



MORPHOSIS

A TRIBUTE TO EERO SAARINEN AND
THE NORTH CHRISTIAN CHURCH



EERO

SAAKINEN

MIT CHAPEL INSPIRATION



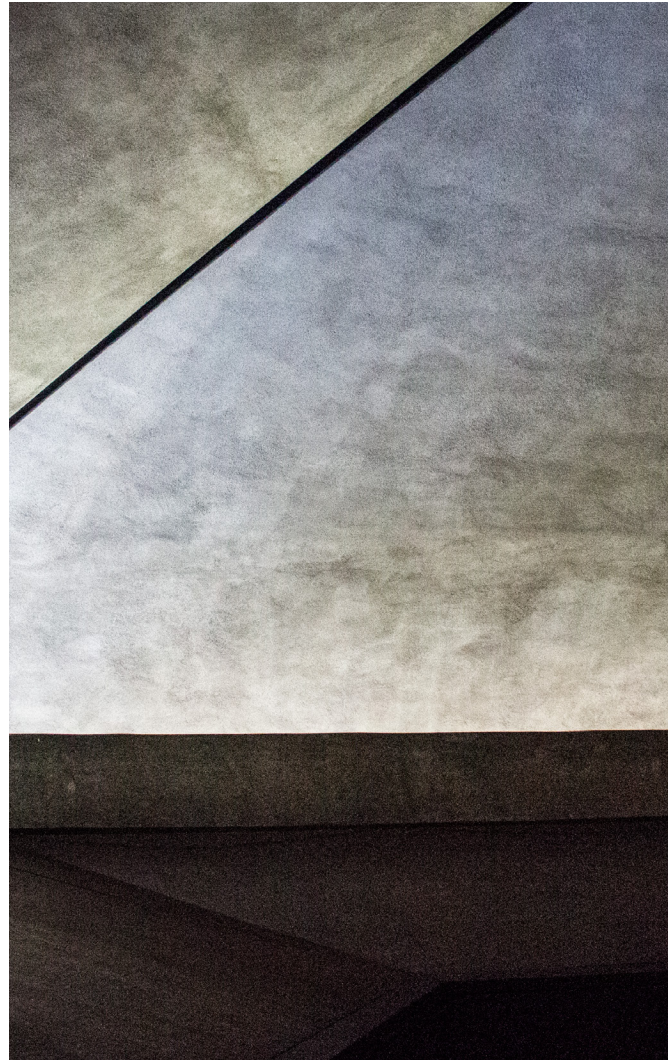
“I have always remembered one night on my travels as a student when I sat in a mountain village in Sparta. There was bright moonlight overhead and there was a soft, hushed secondary light around the horizon. That sort of bilateral lighting seemed best to achieve this other-worldly sense.”

- Eero Saarinen

ORGANIC + CALCULATED

Design Approach of Eero Saarinen

NORTH CHRISTIAN CHURCH INSPIRATION



“As one enters the light also changes, a changing environment, like a decompression chamber from the outside world.”

- Eero Saarinen

COMPRESSION + EXPANSION

Design Approach of Eero Saarinen

“...a building grows from its site.”

- Eero Saarinen

SITE

ANALYSIS

CIRCULATION : OFFSITE APPROACH



● .25 mile radius for likely pedestrian traffic

▲ Primary entrance

▲ Secondary entrance

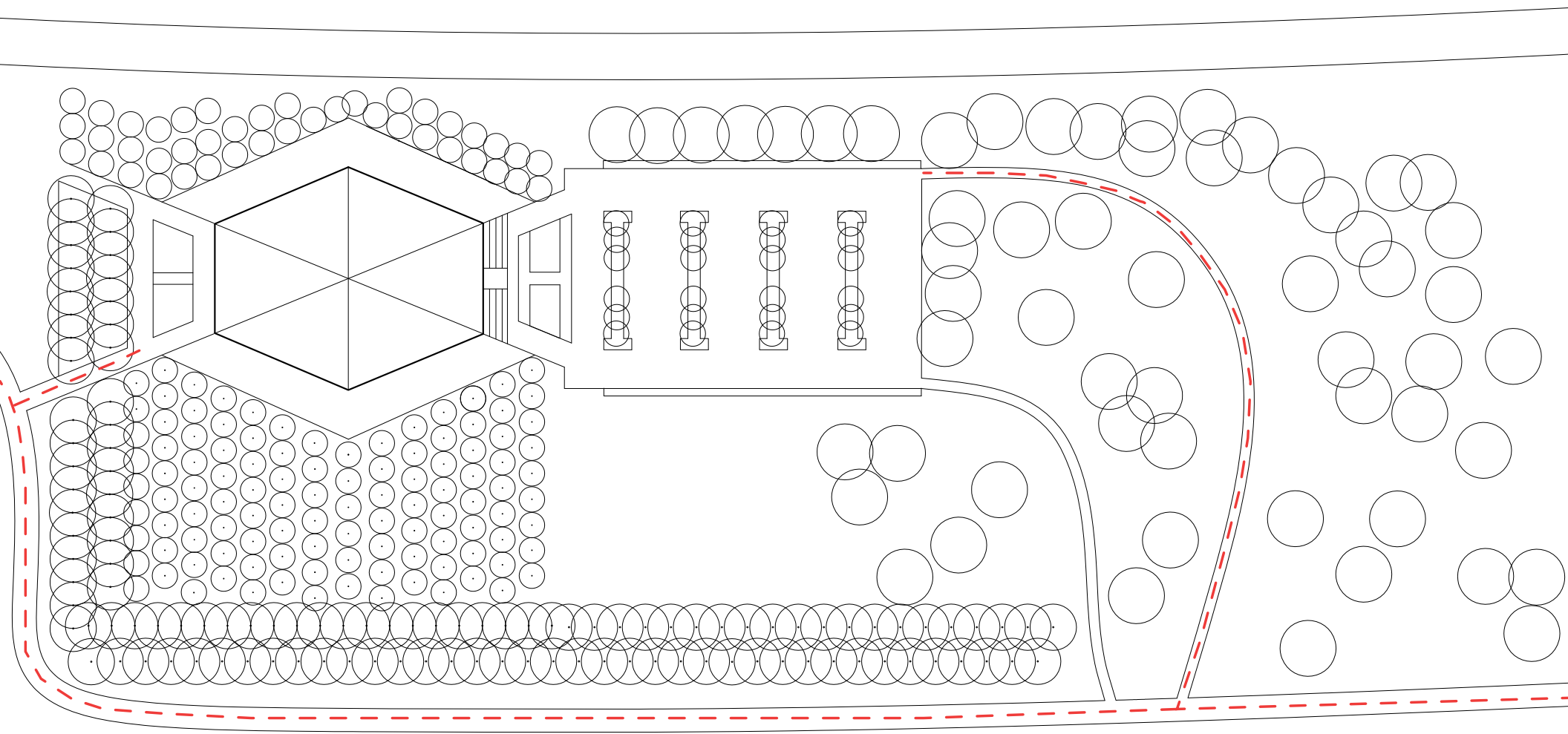
→ Vehicular traffic

● Traffic generators:

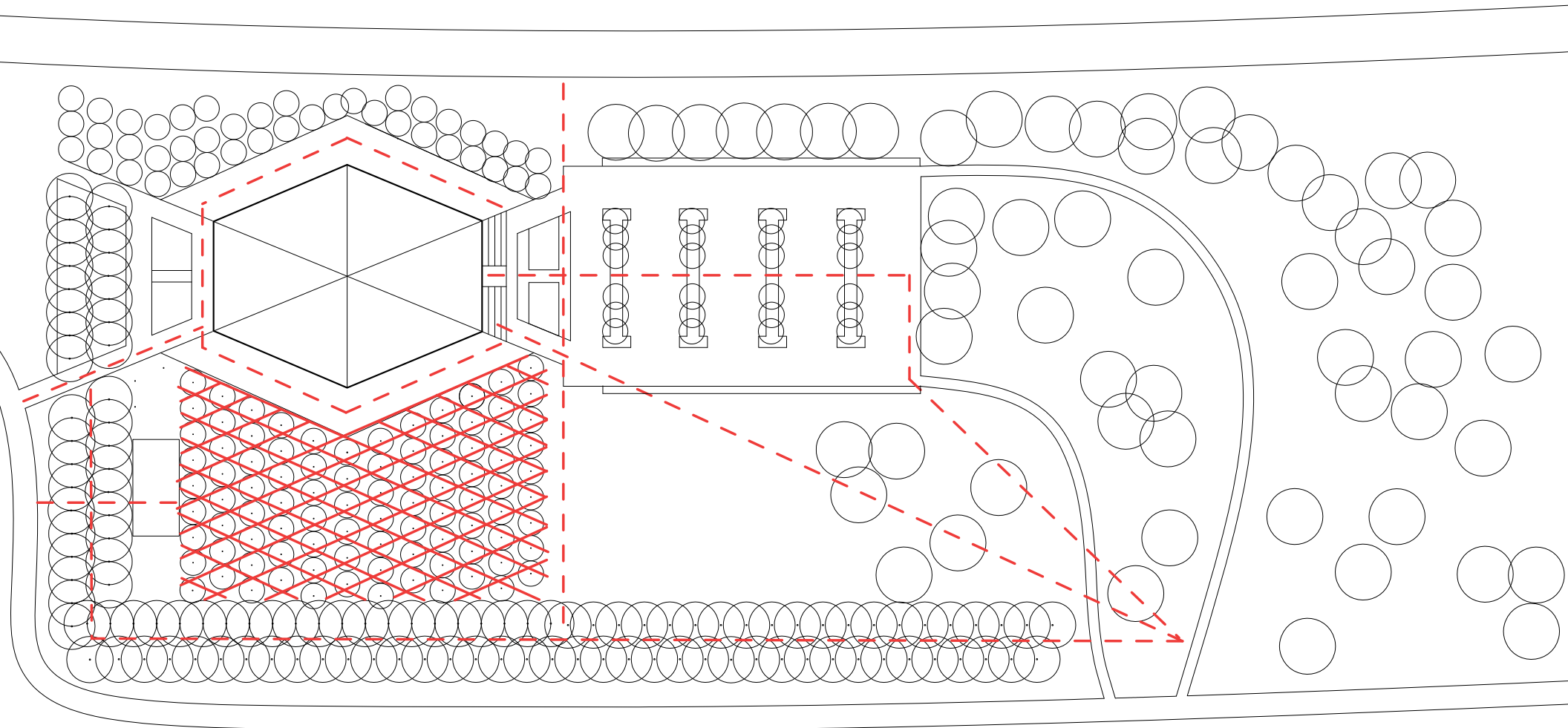
1. 4-way intersection of Washington St. and N National Rd.
2. 4-way intersection of N National Rd. and Home Ave.
3. 4-way intersection of Home Ave. and 27th St.
4. Traffic from downtown Columbus



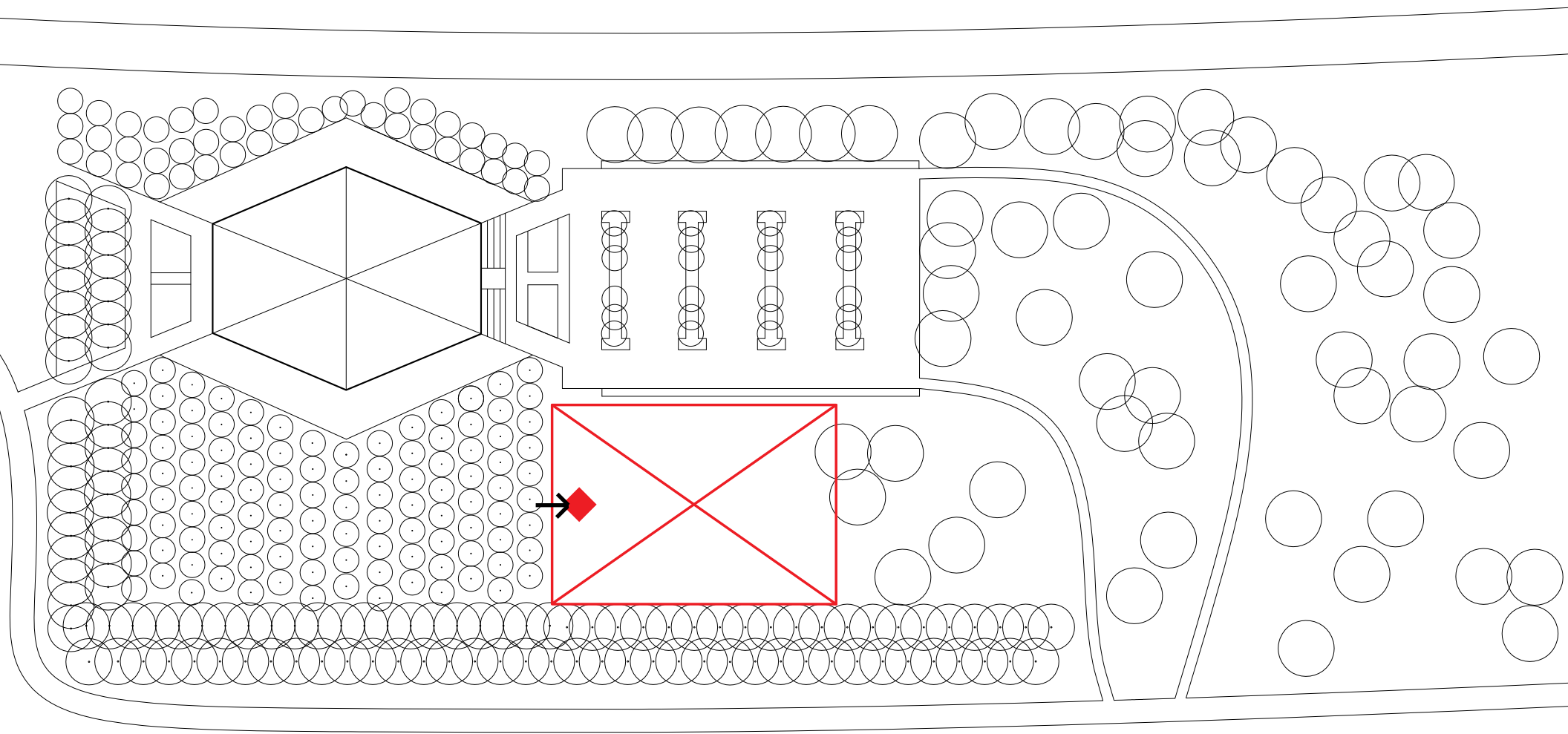
CIRCULATION : VEHICULAR



CIRCULATION : PEDESTRIAN



INSTALLATION LOCATION

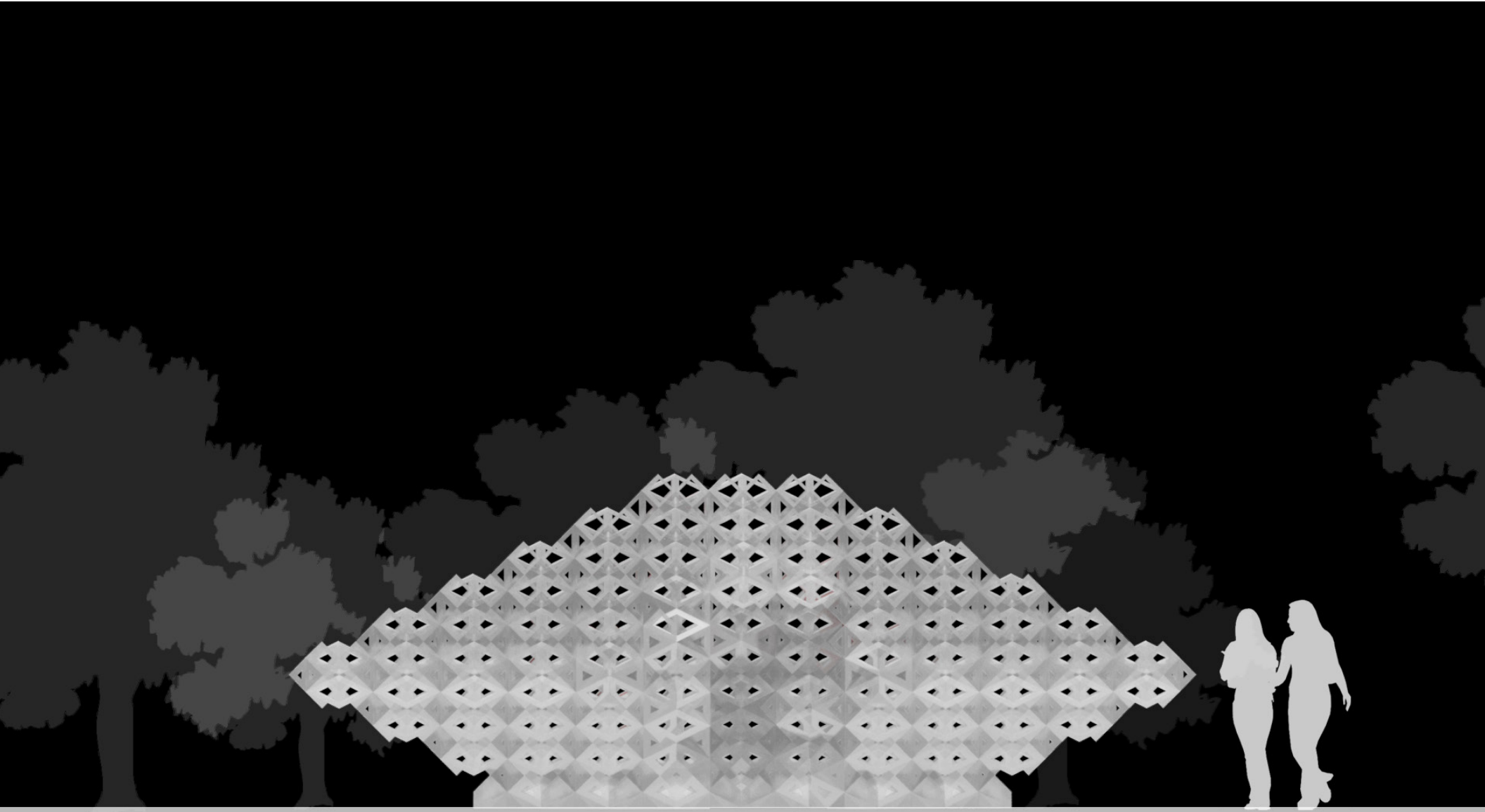


INSTA-

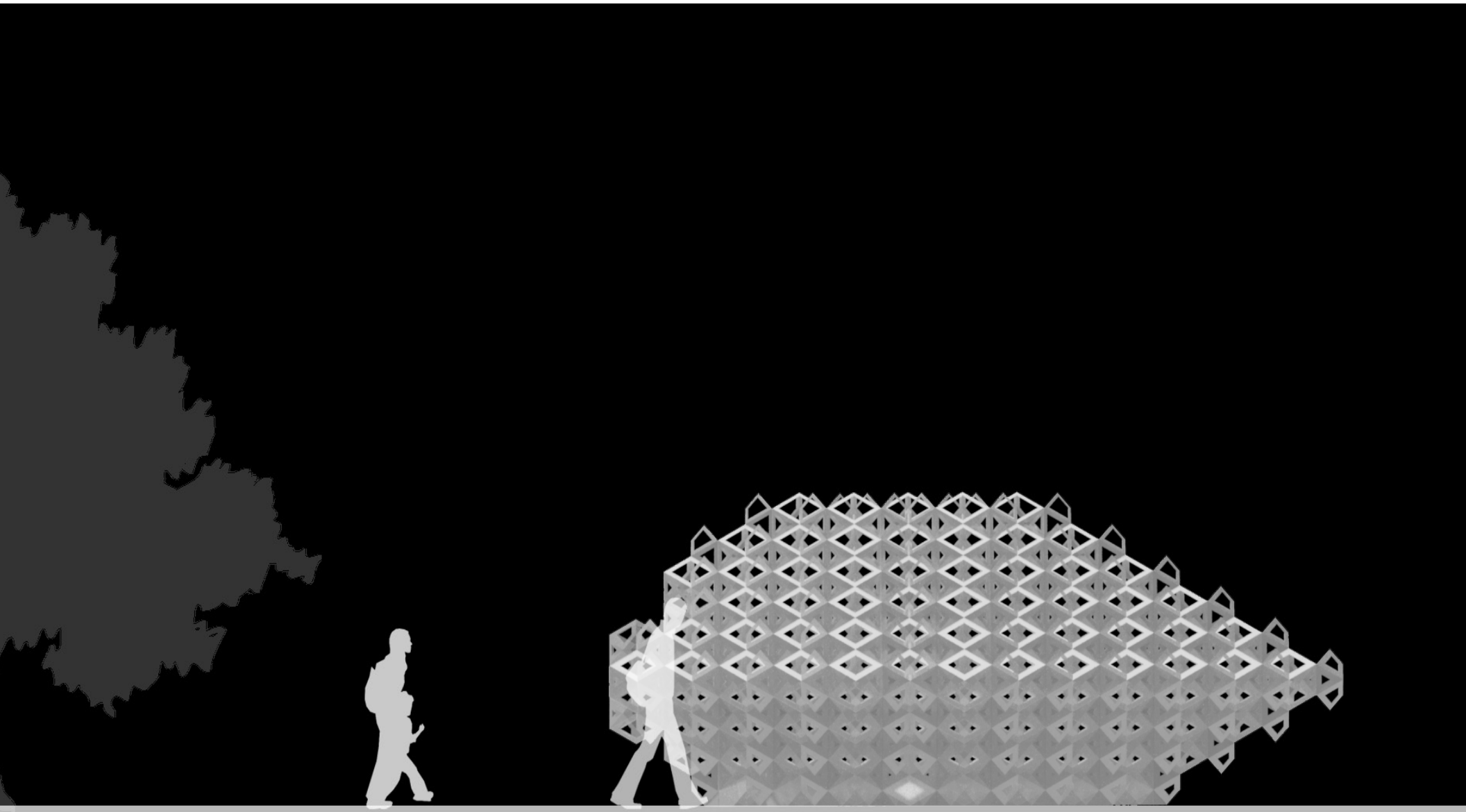
LLATION



INSTALLATION : EAST ENTRY ELEVATION



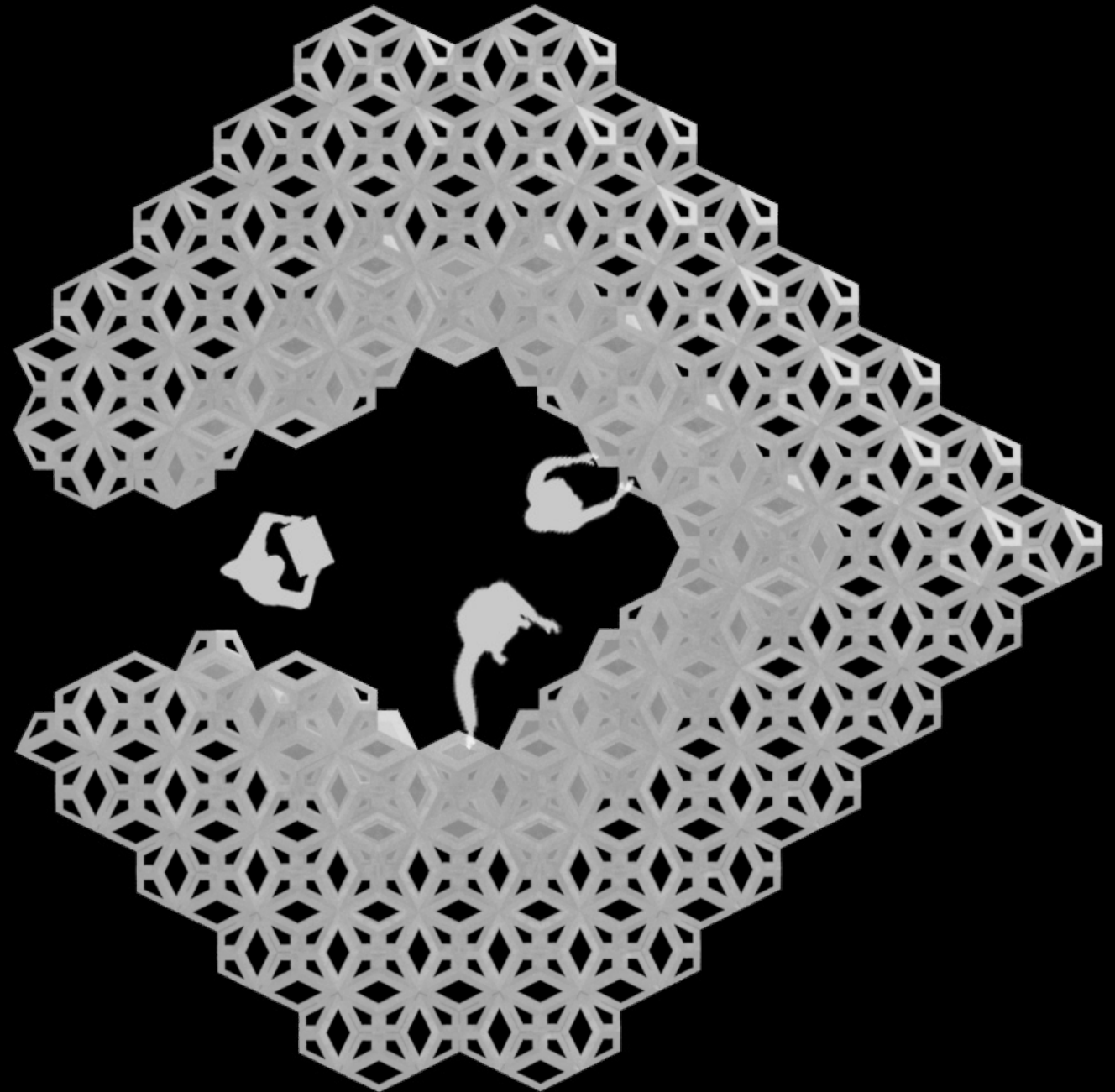
INSTALLATION : NORTH ELEVATION



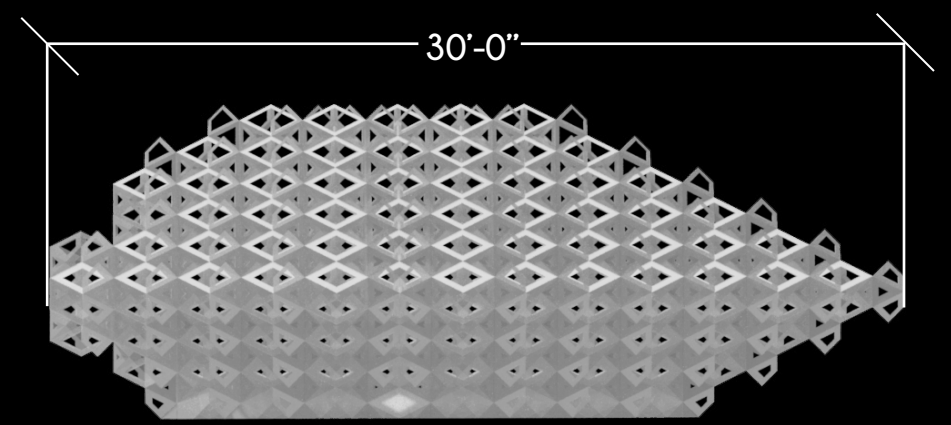
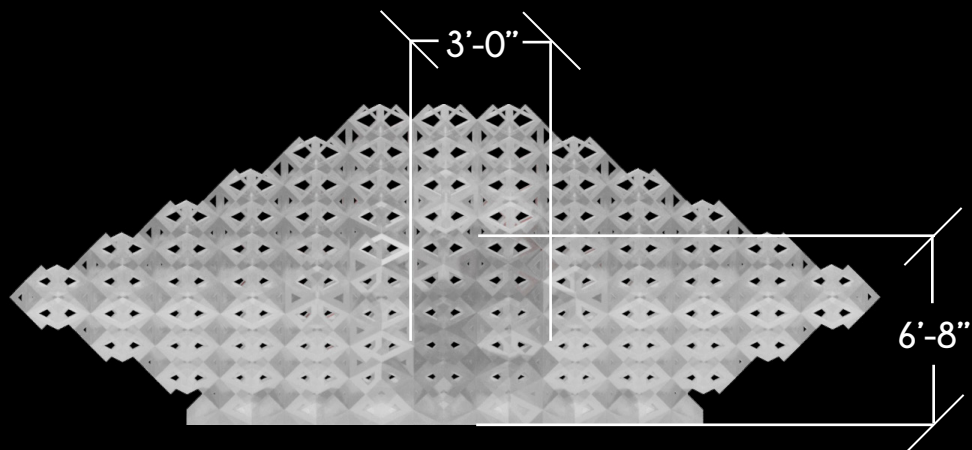
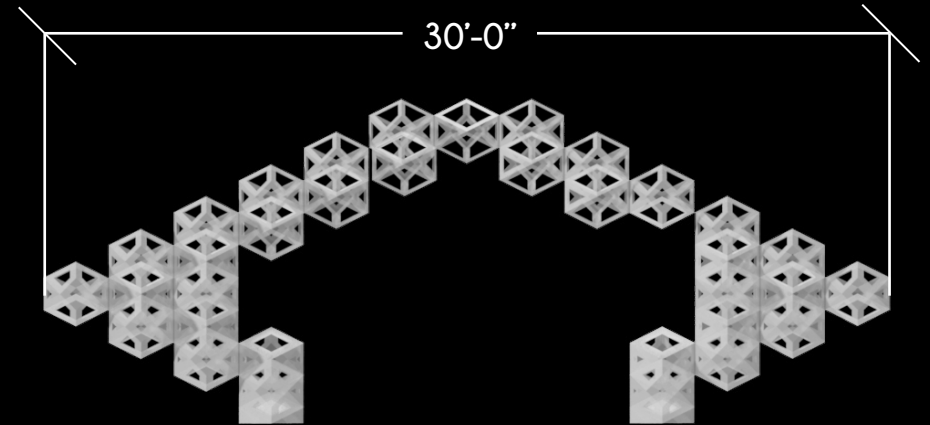
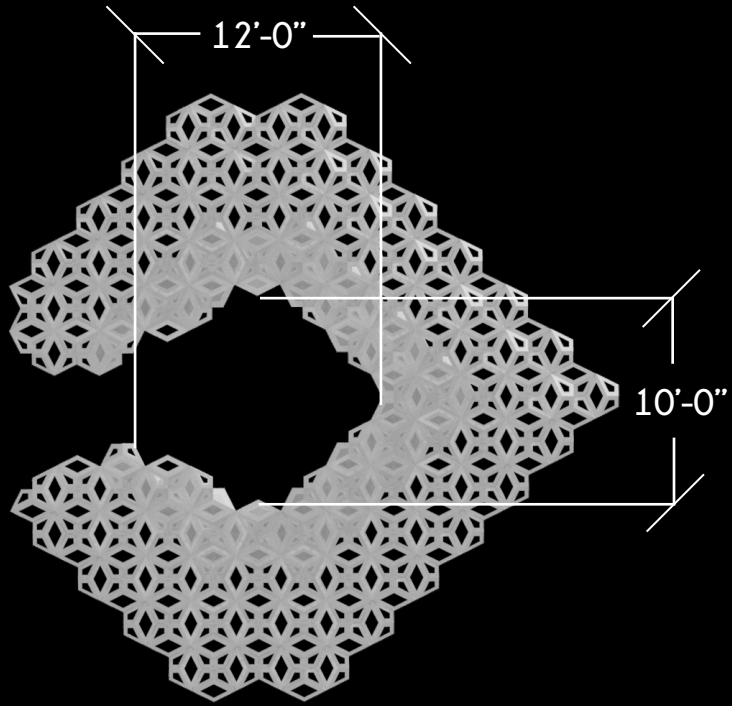
INSTALLATION : WEST SECTION



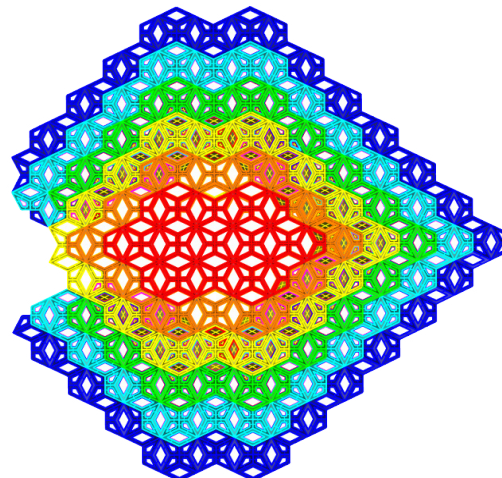
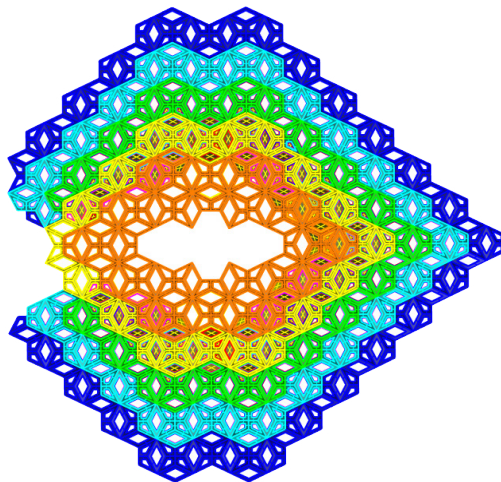
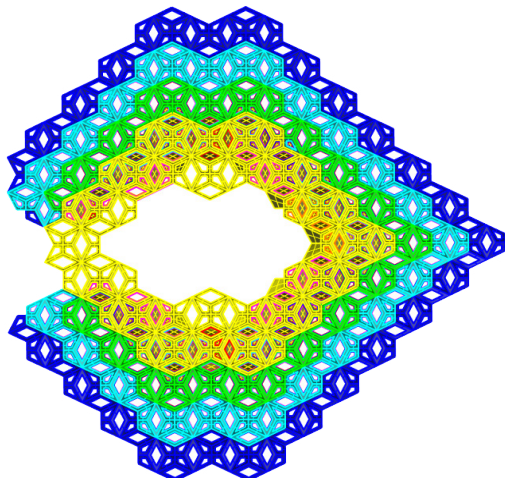
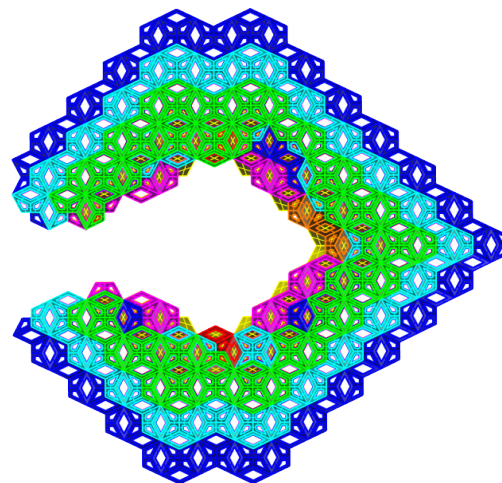
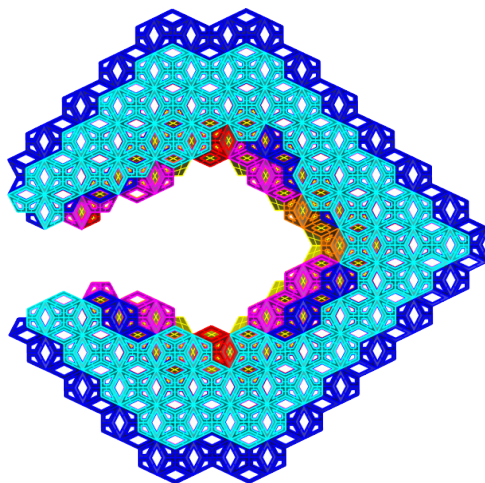
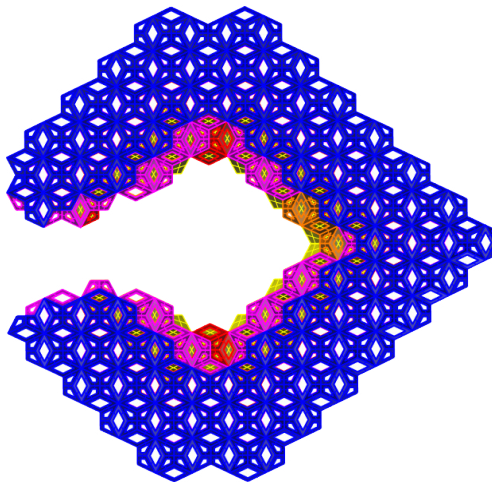
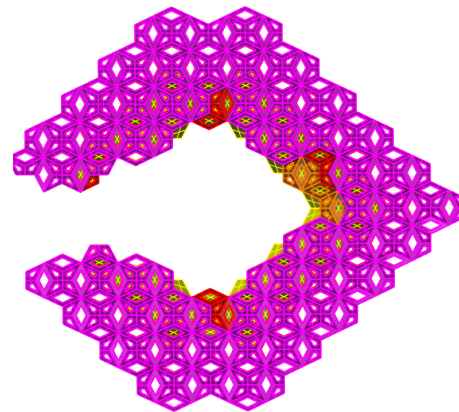
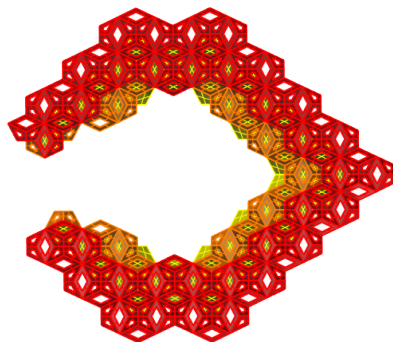
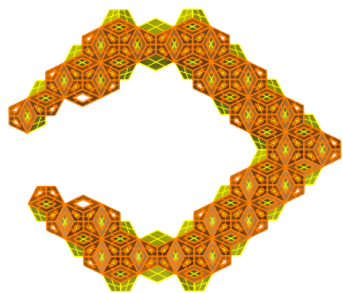
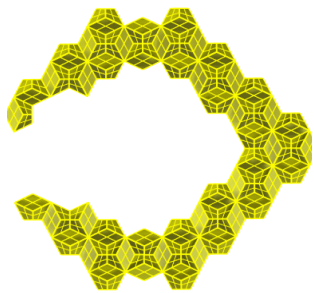
INSTALLATION : PLAN VIEW



INSTALLATION : DIMENSIONS

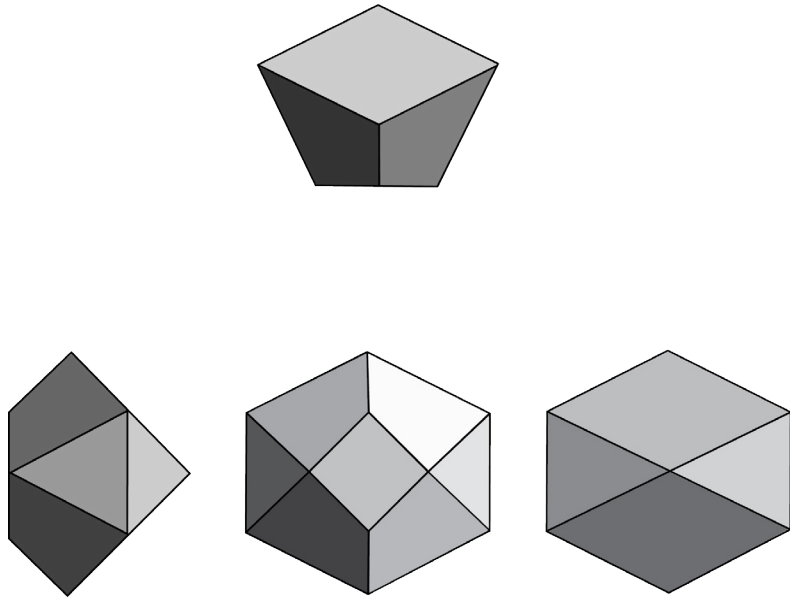


INSTALLATION : LAYERS

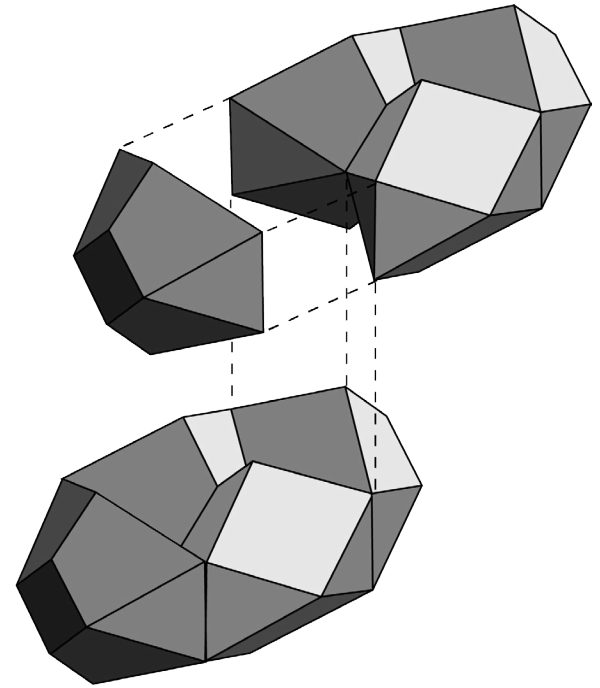


INSTALLATION : BUILDING BLOCKS

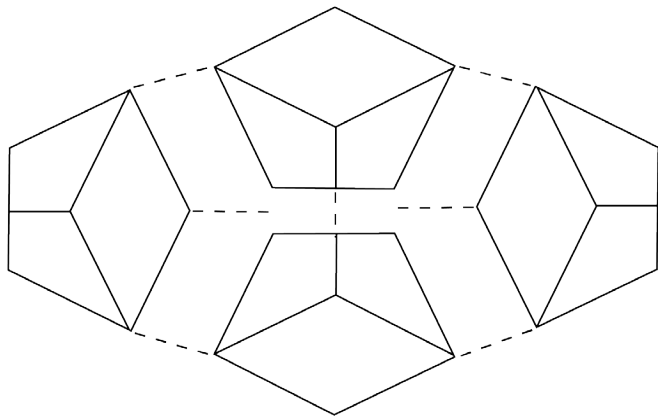
1. UNIT



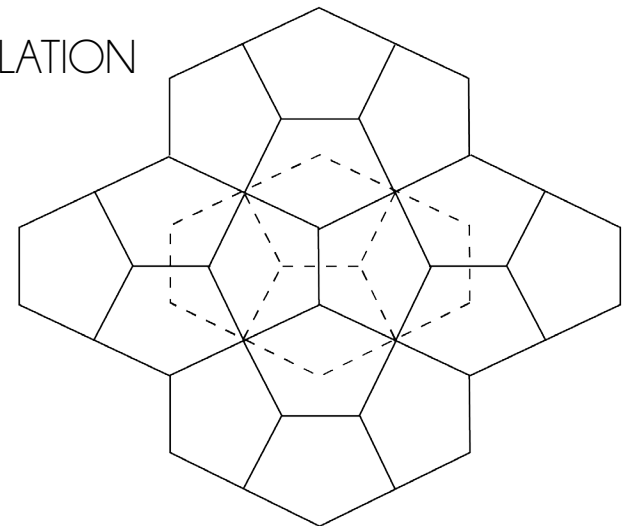
3. STACK



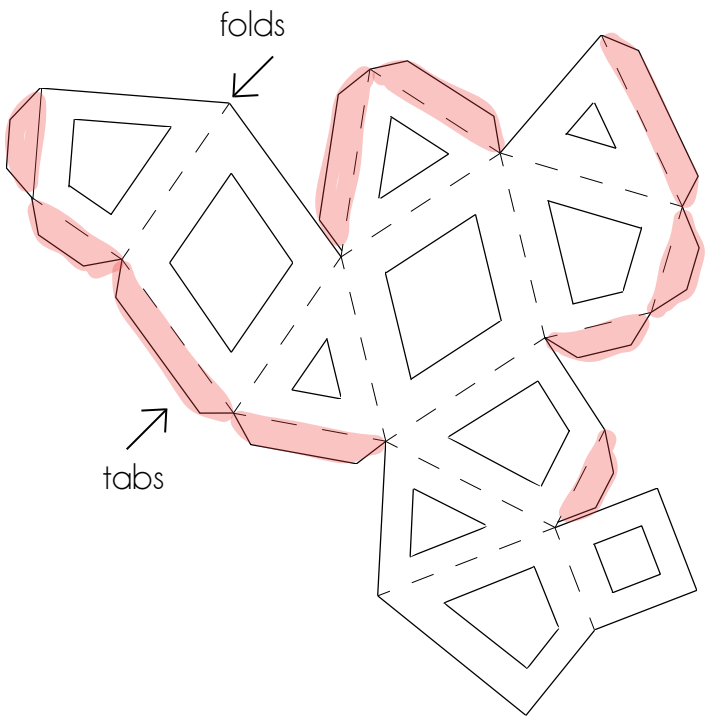
2. BLOCK



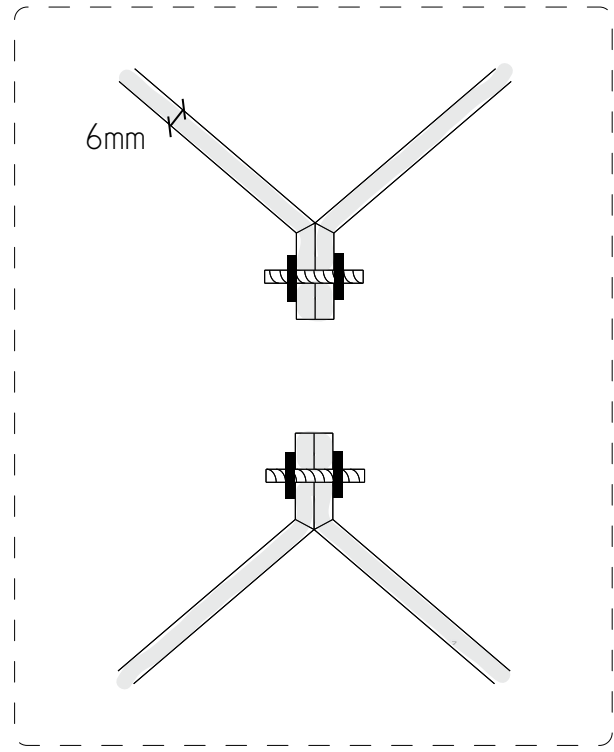
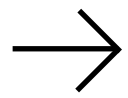
4. TRANSLATION



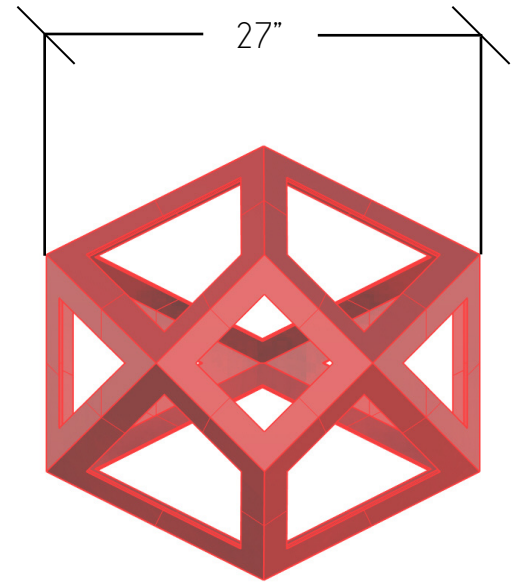
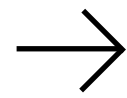
INSTALLATION : ASSEMBLY



TEMPLATE

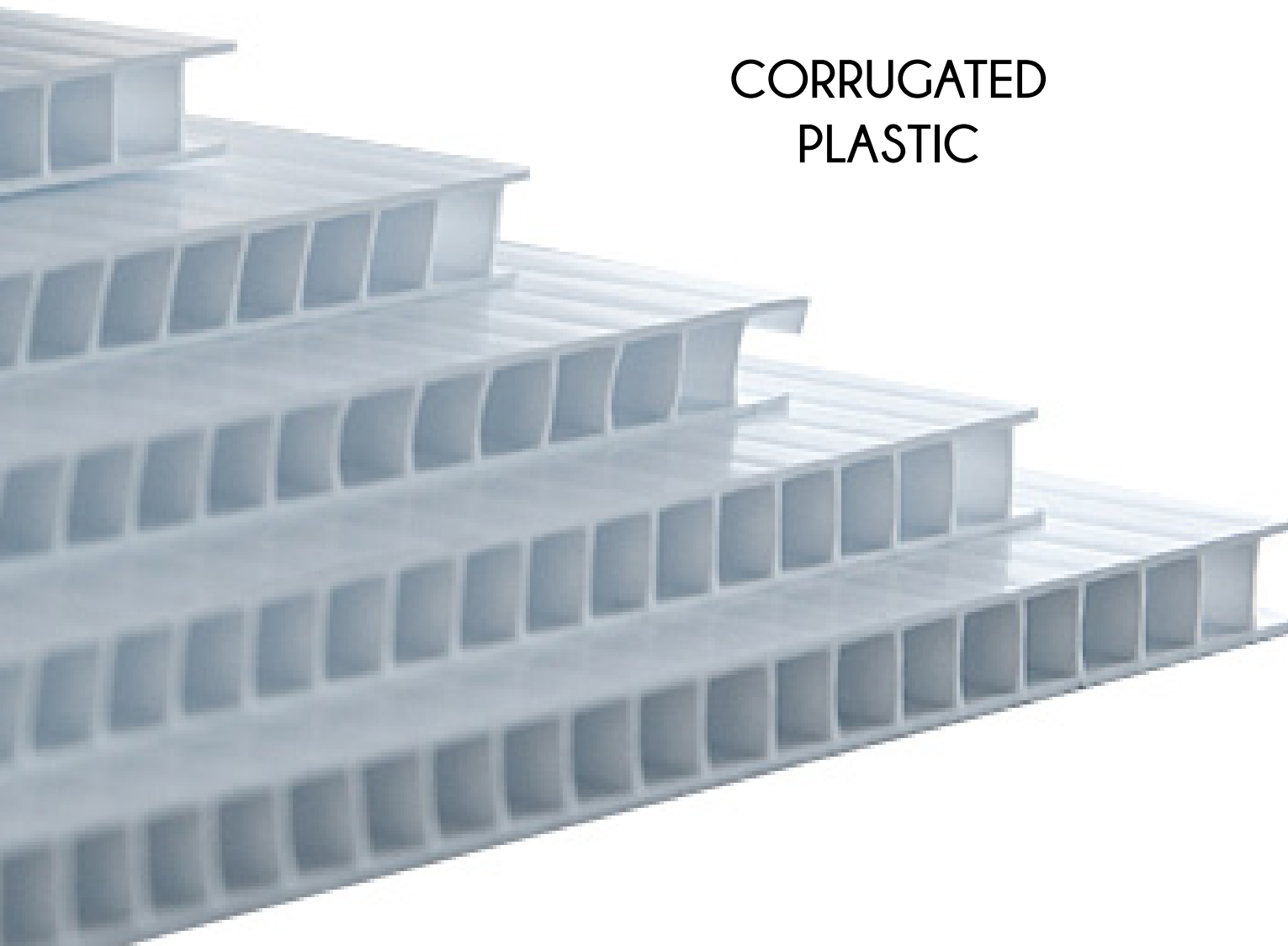


CONNECTIONS



UNIT

INSTALLATION : MATERIAL



CORRUGATED PLASTIC

TRANSLUCENT

6mm THICK

48" x 96" FORMAT

RECYCLABLE

UV INHIBITOR

WATERPROOF

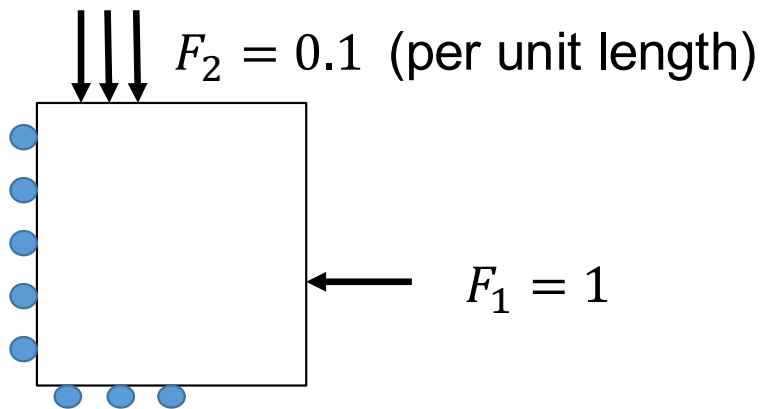
STRENGTH IN
FOLDS AND LAYERS

INSTALLATION : BUDGET

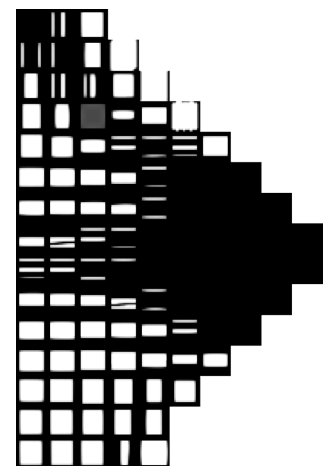
ITEM	PRICE	QUANTITY	ESTIMATE
Corrugated Plastic Sheet 6mm	\$12 per sheet	583 sheets	\$7,000
Plastic Screws and Bolts	\$0.12 per piece	16,000 pieces	\$2,000
Vinyl Stickers	\$10 per sticker	15 stickers	\$150
Estimated Total:			\$9,150
Budget:			\$10,000

INSTALLATION : STRUCTURAL ANALYSIS

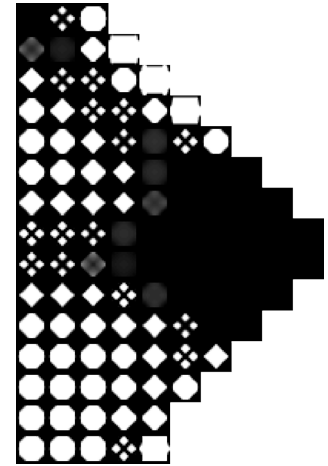
THE CONCEPT SECTION DESIGN FROM MULTISCALE-TOPOLOGY OPTIMIZATION



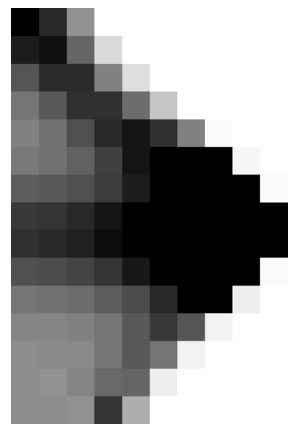
Non-periodic assumption



Max bulk moduli (opt1)

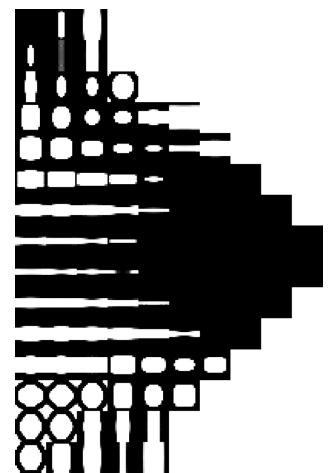


Max shear moduli (opt1)

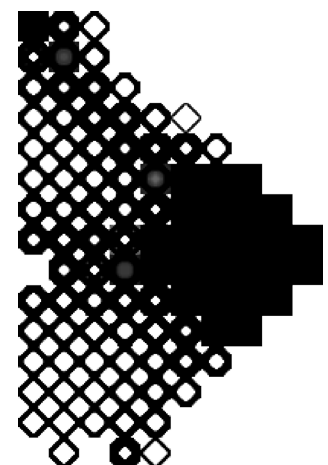


Volume fraction distribution (opt1)

Periodic assumption



Max bulk moduli (opt2)

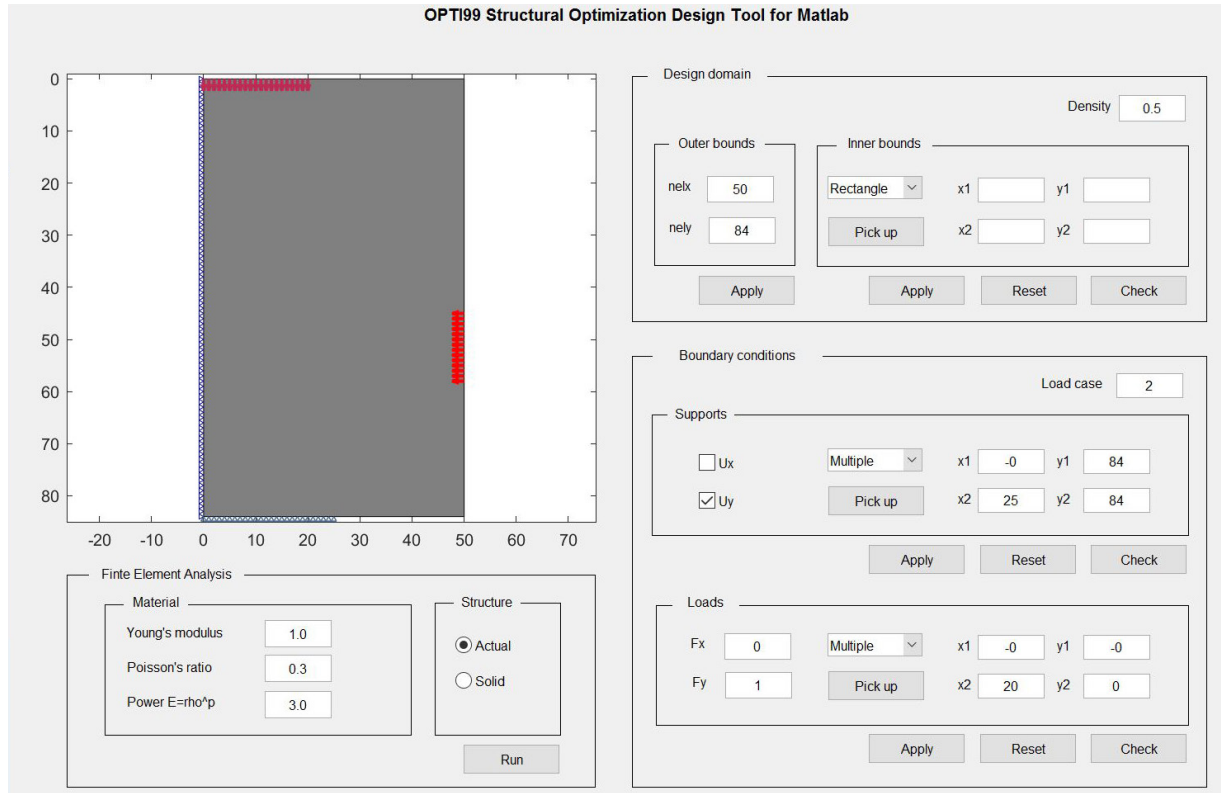
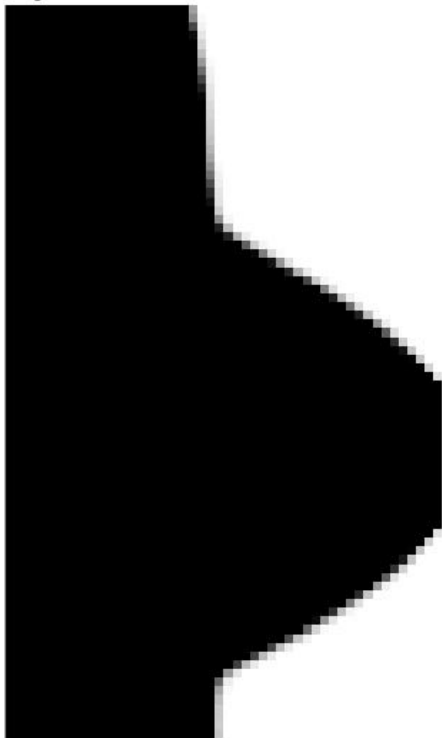


Max shear moduli (opt2)

The figure above shows the optimized solutions for two conditions: Maximum bulk modulus and maximum shear modulus. Bulk modulus gives us an idea about how resistant to compression the structure is. The Shear Modulus gives us the likelihood of deformation when subjected to a shearing force.

INSTALLATION : STRUCTURAL ANALYSIS

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These structures were obtained using separate optimization codes in MATLAB.

The results show that the outer edges of the structure should be solidified for sustaining the side loads. However, a more rigid design would require a solid base to support the structure against its own weight.

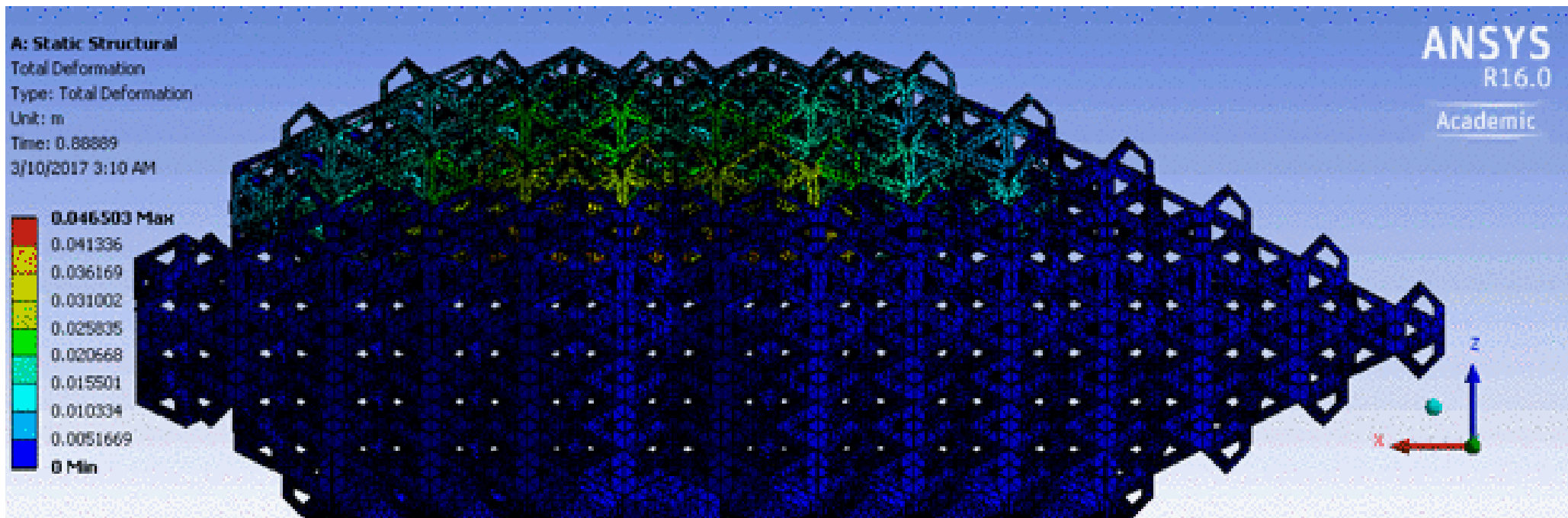
Fabrication:

1. The structure will consist of 756 bisymmetric hendecahedrons.
2. Each of the hendecahedron units shall be manufactured and then bolted remotely and the fabricated structure shall be shifted to the installation venue for final installation.
3. Since the objective is to have minimum compliance for the structure, the base elements used can be made solid.

Assembly:

1. To obtain a rigid installation after assembly, following possible alternatives are suggested: Add supports to base layer of units or solidify base units.
2. The hendecahedrons can be bolted using plastic/metal bolts. They can also be glued using an adhesive provided the material withstands the wind loads
3. If necessary, supporting structures can be used at the outer edges of the structure in order to improve the load sustaining capacity.

INSTALLATION : STRUCTURAL ANALYSIS



Installation Form Material: Corrugated Plastic (Polypropylene)

1. Mechanical Properties (considering sheet of 6mm)

Unit weight = 1400 g/m^2

Flat crush resistance = 230 lb/in^2

Tensile strength = 38 MPA

Young's modulus = 1250 MPA

Elongation at break(50mm/min) = 800%

2. Physical Properties

Water absorption = 0.03% in 24 hours

Melting temperature = 165 degree Celsius

Vicat softening point = 78-148 degree Celsius

Results

1. Deformation:

The maximum and minimum values for deformation were found to be -

Max - 0.406 m

Min - 0.005 m

2. Von Mises Stress:

Max - $5.52 \times 10^6 \text{ Pa}$

Min - $4.614 \times 10^6 \text{ Pa}$

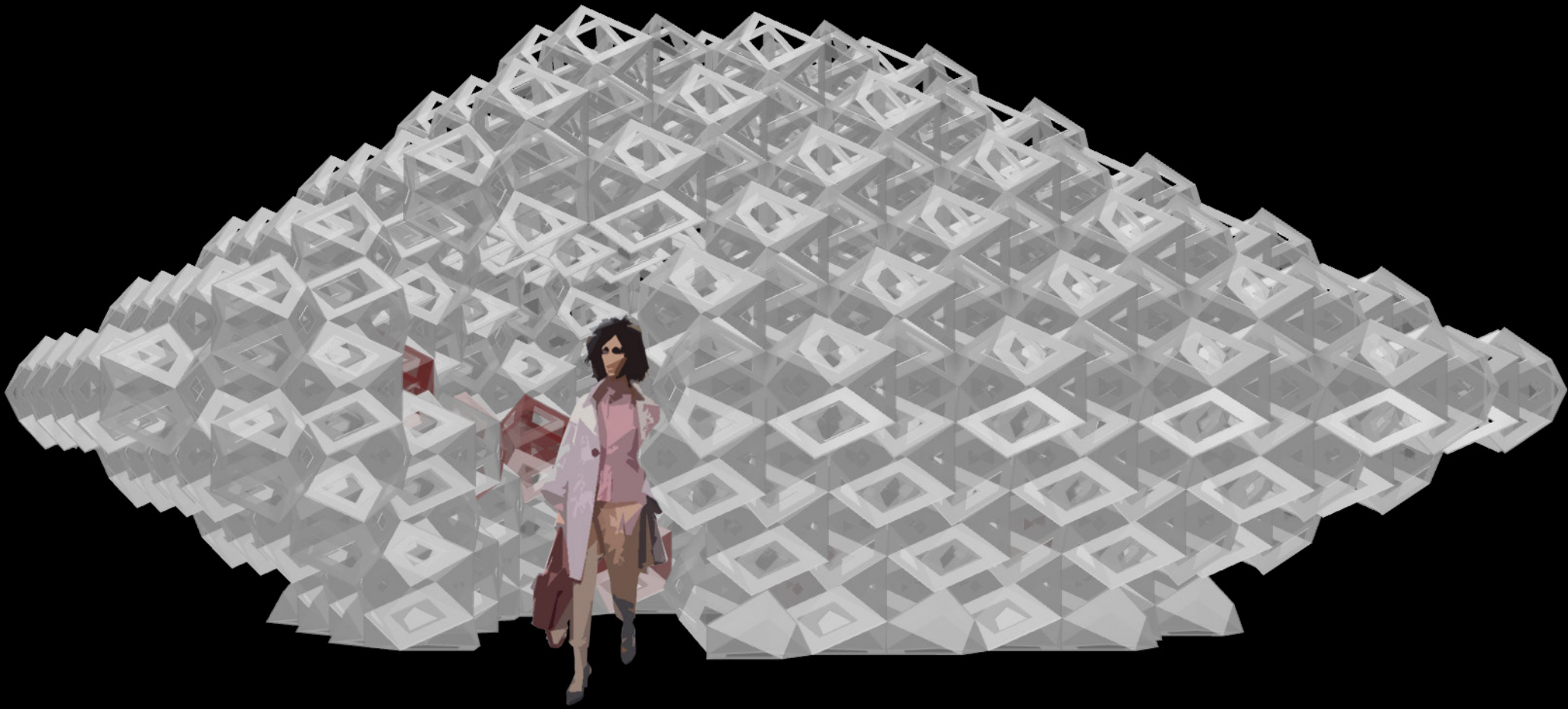
Solutions

1. Brace layer 6 and up from interior

2. Create more rigid form to eliminate stress

EXPER -

IENCE



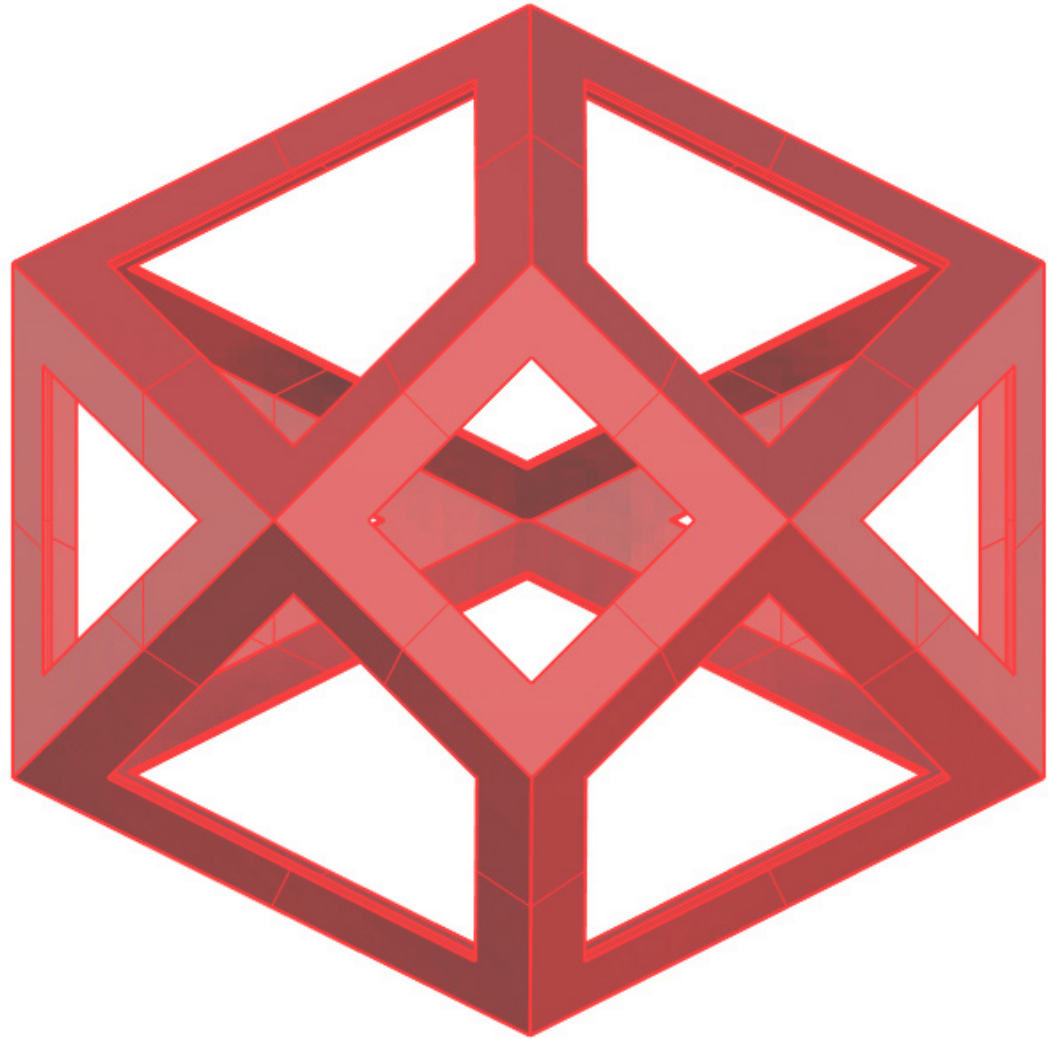
“...the congregation should have a positive feeling of being within the church, in a special, enclosed spiritual world.”

- Eero Saarinen

EXPERIENCE : TRIBUTE

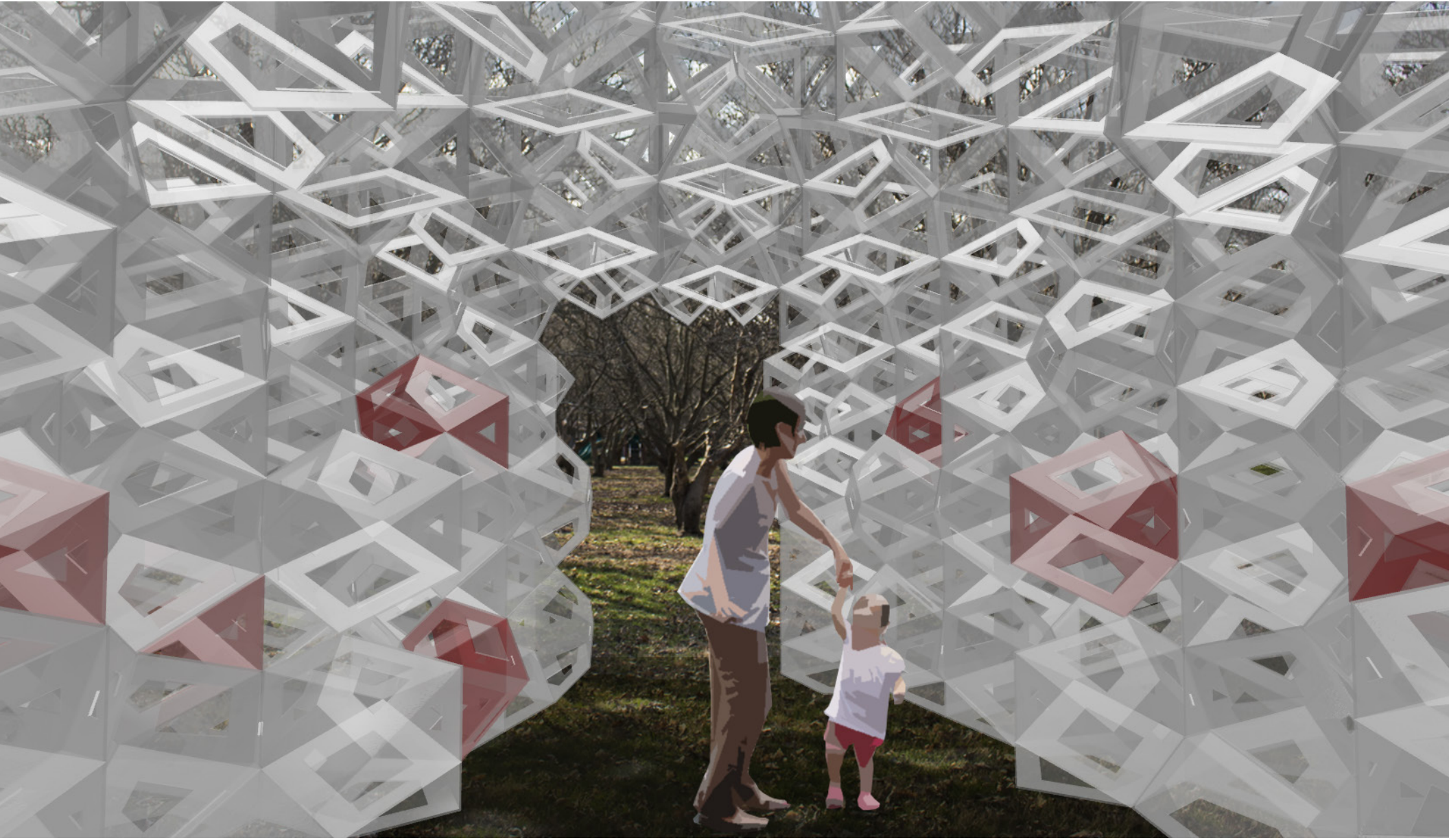
We would like to ask the remaining Disciples of Christ to write a sentence or two describing what the North Christian Church means to them.

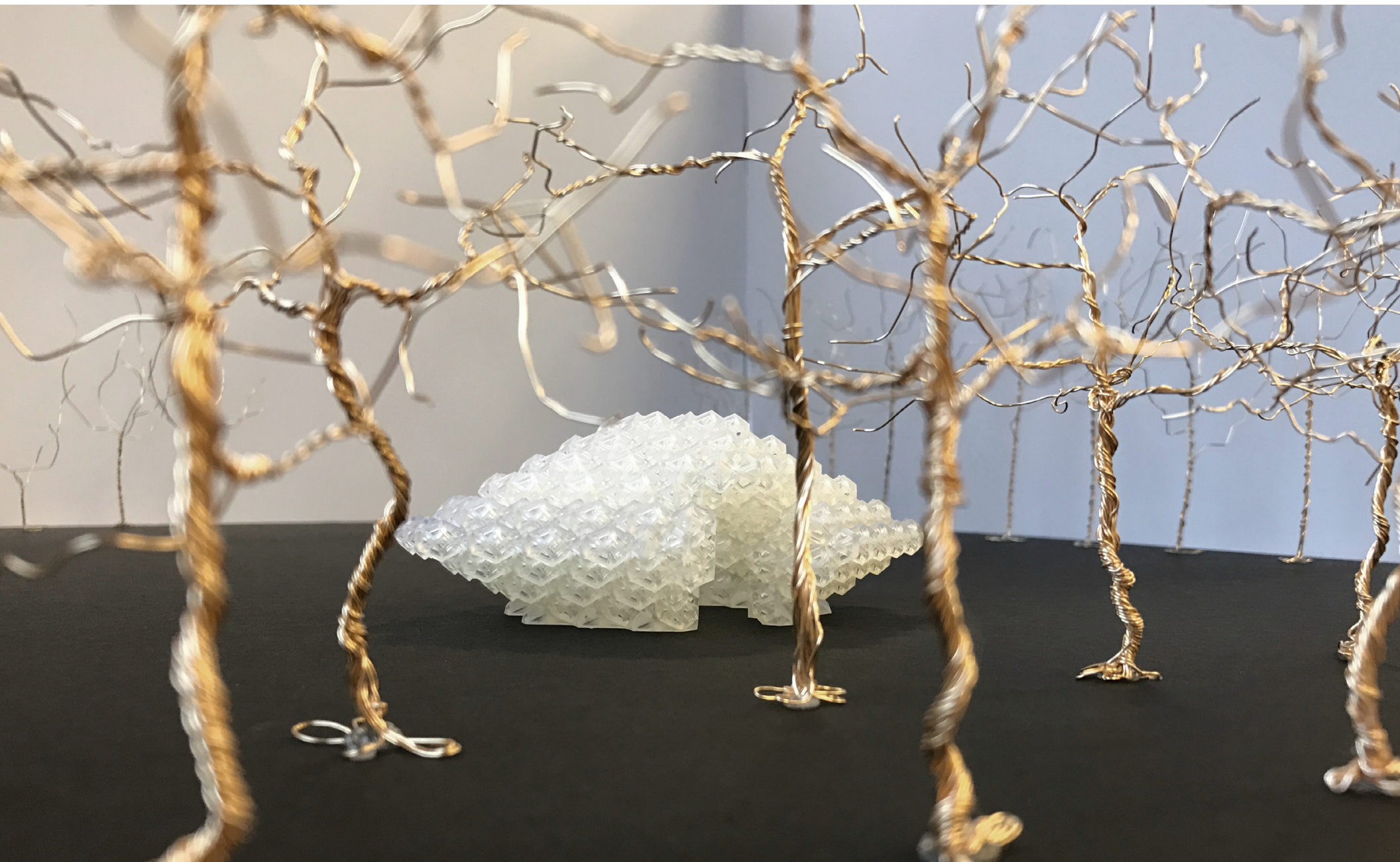
Using vinyl stickers, we will put these responses on the red units within our installation.

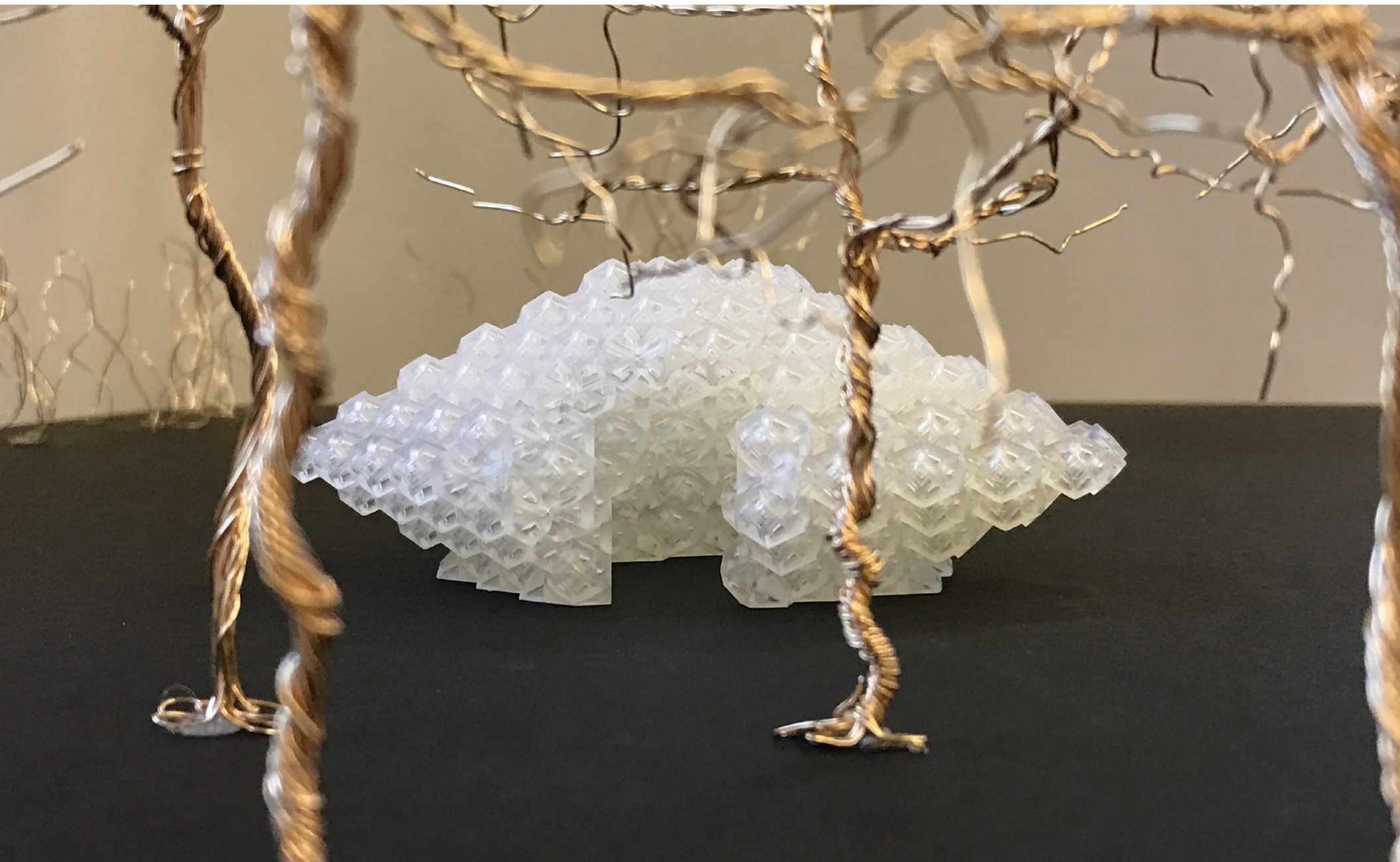


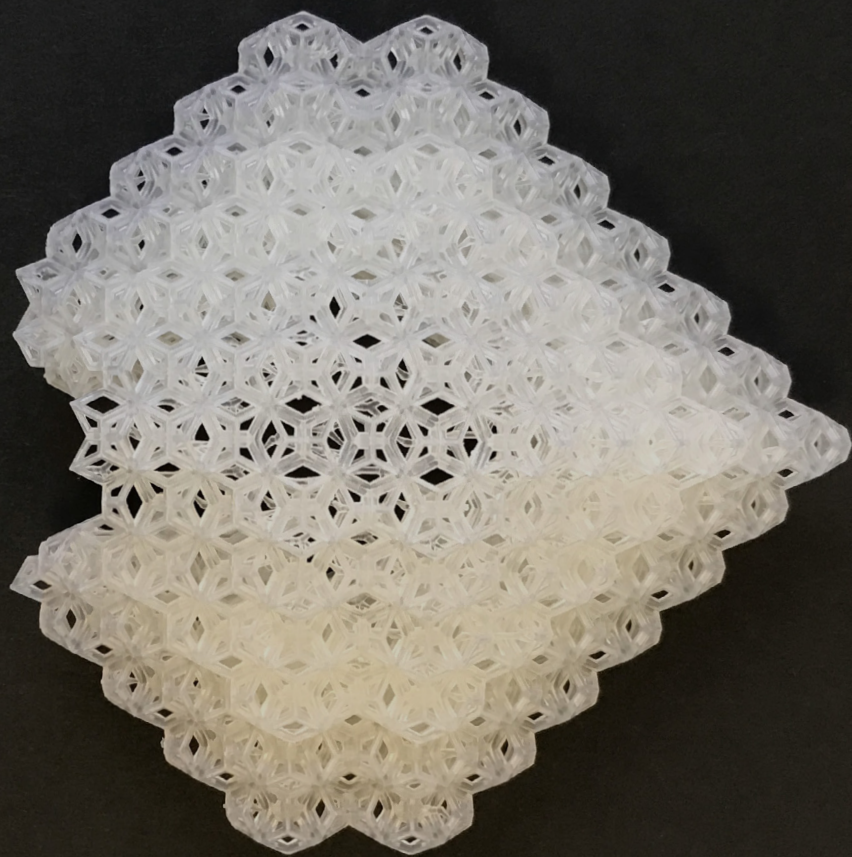


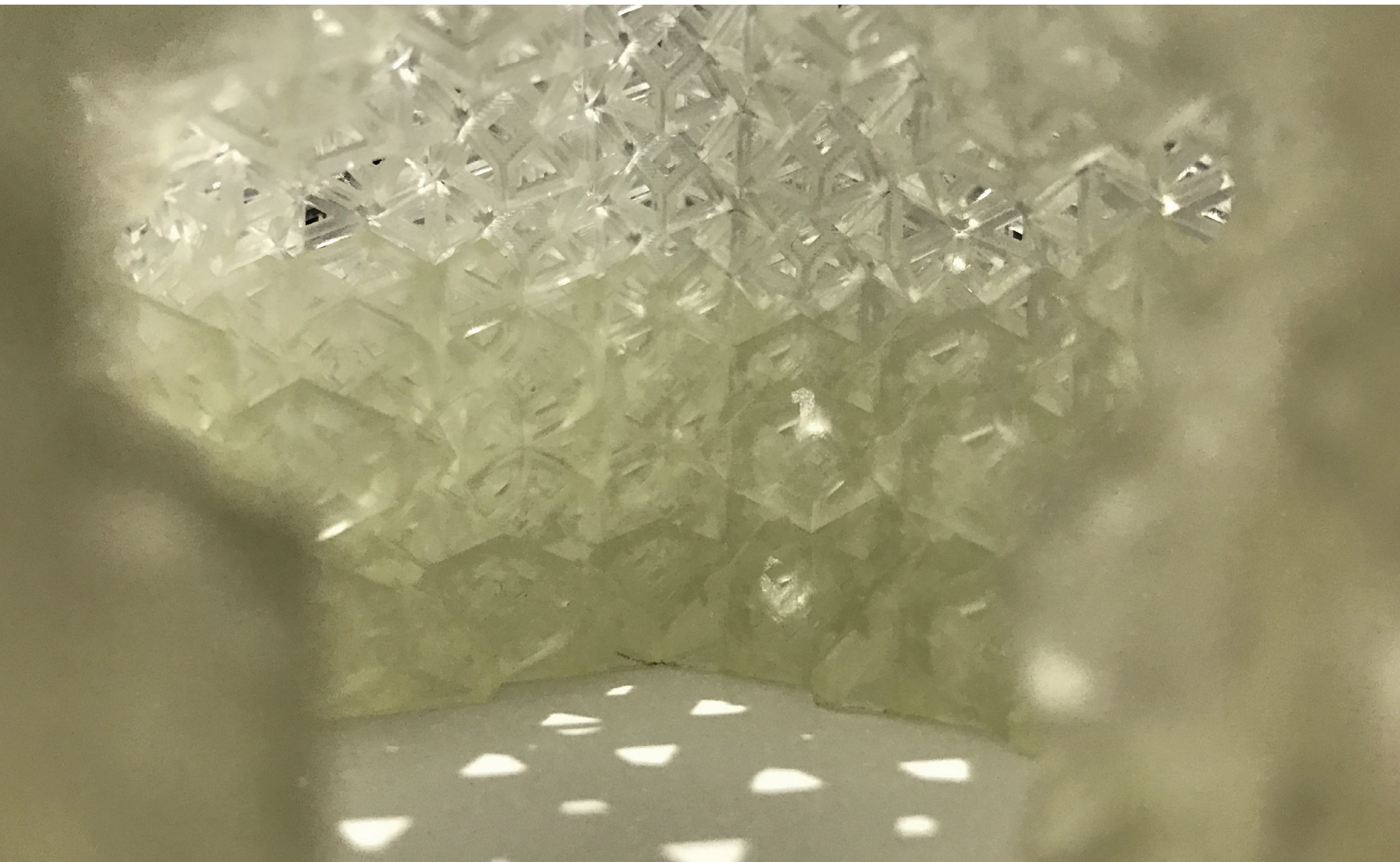


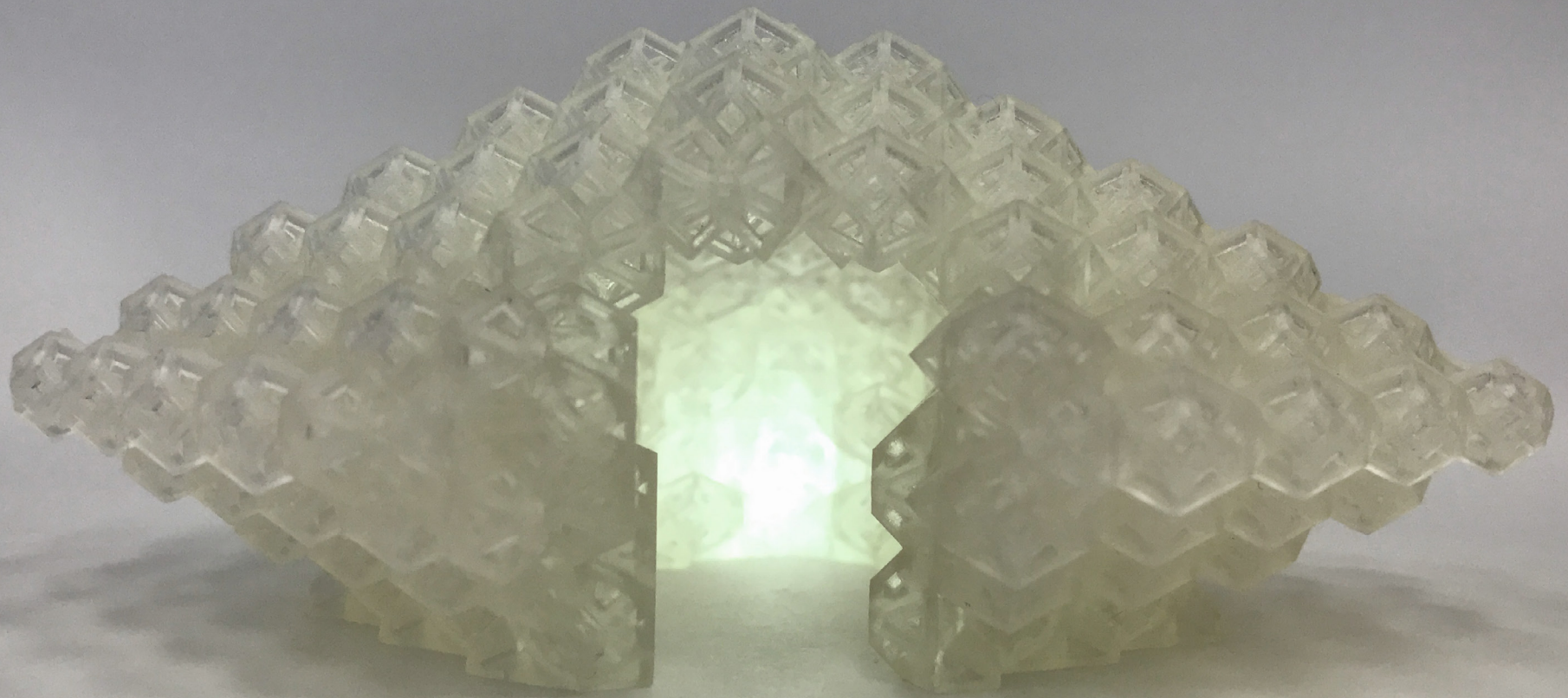


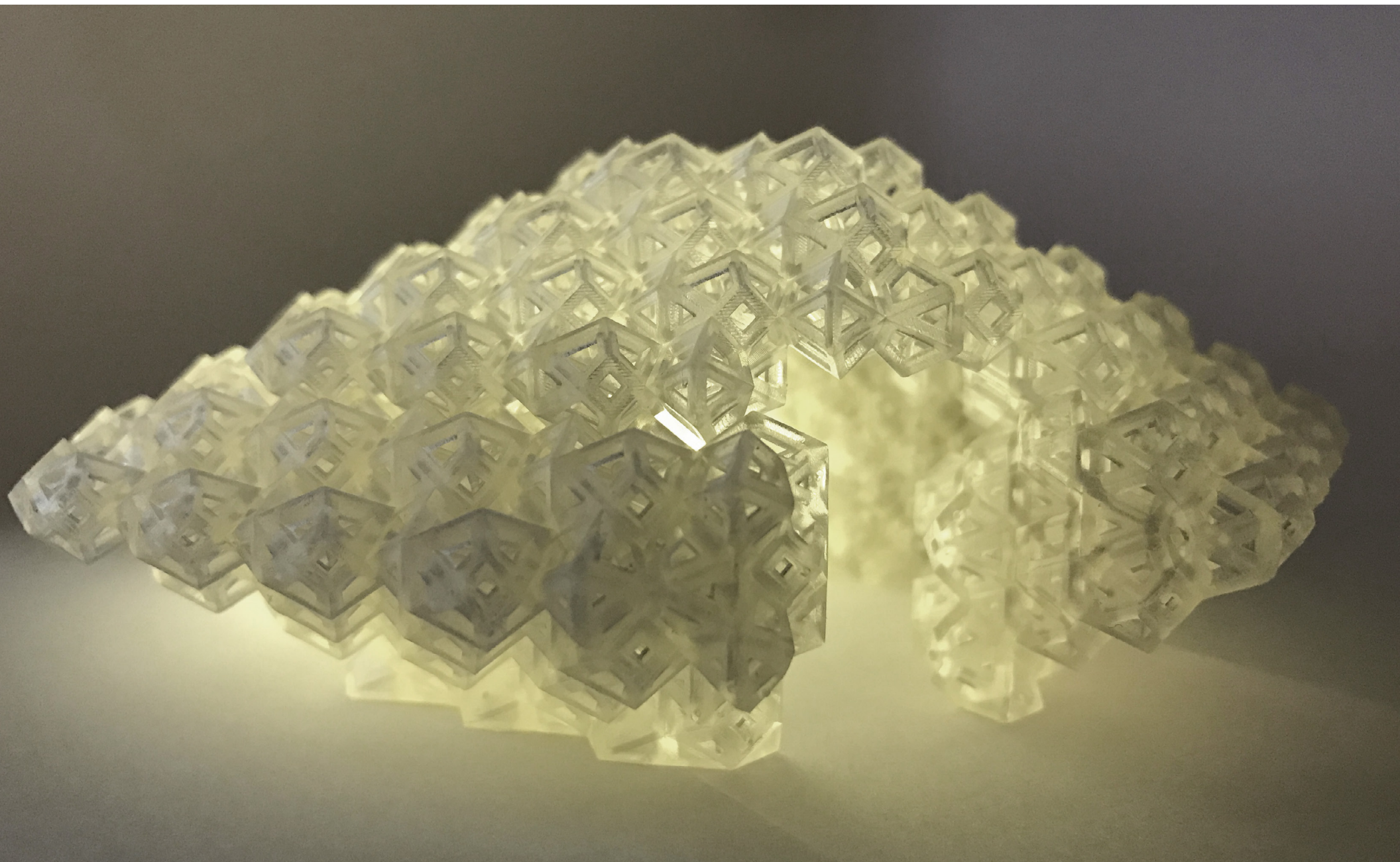


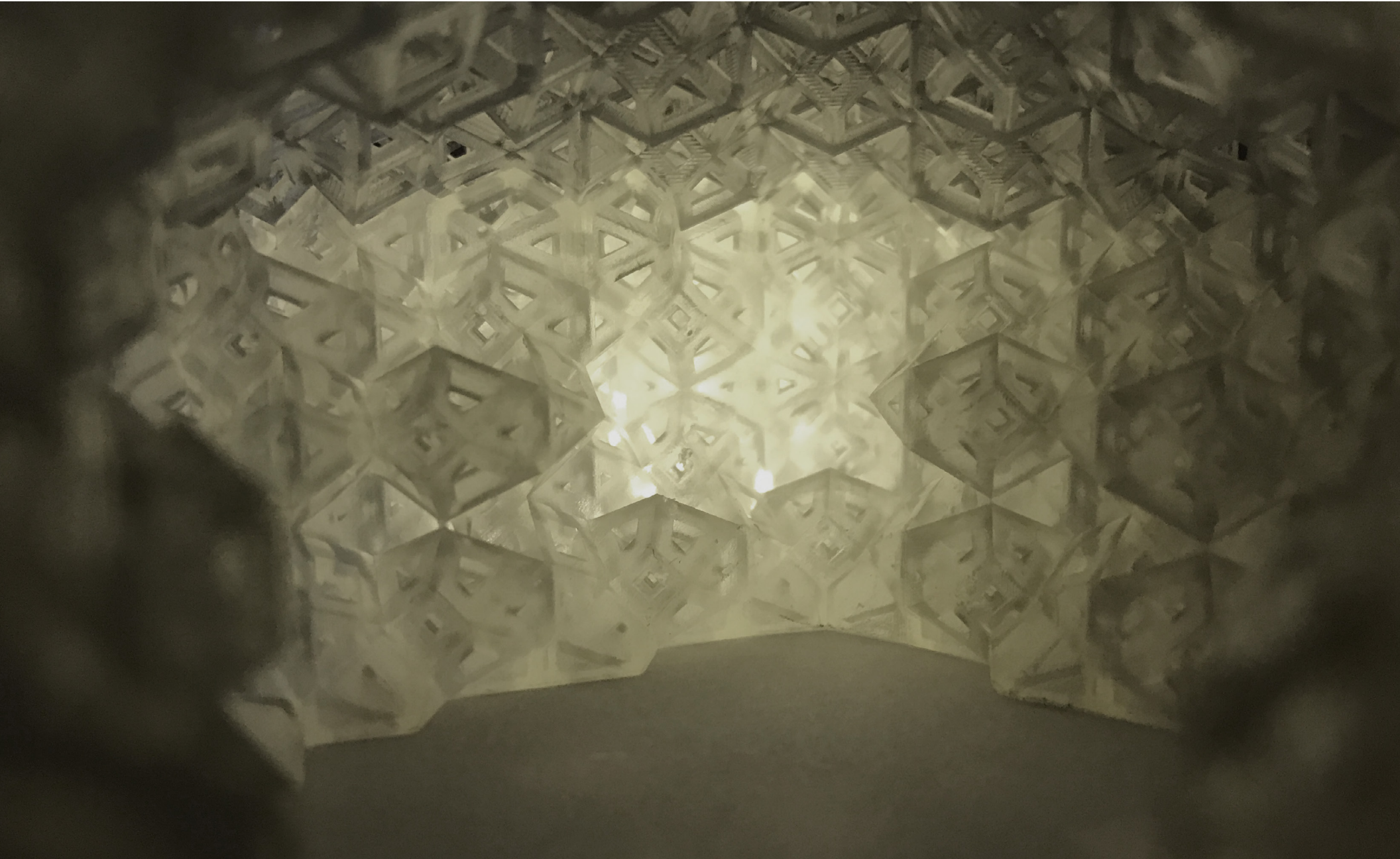












INSTALLATION DESIGN BY:

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Anna Mui

STRUCTURAL ANALYSIS BY:

Atish Dahitule
Neeraj Jat
Shashank Alai
Shalem Shelke