



therangerstation

J. WHITTALL & E. RIVERA

inspired by Mies van der Rohe's 50' x 50' house

TEAM MEMBERS



EDGAR RIVERA

I am a fourth year architecture student from Los Osos, California. I enjoy studying the relationship between structure and architectural design and the systems they create when working together. When I am not in school I enjoy painting, photography, playing basketball and tennis, and hiking.



JAMES WHITTALL

I am a fourth year architectural engineering student from Oakland, California. I am interested in the intersection of design and engineering, and am passionate about imagining creative solutions to structural challenges. I enjoy collaborating with peers in other disciplines, working with architects to create thoughtful designs. In my free time I enjoy running, biking, swimming and hiking.

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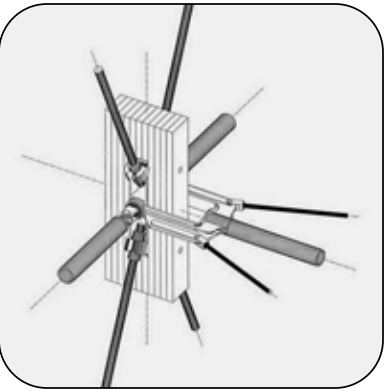
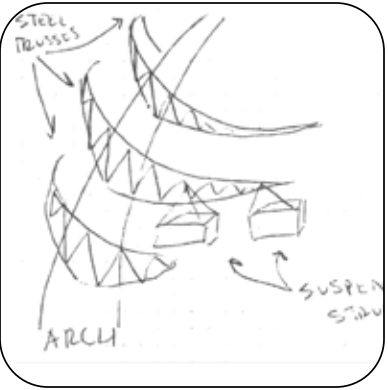
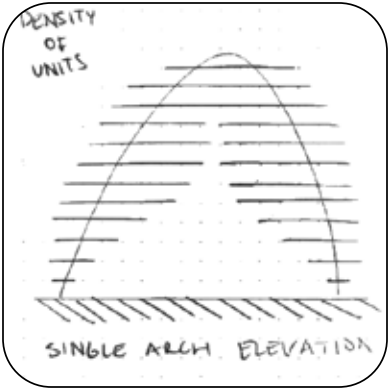
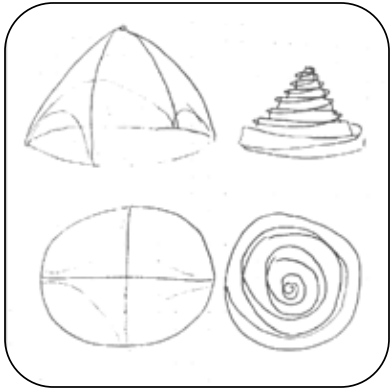
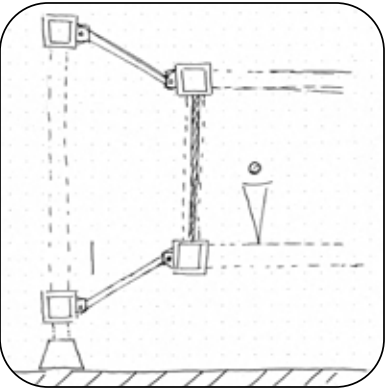
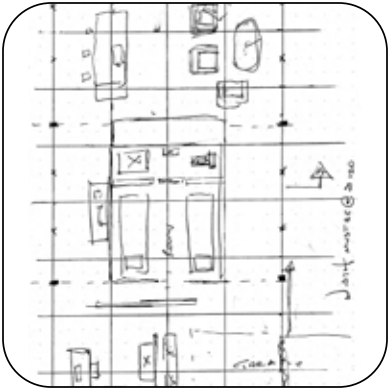
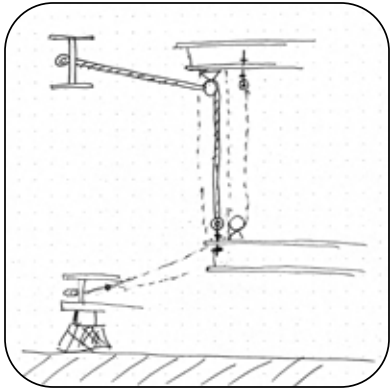
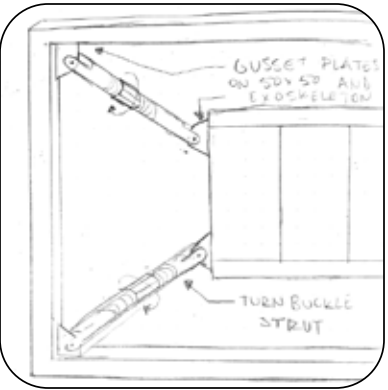
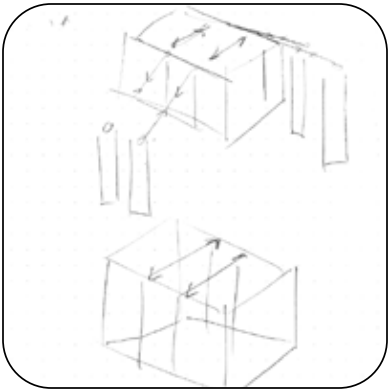
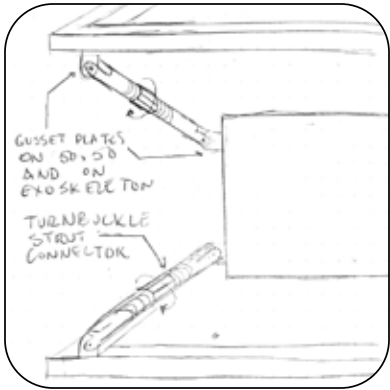
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chapter one

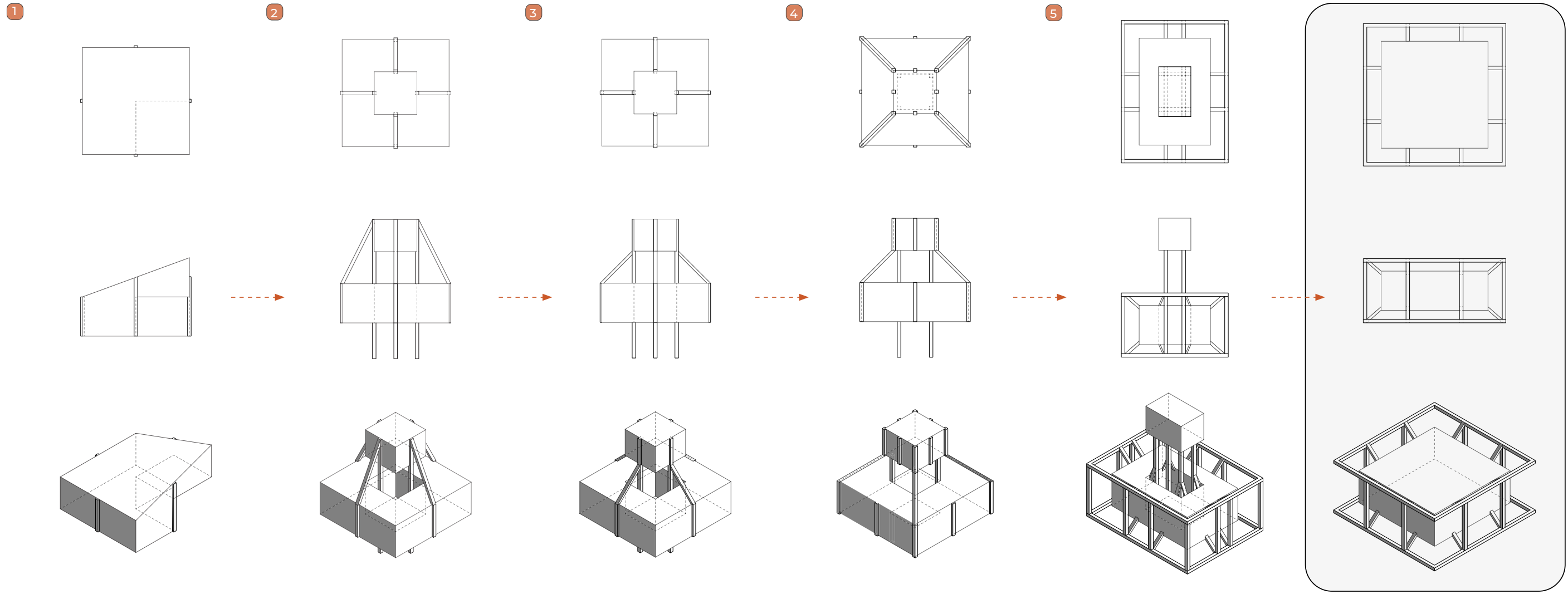
INSPIRATION



chapter two

THE PROJECT

INITIAL DESIGN



INITIAL DESIGN

1 Our first attempt at an initial design model strayed the least from the initial 50x50 design. Our first idea for the project was to make the glass house serve as a lookout of sorts. We maintained the columns at the midspan of each face of the square structure, keeping the corners bare. The main addition we made to the rectilinear structure was the creation of a void space at one corner with the lookout perched above. We chose to loft the lookout, keeping it attached to the structure and simply changing the slope of the roof to create an additional space above the central space. The corner at the void space shifted, translating the mass vertically but keeping the roof in a single plane.

2 This model introduced the lookout as a separate structure perched above the 50x50 home. We made a quick model of the structure with the central mass rather than a corner mass translated vertically, and we raised the entire ensemble from the ground on central columns. This move incorporated the core idea from the 50x50 House (Core House) while being consistent with our desire to incorporate a lookout. We also made the decision to make the outer columns connect to the lookout structure, reaching back from the outer edges of the 50x50 structure to connect to the top of the lookout structure. The columns reaching up to the lookout were more structural than architectural consideration, and we ended shifting them down in subsequent iterations.

3 Our next model involved only a subtle change from the second. We found the diagonal columns connecting the lookout to the base to be both unattractive and structurally unfeasible, and so we shifted them down. With the column connection to the base of the lookout rather than the roof, the angle was decreased significantly and the columns were shortened. This shift had the added benefit of giving the lookout perch more of a distinct feel from the base, with the connecting columns only touching the very base. We liked this column connection more but still felt that the design was a little clunky.

4 Our next iteration moved the diagonal connection columns from the midspan of the structure to the corners. This was a more experimental model, as we knew we wanted to avoid any structural elements at the corners to stick with the Miesian design of the structure. We wanted to examine the effect of changing the columns from a 'plus' in plan to a cross, switching the plan to more of a diagrid as Mies had experimented with rather than then a rectangular grid. While we found this to be more visually appealing than the previous model, we knew we were not going to keep it as it strayed so radically from the Miesian roots of the project.

5 For this model, we first touched upon our suspended core concept. We initially wanted to suspend our structure as a far-fetched grasp at mass damping, to attempt to damp the lateral motion of the structure using its own mass. While this concept proved unfeasible after basic research into mass damping, we fell in love with the idea of suspending the structure, and knew we had to try and incorporate the suspension into our final design. With this model we also determined that we did not want to keep the lookout perched above the structure, for a variety of reasons. From a structural perspective, we knew that the columns required to hold this mass so far above the ground would have to be so significant to provide lateral bracing as to completely take away from the perched aesthetic. We also determined that the suspension of the 50x50 mass and the lookout perched above would be too complicated to include together. We moved forward with the suspension, scrapping the lookout.

Our final model included the suspension we were so excited about in the last iteration and lost the lookout tower. While we were attracted to the idea of a lookout perched above the primary structure, we determined that a glass house suspended in a steel exoskeleton would still provide the 360 degree views we were seeking through the perched lookout. The exoskeleton has the additional benefit of protecting the fragile glass interior structure from its surroundings, adding the ability to deploy the structure on any terrain. With this iteration of our design, we finalized our site and our purpose with the project. We visualized a 50x50 glass structure with midspan columns consistent with the Miesian design, but suspended in a steel exoskeleton. The structure would itself be perched at the peak of forests or national parks, and serve as a lookout for forest fire lookouts, as forest fires will certainly continue to be one of the main natural disasters devastating California. We landed on Big Sur as the site of this particular lookout. The exoskeleton lends well to rugged terrain, allowing the structure to be dropped into a wide variety of landscapes. The exoskeleton also adds contrast to the more delicate glass interior structure.

SITE ANALYSIS

CONE PEAK, BIG SUR, CA

therangerstation is located on the highest peak in the Santa Lucia Mountain Range. It's elevation of 5154' allows it to have unobstructed views east and west, but most importantly north and south to properly survey the mountain range for any sight of first smoke. The site itself has only 1 means of access through foot travel, as the closest unpaved service road lies at a distance of approximately half mile away. With that, the primary transportation of materials to the site for potential construction would be through helicopter or other aviation vehicle. This location is remote enough that it would be necessary to have auxiliary units to provide gas and water, such as small tanks that could be transported easily to a from the site and service road. The predominant wind direction on the site is from the southwest, as these winds blow onshore from the pacific ocean.



Key

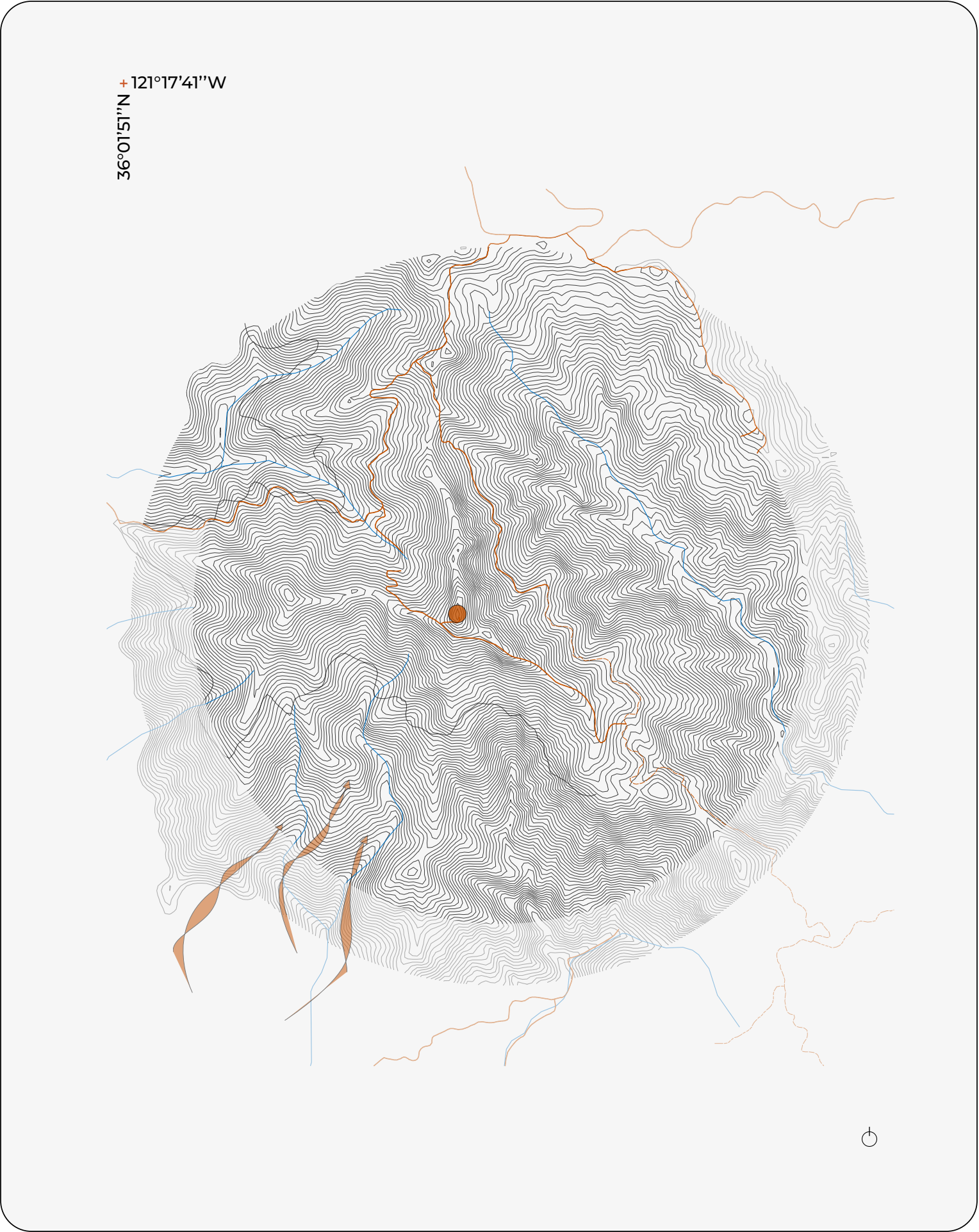
Site

Trails

Unpaved Service Roads

Streams

scale 1" = .5 miles



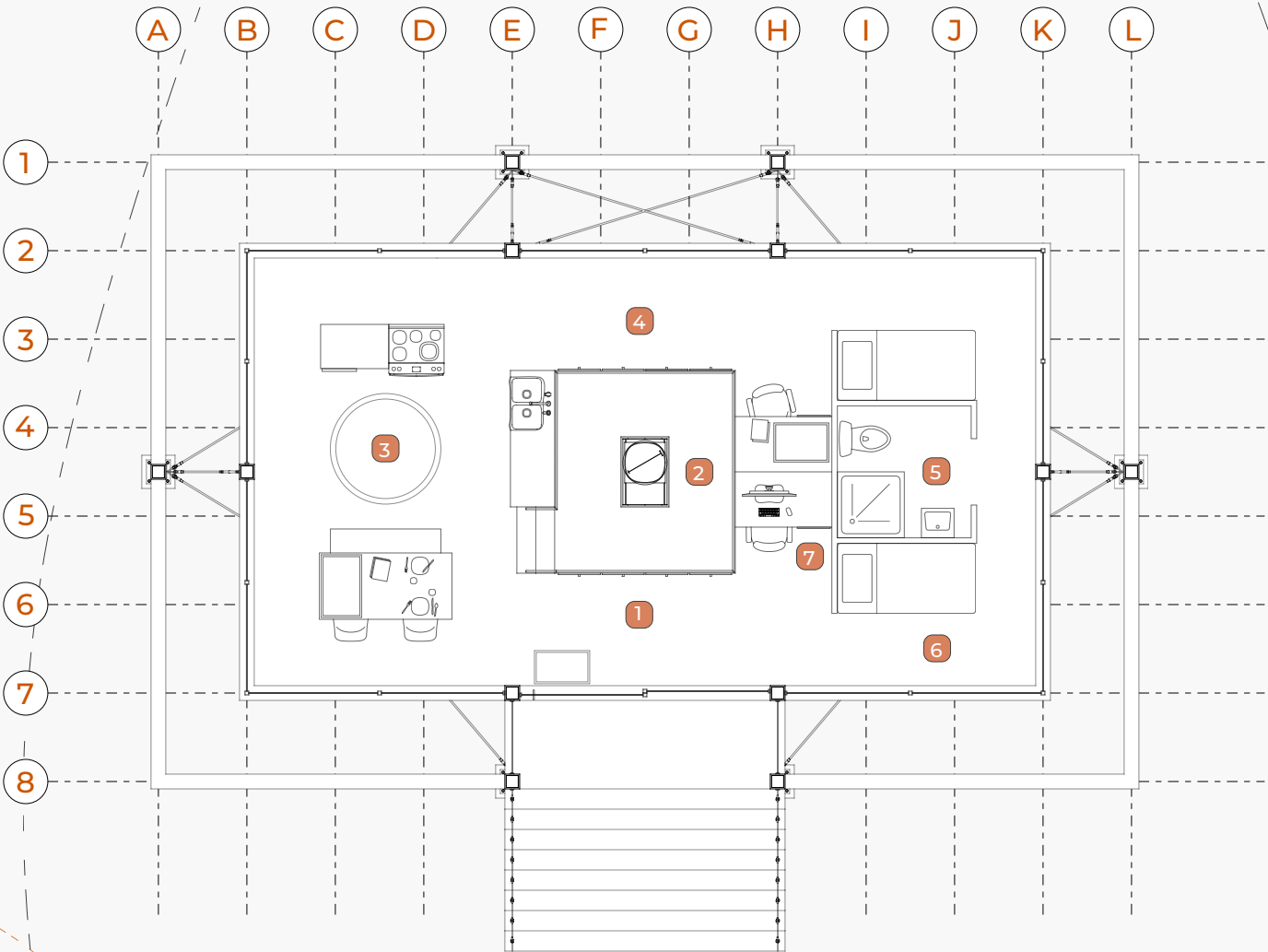
FLOOR PLAN

CONE PEAK, BIG SUR, CA

therangerstation floor plan is arranged around a centrally located Osborne Fire Finder. The placement of the fire finder is vital in the effectiveness of this ranger station, as it is essential to have unobstructed panoramic views of all your surroundings. To the west of the fire finder is a small living quarters with an essential stoye, mini fridge, and sink as well as a small table. These amenities allow rangers the ability to live here for multiple weeks on end. On the eastern side of **therangerstation** are two desks that provide additiye work area, followed by two separated sleeping areas. The bathroom acts as the separating element, which can be accessed through the perimeter walking area. This perimeter allows the continuation of sight lines from the center throughout the building so that the fire finder may operate effectively.

Program

- 1 Entrance
- 2 Osborne Fire Finder Platform
- 3 Living area
- 4 Storage
- 5 Bathroom
- 6 Sleeping Quarters
- 7 Desk

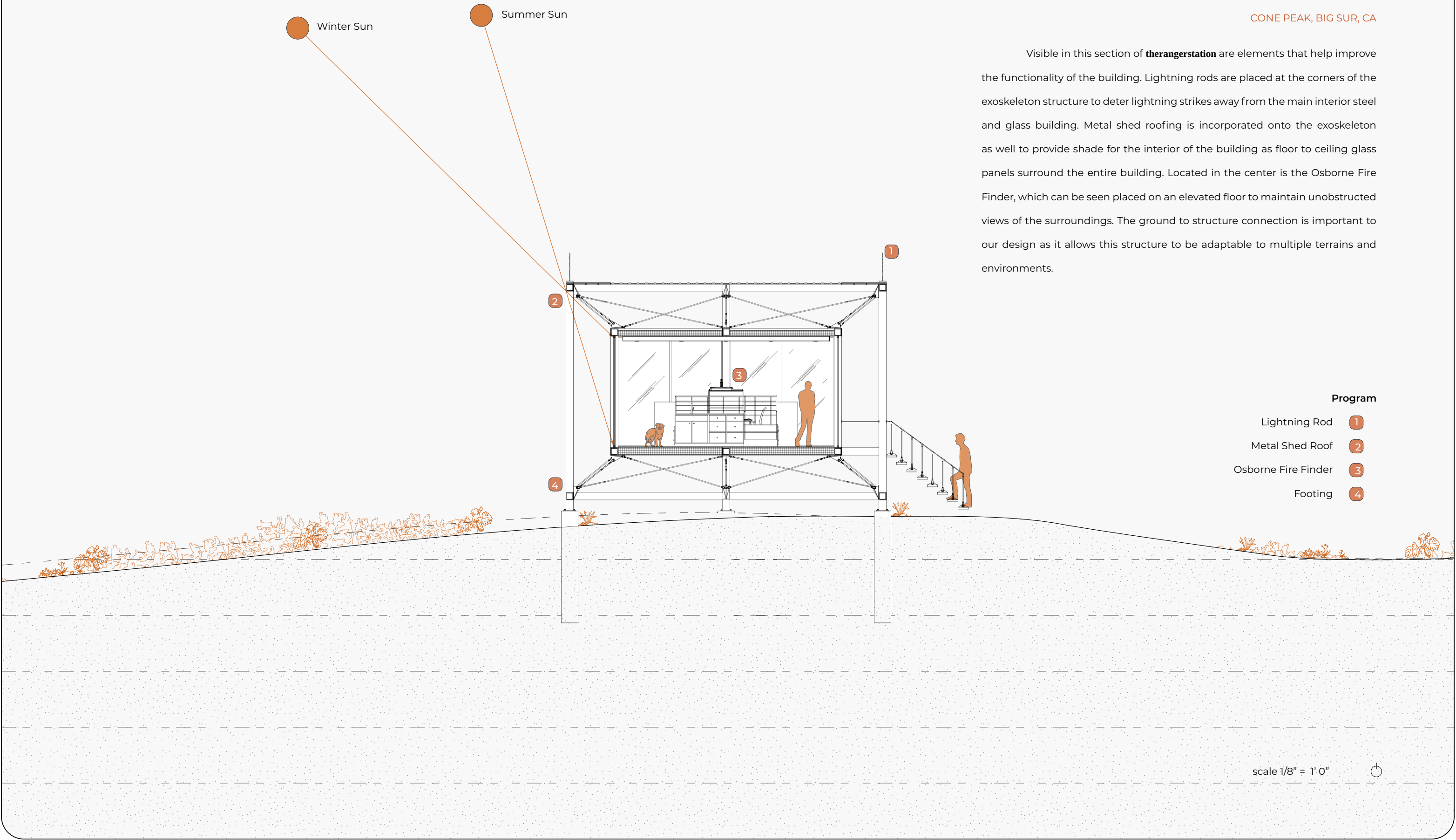


scale 1/8" = 1' 0"

SECTION

CONE PEAK, BIG SUR, CA

Visible in this section of **therangerstation** are elements that help improve the functionality of the building. Lightning rods are placed at the corners of the exoskeleton structure to deter lightning strikes away from the main interior steel and glass building. Metal shed roofing is incorporated onto the exoskeleton as well to provide shade for the interior of the building as floor to ceiling glass panels surround the entire building. Located in the center is the Osborne Fire Finder, which can be seen placed on an elevated floor to maintain unobstructed views of the surroundings. The ground to structure connection is important to our design as it allows this structure to be adaptable to multiple terrains and environments.



Program

- Lightning Rod 1
- Metal Shed Roof 2
- Osborne Fire Finder 3
- Footing 4

scale 1/8" = 1' 0"



SECTION

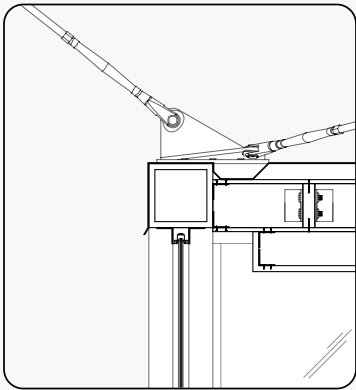
CONE PEAK, BIG SUR, CA

Program

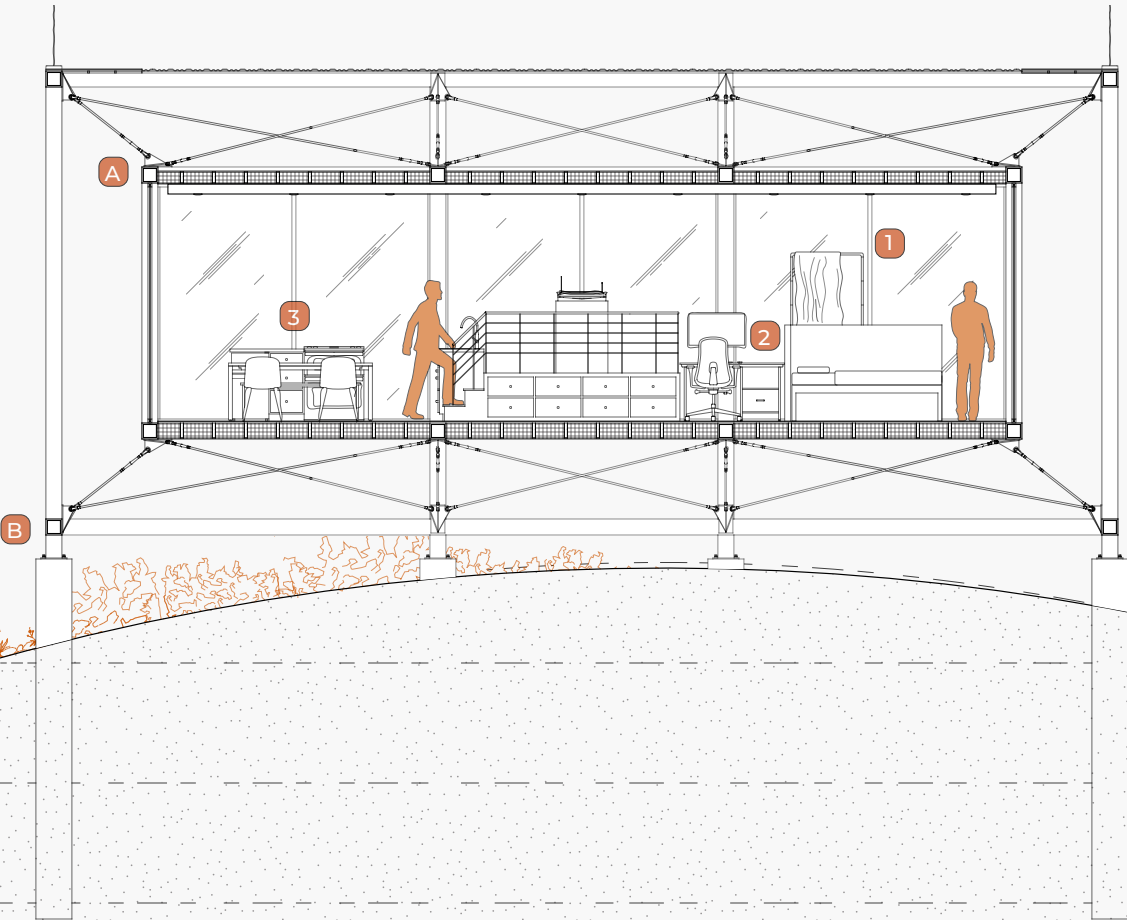
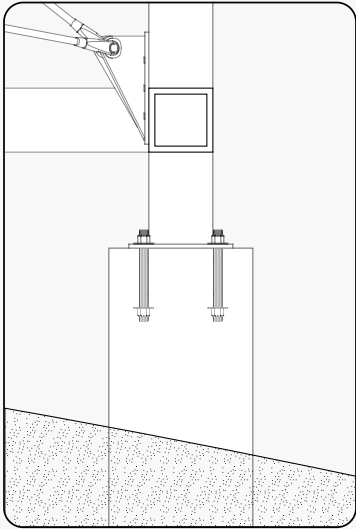
- Retractable Shower 1
- Work Space 2
- Living Area 3

The Osborne Fire Finder is situated on the elevated floor. The ability to lower and raise the retractable shower curtain allows for unobstructed views from the platform.

A Glass to Structure Connection



B Structure to Ground Connection



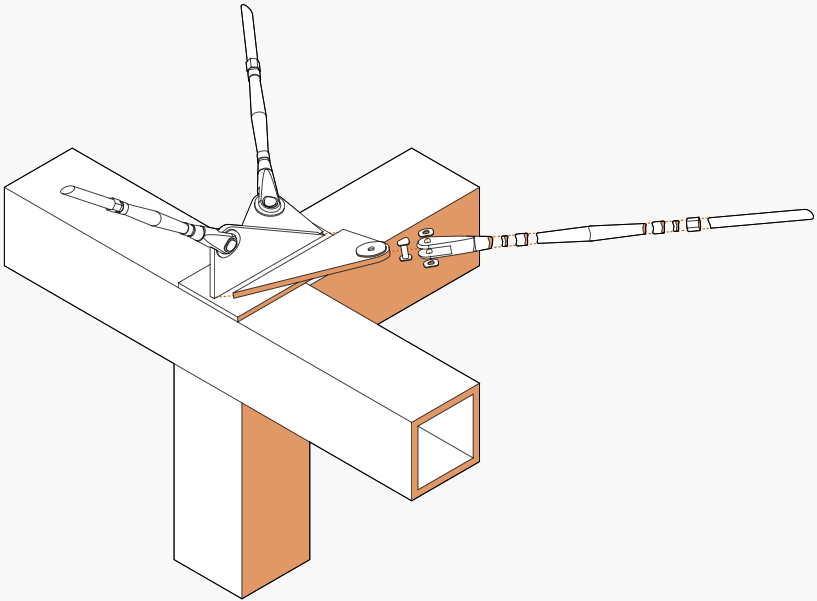
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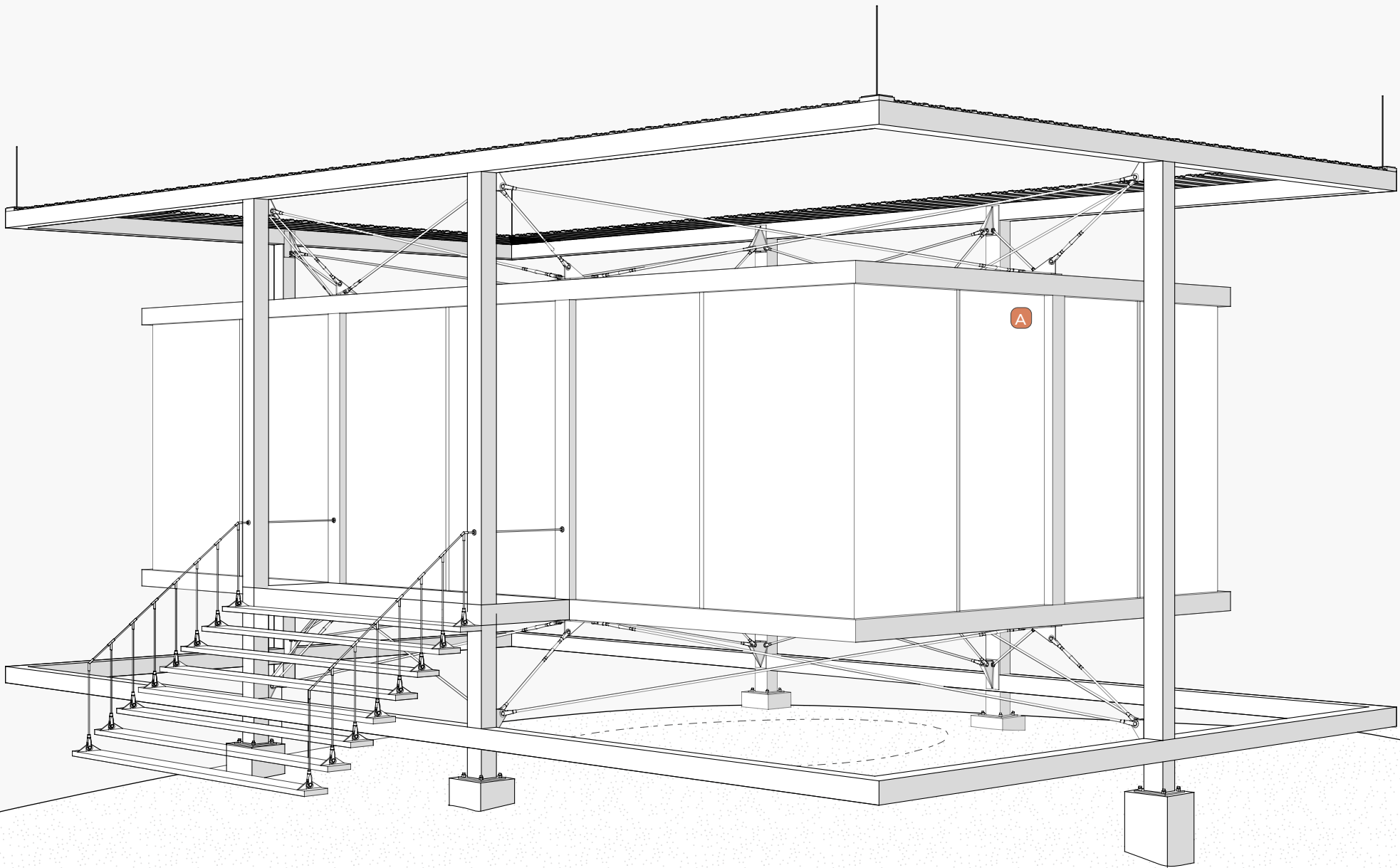
PERSPECTIVE

CONE PEAK, BIG SUR, CA

therangerstation uses a three pronged turnbuckle connection to tether itself to the rigged outer structural frame. This creates an illusion of a light and levitating delicate jewel that is held in place by a rugged steel exoskeleton.



A Turnbuckle Detail



STRUCTURAL

LOAD TAKEOFF:

Assumed Dead Load: 150 psf
Assumed Live Load: 50 psf

*ASCE 7-16 office live load is used
Area of structure: 36' x 20' = 720 ft^2
Total Weight of Inner Box Structure:
200 psf x 720 ft^2 = 144 kips

Exoskeleton Beams and Columns (Compression) ———
Turnbuckle Connections (Tension)
Floating Box Beams and Columns (Tension) ———

MATERIAL:

Square HSS tubes form the exoskeleton.

Top Beams: HSS12x12x5/8

Bottom Beams and Columns: HSS10Wx10x5/8

Exoskeleton supports inner structure through tensile members attached at 6 nodes:

144 k / 6 nodes -> 24 k at each node

Idealize connections as one load at 45 degree angle; loads are actually applied in three vectors fanning away from each node, but due to time constraints are modeled as a single load.

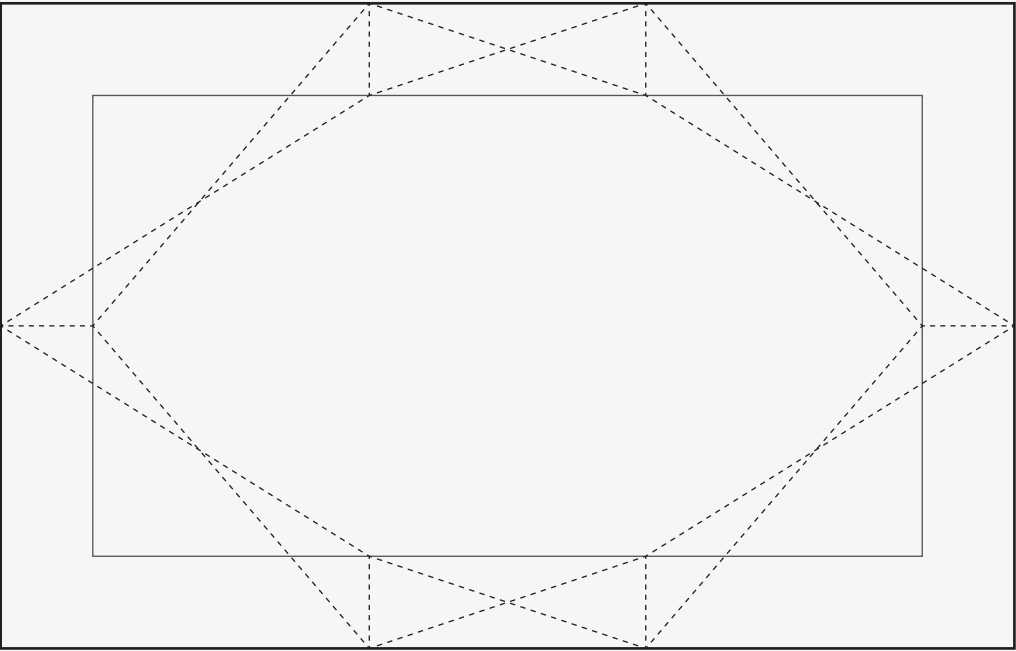
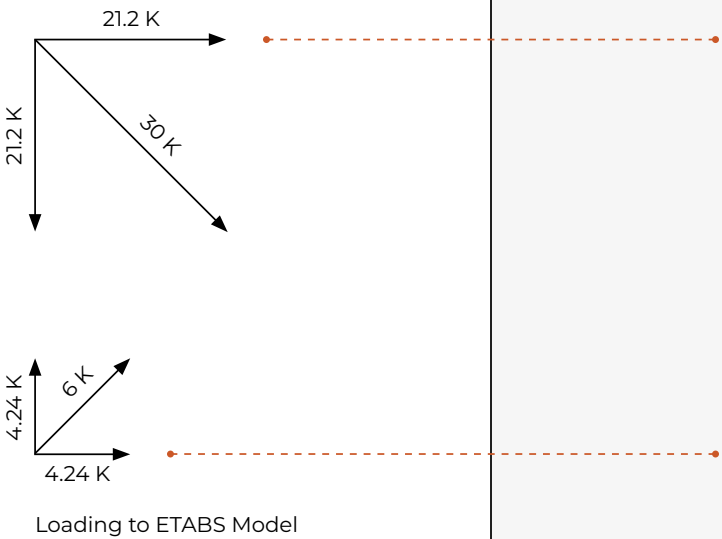
Assume 125% at roof exoskeleton, 25% at base of exoskeleton.

24 k x 1.25 = 30 k at roof

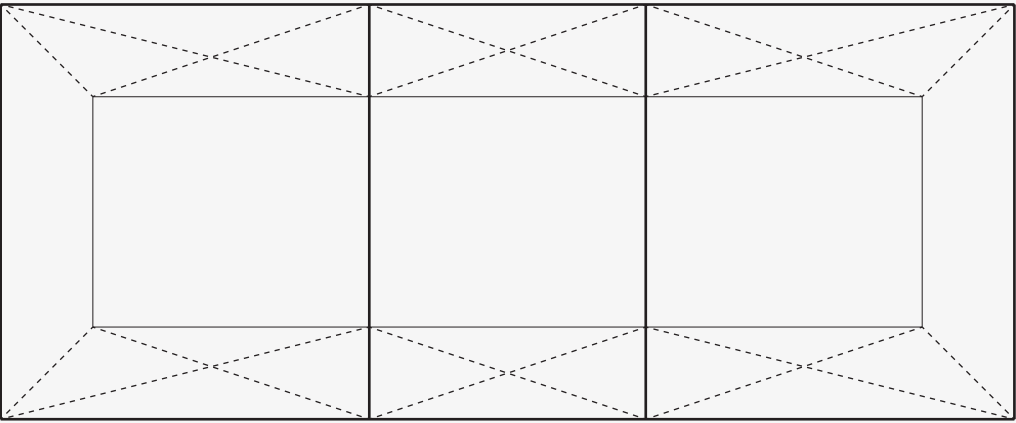
24 k x 0.25 = 6 k at base

30 sin(45) = 21.2 k

6 sin(45) = 4.24 k



Plan



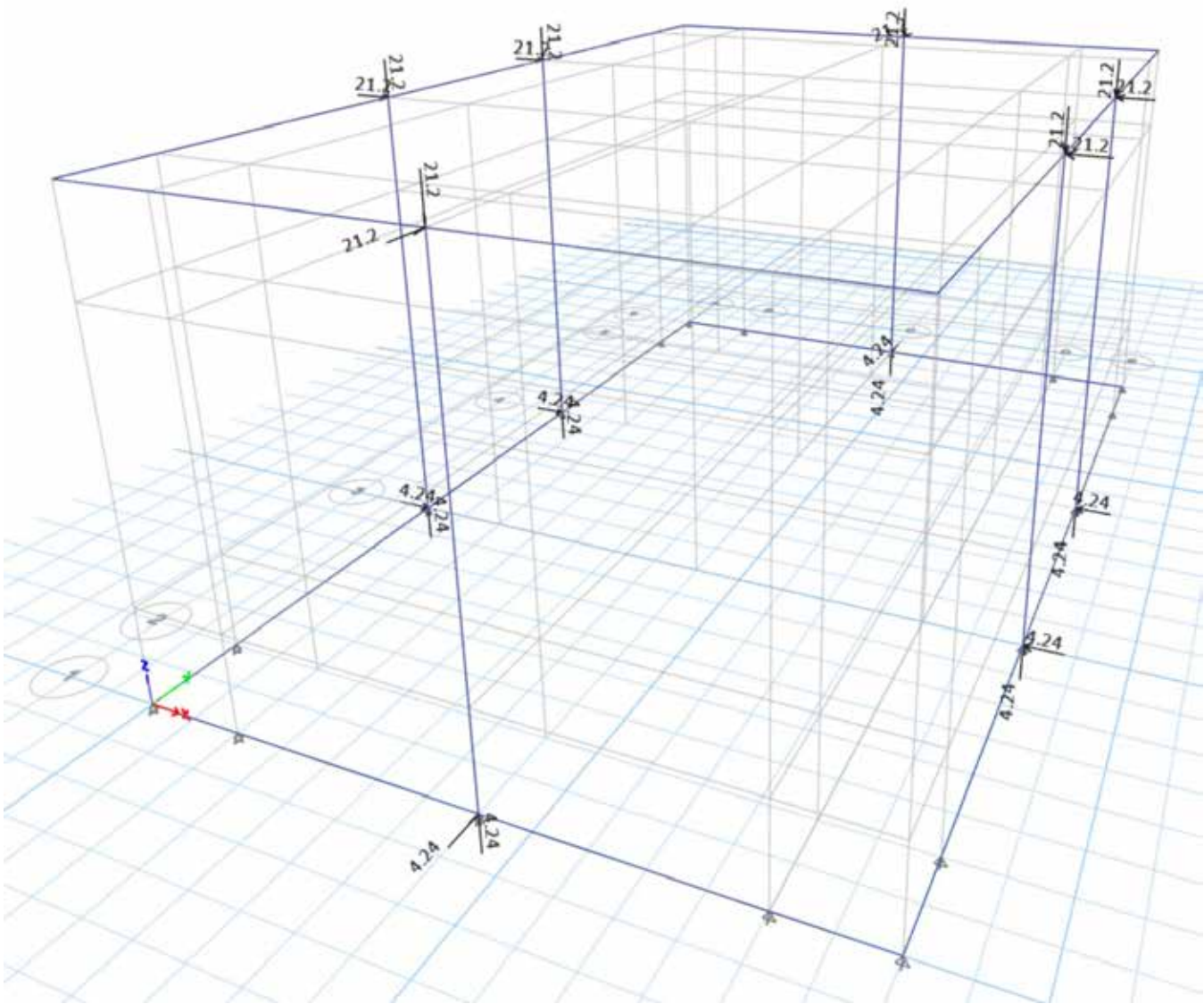
Elevation

STRUCTURAL

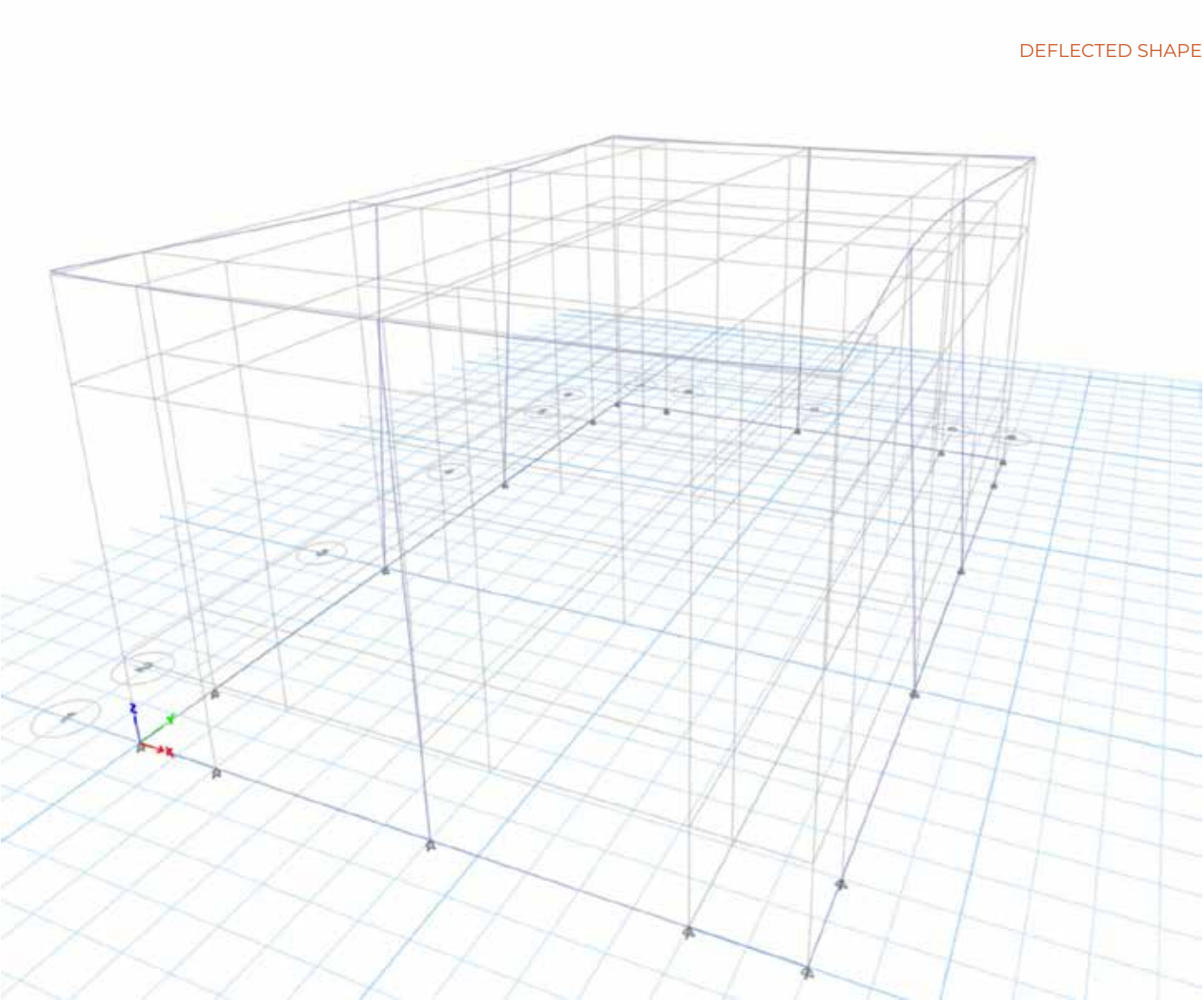
DEFLECTION

The deflection in the upper beams along grid lines 3 and 4 are the controlling deflections; approximately 2" of deflection is observed at the grid lines in the beams. These deflections are not a structural concern, as the inner box is suspended from the structure. The concern regarding the deflection is one of aesthetic discomfort; if the deflection becomes noticeable to the naked eye, occupants may become agitated. The 2" observed deflection along the 40' length of the beam is determined to be acceptable, given that the beam itself is 20' off the ground.

LOADS



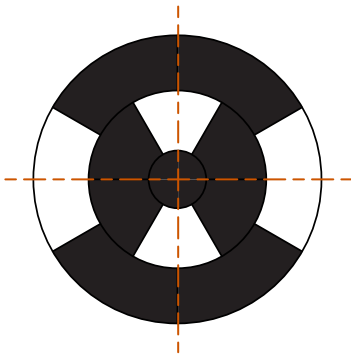
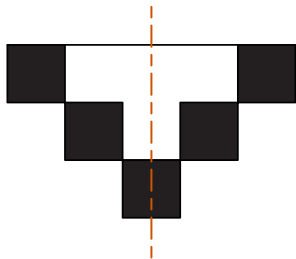
DEFLECTED SHAPE



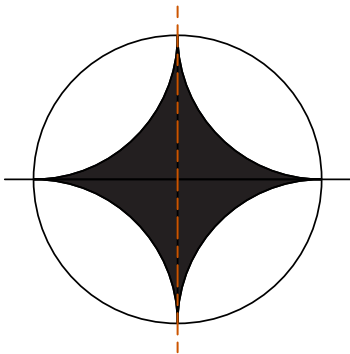
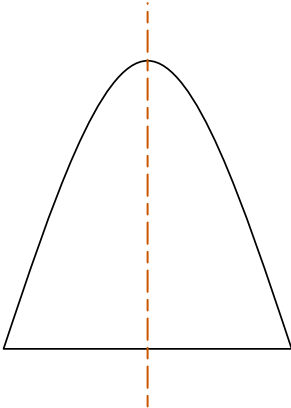
chapter three

FINAL FANTASY

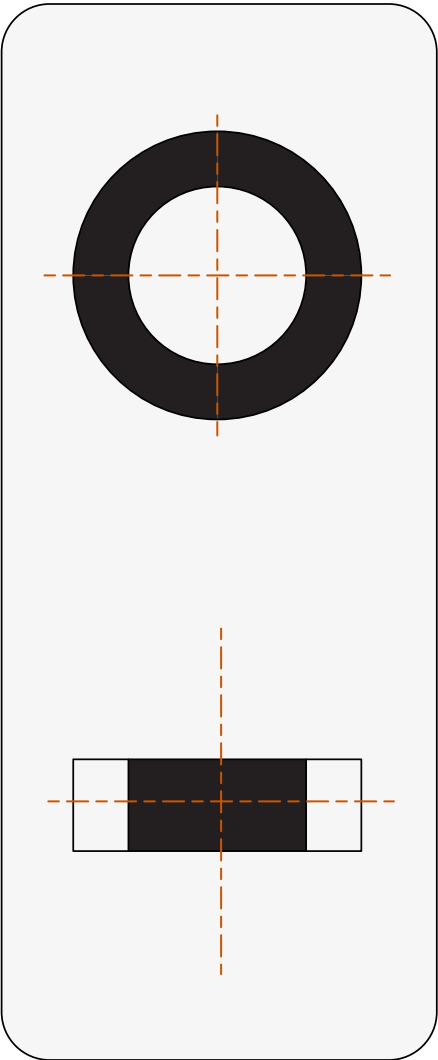
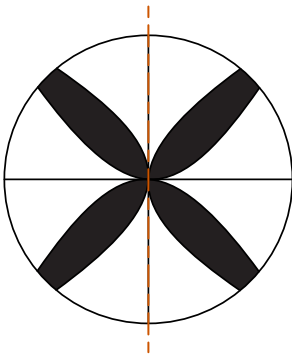
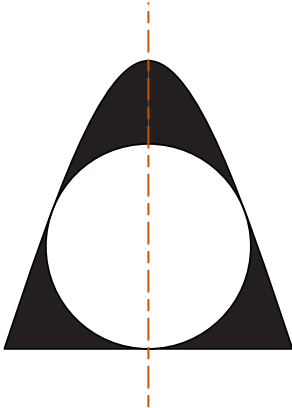
1



2



3



PROCESS

1

Our first iteration of conceptual models for our final fantasy was an early attempt to make our structure modular. We imagined our tensile boxes strung up in a circular layout, with increasing radii as the structures get higher off the ground, similar to a beehive. We didn't have a purpose for the concept, but were just experimenting with shape, depth, and void space. We liked the idea of incorporating circular forms into the project, as we had kept to rectilinear designs for the first stage of the design. While we enjoyed the look of a beehive-like structure, the challenge of suspending the structure or managing to balance it all on the narrow base was concerning.

2

For our second model, we maintained the circular shape in plan but moved away from the precariously balanced structure to a more structurally solid design. We used twin catenary arches to support a plane at the mid height of the structure, imagining that our tensile boxes would be hung from the arches. The catenary arches were inspired by the Gateway Arch in St. Louis, Missouri, but we planned a smaller scale. The catenary arches supported a canopy-like roof structure over the primary structural plane at the mid height.

3

Our third model was similar to the second, with the twin catenary arches and the circular plan maintained. For this iteration, however, we tried fitting circular shapes in the elevation as well as the elevation. We liked the shapes we had come up with and wanted to experiment with the form of the structure in both plan and elevation.

Our final iteration kept the circular form in elevation but changed the plan. We kept our emphasis on the juxtaposition of rectilinear and circular forms but got rid of the catenary arches. As our project has been focused on the relationship between tension and compression, we wanted to use a form that continued that analysis. We found inspiration in the wheel of a bicycle, a circle that somehow manages to be completely in tension. The circular shape of the elevation is essentially a large Ferris Wheel, and the tension spokes of the wheel are interrupted by our tensile structures strung intermittently throughout. We were drawn to the visual of the rectilinear boxes breaking up the circular form. Once we had settled on this form, we began creating a storyline for the Final Fantasy.

FULL CIRCLE

"The darkness of the inside almost feels comforting now. For so long I yearned to experience the outdoors, maybe even to climb up our confining box and gaze over the seemingly never-ending maze of rectilinear structures. To do so, I have always been told, is to risk being seen; and to be seen is to disappear. I ventured beyond our home once, just to get a glimpse of the massive wheel defining the skyline. I wanted to see what was keeping us captive. I felt a rush of adrenaline as I felt the sun on my skin and the wind in my hair. I peered around the edge of my box but immediately shrank back to the safety of darkness; it felt to me that I was noticed as soon as I appeared, though I didn't see any watchful eyes. The monotony of our landscape highlights anything that is not cold, angular, and lifeless. I retreated to the shadows, suddenly appreciating the anonymity and obscurity I so resented.

Our proletarian society was once run by an elite family, the Wardens, with a carefully guarded secret. The Wardens had somehow managed to rise above the ground, to exist in the sky in curiously clear containers. The mysterious boxes were suspended from high above the ground, and the knowledge that allowed these strikingly transparent structures to exist remains a mystery. The Wardens controlled us, keeping the masses on the ground and in the dark; we were stripped of our identities as individuals and even of our names, reduced to a string of numbers and letters. Under the tyranny of the Wardens, we were forced to toil endlessly to further the goals of our evasive captors. They kept watch from the security of their lofted lookouts, ensuring that no cog in the system attempted to stray from their task. For decades, the Wardens kept us on the ground and under their control, dictating our every move and forcing us to work on the improvement of the very technology used to enforce their will.

Tired of the endless tedium, a bold ground dweller incited rebellion, inviting us to use our strength in numbers to take down the elite. Many joined the cause, agreeing to risk their lives for a taste of freedom. Many more, however, refused, too afraid of the retribution sure to follow failure. The rebel, a woman they called D3S1R3, led those who were willing to join in an attempt to overthrow the Wardens and rise above the fetters of the ground. She sought the technology the Wardens coveted to cure her daughter of a mysterious ailment that left her feeble and on the brink of death.

I did not witness any of the violence that ensued, I only heard the screams and roars from above. I remained in the confines of my box; as a child, I was of little use to the rebels. After the commotion died down, there was only a familiar silence. Had D3S1R3 and the other ground dwellers succeeded? Or were we all destined to suffer the consequences of individual thought?

The events that followed were only recently recounted to me. D3S1R3 and her riotous rebels were successful in their coup, but freedom came at great cost. D3S1R3 managed to tear down the translucent symbols of the Warden's power, but in the process lost her family, and with them her reason to fight. She blamed those on the ground who refused to support her, believing that with their help she could have avoided her tragic loss. Resentful of the weakness of her fellow ground dwellers, D3S1R3 took to the sky, using the secrets she had gained to string the Warden's boxes from the highest remaining point in the landscape: a massive, abandoned relic of the past, what they called a wheel. D3S1R3 set up a new regime from the safety of her perch, reinstating the very same tyranny she had fought to erase.

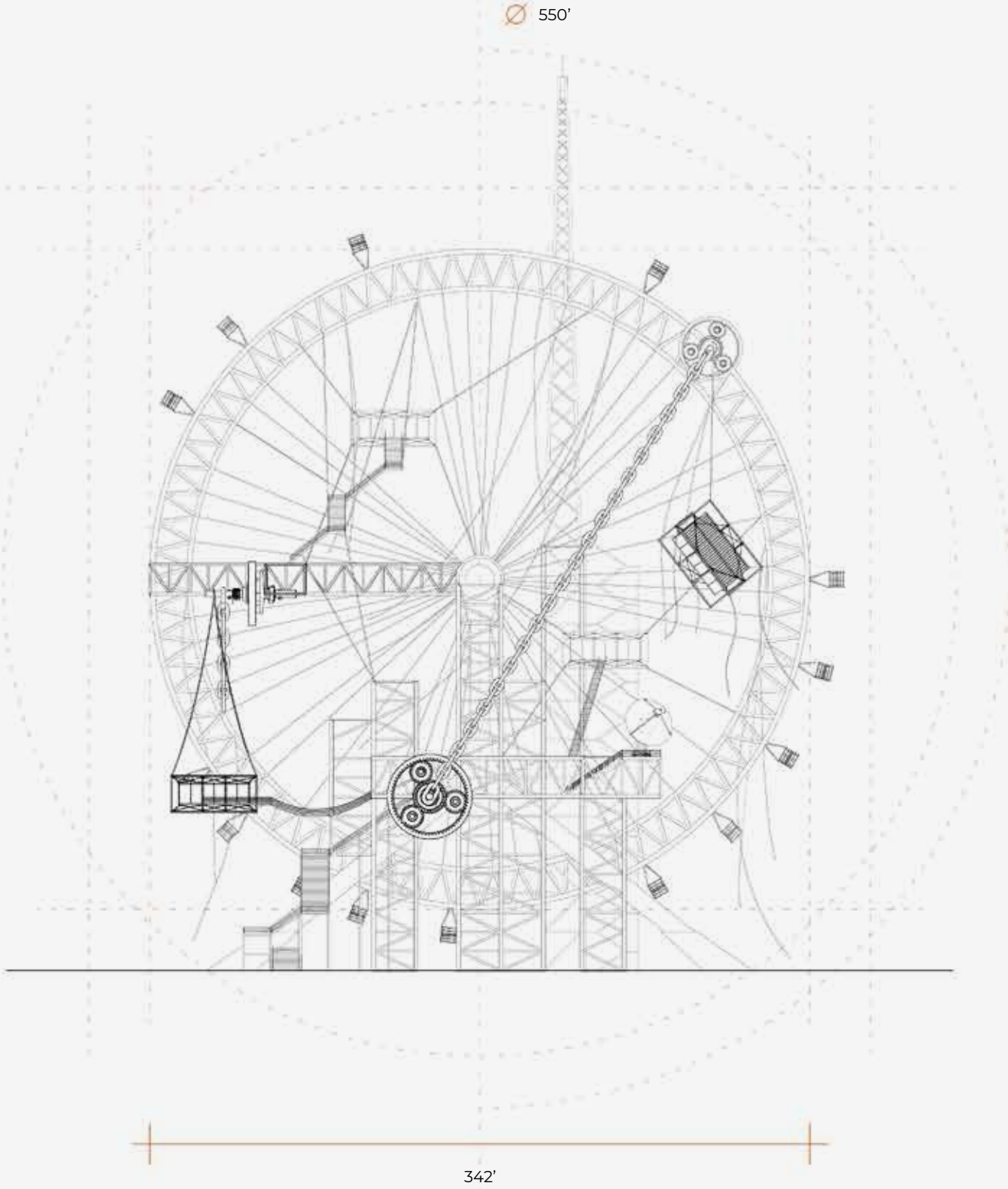
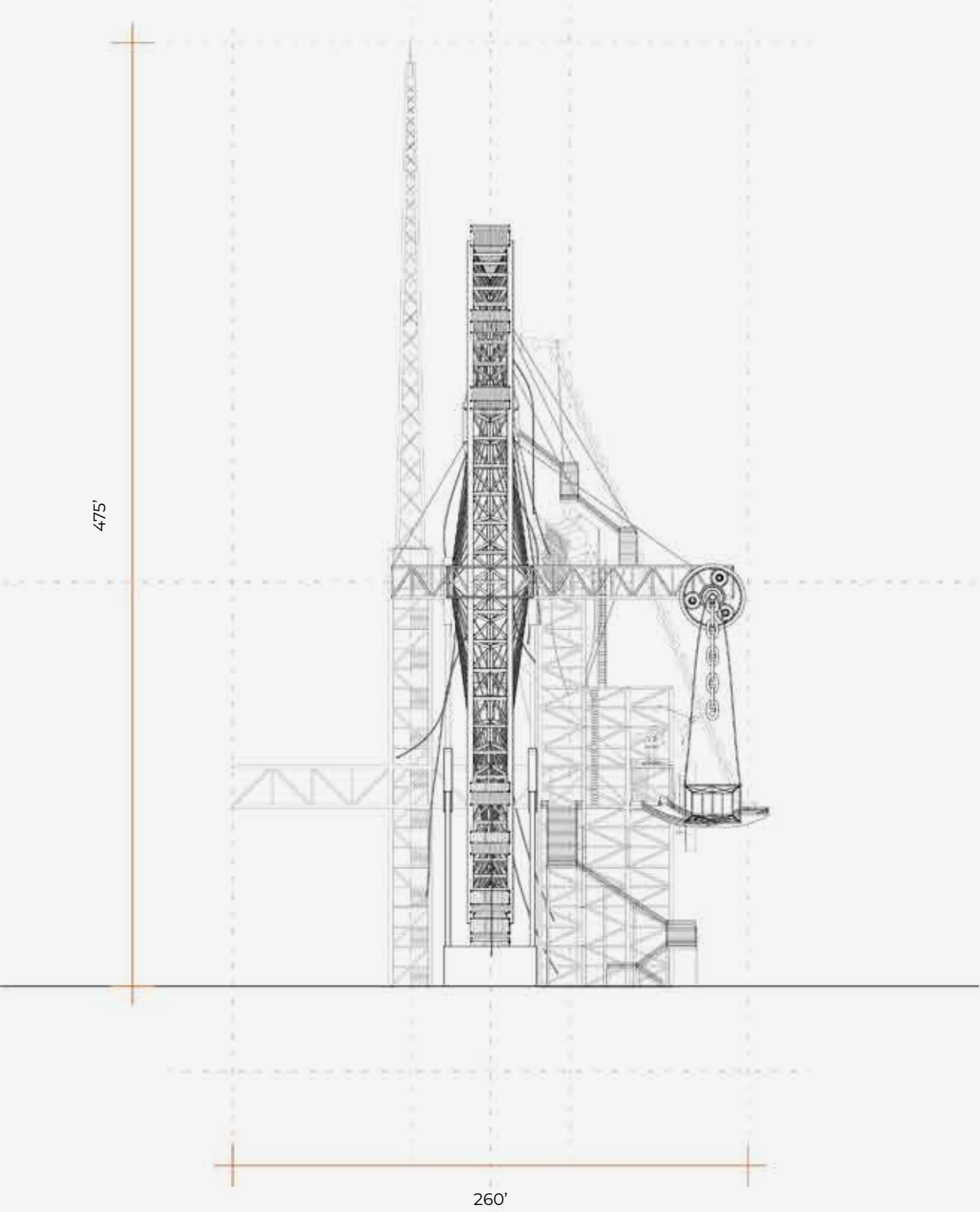
I wonder if she realizes the cycle she is continuing. Did the Wardens ever exist on the ground? Did they exist at all? Are we all victims of D3S1R3?"

- J. WHITTALL



- E. RIVERA

ELEVATIONS







thank you

