TRANSCEND

ONSEN | HAKONE, JAPAN
Driven by the site's environment and culture, our design intent is to embrace the people's belief in the spiritual marriage of the surrounding mountains and the volcanically heated onsen.
TOPOGRAPHICAL POINTS OF SITE

APEX DETERMINED CORRESPONDING TO PROGRAM

DRAPE SURFACE OVER CURVES

SMOOTH SURFACE

SHIFT CONTROL POINTS ACCORDING TO DESIGN

CREATE LEVELLED FOOTING

FINAL FORM WITH OCULUS

FORM GENERATION MCNEEL RHINOCEROS 02

FLOOR PLAN

1 ENTRY LOBBY
2 MEN'S CHANGING ROOM
3 MEN'S OUTDOOR BATH
4 MEN'S INDOOR BATH
5 WOMEN'S CHANGING ROOM
6 WOMEN'S INDOOR BATH
7 WOMEN'S OUTDOOR BATH

ENTRY LOBBY
MEN'S CHANGING ROOM
MEN'S OUTDOOR BATH
MEN'S INDOOR BATH
WOMEN'S CHANGING ROOM
WOMEN'S INDOOR BATH
WOMEN'S OUTDOOR BATH

FLOOR PLAN
THIN OCULUS EDGE

LIP TO REROUTE RAINWATER

1. WIRE MESH REINFORCEMENT
2. SCREW CONNECTION TO CONCRETE SHELL
3. ACRYLIC OCULUS COVER
4. CONTINUOUS REINFORCEMENT AROUND OCULUS CIRCUMFERENCE
OCULUS CONNECTION DETAIL

1. THREADED BOLT CONNECTION WITH TWISTING HEADS
2. ACRYLIC OCULUS COVER

SOL GROTTO
RAEL SAN FRATELLO
BERKELEY BOTANICAL GARDEN
Indicates 6’ Clear Head Space
Acrylic Lighting Tubes

1 4" S.O.G.
2 1-4" S.O.G.
3 Metal Grating for Drainage
4 Resting Bed of Gravel with L.E.D. Lighting Embedded
5 2” Diameter Transparent Tubes
STRUCTURAL ANALYSIS

GRAVITY ANALYSIS

AVG. GRAVITY SHELL STRESSES ~30 PSI

MESH
BUCKLING ANALYSIS
SAFETY FACTOR: 11.49

*ALL NUMERICAL VALUES IN PSI

STRUCTURAL ANALYSIS
BUCKLING

STRUCTURAL ANALYSIS
RESPONSE SPECTRUM

RESPONSE SPECTRUM ANALYSIS
SDS: 1.52
STRUCTURAL ANALYSIS
TIME HISTORY

TIME HISTORY ANALYSIS
NORTHRIDGE EARTHQUAKE GROUND MOTION

CONCEPTS
## Free-Form Catalan Vault

**Zurich, Switzerland**

### Construction Precedent

- **Construction**: Hakone Construction
- **Materials**: Recycled Material, Aluminum Scaffolding (Rental), Soil, Concrete, Glass Tubes

### Construction Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Amount</th>
<th>Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot; Plywood Sheet</td>
<td>1,500 SQ FT</td>
<td>$340</td>
</tr>
<tr>
<td>5mm Roofing Membrane</td>
<td>14,800 SQ FT</td>
<td>$784</td>
</tr>
<tr>
<td>Recycled Material</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Aluminum Scaffolding (Rental)</td>
<td>50 QTY</td>
<td>$42,300</td>
</tr>
<tr>
<td>Soil</td>
<td>750 CY</td>
<td>N/A</td>
</tr>
<tr>
<td>Concrete</td>
<td>400 CY</td>
<td>$26,000</td>
</tr>
<tr>
<td>Glass Tubes</td>
<td>400 CT</td>
<td>$2,400</td>
</tr>
</tbody>
</table>

### Hakone Construction

- **Material**: 4'x8' Cardboard
- **Amount**: 28 Sheets
- **Cost Estimate**: Donated

### Cal Poly Construction

- **Material**: 3.5 mm Plastic Membrane
- **Amount**: 100 SQ FT
- **Cost Estimate**: Donated

- **Material**: 2x3 Lumber (Formwork)
- **Amount**: 8
- **Cost Estimate**: $30

- **Material**: 2x6 Lumber (Formwork)
- **Amount**: 8
- **Cost Estimate**: $76
06 CONSTRUCTION SECTION

1 MEMBRANE
2 CONCRETE SHELL
3 SOIL
4 PLATFORM

06 CONSTRUCTION EXPLODED AXON

HAKONE CONSTRUCTION PROPOSED METHOD
MODELS
CAL POLY SCALE 07

PALLET SUBSTITUTION FOR SCAFFOLDING

CARDBOARD WAFFLE GRID SUBSTITUTION FOR PLYWOOD

FILLING WAFFLE VOIDS WITH SAND

ATTACHED EDGES TO RETAIN SAND
SMOOTHED SAND SURFACE

APPLICATION OF PLASTIC MEMBRANE

CONCRETE IS APPLIED WITH WIRE MESH AS REINFORCEMENT

CONCRETE IS SMOOTHED AND FINISHED FOR CURING
CURED CONCRETE SHELL

FORMWORK REMOVAL

FORMWORK REMOVED AND SUPPORT BEAMS ARE PLACED

LIGHTING PREPARED FOR INSTALLATION