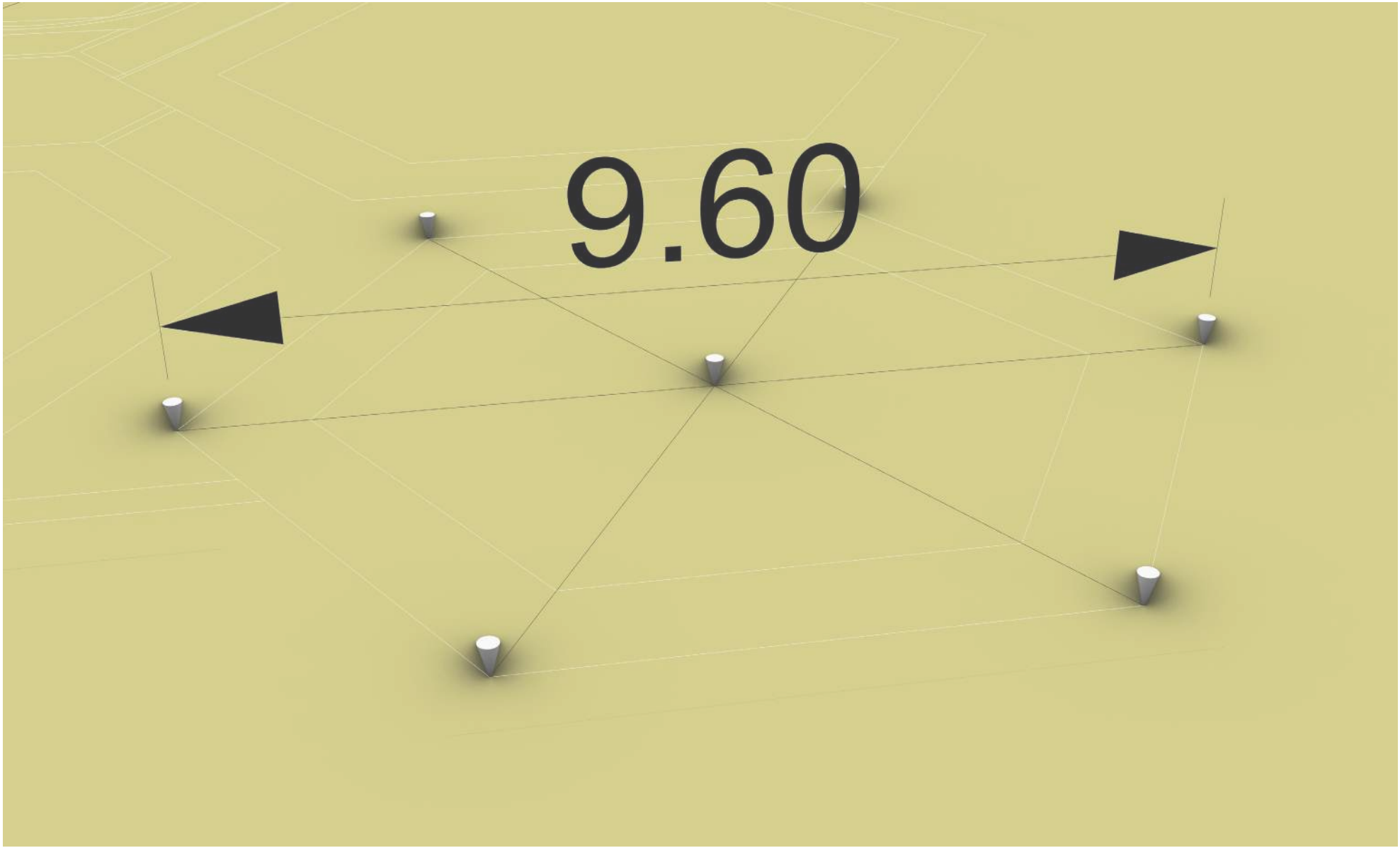
Vault set out with lines

3) Construction process



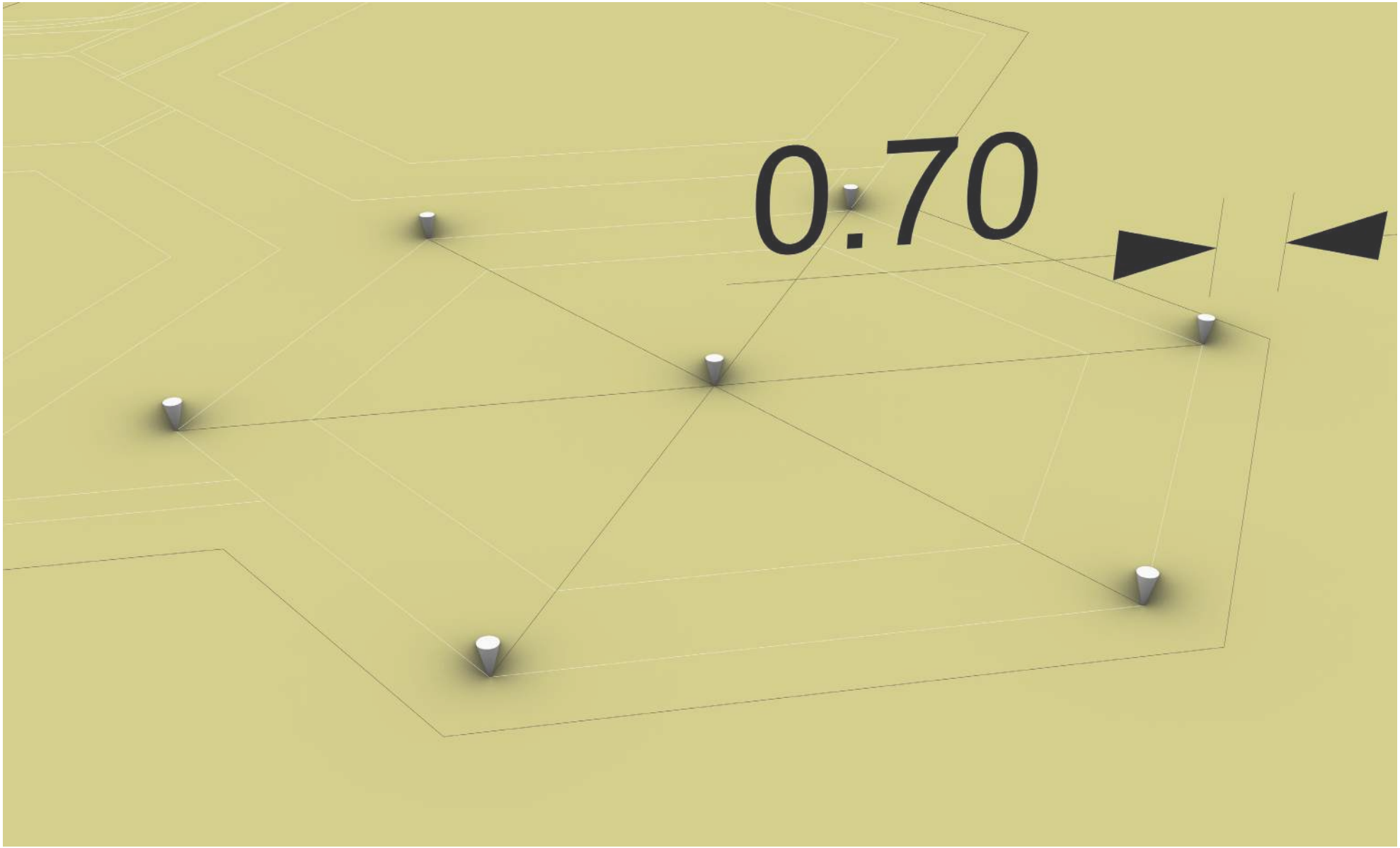
1) Choose any hexagon

3) Construction process



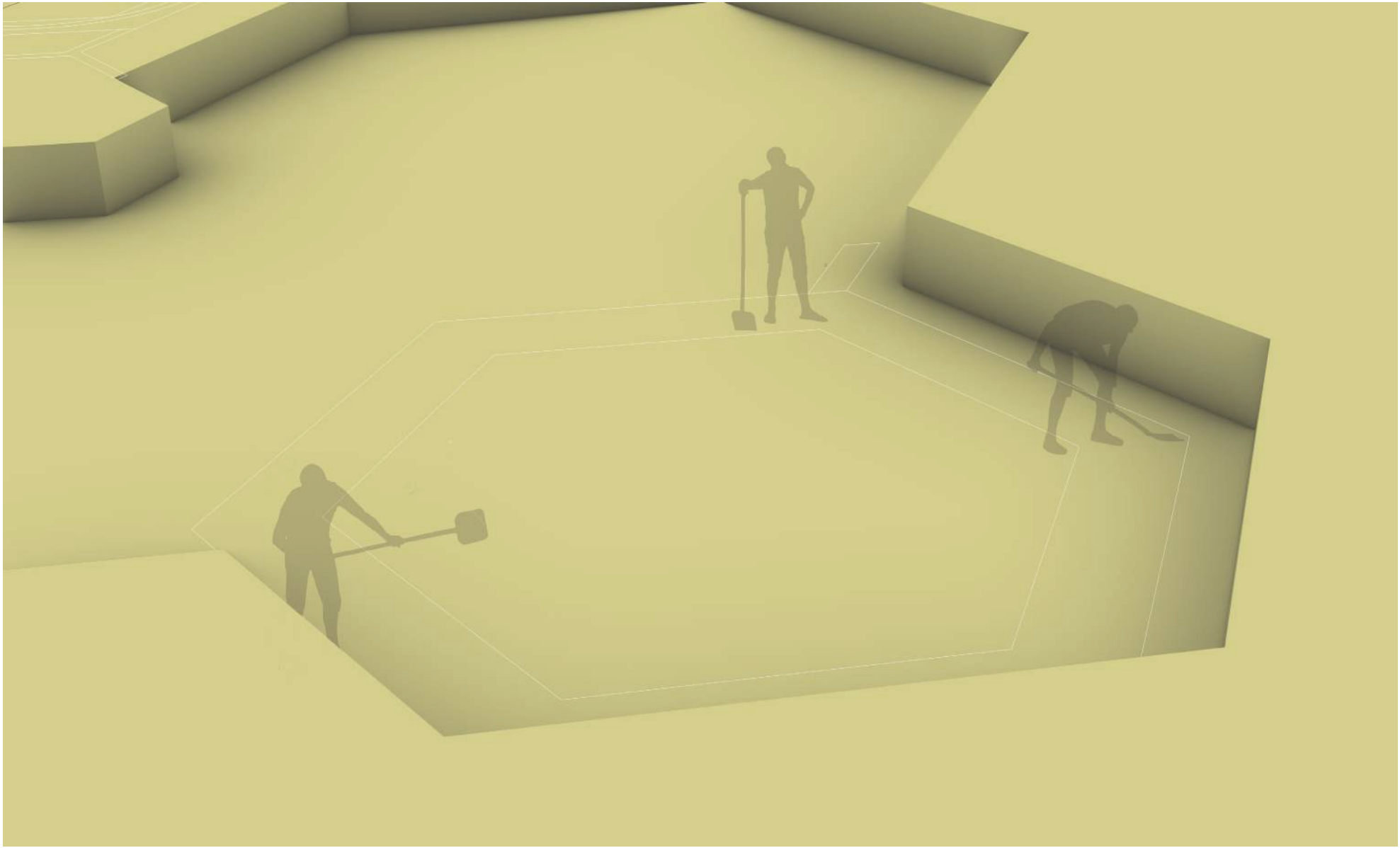
2) Set out the size

3) Construction process



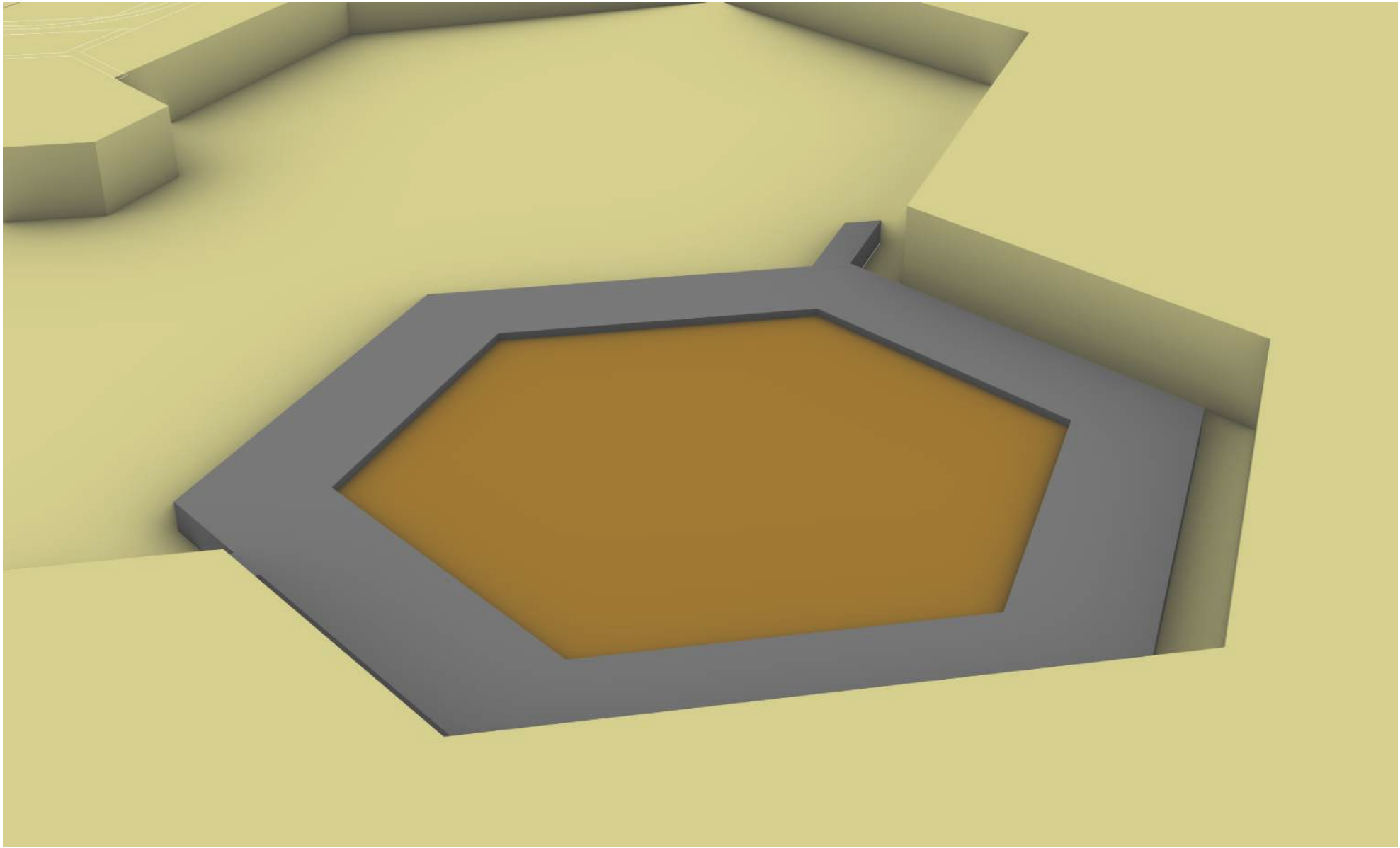
3) Add another 70 centimeters around the hexagon

3) Construction process



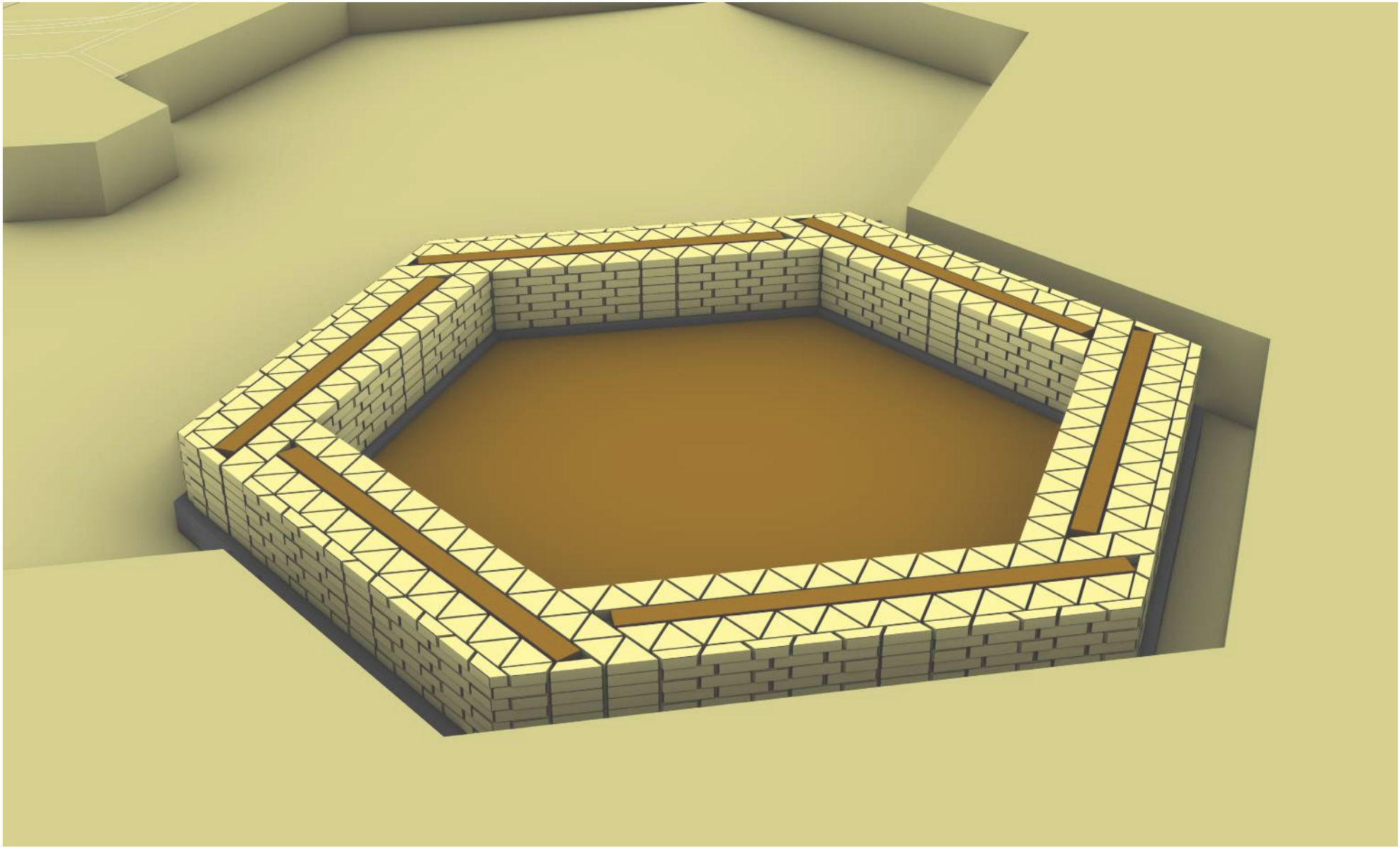
4) Dig 1 meter deep

3) Construction process



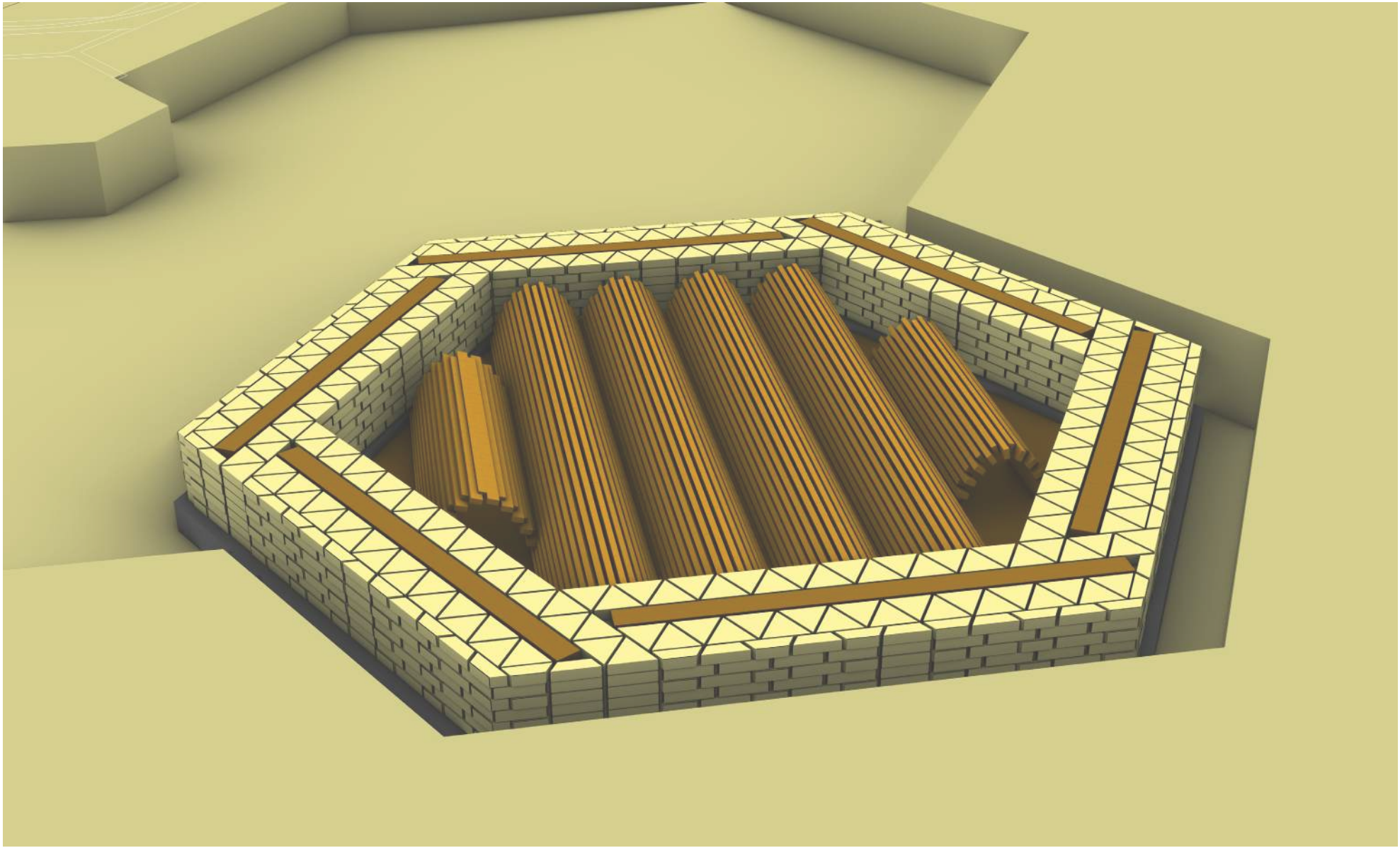
5) Create a foundation with rocks

3) Construction process



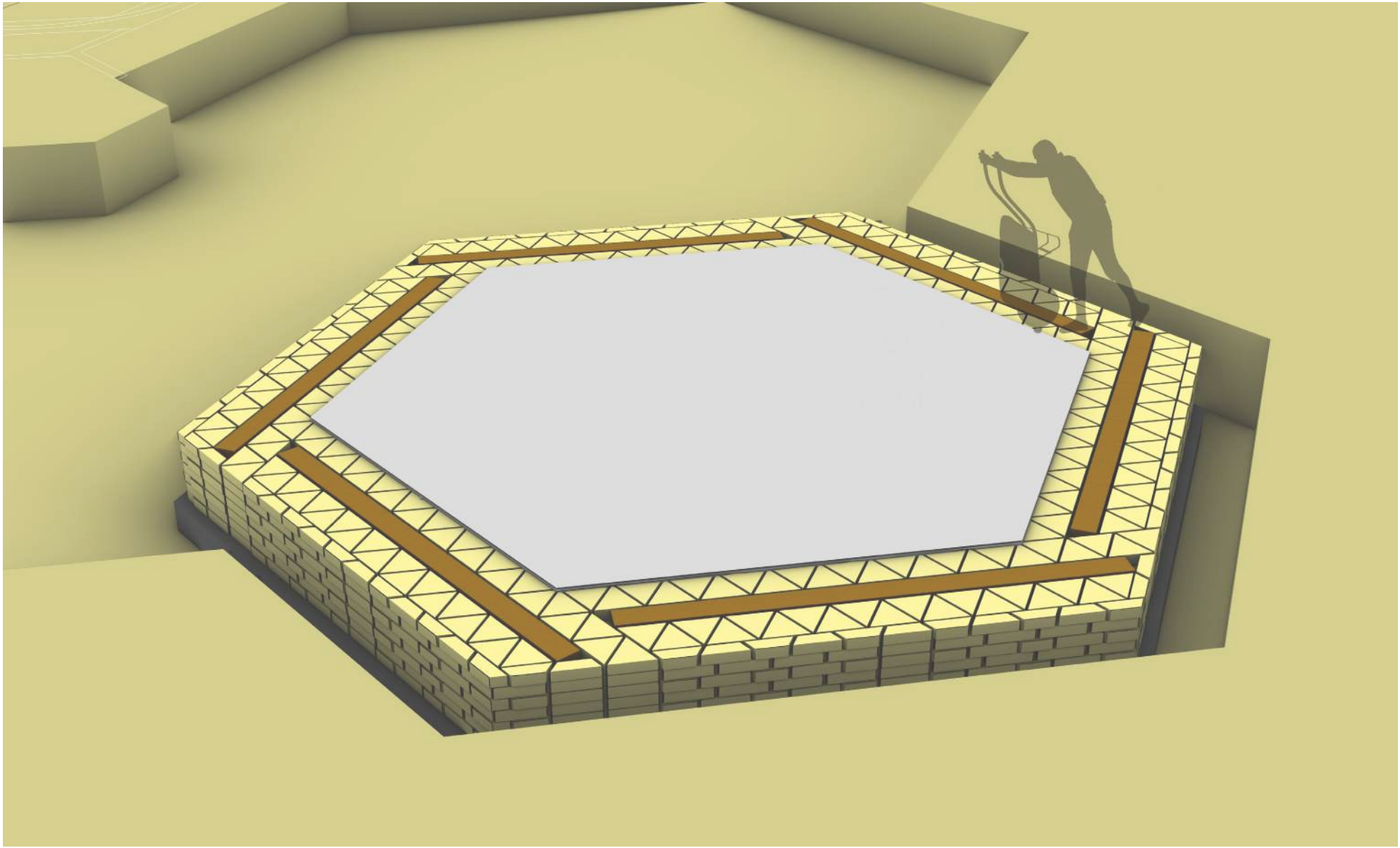
6) Build foundation walls until ground level

3) Construction process



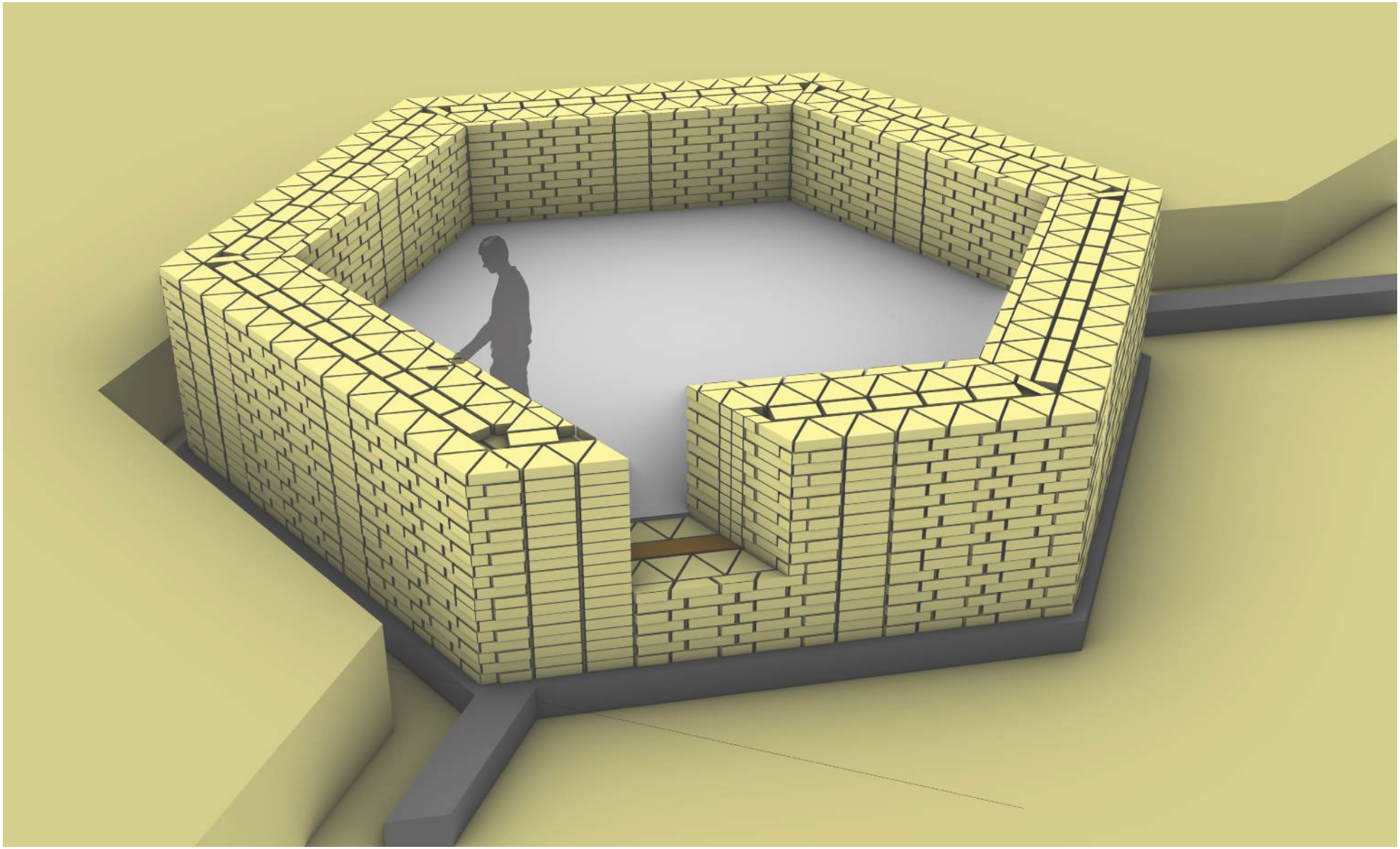
7) Build vaults for floorheating

3) Construction process



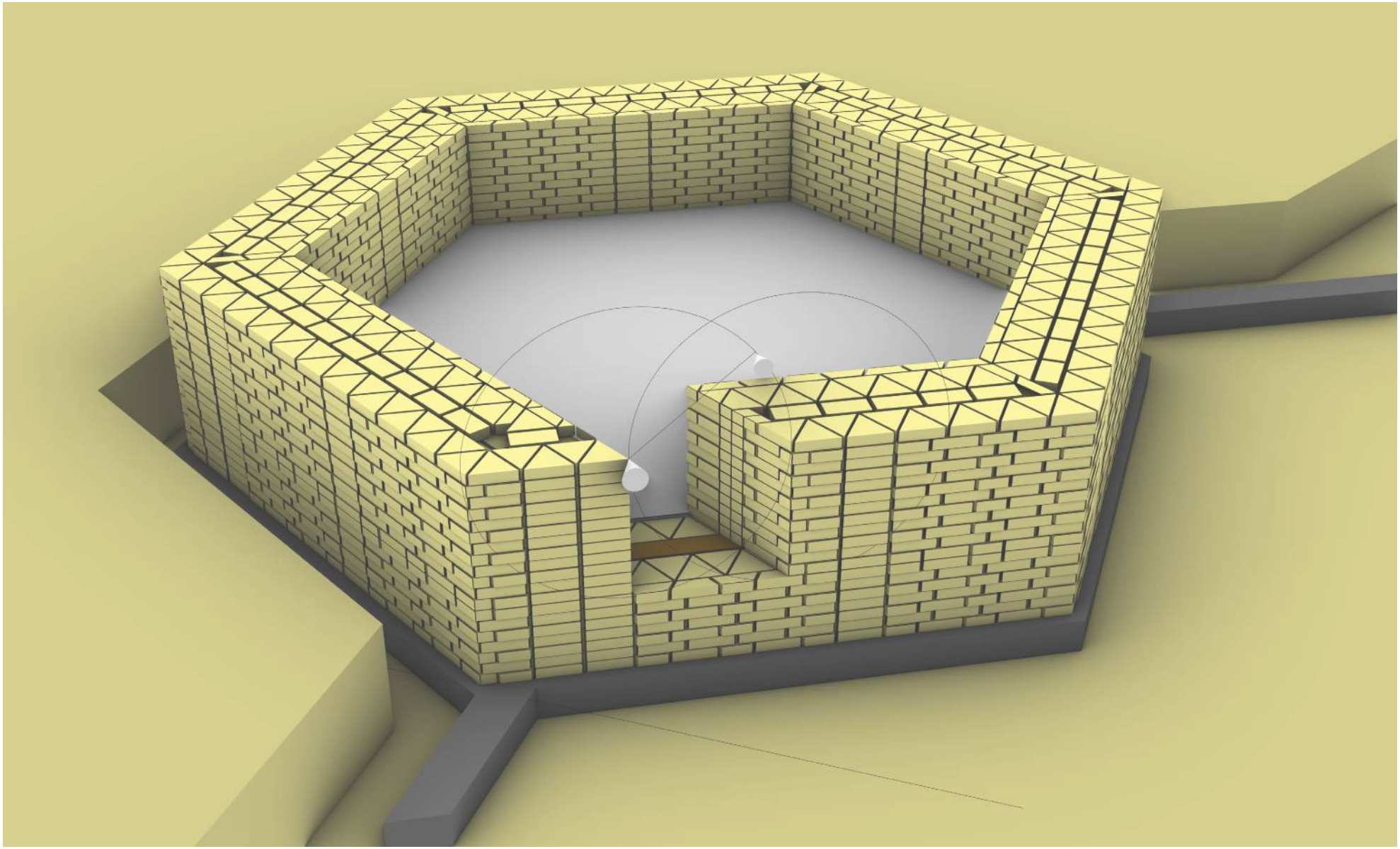
8) Fill the vaults with earth

3) Construction process



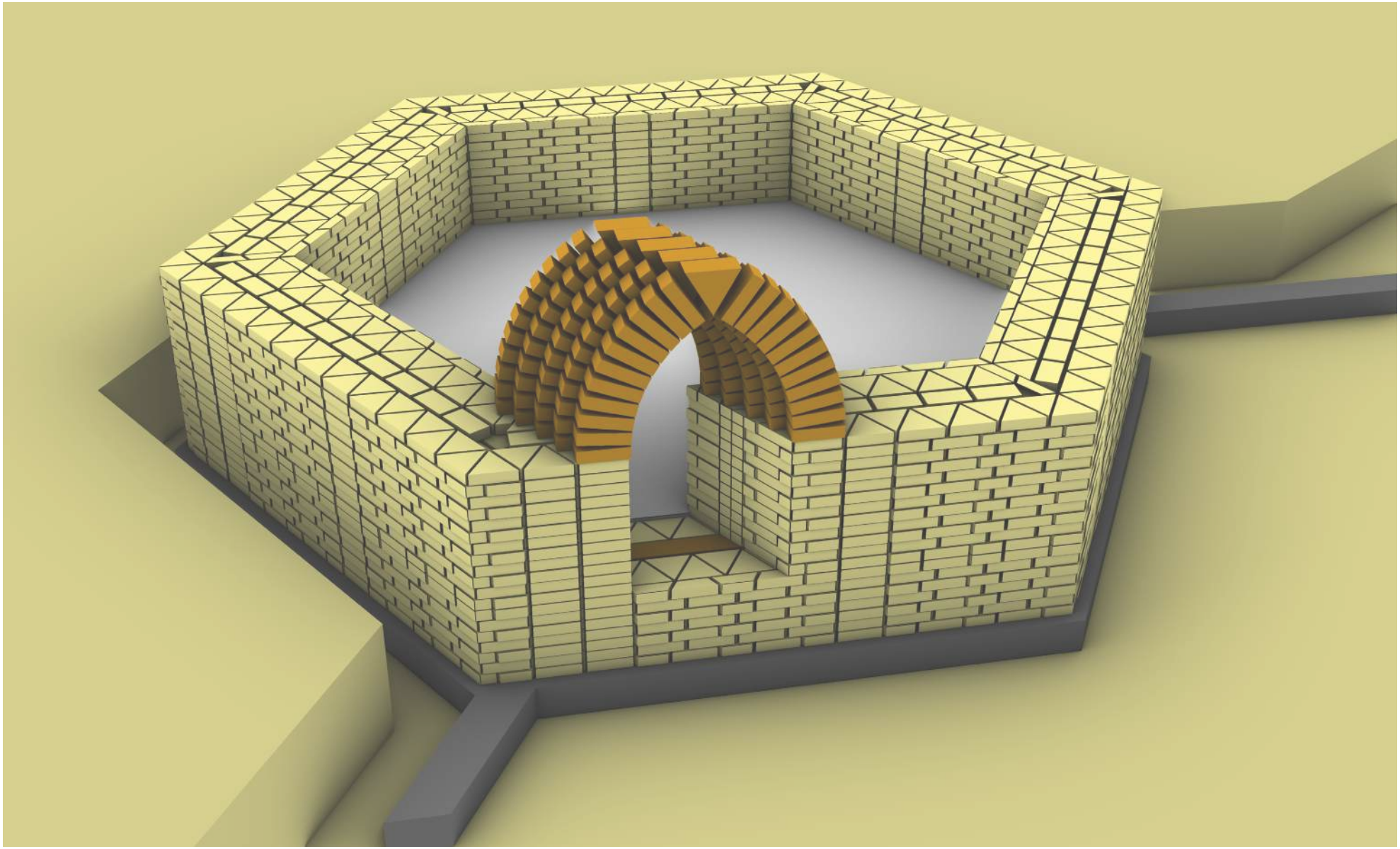
9) Build the walls up unto door height

3) Construction process



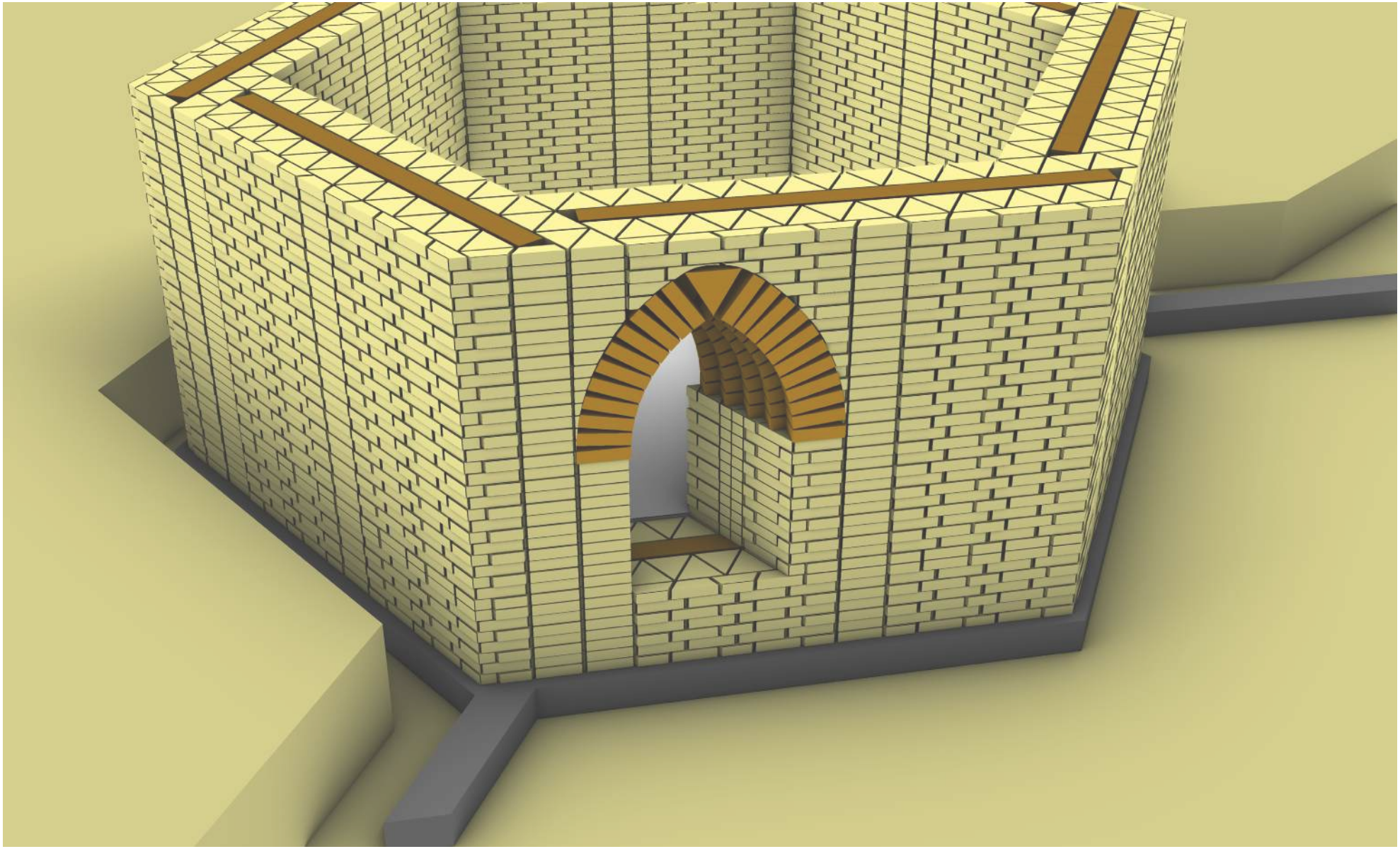
10) Set out door space and create outline with circles

3) Construction process



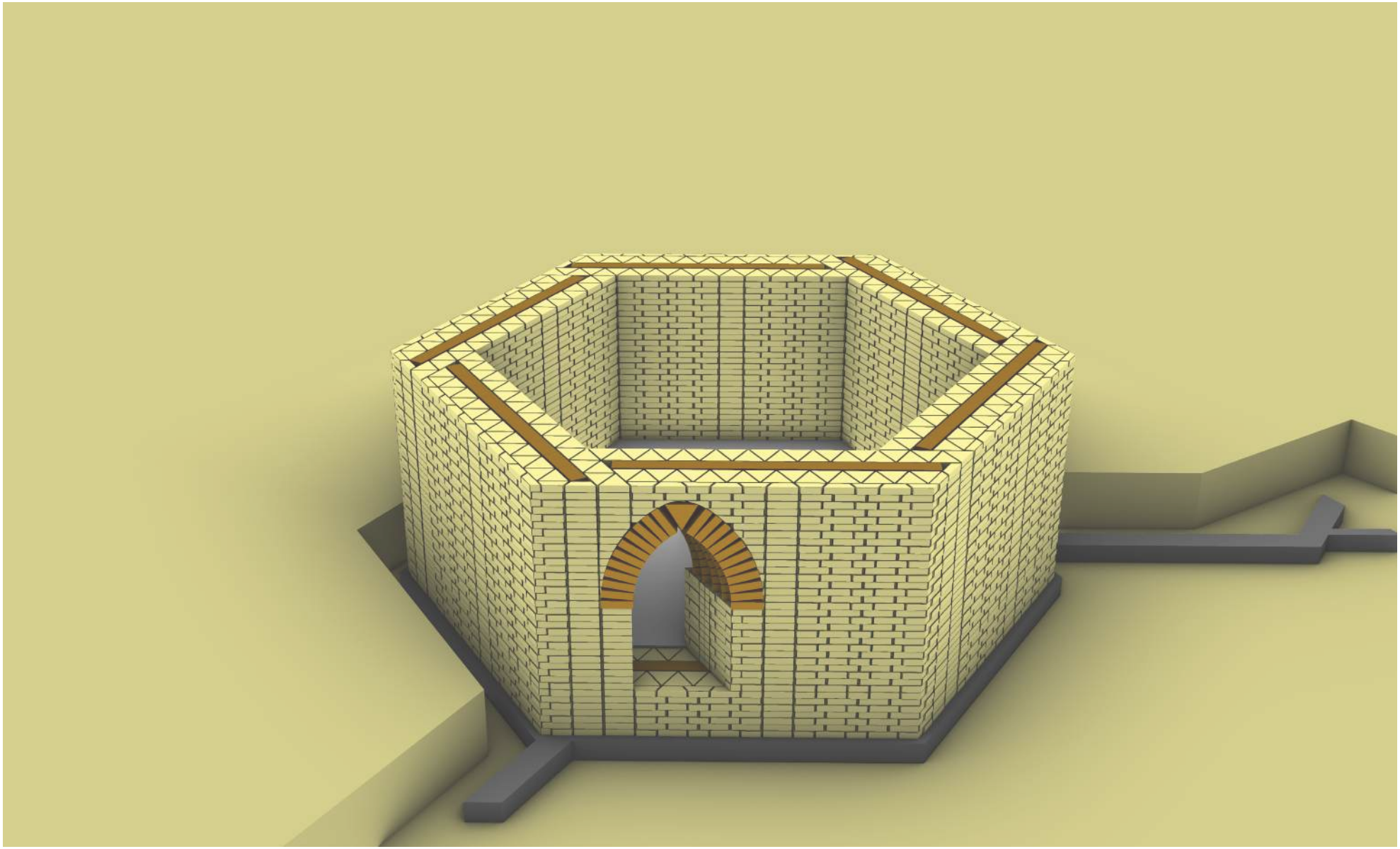
11) Build the door arch

3) Construction process



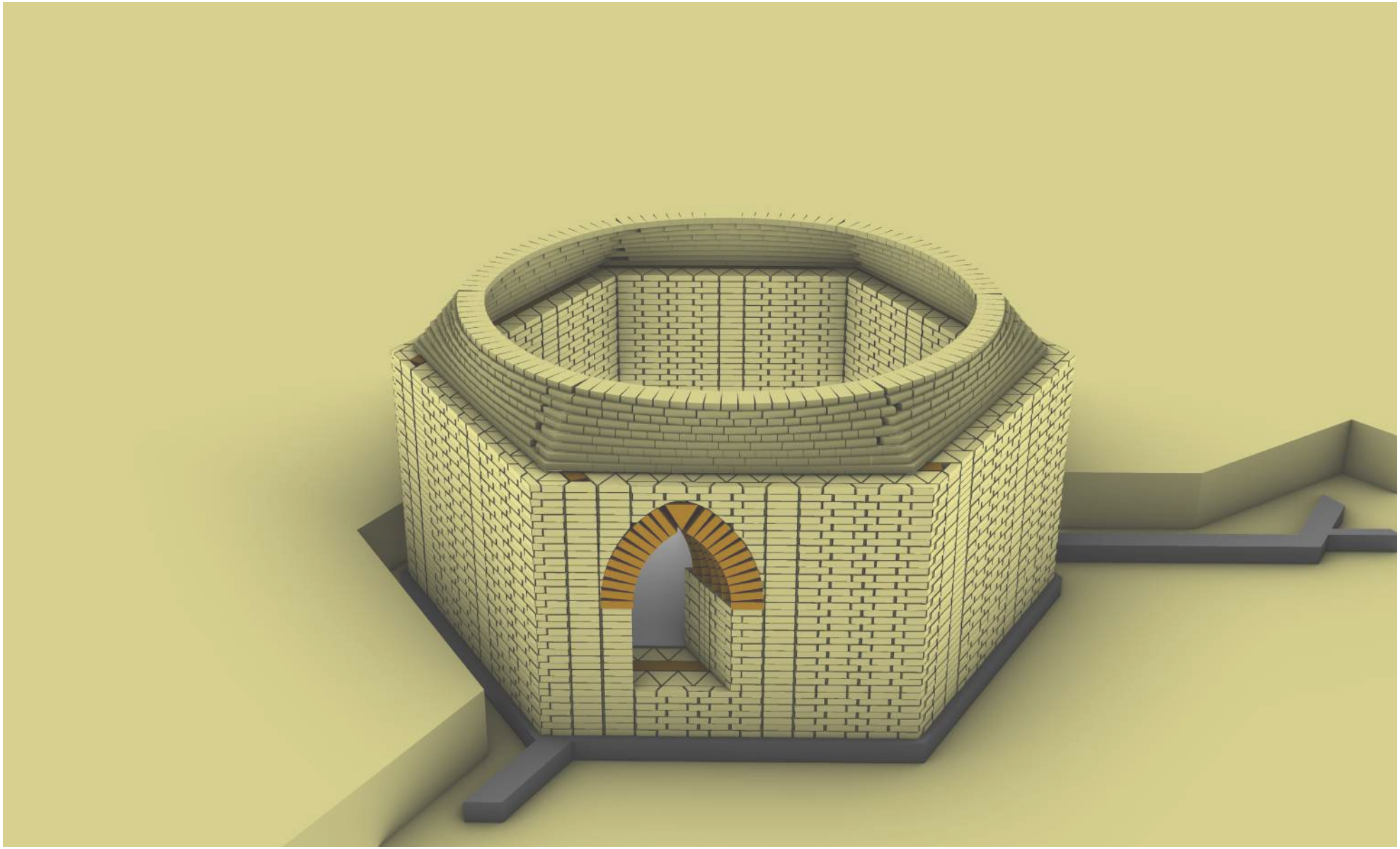
12) Build the rest of the wall

3) Construction process



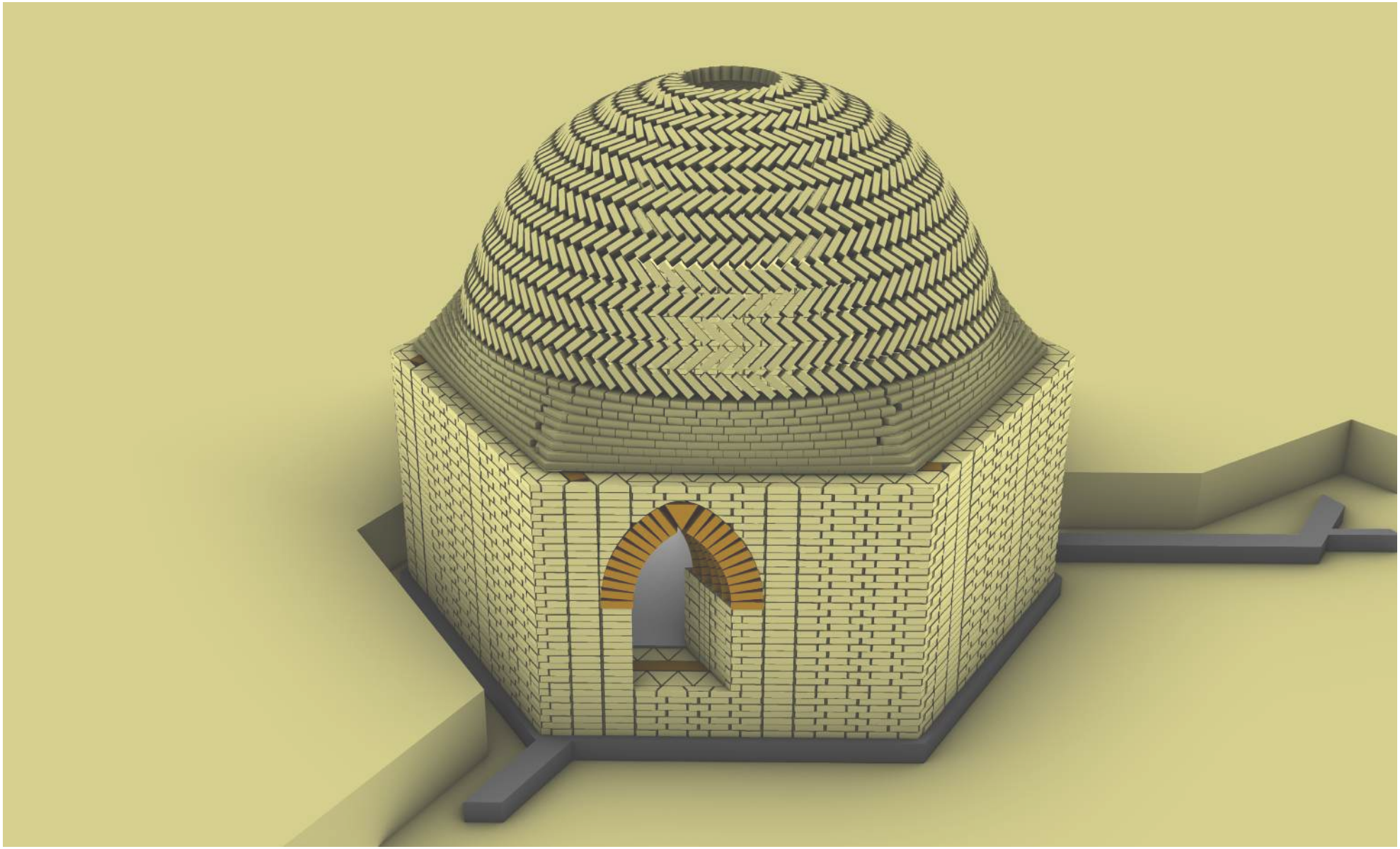
13) Set up construction space

3) Construction process



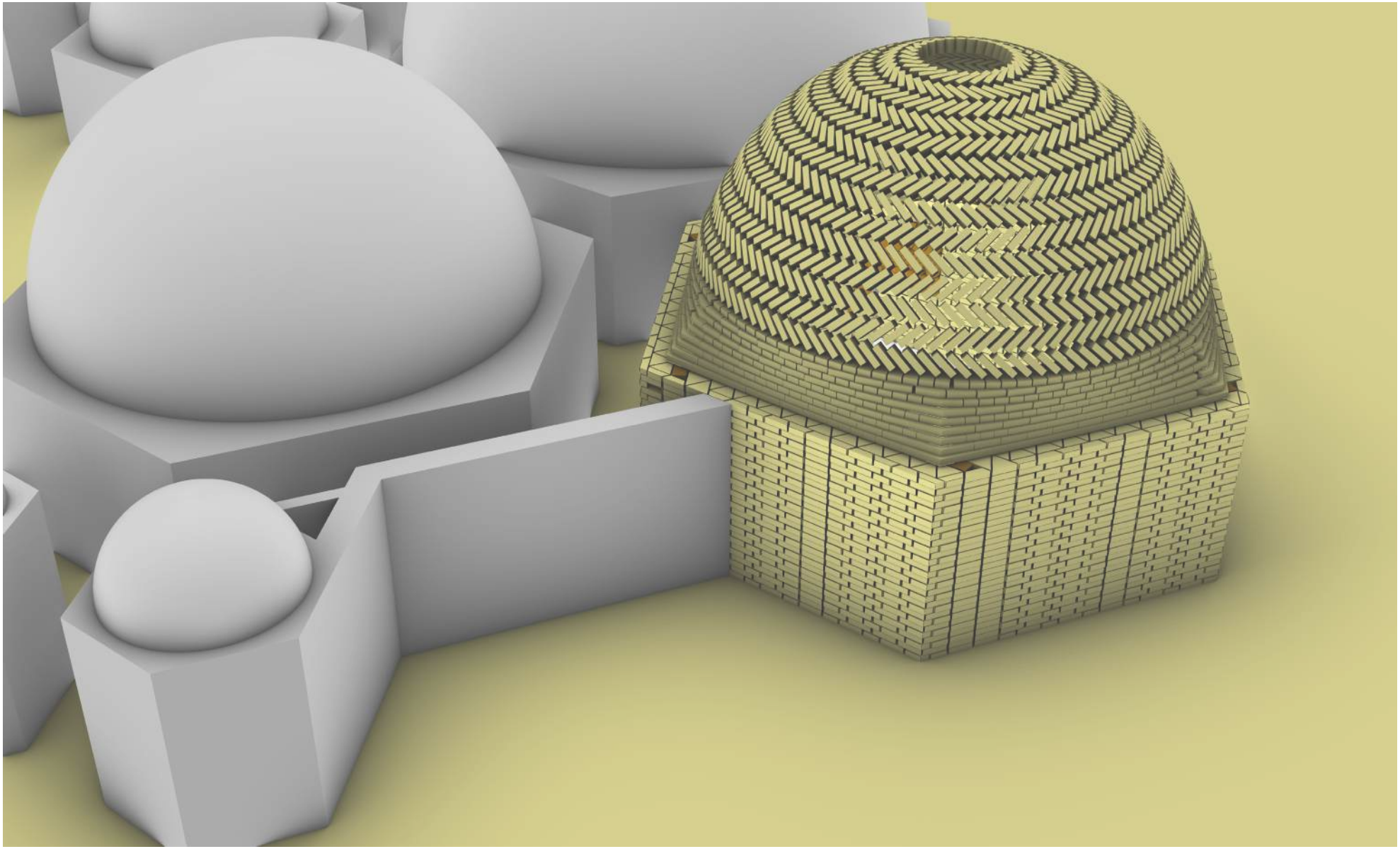
14) Build the first 9 layers to go from hexagon to circle

3) Construction process



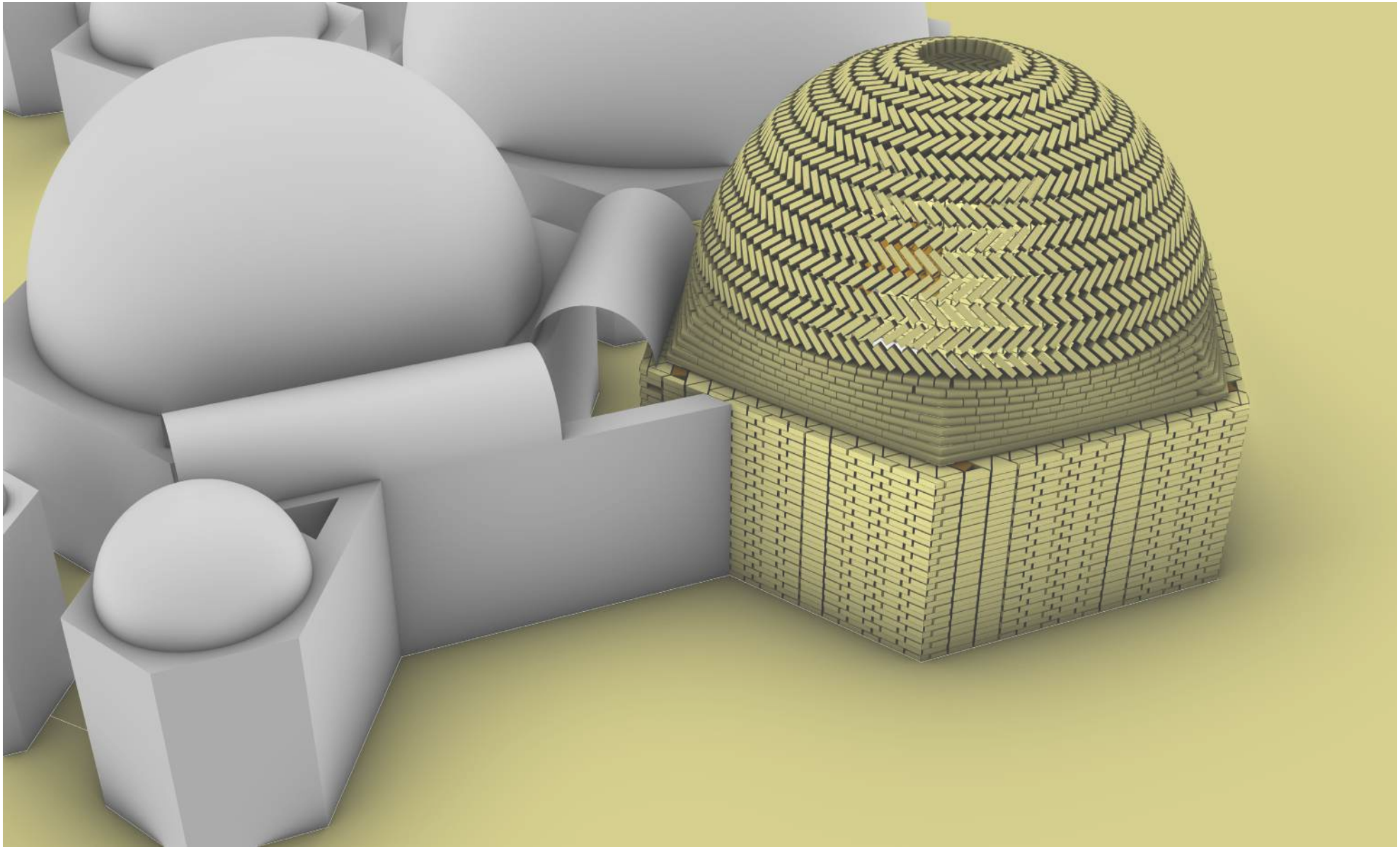
15) Build the rest of the dome

3) Construction process



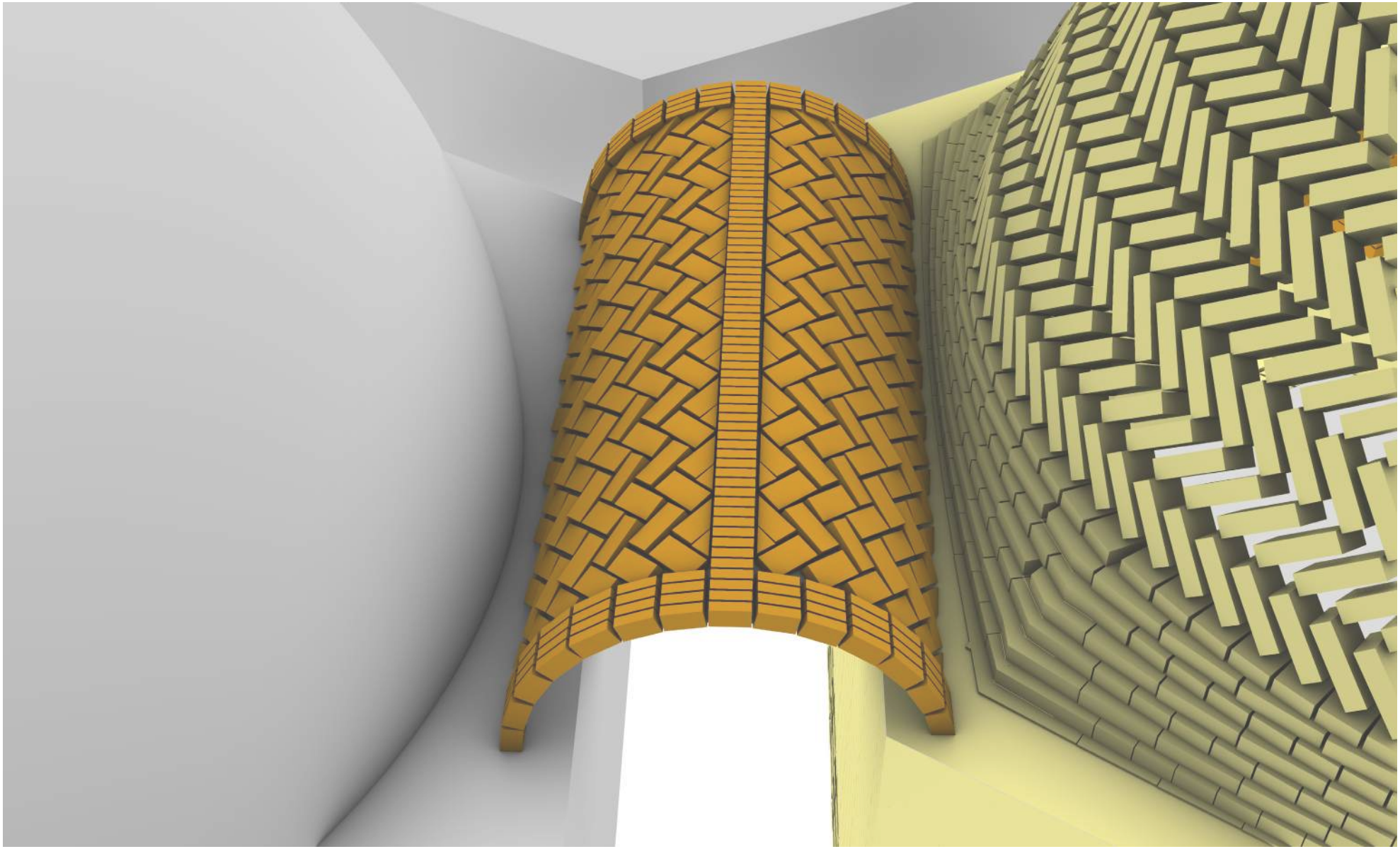
16) After the rest of all the domes are build, continue

3) Construction process



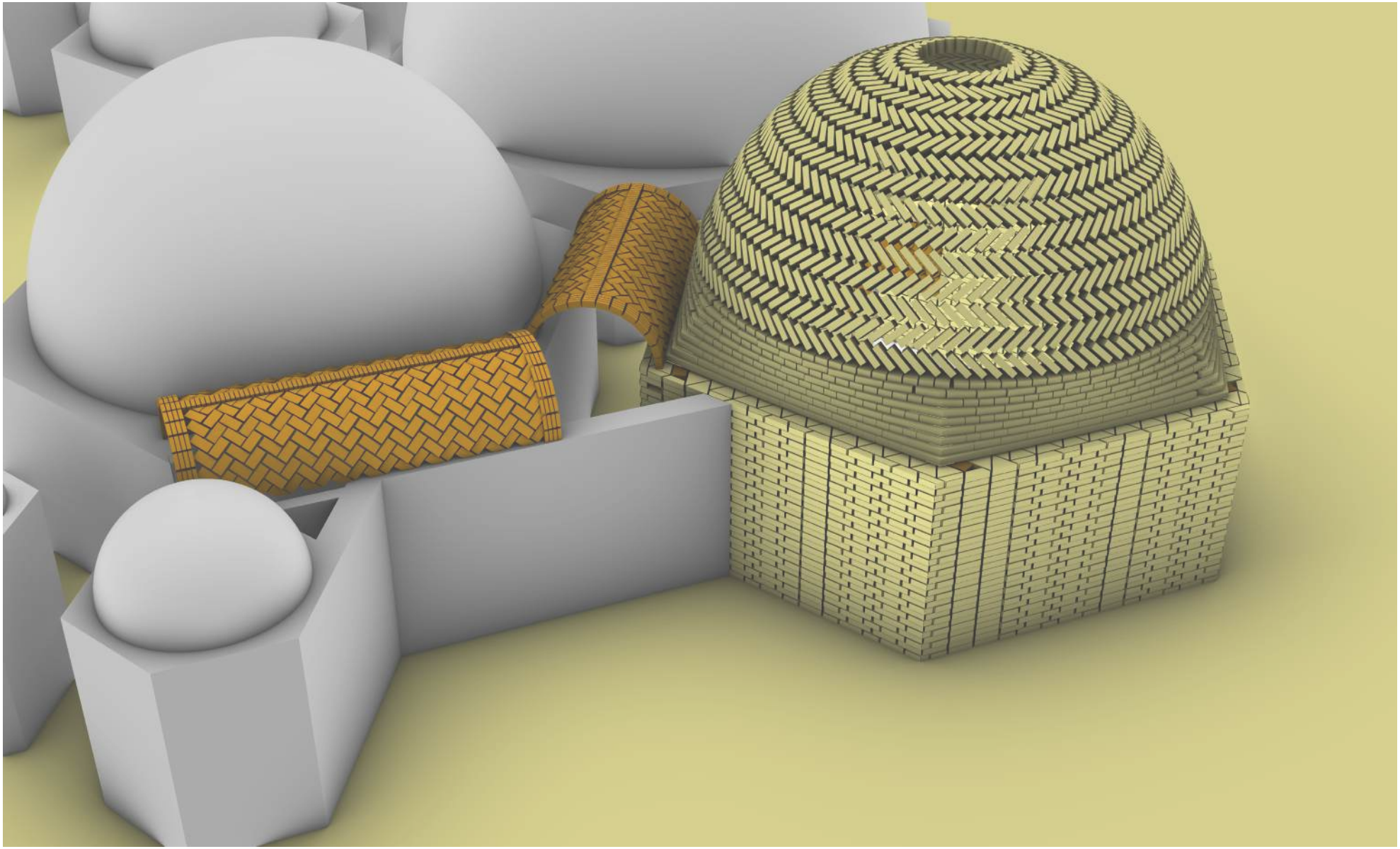
17) Set out the corridor spaces

3) Construction process



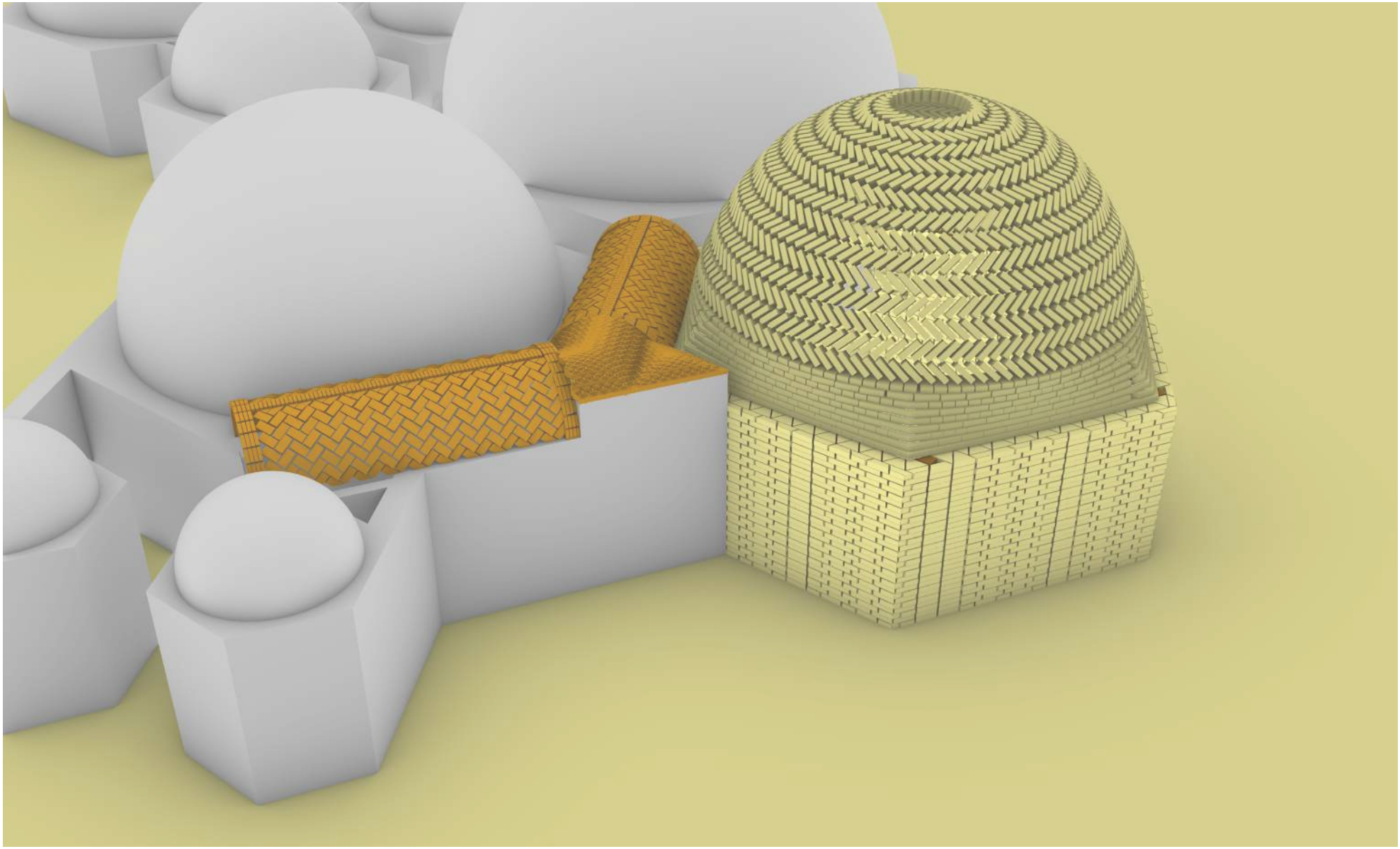
18) Basic vault bricklaying with normal arabic techniques

3) Construction process



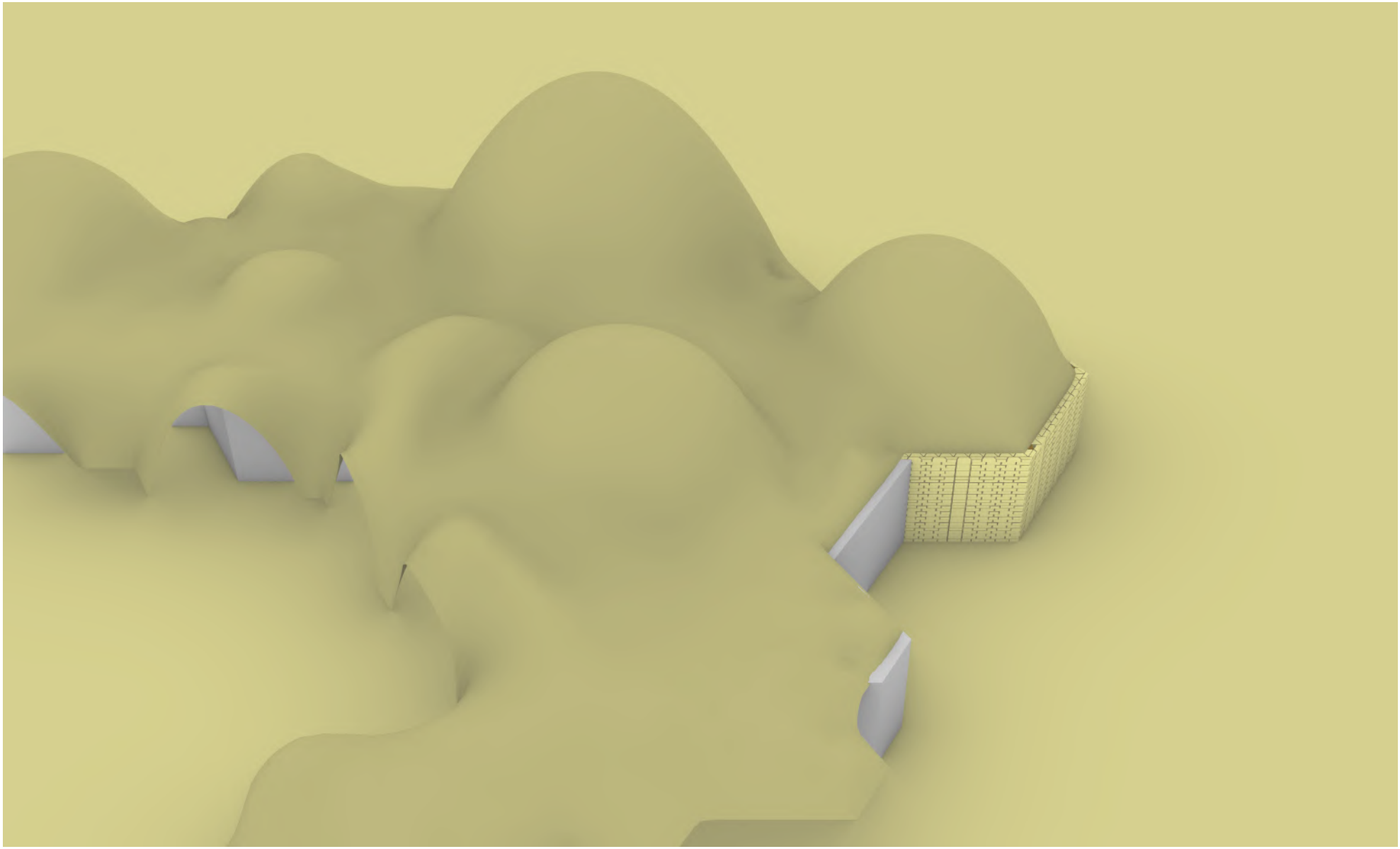
19) Build all the vaults

3) Construction process

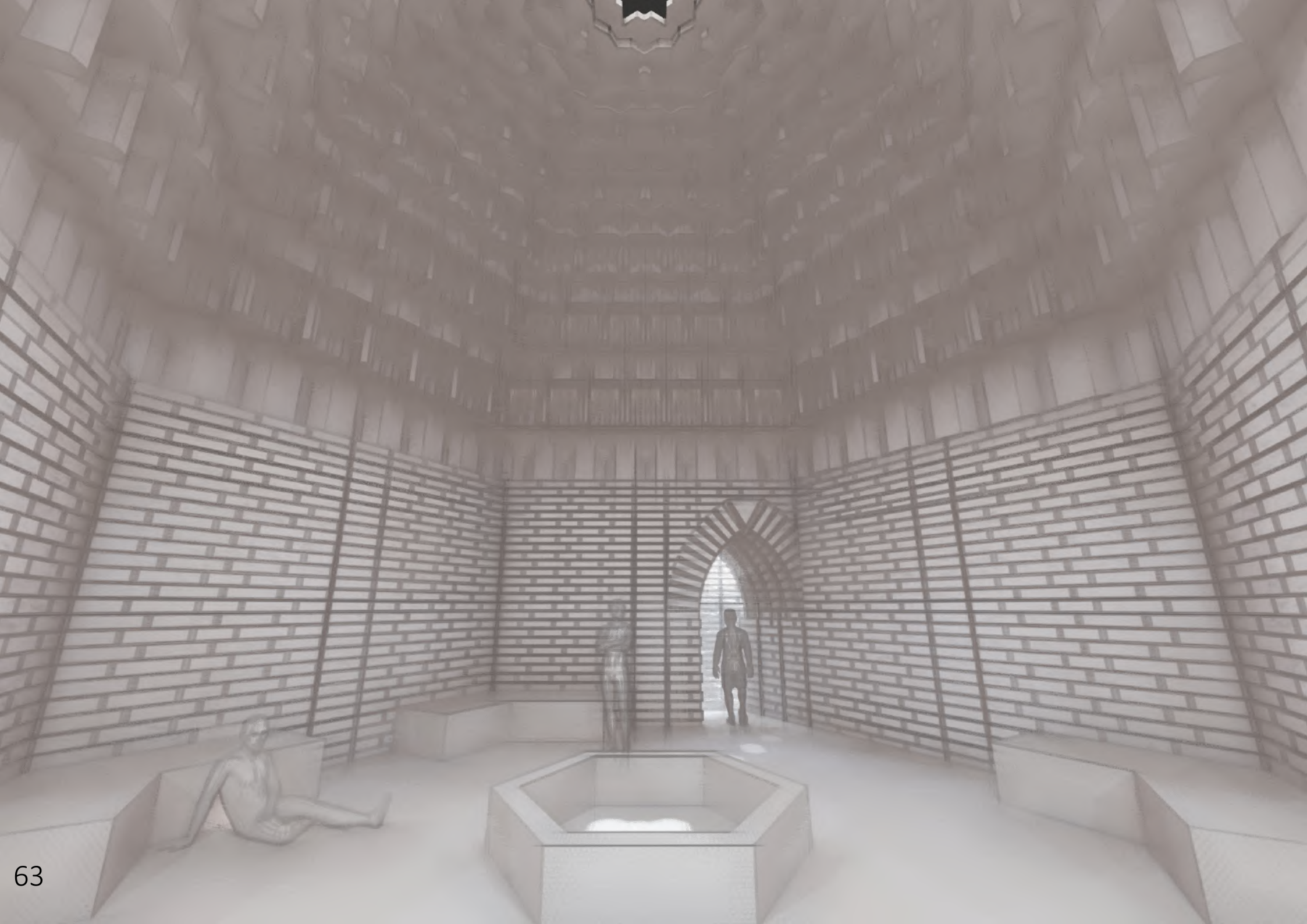


20) Build the connection spaces with muqarnas

3) Construction process

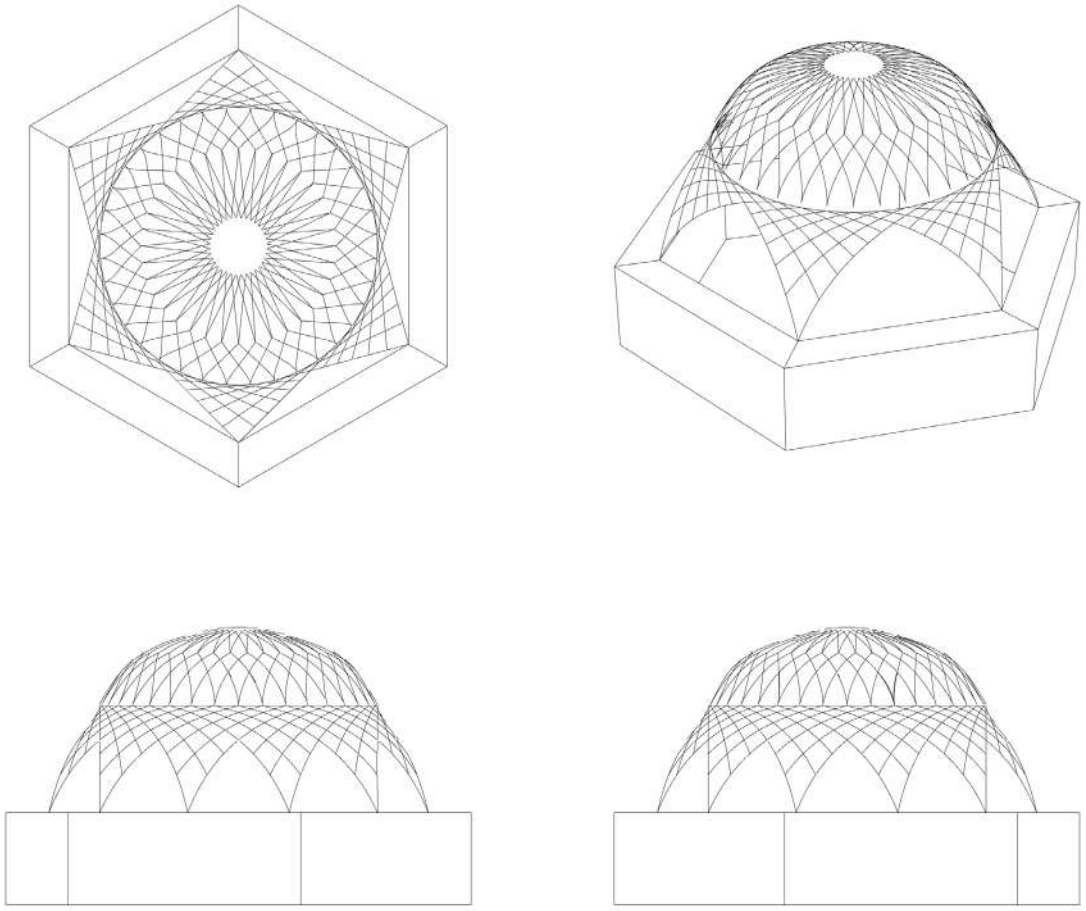


21) When everthing is built, fill everything with earth for second roof.



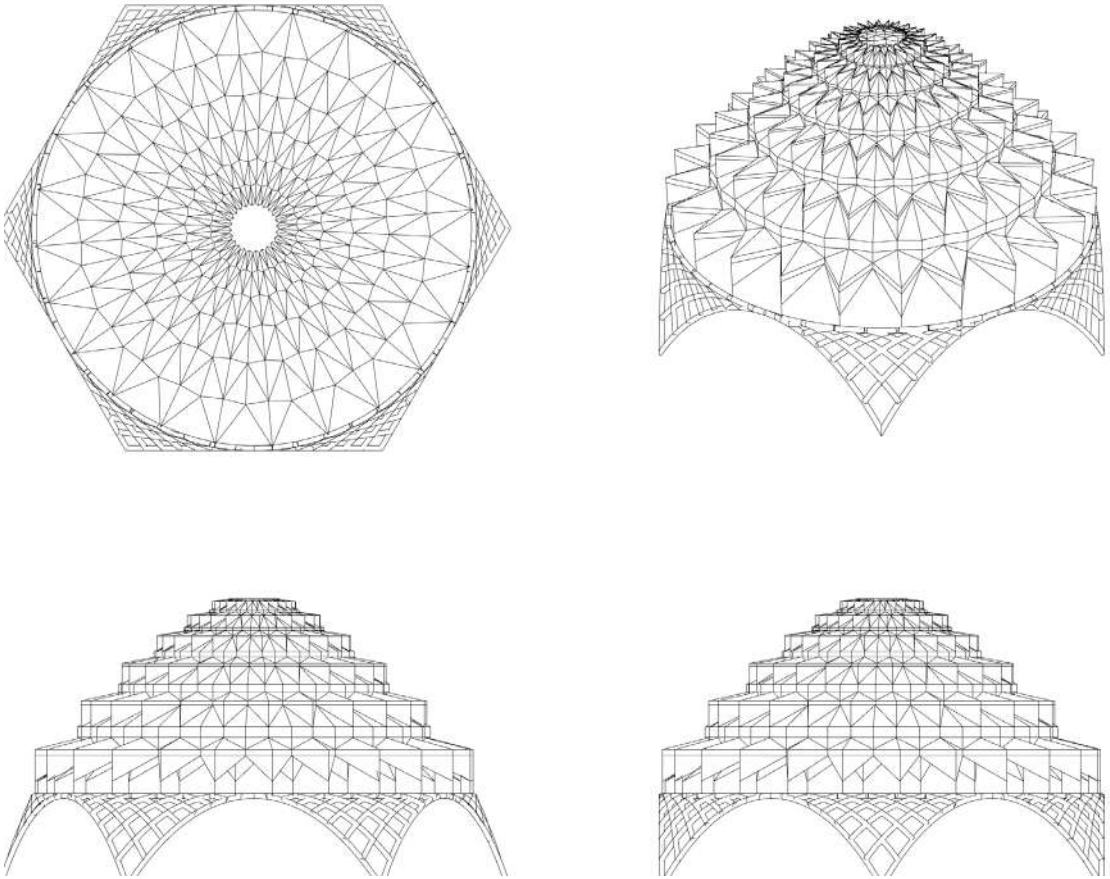
3) Constructing domes: Geometrical approach

We aimed to realize a aestheticly pleasing and visual structure for the dome of the hot house.



1st : Karbandi Pendentive and Dome

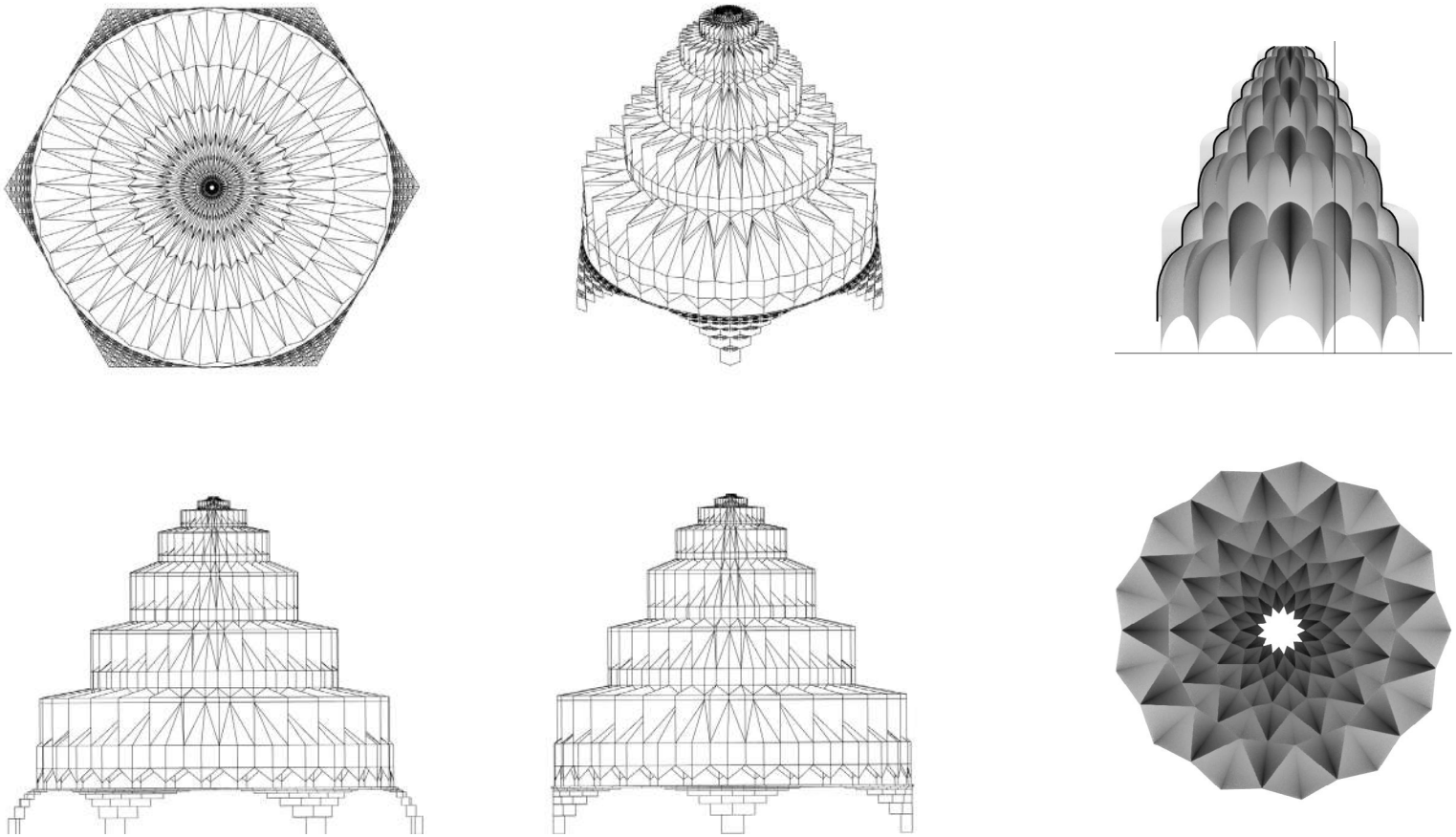
3) Constructing domes: Geometrical approach



2nd: Karbandi Pendentive and Murqarnass Dome

3) Constructing domes: Geometrical approach

Because of consistency then we tried to make pendentives and the dome from the muqarnas.



3rd: Karbandi Pendentive and Murqarnass Dome

3) Constructing domes: Geometrical approach

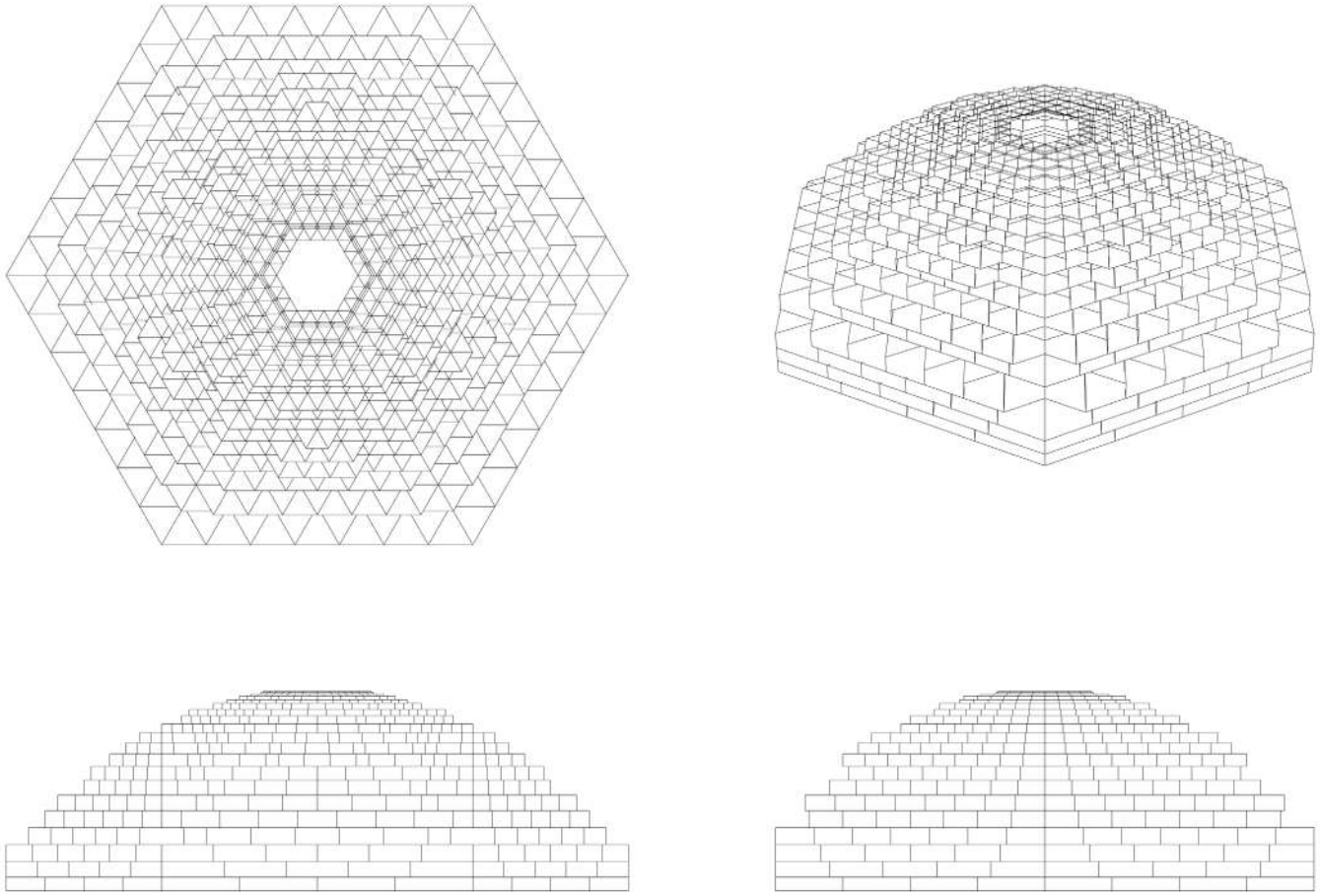
Disadvantages:

- Not following the tessellation
- The height and width has to be manually adjusts by sliders to get to simulate the form finding geometry
- Not working for asymmetrical shapes

... So we tried a topological approach

3) Constructing domes: Topological approach

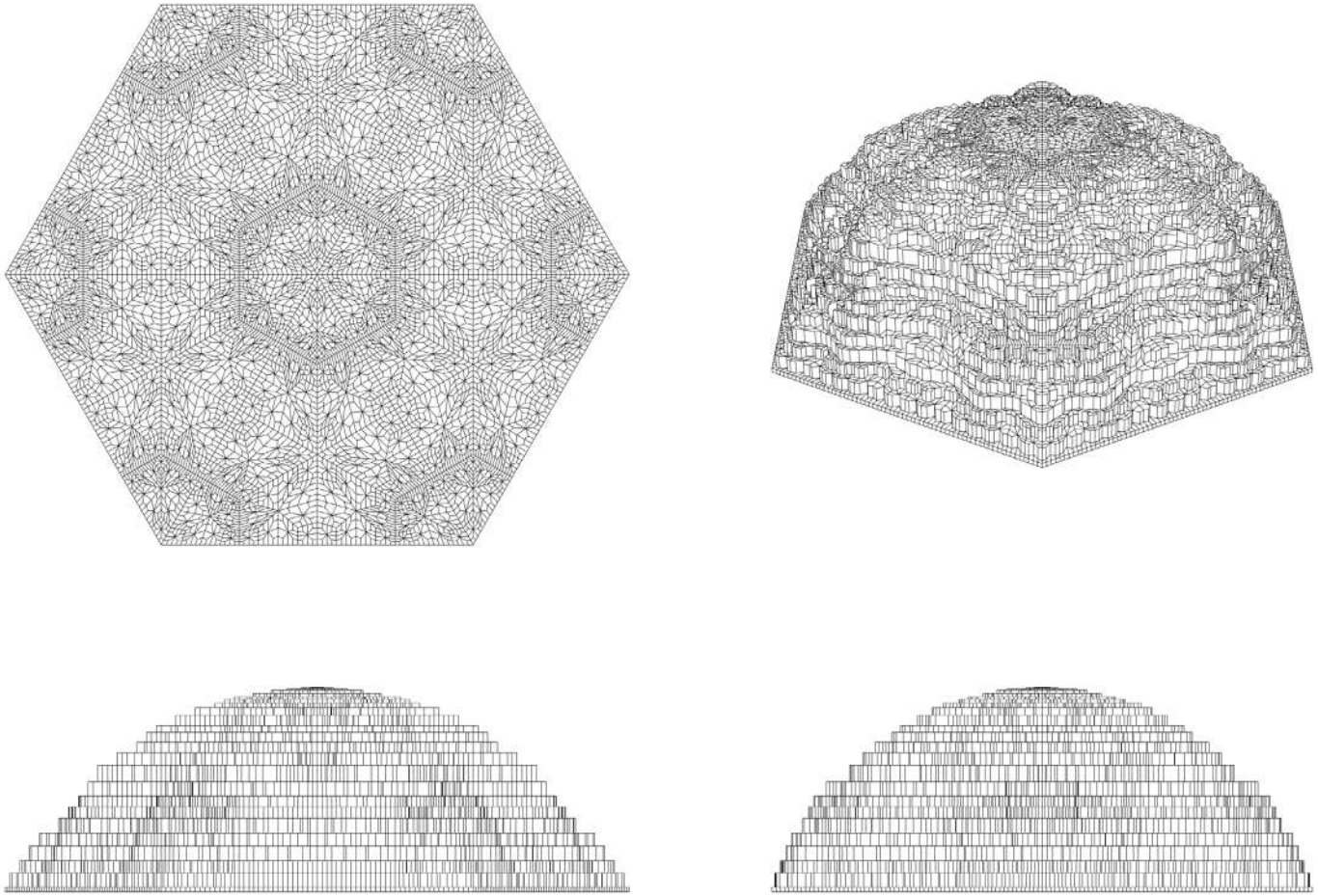
Intersecting the chosen modules with the relaxed geometry.
Unfortunately the modules can not be placed evenly on the input surface and in the corners as wished.



1st topological approach

3) Constructing domes: Topological approach

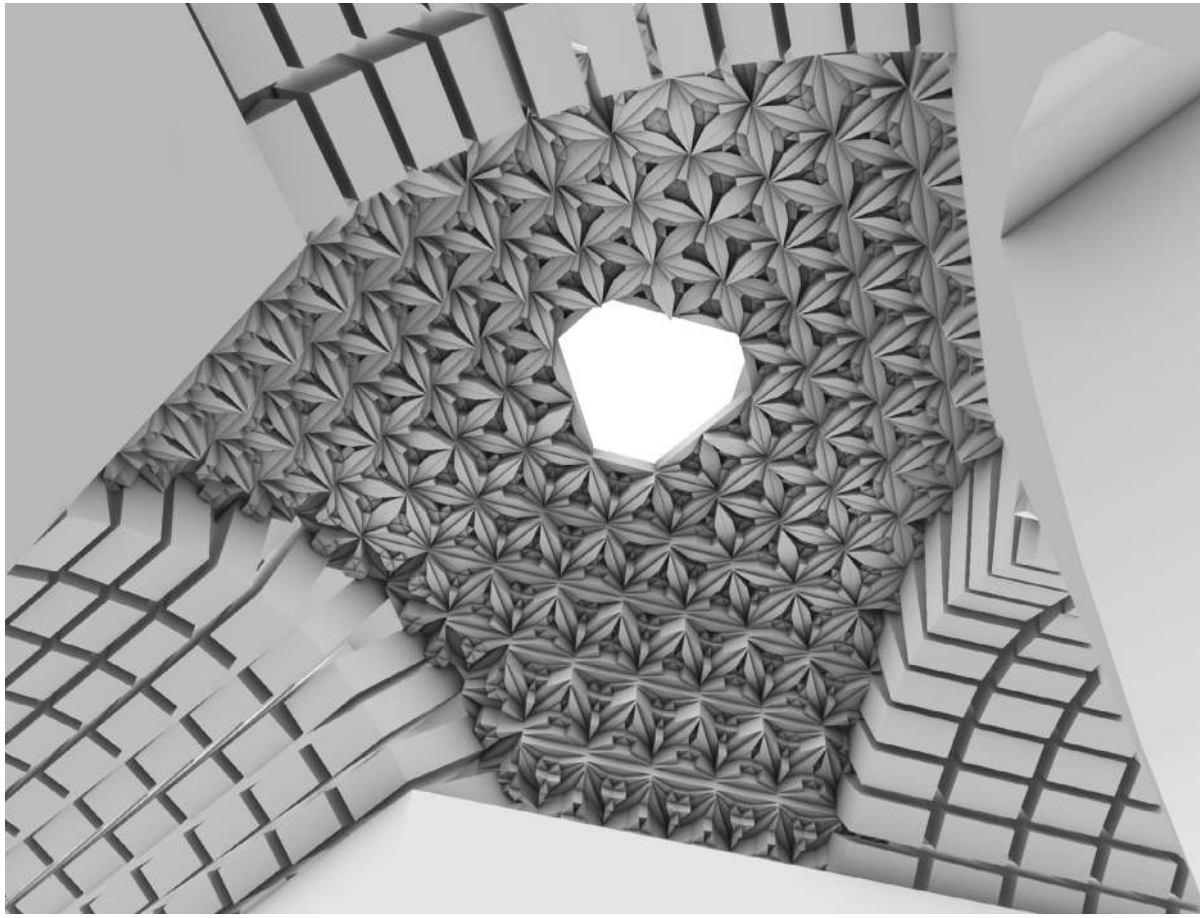
In this approach we defined each offset of the mesh tessellation as a muqarnas slab and intersected it with relaxed geometry.



2nd topological approach

3) Constructing domes: Topological approach

This time it worked with both different tessellations from simple ones to more complex ones and it worked even with asymmetrical shapes at junction of our corridors.



2nd topological approach , with asymetrical shape

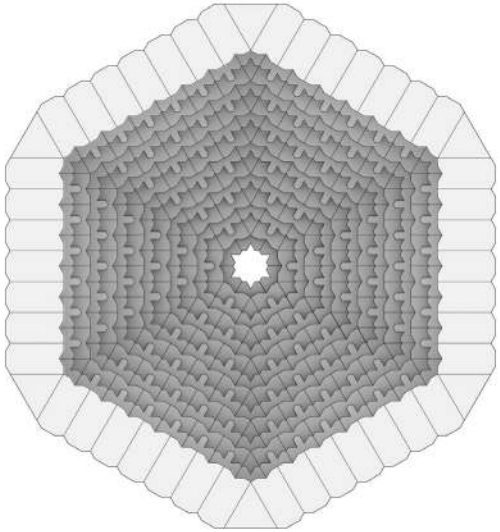
3) Constructing domes: Buildability

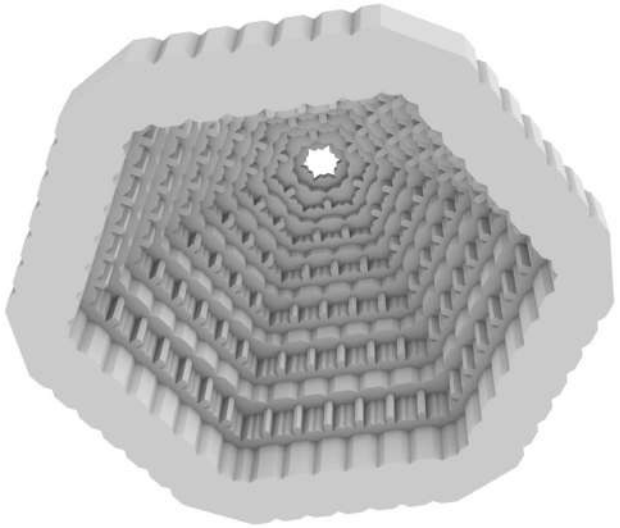
How to make a buildable murqanas dome:

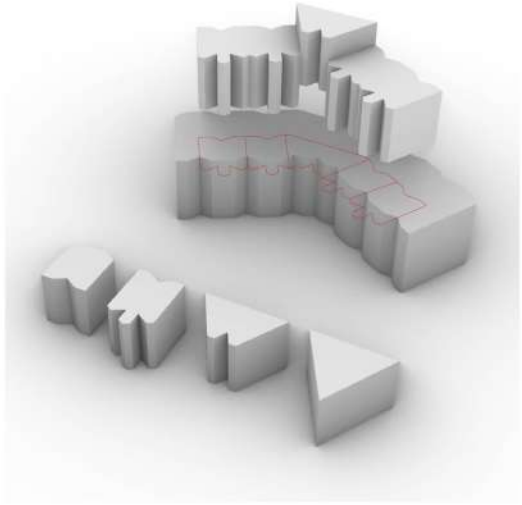
More material to the back of the elements: increases structural stability

Intersecting the geometry with the inner face mesh to reduce the not needed parts.

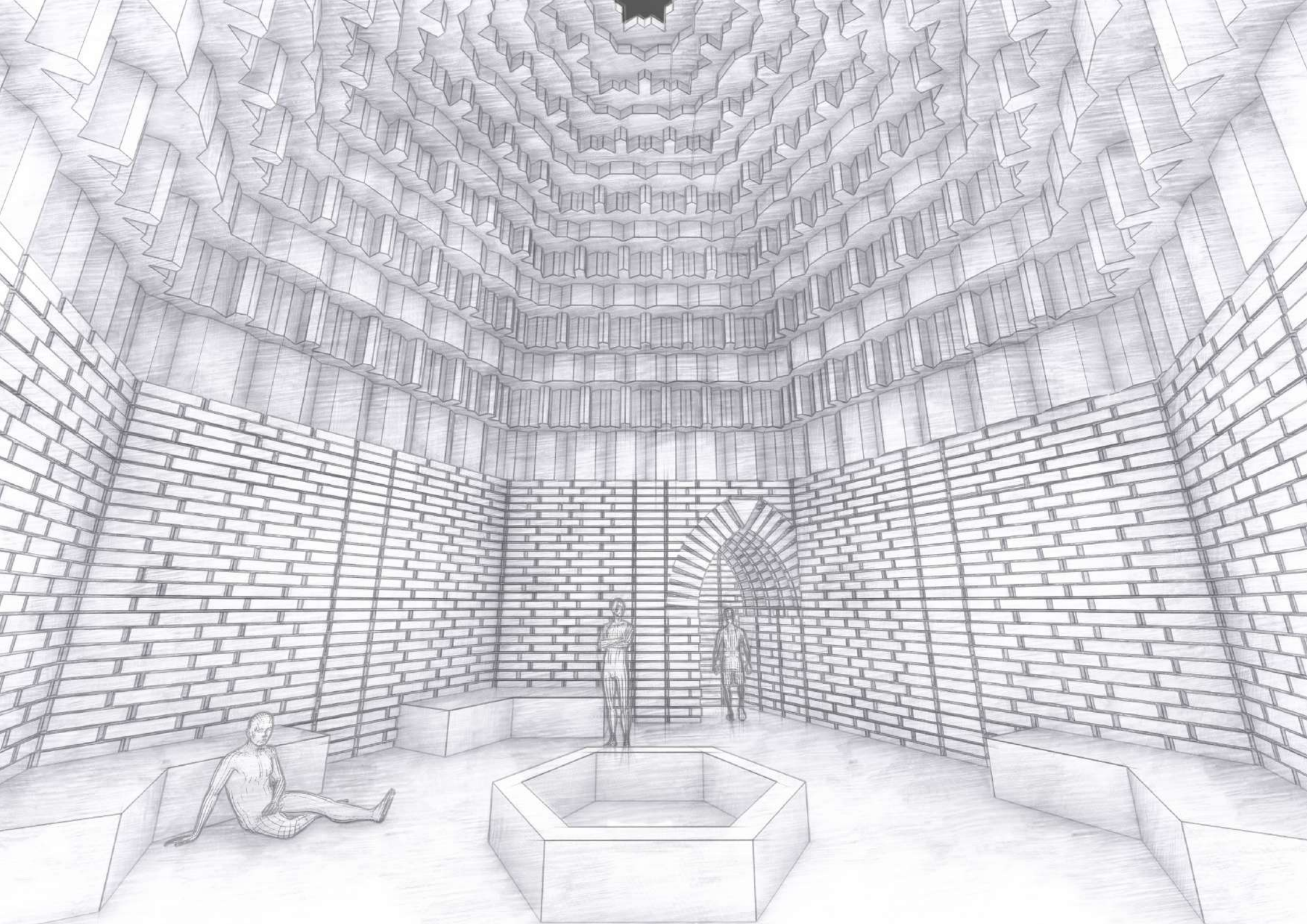
3) Constructing domes: Buildability



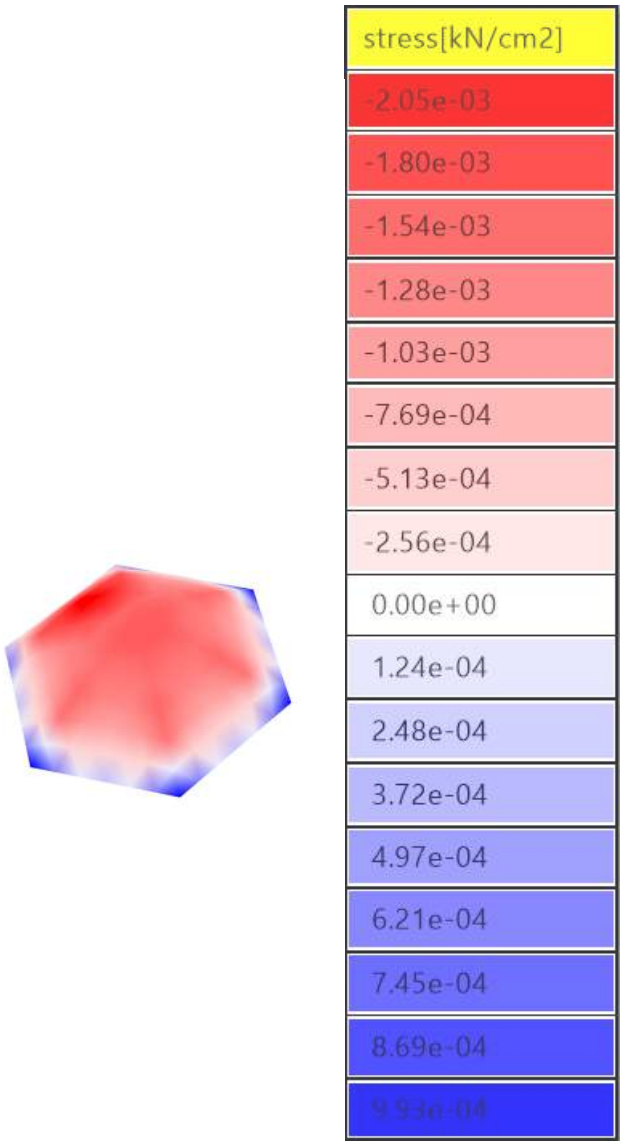


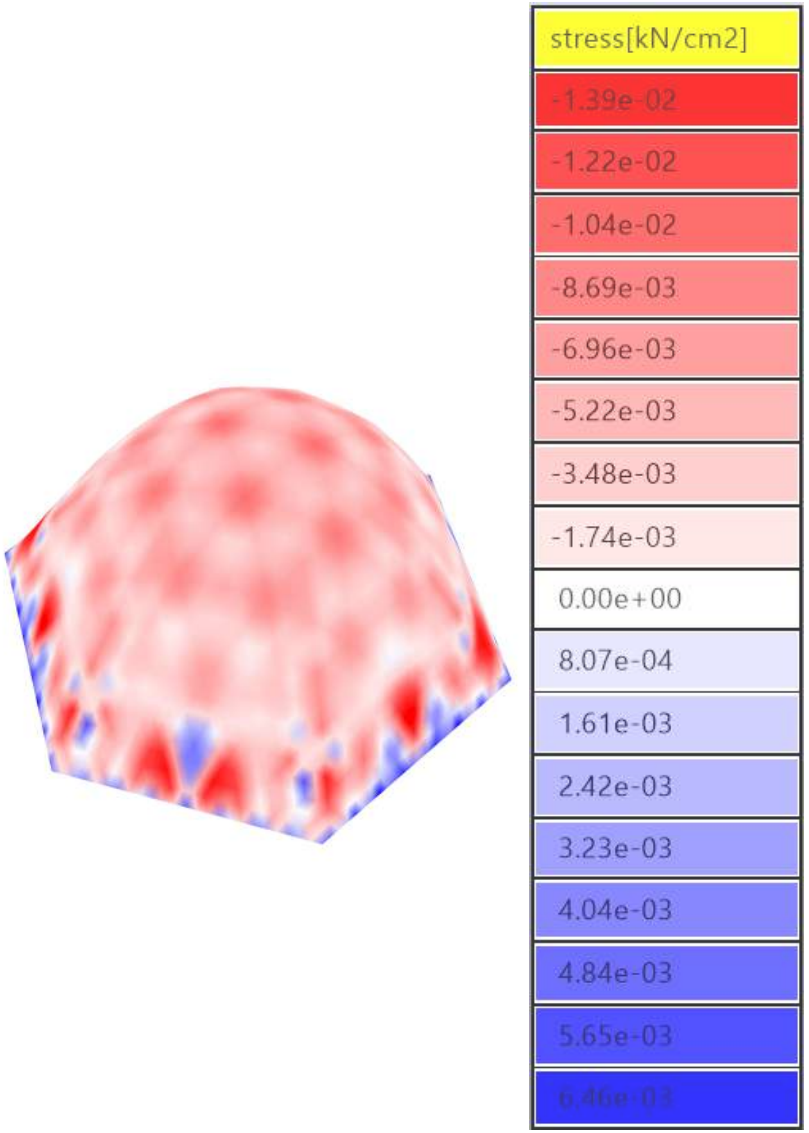


contruction modules

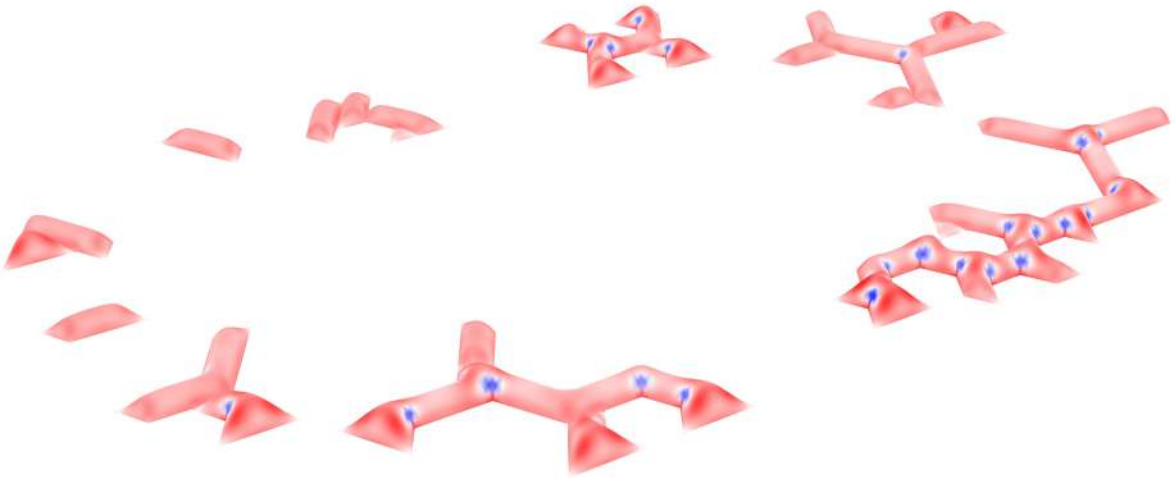


4) Structure Analysis



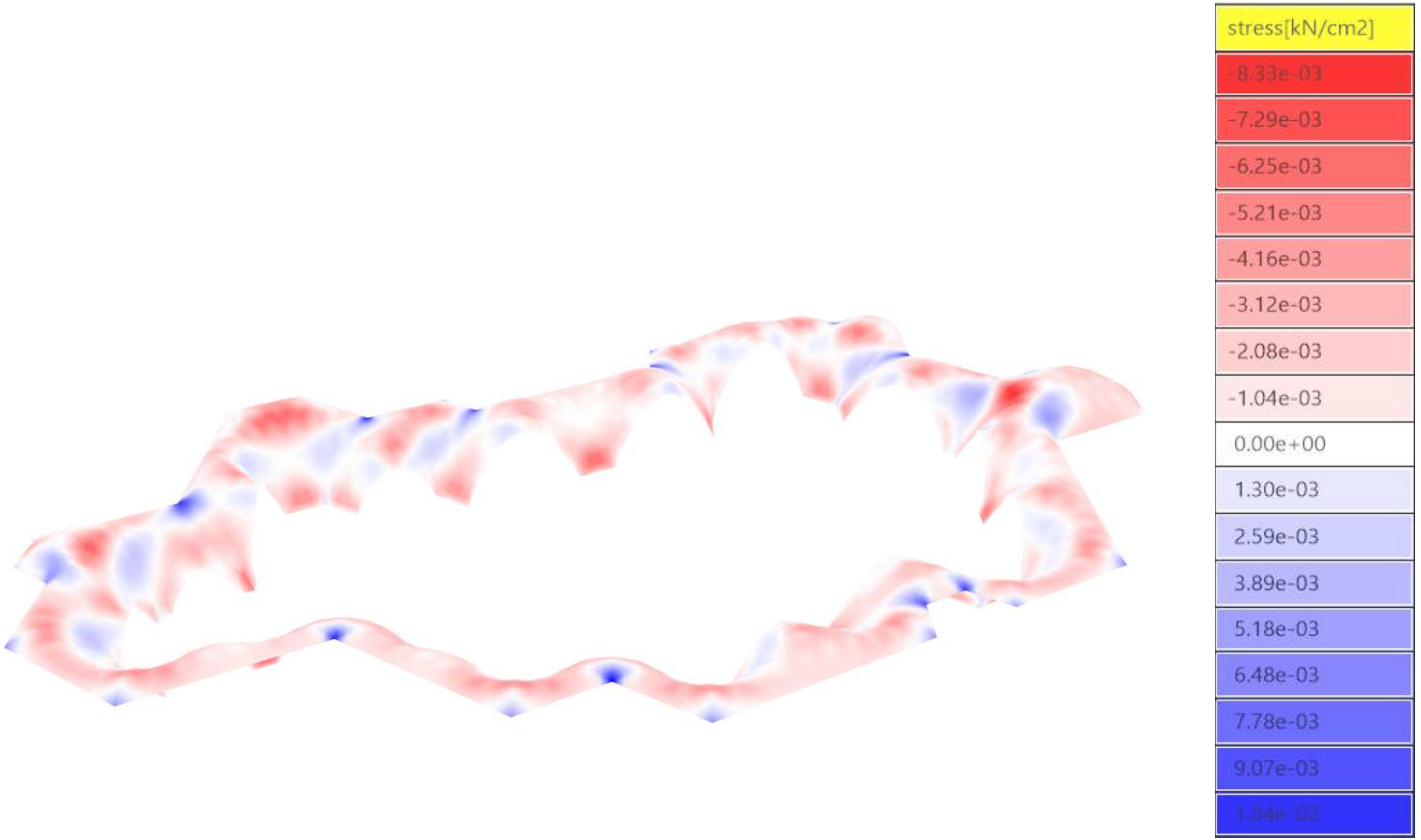


4) Structure Analysis

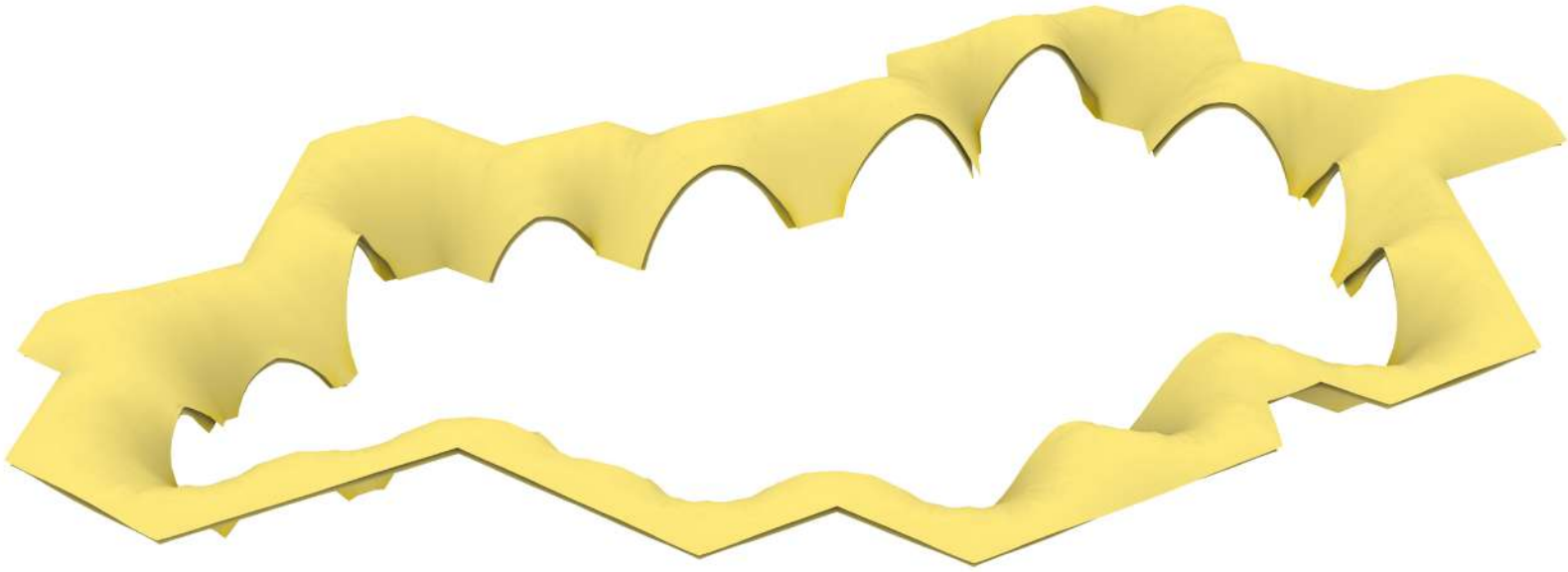


stress[kN/cm2]
-1.51e-03
-1.32e-03
-1.13e-03
-9.42e-04
-7.54e-04
-5.65e-04
-3.77e-04
-1.88e-04
0.00e+00
7.49e-05
1.50e-04
2.25e-04
2.99e-04
3.74e-04
4.49e-04
5.24e-04
5.99e-04

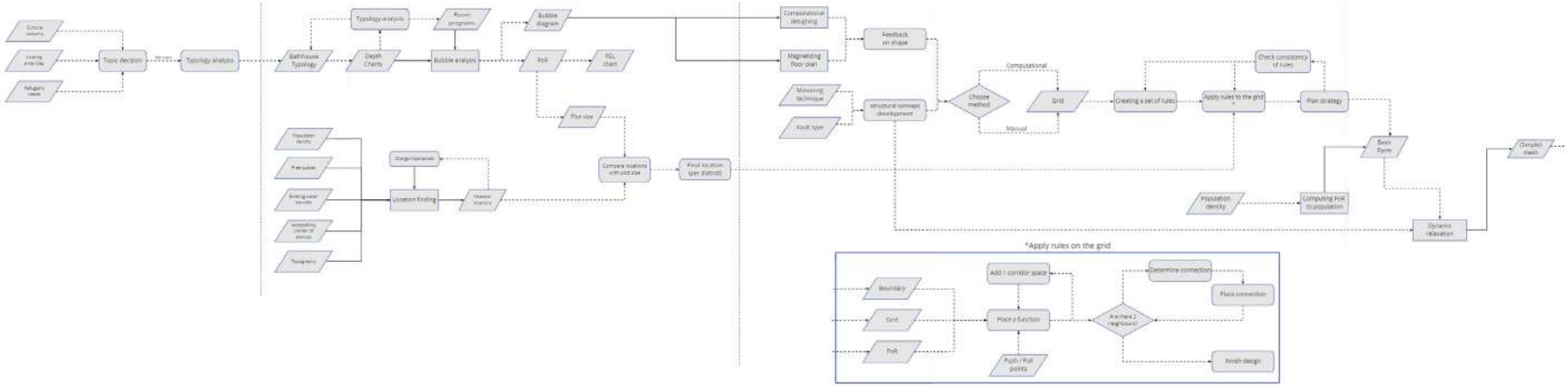
4) Structure Analysis

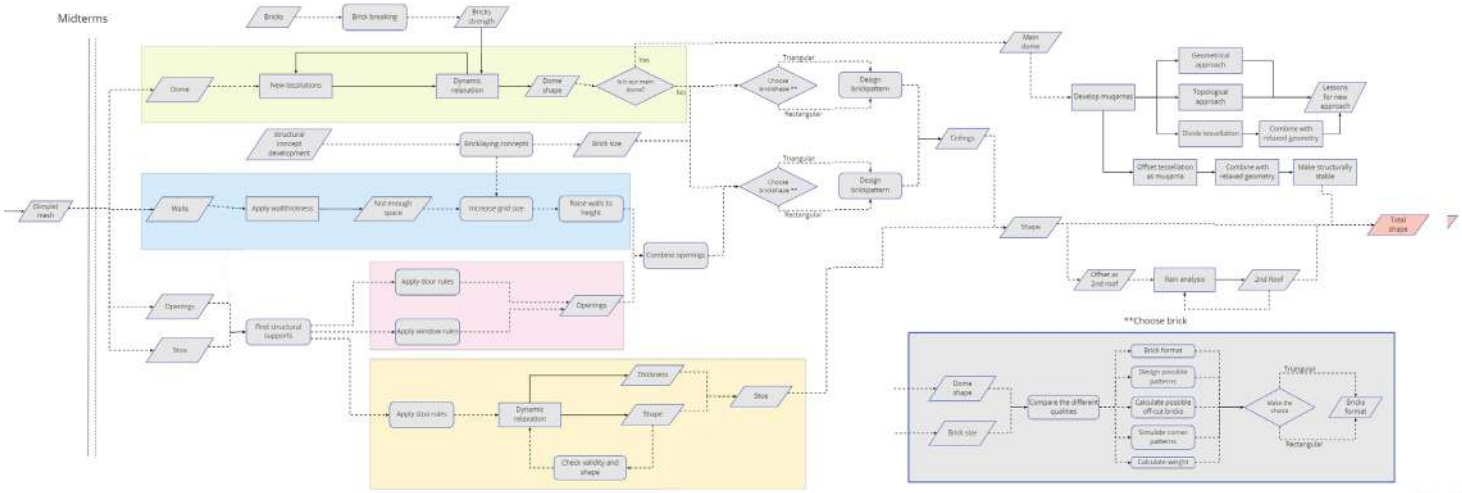


4) Structure Analysis



Flowchart:


Topic decision
Typology analysis
Bathhouse Typology
Depth Charts
Bubble analysis
PoR
Bubble diagram
Computational designing
Feedback on shape
Choose method
Computational
Manual
Grid
Creating a set of rules
Apply rules to the grid
Check consistency of rules
Plan strategy
Basic form
Dynamic relaxation
Population density
Computing PoR to population
Location finding
Compare locations with cost size
Final location (per district)
*Apply rules on the grid
Boundary
Grid
PoR
Add 1 corridor space
Place a function
Push / Pull points
Determine connection
Place connection
Finish design


Midterms
Bricks
Brick breaking
Bricks strength
Dome
New tesselations
Dynamic relaxation
Dome shape
Is it our main dome?
Yes
No
Triangular
Rectangular
Design brickpattern
Main dome
Ceilings
Develop muqarnas
Geometrical approach
Topological approach
Lessons for new approach
Divide tesselation
Combine with relaxed geometry
Offset tesselation as muqarnas
Combine with relaxed geometry
Make structurally stable
Total shape
Shape
Offset as 2nd roof
Rain analysis
2nd Roof
structural concept development
Bricklaying concepts
Brick size
Walls
Apply walkthroughness
Not enough space
Increase grid size
Raise walls to height
Combine openings
Openings
Stair
Find structural supports
Apply door rules
Apply window rules
Openings
Apply stair rules
Dynamic relaxation
Thickness
Shape
Stair
Check validity and shape
**Choose brick
Dome shape
Brick size
Compare the different qualities
Brick format
Design possible patterns
Calculate possible official bricks
Simulate corner patterns
Calculate weight
Make the choice
Brick format

5) Final Product and Visualisation

5) Final Product and Visualisation

Section in length

Thank you for your attention