

# 2017-2018 Design-Build

Sonoran Pentapus S-cape  
32411

A gridshell pavilion and integrated landscape are designed to revitalize the entrance and forecourt of a design college at a major research university in the southwestern United States. The project was delivered through a series of three 4th and 5th year studios and independent studies.

The project is driven by the following forces. **LOCALE:** the site is located along the busiest pedestrian pathway on campus; its western exposure in the hot arid climate is a deterrent and the host college suffers physical obscurity in an otherwise dynamic fine arts district. **GRIDSHELL:** the project is principally funded by an international multi-university grant researching best practices in educational design build and mandates that the project feature a gridshell pavilion. **PEDAGOGY:** in four dimensions:

**1\_educere:** the Latin root of the word education meaning “to draw out.” Students are exposed to risks, challenged with responsibilities in unfamiliar territories, given opportunities to fail and make amends. Our students were in charge of coordination with engineers and building authorities, designed rigging and formwork, became certified structural welders, and performed all aspects of construction under faculty guidance and the mentorship of the University Facilities Management personnel.

**2\_Pragmatism:** in the philosophical sense, “consequence”. To consider the consequence of our actions and our designs is to optimize our efforts and our performance as architects. In design build we must transcend the often uttered phrase “the idea of.” We cannot afford to entertain “the idea of sunlight,” we must embrace the poetic inclination but render it tangible and apply performance criteria.

**3\_Collaboration:** is the construction of consensus through individual contributions. It is a critical, proactive and consuming process. We optimized collaboration through bi-weekly self/peer/faculty evaluations that serve as mechanisms for reflection and provide the feedback necessary to optimize one’s performance as a member of the collective.

**4\_Practice Laboratory:** these design build studios were conducted as a practice laboratory with choreographed opportunities for students to propose and evaluate procedures, rationales and organizational structures. Students are encouraged to become agents of change, they will inherit the profession and it is paramount that they transcend the aspiration of assimilation and advance with an informed mind and the courage to implement change.



the **SONORAN PENTAPUS**  
**s·cape**



*The great book,  
always open and which  
we should make an effort to read,  
is that of Nature.*  
- Antoni Gaudi

A gridshell pavilion and integrated landscape designed to revitalize the entrance and forecourt of a design college at a major research university in the southwestern United States. The project was delivered through a series of three 4th and 5th year architecture studios and independent studies.

The project is driven by three forces. 1\_PEDAGOGY in four dimensions: *Edūcere, Pragmatism, Collaboration and Practice Laboratory*. 2\_LOCALE: the site is located along the busiest pedestrian pathway on campus; its western exposure in the hot arid climate is a deterrent and the host college suffers physical obscurity in an otherwise dynamic fine arts district. 3\_GRIDSHELL: the project is principally funded by an international multi-university grant researching best practices in educational design build and mandates that the project feature a gridshell pavilion.

# educere

the Latin root of the word education meaning “to draw out.” Students are exposed to risks, challenged with responsibilities in unfamiliar territories, given opportunities to fail and make amends. Our students were in charge of coordination with engineers and building authorities, designed rigging and formwork, became certified structural welders, and performed all aspects of construction under faculty guidance and the mentorship of the University Facilities Management personnel.

# collaboration

the construction of consensus through individual contributions. It is a critical, proactive and consuming process. We optimized collaboration in the design build studios through bi-weekly self/peer/faculty evaluations that serve as mechanisms for reflection and provide the feedback necessary to optimize one’s performance as a member of the collective.

$1+1 > 2$

Robert LeRicolais

# pragmatism

in the philosophical sense, “consequence”.

To consider the consequence of our actions and our designs is to optimize our efforts and our performance as architects.

In design build we must transcend the often uttered phrase “the idea of.” We cannot afford to entertain “the idea of sunlight,” we must embrace the poetic inclination but render it tangible and apply performance criteria.

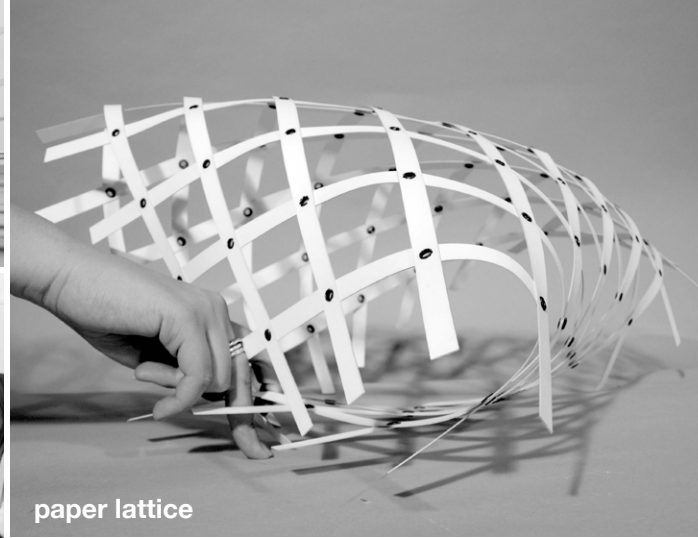
# practice laboratory

studios were conducted as practice laboratories with choreographed opportunities for students to propose and evaluate procedures, rationales and organizational structures. Students are encouraged to become agents of change, they will inherit the profession and it is paramount that they transcend the aspiration of assimilation and advance with an informed mind and the courage to implement change.

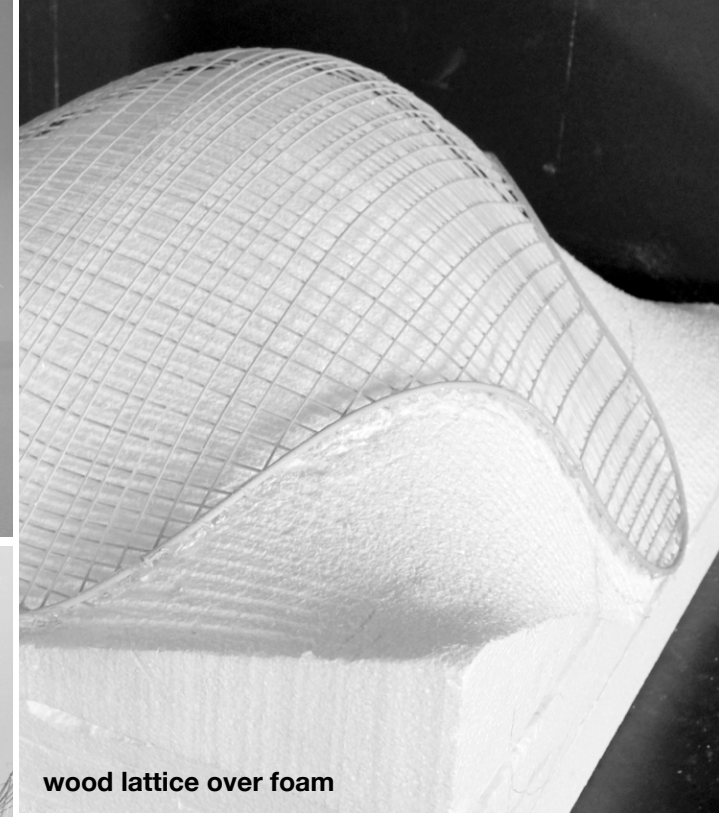




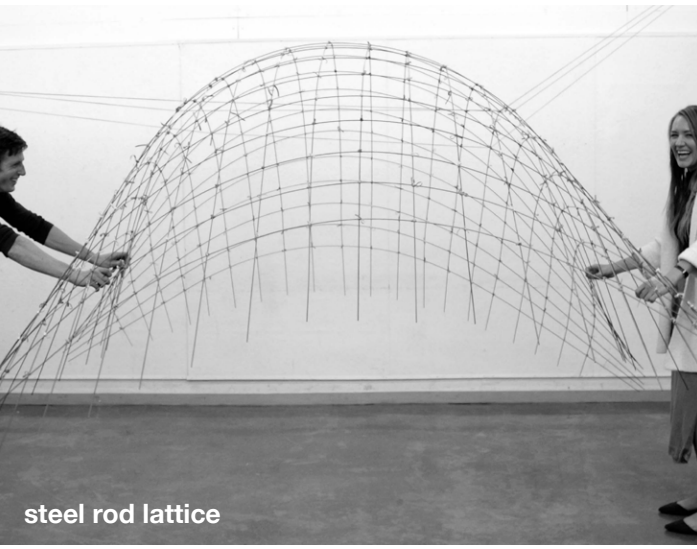
steel rod lattice



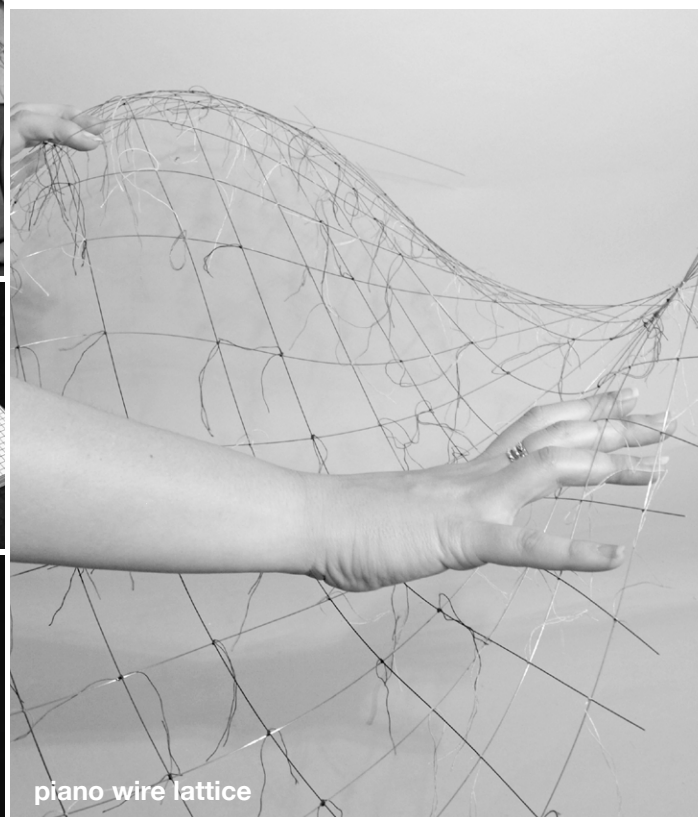
paper lattice



wood lattice over foam



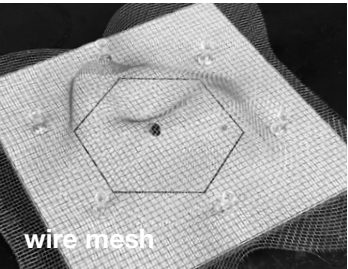
steel rod lattice



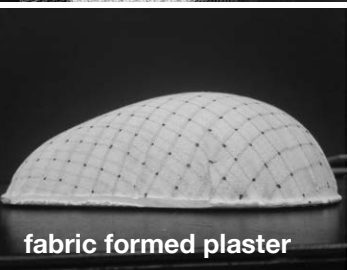
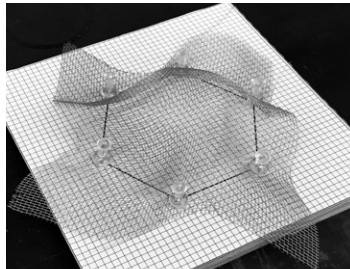
piano wire lattice



large wood lattice



wire mesh



fabric formed plaster



wood lattice over plaster



chain modeling



small wood lattice

**1 CATENARY**

A natural curve formed by a chain hanging freely from two points

**2 LATTICE**

An interdependent layered fabric comprised of linear rods

- Single: one layer of crisscrossing rods
- Double: two layers of crisscrossing rods

**3 THRUST PLANE**

The geometric plane through which thrust is resolved, in the context of catenary modeling it serves as the reflection plane, mirroring the tensile and compression geometries

**4 SYNCLASTIC SURFACE**

Contain members in either only tension or only compression

**5 SHEAR BRACING**

Linear members connecting nodes diagonally, providing shear resistance to the lattice

**6 NODE**

The moment resistant connection between to intersecting rods

**7 CELL**

The space formed between four adjacent rods, two in each direction

**8 ROD / LATH**

A linear compressive member, the most fundamental component of a gridshell

**9 OPENING**

A strategic interruption of the structural force flow for purposes of accessibility and fenestration [*"The art of structures is where to put holes"* –Robert Le Ricolais]

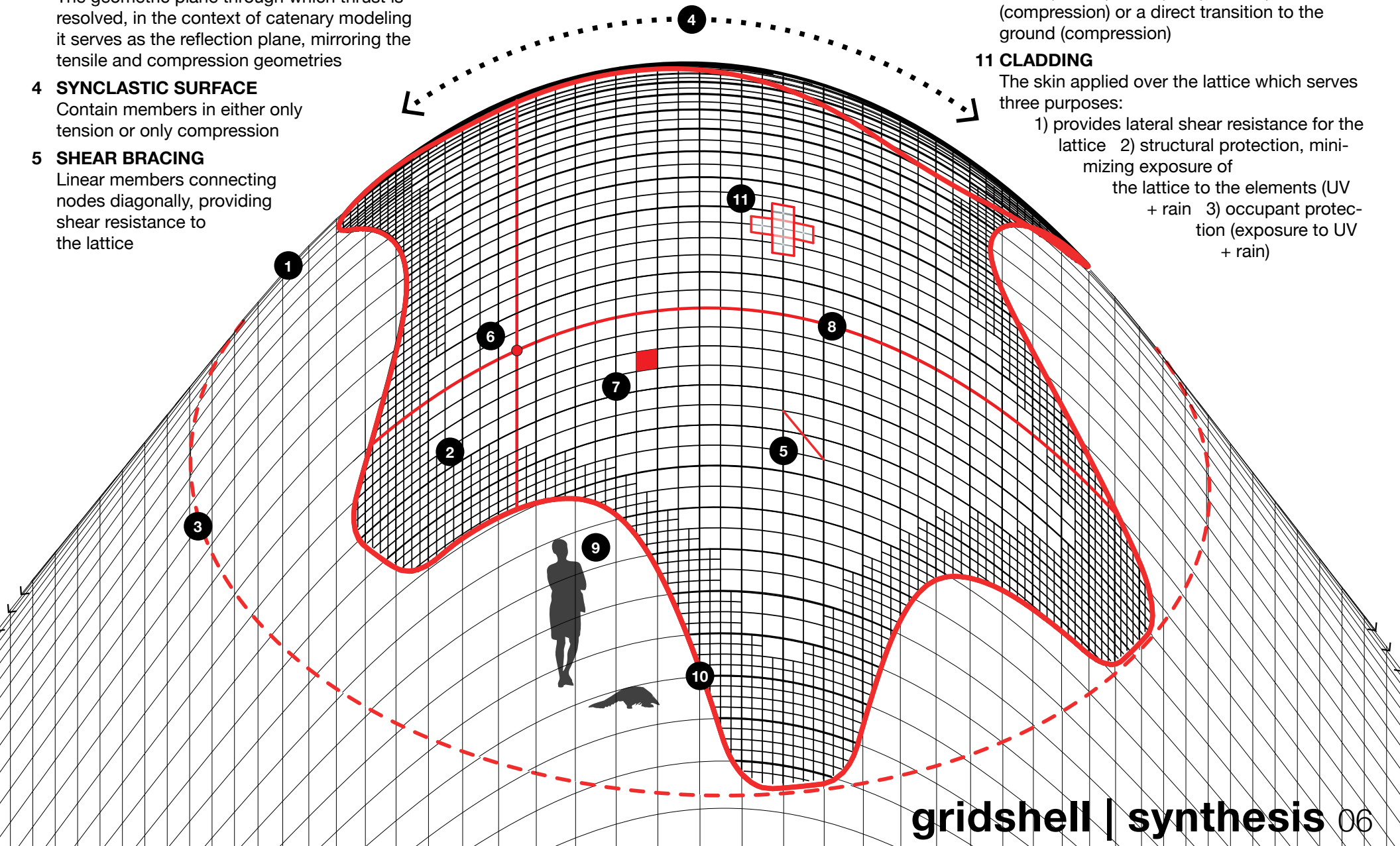
**10 BOUNDARY CONDITION**

The perimeter that defines the extent of the gridshell, resolves thrust and translates forces to the ground. It may function as an edge beam (flexure), arch (compression), oculus (compression) or a direct transition to the ground (compression)

**11 CLADDING**

The skin applied over the lattice which serves three purposes:

- 1) provides lateral shear resistance for the lattice
- 2) structural protection, minimizing exposure of the lattice to the elements (UV + rain)
- 3) occupant protection (exposure to UV + rain)



## ACCESSIBILITY

**NEXUS:** new 1/20 paths provide universal access to the previously inaccessible adjacent northern terraces (across pre-existing stair landings) and to the shell + scape proper

## SOAP BOXES

**NEXUS:** moveability allows users to reconfigure the blocks in response to programmatic and social preferences

**COMFORT:** the ability to slide the bench blocks invites diverse ergonomic interpretations

## STAIR EXTENSION

**NEXUS:** demolishing an existing wall and extending the stairs southward improves visual connectivity and circulation with the host building

## PLANTERS

**WALK the WALK:** planters provide students and faculty with opportunities to experiment with plants and microclimates

**SCAPE:** integrating planters into the hardscape and furniture elements creates intimate and inviting spaces

## DETENTION BASIN

**WALK the WALK:** demonstrates strategies for water reclamation and aquifer recharging, a significant issue in this hot arid region

**NEXUS:** rain events leave a pool of water for 1-3 days, an attraction emulating the ephemeral stream beds indigenous to the region; shade: provide it and they will come

**SCAPE:** concrete spillway replaced with urbanite and plantings; irregular edging blends hardscape with softscape and minimizes erosion

**COMFORT:** mature vegetation will offer psychological and thermal delight through shade and lower ambient temperatures

## GRIDSHELL + SCAPE

**WALK the WALK:** embodiment + expression of the values, abilities and rigor of the college; a demonstration not a claim

**NEXUS:** a social / event hub with optimal connections to surrounding circulation paths

**SCAPE:** a fluid symbiotic relationship between architecture and landscape

**COMFORT:** an intimate oasis of thermal comfort in a difficult site exposed to harsh western afternoon light in this hot arid environment





cleaning pre-existing donor bricks for relocation



heavy rain produces mudslide into adj. underpass



concrete pour | east foundation ballast



concrete removal



pre-pour electrical + re-bar inspections



welding certification coupons: before + after testing



blue "MISTAKE" leads to WC shutdown in building



formwork installation



students training for welding certification (+ popsicle)



flat gridmat, wire tied 1/2" A36 steel rods 20" x 20"



full deployment of suspended formwork



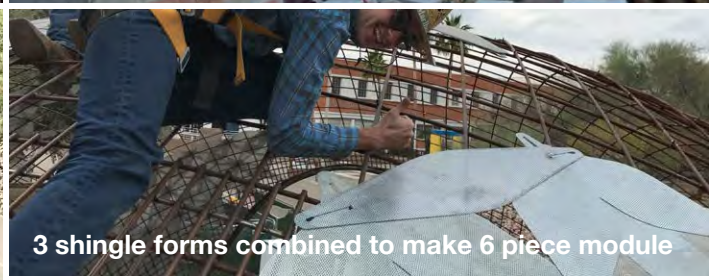
boundary: 37 cold formed and stitch welded 1/2" rods



partial deployment of suspended formwork



27 minutes to complete "springing" of gridshell



3 shingle forms combined to make 6 piece module



one person raising shell with chain driven hoist



forming and trimming the openings



trial installation

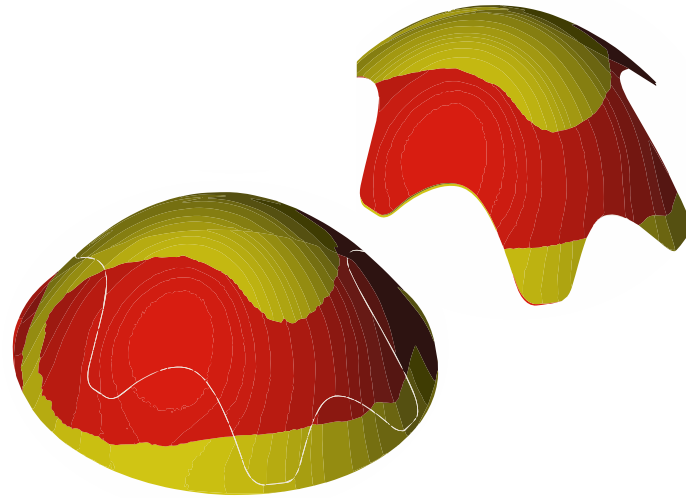


trimmed shell with lattice densification at perimeter

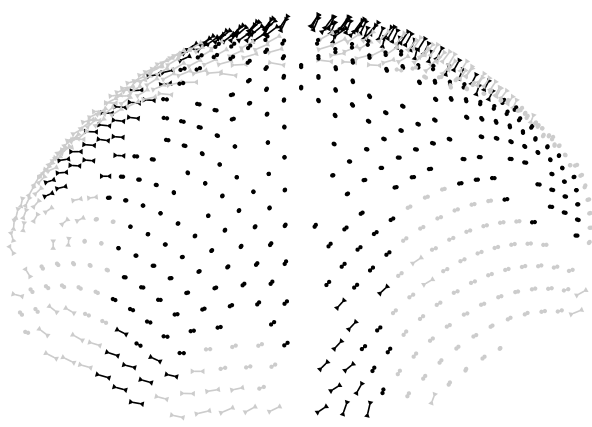


cladding in quadrants with transitional seams

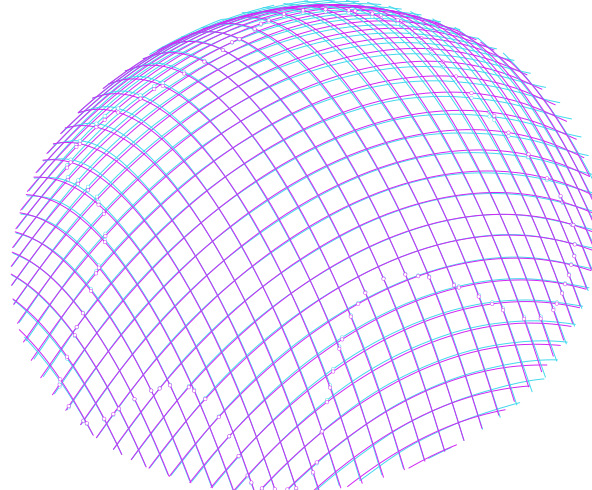
shell raising 09



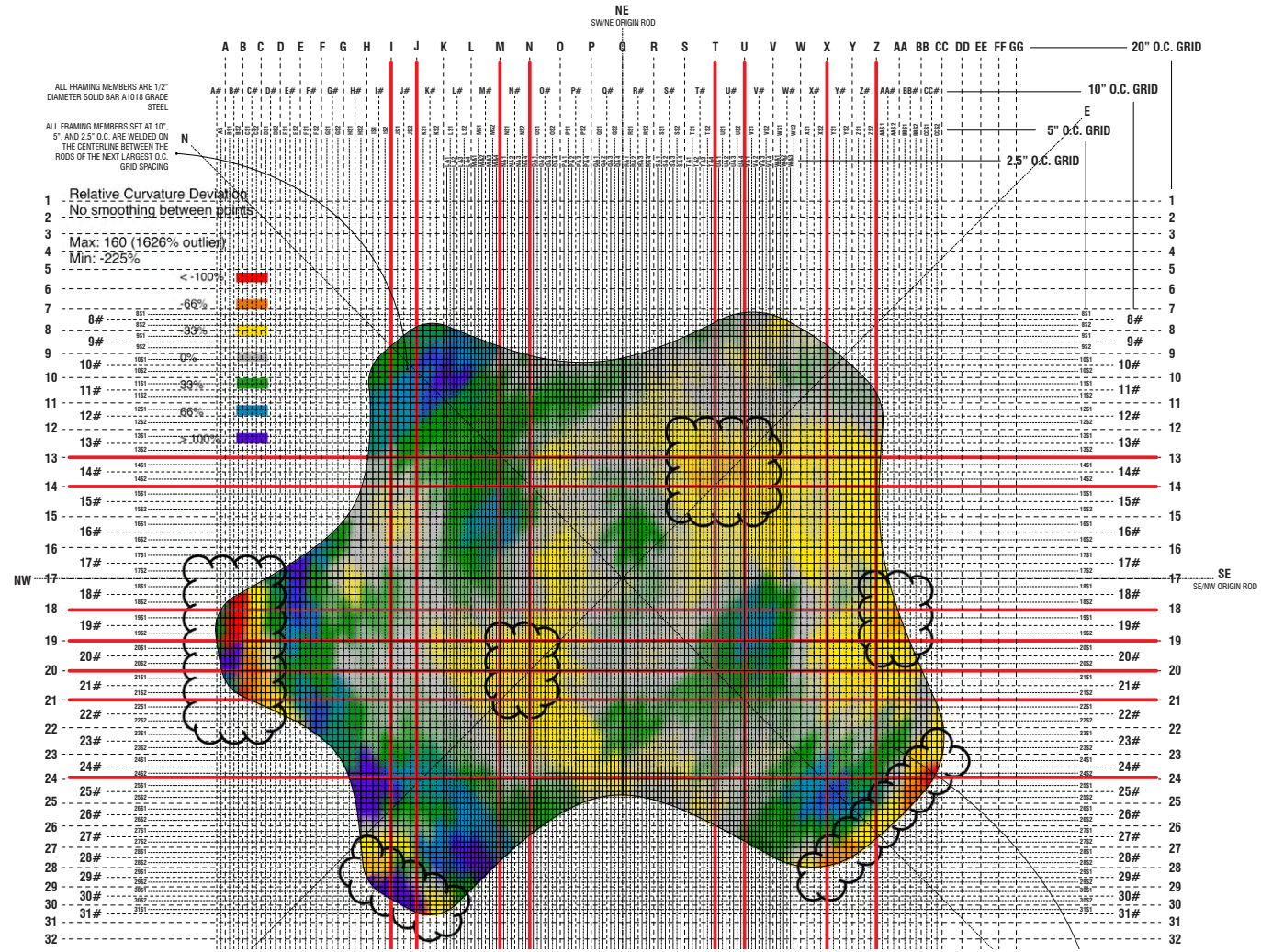
design geometry extracted from catenary field



node displacement | design to initial formation



rod displacement | second scan to revised design



finite element analysis illustration | indicating rods to be adjusted



3D laser scanning | > 4500 points | 3 times



nodes flagged for evaluation + adjustment



looking North-Northwest



looking Northwest



looking Southeast



handrails



displaced donor bricks cast in stairs



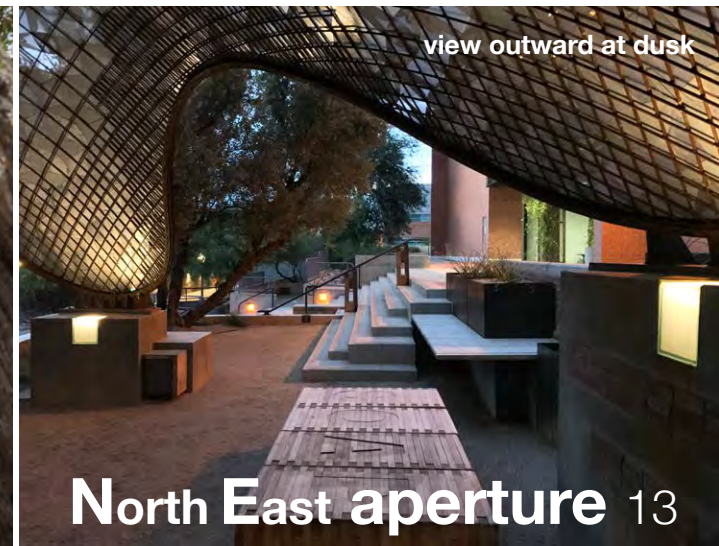
imprint of olive that fell during concrete finishing



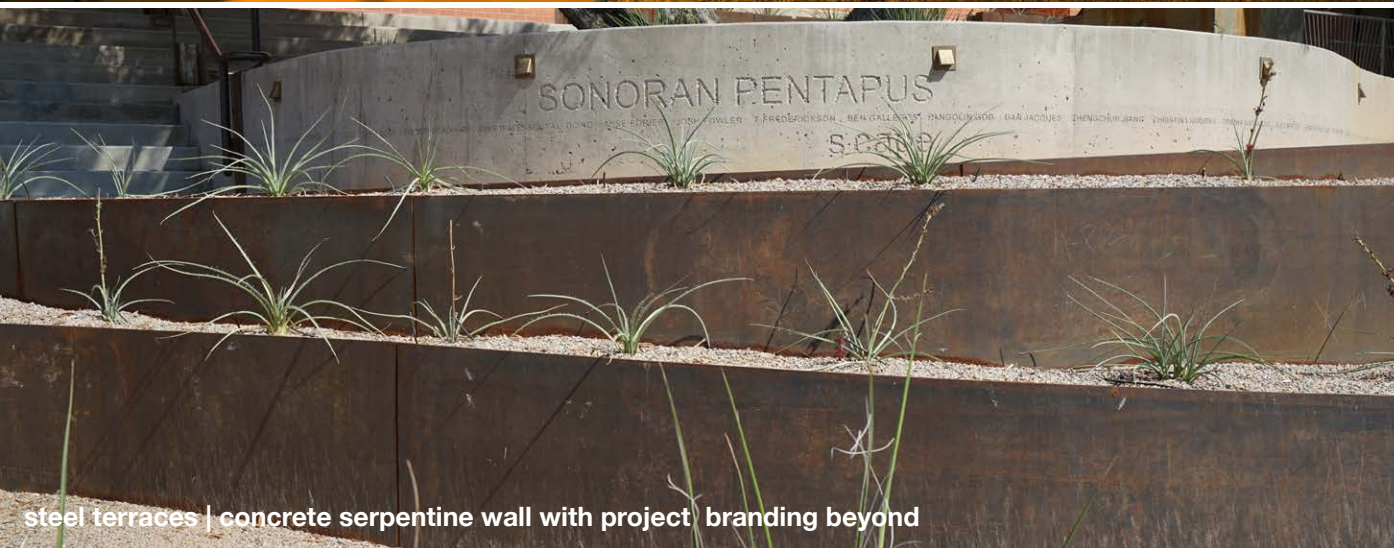
table, planters + moveable "SOAP" boxes



view from terrace path

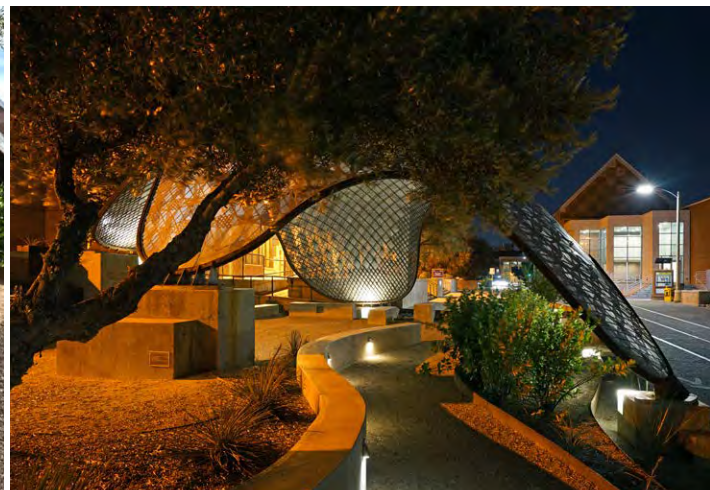


view outward at dusk



steel terraces | concrete serpentine wall with project branding beyond

ramp entrance



signage + credits | sandblasted on serpentine wall

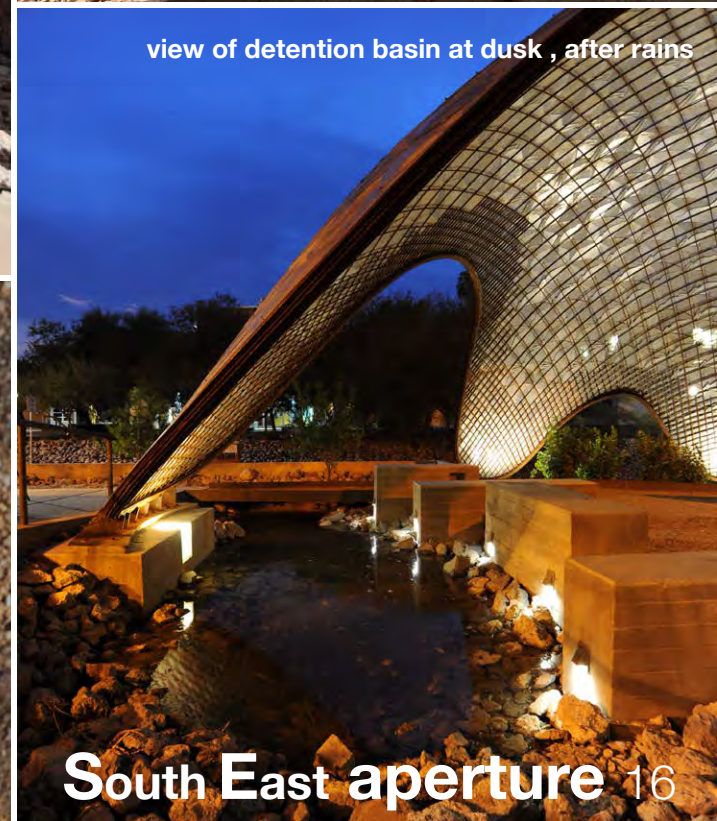
view from terrace path at night

view from terrace path at midday





view through barrier plants and anchorage



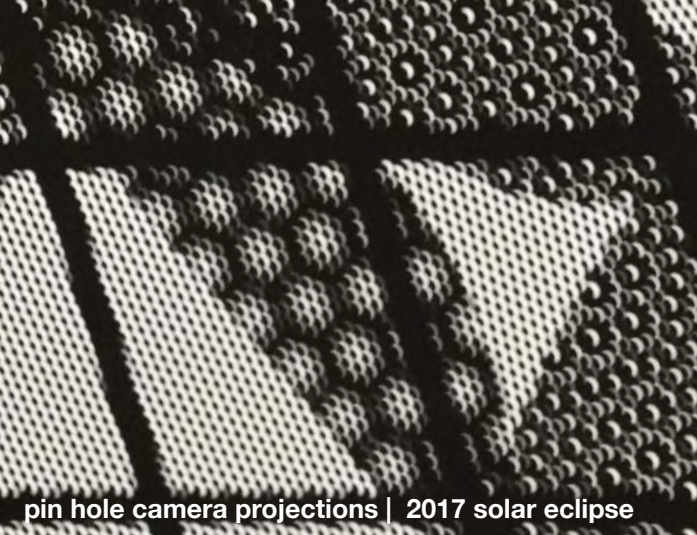
view of detention basin at dusk , after rains



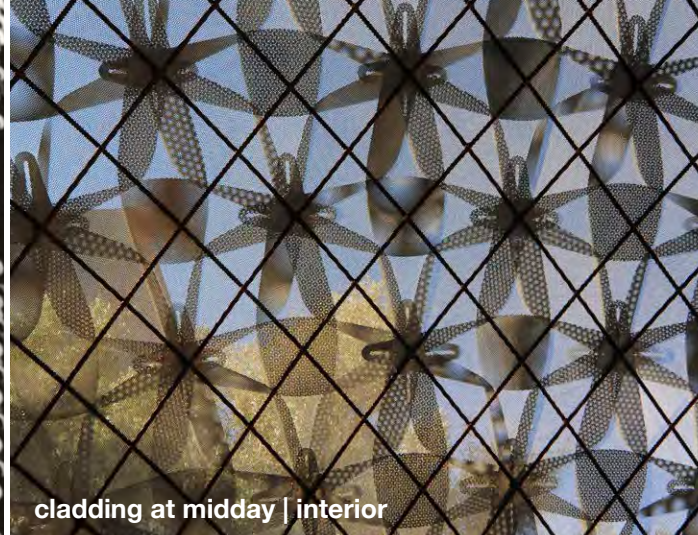
concrete bench, urbanite + light at detention basin



imprint of Canadian maple leaf from grant partners



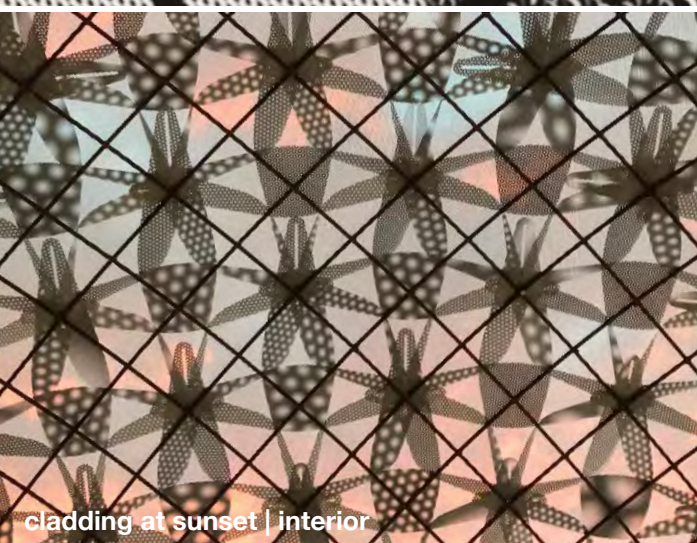
pin hole camera projections | 2017 solar eclipse



cladding at midday | interior



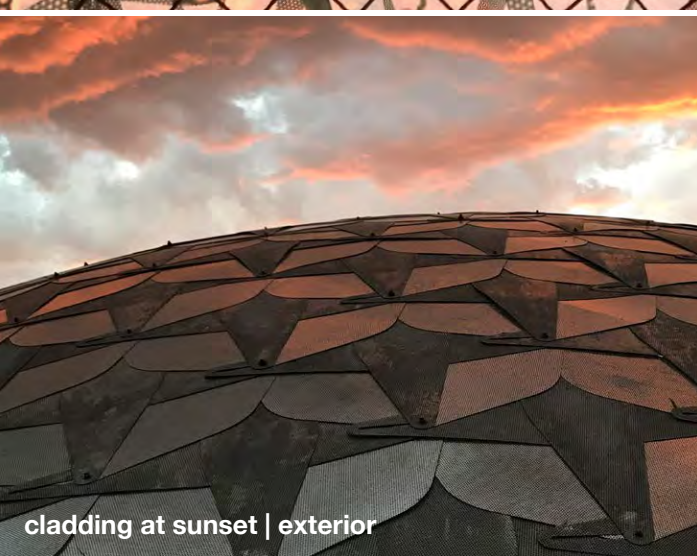
cladding at midday | exterior



cladding at sunset | interior



mid afternoon | effects of perforated zinc plated 24 ga. sheet steel shingles



cladding at sunset | exterior



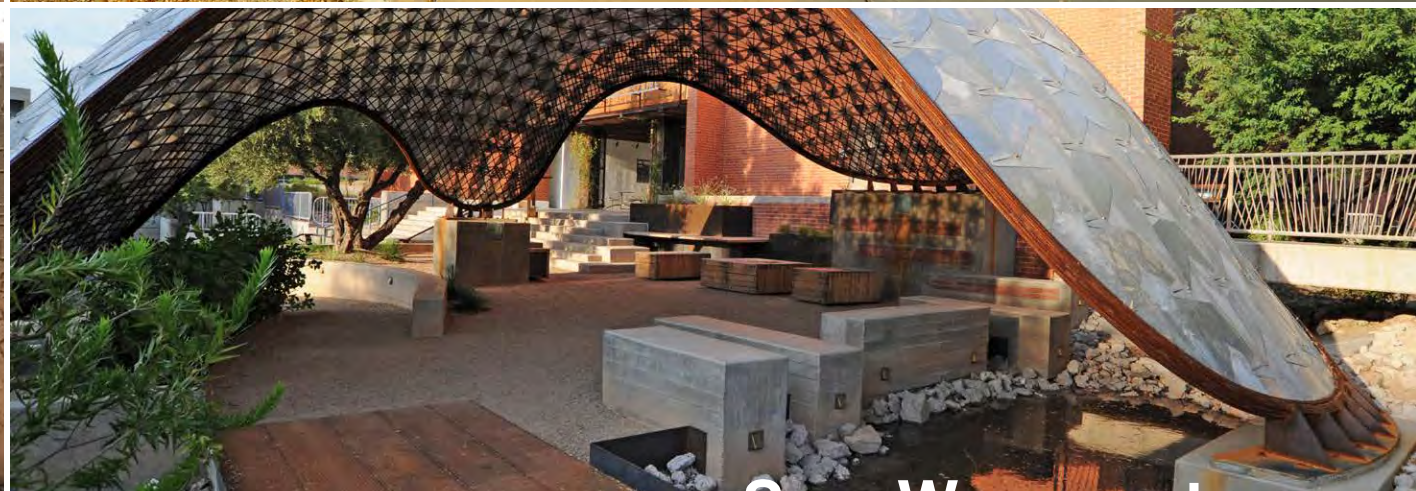
easter egg | han solo frozen in carbonite

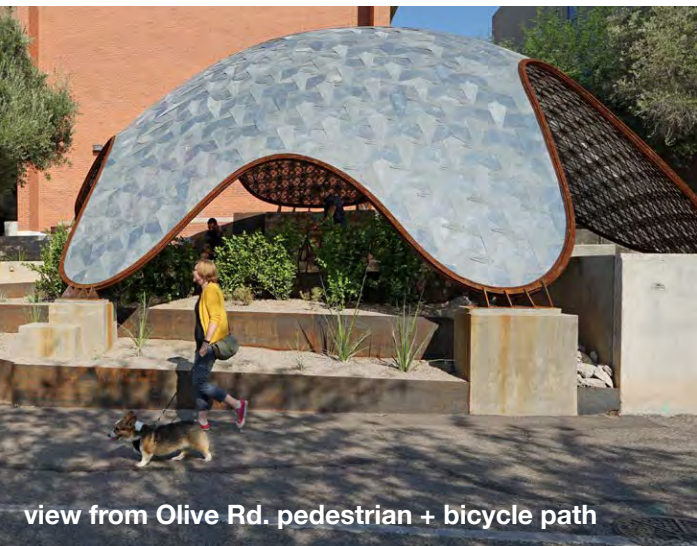


outlet at concrete bench with power symbol



acknowledgements sandblasted in concrete bench





view from Olive Rd. pedestrian + bicycle path



gridshell anchorage + light enclosure



small towns, directions and distances in relief

A group of approximately 15 construction workers, including men and women, are posed on a construction site. They are wearing various safety gear such as hard hats (white and red), high-visibility vests (yellow and orange), and safety glasses. Some are holding tools or equipment. In the foreground, there is a large wooden formwork structure. The background shows a brick building and some trees. The overall scene is a busy construction site.

# CREDITS

**excluded for anonymity  
to be submitted if  
project is recognized**