MEET THE TEAM

Meng SE
Catrin CM
Marveliz Ap
Mike, Maria, Enrique, Ana
Owners
Ben CM
Martin A
Marios MEP
Robert SE
The Task at Hand

New building reflecting values of UNR’s School of Engineering Commitment to Local Impact: Bringing the latest engineering technologies to Nevada
10.5 mil budget, 30,000 GSF, 1-year max construction
Solar Resources

- Average Roof Solar Resource: ~6KWh/m²/day
- Moderate Solar Resources from southern walls in Fall, Winter, Spring
- 252 Sunny Days
Sun Path Visualization

- Summer Solstice
- Fall Equinox
- Winter Solstice
- Spring Equinox

Images at 8am, 12pm, and 5pm for each season.
Important Site Conditions

Highly Seismic Area
Shallow Water Table
Large Fluctuation in Temps. (daily and seasonally)
High desert winds - 60 mph avg
Rain Shadow: 7 in. of rain, 23 in. of snow

Climate Conditions
99% heating design Temperature = 14.9F
1% cooling design Temperature = 92.5F
Average humidity: 60%

Indoor Design Conditions
51 days above 90F, HDD68=5674
166 days below freezing, CDD74=508
Our Design Process

Tool Box

Constant Communication

<table>
<thead>
<tr>
<th>1. Expression of Big Idea</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2. Site Connection</td>
</tr>
<tr>
<td>1 3. User Comfort</td>
</tr>
<tr>
<td>1 2 4. Water Challenge</td>
</tr>
<tr>
<td>1 5 5. Sustainability</td>
</tr>
<tr>
<td>1 2 6 6. Floor to Ceiling Height</td>
</tr>
<tr>
<td>1 7 7 7. Structural Strength (Seismic Performance)</td>
</tr>
<tr>
<td>1 2 3 4. Cost</td>
</tr>
<tr>
<td>1 2 3 4. Constructability</td>
</tr>
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<td>1 2 3 12. Interdisciplinary Integration</td>
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<td>6</td>
<td>3</td>
<td>9</td>
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<td>7</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>11</td>
<td>6</td>
</tr>
</tbody>
</table>

55 ideas in 10 mins!!
Big Idea 1: Canyon

Architecture
Canyon + Building
Green spaces around our site
Connecting the green areas through our building
Utilizing the sunlight in our programming
Level 1
Big Idea 1: Canyon

Structural Engineering
Earthquake

Highly seismic area
Site Class D
Risk Category II

USGS-Provided Output

\[
\begin{align*}
S_S &= 1.963 \text{ g} \\
S_M &= 1.963 \text{ g} \\
S_{DS} &= 1.308 \text{ g} \\
S_1 &= 0.663 \text{ g} \\
S_{M1} &= 0.994 \text{ g} \\
S_{D1} &= 0.663 \text{ g}
\end{align*}
\]
Elevation

- Level 4: 30' - 0"
- Level 3: 18' - 0"
- Level 2: 6' - 0"
- Level 1: -6' - 0"

- 6 ft below grade
- Increase floor-ceiling height
- Increase user comfort
Soil Profile

(Grade at 4580 ft Elevation) 0 ft

1.58 ft

Water Table (4 ft)

2.42 ft

Excavation (7 ft)

4.67 ft

7 ft

<table>
<thead>
<tr>
<th>Depth of Excavation</th>
<th>Soil Type</th>
<th>Thickness</th>
<th>Bearing Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stony Sandy Loam and Heavy Loam</td>
<td>19&quot;</td>
<td>1500 psf</td>
</tr>
<tr>
<td></td>
<td>Sandy Clay Loam</td>
<td>10&quot;</td>
<td>1500 psf</td>
</tr>
<tr>
<td></td>
<td>Clay and Clay Loam</td>
<td>27&quot;</td>
<td>1500 psf</td>
</tr>
<tr>
<td></td>
<td>Very Gravelly Sandy Loam and Very Gravelly Loam</td>
<td>28&quot;</td>
<td>5000 psf</td>
</tr>
<tr>
<td></td>
<td>Volcanic Rock</td>
<td>unknown</td>
<td>8000 psf</td>
</tr>
</tbody>
</table>
Foundation

Hydrostatic Forces

- water table (4’ below grade)
- basement (6’ below grade)

Mat Foundation

- need thicker base slab
- 4000 psi concrete - 18” thick placed 6’ below grade

125 psf
1250 k
2400 k

Building
Retaining Wall

allow sunlight into the basement

Cost for Value

waterproofed retaining wall around all four sides
Find the Structural System

- Structural Performance
- Material
- Architectural Aspects
- Building Services
- Costs
- Sustainability
- A - SE - MEP - CM Collaboration
- Constructibility
- Type of Construction

A - SE - MEP - CM Collaboration

30
## Canyon - Design Loads

<table>
<thead>
<tr>
<th>PT Concrete Option</th>
<th>Steel Option</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gravity</strong></td>
<td><strong>Gravity</strong></td>
</tr>
<tr>
<td>Dead Load</td>
<td>Dead Load</td>
</tr>
<tr>
<td>120 psf</td>
<td>80 psf</td>
</tr>
<tr>
<td>Live Load</td>
<td>Live Load</td>
</tr>
<tr>
<td>100 psf</td>
<td>100 psf</td>
</tr>
<tr>
<td>Snow Load</td>
<td>Snow Load</td>
</tr>
<tr>
<td>10 psf</td>
<td>10 psf</td>
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<td><strong>Lateral</strong></td>
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<tr>
<td>Wind Base Shear</td>
<td>Wind Base Shear</td>
</tr>
<tr>
<td>65 kips</td>
<td>65 kips</td>
</tr>
<tr>
<td>Seismic Base Shear</td>
<td>Seismic Base Shear</td>
</tr>
<tr>
<td><strong>625 kips</strong></td>
<td><strong>520 kips</strong></td>
</tr>
</tbody>
</table>
Canyon - PT Concrete Option
PT Concrete

Challenge
- Floor Height
- Span of Auditorium

Advantages
- Increased Clear Spans
- Thinner Slabs
- Lighter Structure
- Reduced Deflections

Design
- Solid Flat Slab: 9"
- Columns 12” x 12”
Canyon - PT C Level 1

- **Column:** 12” x 12”
- **Beam:** 10” x 20”
  - Typ. Span: 19’, 24’
- **Tendon x - direction**
  - Typ. Span: 19’
- **Tendon y - direction**
  - Typ. Span: 19’
- **Cantilever**
Canyon - PT C Level 2

- Column: 12” x 12”
- Beam: 10” x 20”
  Typ. Span: 19’, 24’
- Beam: 12” x 24”
  Typ. Span: 38’ (audit)
- Tendon x - direction
  Typ. Span: 19’
- Tendon y - direction
  Typ. Span: 19’
- Cantilever
Canyon - PTC Level 3

Column: 12” x 12”
Beam: 10” x 20”
Typ. Span: 19’, 24’
Beam: 12” x 24”
Typ. Span: 38’
Tendon x - direction
Typ. Span: 19’
Tendon y - direction
Typ. Span: 19’
Cantilever
Canyon - PT C Section

- Column: 12" x 12"
- Beam: 10" x 20"
- Typically Span: 19', 24'
- Tendon x-direction
  - Typically Span: 19'
- Cantilever each Span 19'
Canyon - PT C Lateral System

Advantages
- reduce forces and accelerations more than factor 3
- reduce weight of structural system
- minimizing of foundation
- cost saving

2x cores isolated on the ground level

structure isolation
ground level
water

Energy dissipation core
Layers of rubber and steel
Steel mounting plate

Dynamic Isolation Systems
Canyon - PT C Evolution
SE - Arch Collaboration

A-SE-MEP

OWNER INPUT

REARRANGEMENT OF ROOMS
Canyon - Steel Option
Ecospan Composite Floor System

Advantages:
- 89% recycled steel material
- open web configuration for MEP design

Design:
- 3” LW concrete slab
- 2” steel deck
- 20” steel joist
- shear studs: Shearflex HD screw (5/16” dia.)
Canyon Steel - Level 2

- **20” Ecospan Joist**
  - Typ. Span: 19’

- **Girder: W21x44**
  - Typ. Span: 19’, 28.5’

- **Auditorium: W24x68**
  - Typ. Span: 38.5’

- **Column: W14x90**

- **Cantilever: 9.5’**

- **Bridges**
20” Ecospan Joist
Typ. Span: 19’

Girder: W21x44
Typ. Span: 19’, 28.5’

Auditorium: W24x68
Typ. Span: 38.5’

Column: W14x90

Cantilever: 9.5’

Bridges
Lateral System

Two wings seismically independent

Teflon slider

Stairwell

BRBF

Canyon

Structural Engineering

12'

28.5'

14' - 3''

23' - 9''

5 7/8''

28' - 6''

38' - 4 1/8''

28' - 6''

9' - 17/8''
Braced frame connection

Cantilever welded connection
Chaotic columns

Arch - SE Coordination

Room rearrangement
Exposed columns in atrium

Canyon waterfall

“Water Column”

Controlled water flow to reflect real time water consumption of the building
Big Idea 1: Canyon
Steel Option
Mechanical Room - Vertical Shafts

- **Mechanical Room**
- **Vertical Shafts**
- **AHUs**

![Diagram of Mechanical Room and Vertical Shafts]

**Canyon**

**M E P**

AHU 1

AHU 2

Mechanical Room - Vertical Shafts
Basement’s Distribution Tree

- Supply Air Ducts
- Return Air Ducts
Ground Floor’s Distribution Tree

Supply Air Ducts

Return Air Ducts
1st Floor’s Distribution Tree

Supply Air Ducts

Return Air Ducts
Typical Floor Sandwich
### Performance Relative to Life Cycle Impact Targets

<table>
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<tr>
<th>Impact</th>
<th>Target</th>
<th>Project</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon (kgCO2e)</td>
<td>5,631,313</td>
<td>3,204,042</td>
<td>57%</td>
</tr>
<tr>
<td>Energy (MJ)</td>
<td>131,385,813</td>
<td>48,114,482</td>
<td>37%</td>
</tr>
<tr>
<td>Water (kgH2O)</td>
<td>110,021,918</td>
<td>298,117,088</td>
<td>271%</td>
</tr>
<tr>
<td>Ozone (kgCFC11ε)</td>
<td>-</td>
<td>1.36E-01</td>
<td>-</td>
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First rough Estimation

More Detailed Calculation - First water reduction attempt

Detailed Calculation

STV Evolution
PT C Option
Mechanical Room-Vertical Shafts

- Mechanical Room
- Vertical Shafts
- AHUs

Canyon
M E P

AHU 1

AHU 2

Mechanical Room-Vertical Shafts
Basement’s Distribution Tree

- Supply Air Ducts
- Return Air Ducts
- Heating & Cooling Plenums
Ground Floor’s Distribution Tree

Supply Air Ducts
Return Air Ducts

Heating & Cooling Plenums
1st Floor’s Distribution Tree

Supply Air Ducts
Return Air Ducts
Heating & Cooling Plenums
Pressurized Plenum
0.05" - 0.10" w.g.

Typical Floor Sandwich

8"
9"
8"
9'-11"
12'

Canyon
M E P
Performance Relative to Life Cycle Impact Targets

<table>
<thead>
<tr>
<th>Impact</th>
<th>Canyon - Steel</th>
<th>Canyon - Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon (kgCO2e)</td>
<td>5,631,313</td>
<td>3,376,024</td>
</tr>
<tr>
<td>Energy (MJ)</td>
<td>131,385,813</td>
<td>49,132,653</td>
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<tr>
<td>Water (kgH2O)</td>
<td>110,021,918</td>
<td>300,654,169</td>
</tr>
<tr>
<td>Ozone (kgCFC11e)</td>
<td>-</td>
<td>1.45E-01</td>
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</tbody>
</table>

GWP 57% 60%
Energy 37% 37%
Water 271% 273%
Big Idea 1: Canyon Construction Management
SITE LAYOUT (Steel)
NEED BIGGER LAYDOWN AREA FOR STEEL!
2 CRANES FOR FASTER CONSTRUCTION
Material Suppliers
Equipment and Labor Suppliers
Multiquip DCA45 Portable Generator Set
Supplier: United Rentals Reno

CASE 580N Backhoe
Supplier: America Rents Reno

Dozer, 70HP Cat
Class Code: 906-2070
Supplier: United Rentals Reno

LIEBHERR LR1200SX 275 TON
Supplier: Bragg Crane
Prefabricated Formworks:

❖ Reduces on site labor
❖ Speed up construction schedule
Temporary Exterior Covering:

- Interior work can start before facade is installed
- Acts as a safety net.
Early Elevator Installation:

- Elevator can be used to transport people/material for the remaining construction period.
- Less obstruction for elevator subcontractor
<table>
<thead>
<tr>
<th></th>
<th>CONCRETE</th>
<th>STEEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Construction Duration</td>
<td>48 WEEKS</td>
<td>44 WEEKS</td>
</tr>
<tr>
<td>Total Float</td>
<td>4 WEEKS</td>
<td>8 WEEKS</td>
</tr>
<tr>
<td>Meets overall deadline?</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Building covered up before December?</td>
<td>❌</td>
<td>✔️</td>
</tr>
<tr>
<td>Computer rooms can open in time?</td>
<td>❌</td>
<td>✔️</td>
</tr>
</tbody>
</table>
Budget and Target

Return on Investment - 1.51%
Expected Inflation - 2.34%
5-Year Treasury Bond

Budget = $10,071,424
Target = $10,000,000

Canyon Construction Management
Estimating Process

1. Past Project Research
2. RSMeans S.F. Estimate
3. Discipline Specific Input
4. Search RSMeans Database
5. Contact Industry Vendors
6. Update TVD Sheets
Team Influence
### TVD Example

#### Target vs. Estimate

<table>
<thead>
<tr>
<th>Description</th>
<th>RS Means Line Item</th>
<th>RS Means Unit Cost</th>
<th>Current Data</th>
<th>Reliability</th>
<th>Current Estimate</th>
<th>Target Value</th>
<th>Delta</th>
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</thead>
<tbody>
<tr>
<td>Strip footing, concrete reinforced, load 11.1 klf, wall bearing capacity 6 ksf, 12’ deep x 4’ wide</td>
<td>A:1618 Standard Foundations</td>
<td>L.F.</td>
<td>456</td>
<td>L.F.</td>
<td>$19,230</td>
<td>$21,000</td>
<td>$1,770</td>
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<tr>
<td>Dynamic isolation systems base isolators</td>
<td>A:1629 Special Foundations</td>
<td>E.A.</td>
<td>37</td>
<td>E.A.</td>
<td>$39,000</td>
<td>$39,000</td>
<td>0</td>
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<tr>
<td>Slab on grade, 8’ thick, light industrial, reinforced - value multiplied by 2 to get the 16’ CRM.</td>
<td>A:1630 Slab on Grade</td>
<td>S.F.</td>
<td>1125</td>
<td>S.F.</td>
<td>$7,300</td>
<td>$7,300</td>
<td>0</td>
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<tr>
<td>Foundation wall, GCL, 8’ wall height, sheet d, and concrete</td>
<td>A:2023 Basement Walls</td>
<td>L.F.</td>
<td>468</td>
<td>L.F.</td>
<td>$51,000</td>
<td>$51,000</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Quantity Reliability

- **High**: 6%
- **Medium**: 31%
- **Low**: 63%

#### Cost Data Reliability

- **High**: 11%
- **Medium**: 40%
- **Low**: 49%

#### Overall Reliability

- **High**: 6%
- **Medium**: 31%
- **Low**: 63%
Canyon Cost Breakdown

Concrete Option

- B Shell: $1,916,847, 46%
- E Equipment and Furnishing: $41,800, 1%
- C Interiors: $803,030, 19%
- D Services: $207,499, 5%
- H General Conditions: $959,317, 23%
- A Substructure: $242,732, 6%

Steel Option

- B Shell: $2,678,090, 52%
- E Equipment and Furnishing: $41,800, 1%
- C Interiors: $803,030, 15%
- D Services: $207,499, 4%
- H General Conditions: $1,216,267, 24%
- A Substructure: $215,629, 4%
Canyon Idea Targets

Concrete Option

Steel Option
# Canyon Cost Breakdown

<table>
<thead>
<tr>
<th>Canyon Idea</th>
<th>Steel</th>
<th>Concrete</th>
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</thead>
<tbody>
<tr>
<td>A Substructure</td>
<td>$216,000</td>
<td>$243,000</td>
</tr>
<tr>
<td>B Shell</td>
<td>$2,679,000</td>
<td>$1,917,000</td>
</tr>
<tr>
<td>C Interiors</td>
<td>$804,000</td>
<td>$804,000</td>
</tr>
<tr>
<td>D Services</td>
<td>$208,000</td>
<td>$208,000</td>
</tr>
<tr>
<td>E Equipment and Furnishing</td>
<td>$42,000</td>
<td>$42,000</td>
</tr>
<tr>
<td>F Specialty Construction</td>
<td>$ -</td>
<td>$ -</td>
</tr>
<tr>
<td>G Building Sitework</td>
<td>$ -</td>
<td>$ -</td>
</tr>
<tr>
<td>H General Conditions</td>
<td>$1,217,000</td>
<td>$960,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$5,163,000</strong></td>
<td><strong>$4,172,000</strong></td>
</tr>
</tbody>
</table>
Big Idea 2: Oasis

Architecture
Main flow from the campus
Creating a social hub inside the building
Level 1

Oasis Architecture

- MEP
- Auditorium
- Large Class
- Small Class
- Toilet
Level 3

Oasis

Architecture

Faculty
Seminar
Student
Storage
Toilet
Section 1

PUBLIC SPACE

PRIVATE SPACE

Oasis

Architecture
Section 2
Solar determined facade
Big Idea 2: Oasis

Structural Engineering
# Oasis - Design Loads

<table>
<thead>
<tr>
<th>Timber Option</th>
<th>Steel Option</th>
</tr>
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<tbody>
<tr>
<td><strong>Gravity</strong></td>
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</tr>
<tr>
<td>Dead Load</td>
<td>Dead Load</td>
</tr>
<tr>
<td>60 psf</td>
<td>80 psf</td>
</tr>
<tr>
<td>Live Load</td>
<td>Live Load</td>
</tr>
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<td>100 psf</td>
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<tr>
<td>Wind Base Shear</td>
<td>Wind Base Shear</td>
</tr>
<tr>
<td>65 kips</td>
<td>65 kips</td>
</tr>
<tr>
<td>Seismic Base Shear</td>
<td>Seismic Base Shear</td>
</tr>
<tr>
<td>420 kips</td>
<td>520 kips</td>
</tr>
</tbody>
</table>
Oasis - Timber Option

Dimensions:
- 116' length
- 36' width
- 58' height

Structural Engineering
Oasis - Timber

Challenge
- Sustainability
- Earthquake

Advantages
- Less Weight of the Construction

Design
- Glued Laminated Timber
- Plywood Web Joist
Oasis - Timber Level 1

- Column: 16” x 16”
- Column: 12” x 12”
- Girders: 12” x 32”
  Typ. Span: 29’, 38’ (audit)
- Girders: 12” x 20”
  Typ. Span: 20’
- Plywood Web Joist:
  16” x 1.6”
Oasis - Timber Level 2

- **Column:** 16” x 16”
- **Column:** 12” x 12”
- **Girders:** 12” x 32”
  - Typ. Span: 29’, 38’
  - (audit)
- **Girders:** 12” x 20”
  - Typ. Span: 20’
- **Plywood Web Joist:** 16” x 1.6”
Oasis - Timber Level 3

- Column: 16” x 16”
- Column: 12” x 12”
- Girders: 12” x 32”
 Typ. Span: 29’, 38’
  (audit)
- Girders: 12” x 20”
  Typ. Span: 20’
- Plywood Web Joist:
  16” x 1.6”
1. 3” Floor Screed
2. 1” Lumber Boards
3. Girders 12” x 20”
4. Plywood Web Joist 16” x 1.6”
5. Fire Protection Covering
Oasis - Steel Option

Dimensions:
- Width: 58’
- Length: 116’
- Height: 36’
20” Ecospan Joist
Typ. Span: 29’

Girder: W21x44
Typ. Span: 29’

Auditorium: W24x68
Typ. Span: 38’-8”

Column: W14x90

Column: W8x31

Cantilever: 9’-8”
Oasis Steel-Level 3

- **20” Ecospan Joist**
  - Typ. Span: 29’

- **Girder: W21x44**
  - Typ. Span: 29’

- **Auditorium: W24x68**
  - Typ. Span: 38’-8”

- **Column: W14x90**

- **Cantilever: 9’-8”**
Big Idea 2: Oasis

MEP
Steel Option
Mechanical Room-Vertical Shafts

- Mechanical Room
- Vertical Shafts
- AHUs

Oasis

M E P
Basement’s Distribution Tree

- Supply Air Ducts
- Return Air Ducts
- Upper Floor’s Inner Perimeter
Ground Floor’s Distribution Tree

- Supply Air Ducts
- Return Air Ducts
- Upper Floor’s Inner Perimeter
1st Floor’s Distribution Tree
Typical Floor Sandwich
Performance Relative to Life Cycle Impact Targets

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<td>296,954,338</td>
<td>270%</td>
</tr>
<tr>
<td>Ozone (kgCFC11*)</td>
<td>-</td>
<td>1.33E-01</td>
<td>-</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Impact</th>
<th>Canyon - Steel</th>
<th>Canyon - Concrete</th>
<th>Oasis - Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWP</td>
<td>57%</td>
<td>60%</td>
<td>56%</td>
</tr>
<tr>
<td>Energy</td>
<td>37%</td>
<td>37%</td>
<td>36%</td>
</tr>
<tr>
<td>Water</td>
<td>271%</td>
<td>273%</td>
<td>270%</td>
</tr>
</tbody>
</table>
Timber Option
Mechanical Room - Vertical Shafts
Ground Floor’s Distribution Tree
Typical Floor Sandwich

12' 9' 8' 4"

2' 4"
## Performance Relative to Life Cycle Impact Targets

<table>
<thead>
<tr>
<th>Impact</th>
<th>Target</th>
<th>Project</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon (kgCO2e)</td>
<td>5.631,313</td>
<td>3,155,564</td>
<td>56%</td>
</tr>
<tr>
<td>Energy (MJ)</td>
<td>131,385,813</td>
<td>47,886,696</td>
<td>36%</td>
</tr>
<tr>
<td>Water (kgH2O)</td>
<td>110,021,918</td>
<td>297,425,466</td>
<td>270%</td>
</tr>
<tr>
<td>Ozone (kgCFC11e)</td>
<td>-</td>
<td>1.33E-01</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact</th>
<th>Canyon - Steel</th>
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<th>Oasis - Timber</th>
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</tr>
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<td>Water</td>
<td>271%</td>
<td>273%</td>
<td>270%</td>
<td>270%</td>
</tr>
</tbody>
</table>
Water Challenge

Conserving, conserving, conserving

Low-no-water use sanitary facilities

Fiber cotton
<table>
<thead>
<tr>
<th><strong>BrainMerge ©</strong></th>
</tr>
</thead>
</table>

### Biomimicry

<table>
<thead>
<tr>
<th><strong>Marratia Botannia</strong></th>
<th><strong>lotus</strong></th>
<th><strong>United States</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mausa Wasa</strong></td>
<td><strong>shell of bugs - good for water collection</strong></td>
<td><strong>United States</strong></td>
</tr>
</tbody>
</table>

### Recycled Water

<table>
<thead>
<tr>
<th><strong>carrin marcellina</strong></th>
<th><strong>re-cyclable water</strong></th>
<th><strong>United States</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>marratia Botannia</strong></td>
<td><strong>use greywater</strong></td>
<td><strong>United States</strong></td>
</tr>
<tr>
<td><strong>Mausa Wasa</strong></td>
<td><strong>minimize greywater for toilet</strong></td>
<td><strong>United States</strong></td>
</tr>
</tbody>
</table>

### Water Collection

<table>
<thead>
<tr>
<th><strong>Marcelia Santas</strong></th>
<th><strong>sand garden</strong></th>
<th><strong>United States</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>carrin marcellina</strong></td>
<td><strong>create water</strong></td>
<td><strong>United States</strong></td>
</tr>
</tbody>
</table>

### Water Metering

<table>
<thead>
<tr>
<th><strong>Marcelia Santas</strong></th>
<th><strong>solar hot water system</strong></th>
<th><strong>United States</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Robert Hartinga</strong></td>
<td><strong>use snow</strong></td>
<td><strong>Germany</strong></td>
</tr>
</tbody>
</table>

### Reducing Water Used

<table>
<thead>
<tr>
<th><strong>Marcelia Santas</strong></th>
<th><strong>use greywater</strong></th>
<th><strong>United States</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Robert Hartinga</strong></td>
<td><strong>reduce flow rate</strong></td>
<td><strong>Germany</strong></td>
</tr>
</tbody>
</table>

*Notes:*
- **Benjamin Cohen**
- **Martina Tuxbau**
- **Marcelia Santas**
- **Robert Hartinga**
- **Marratia Botannia**
- **Mausa Wasa**
- **Marratia Botannia**
- **Marcelia Santas**
- **Martina Tuxbau**

**Country References:**
- United States
- Denmark
- United Kingdom
- Germany
Big Idea 2: Oasis

Construction Management
Site Logistics
NEED BIGGER LAYDOWN AREA FOR STEEL!
2 CRANES FOR FASTER CONSTRUCTION
TERMITES!!
- Inspect the ground for termites
- Treat ground for termite infestation REGARDLESS of conditions reported.

MOISTURE!!
- High water table
- Take extra precautions to prevent moisture infiltration.
<table>
<thead>
<tr>
<th></th>
<th>TIMBER</th>
<th>STEEL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Construction Duration</strong></td>
<td>46 WEEKS</td>
<td>44 WEEKS</td>
</tr>
<tr>
<td><strong>Total Float</strong></td>
<td>6 WEEKS</td>
<td>8 WEEKS</td>
</tr>
<tr>
<td><strong>Meets overall deadline?</strong></td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>Building covered up before December?</strong></td>
<td>✗</td>
<td>✔️</td>
</tr>
<tr>
<td><strong>Computer rooms can open in time?</strong></td>
<td>✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>
Oasis Cost Breakdown

**Timber Option**

- H General Conditions, $1,863,822, 30%
- D Services, $1,914,849, 31%
- E Equipment and Furnishing, $41,800, 1%
- C Interiors, $499,426, 8%
- B Shell, $1,602,027, 26%

**Steel Option**

- H General Conditions, $1,201,420, 23%
- E Equipment and Furnishing, $41,800, 1%
- D Services, $207,499, 4%
- C Interiors, $800,526, 16%
- B Shell, $2,637,417, 52%

**COST ESTIMATE**

- A Substructure, $216,530, 4%
Oasis Idea Targets

**Timber Option**

**Steel Option**

![Graphs showing TVD - TARGETS BY CLUSTER for Timber and Steel Options.](image-url)
Oasis Cost History

*RSMeans data replaced with actual data*
# Oasis Cost Breakdown

<table>
<thead>
<tr>
<th>Oasis Idea</th>
<th>Timber</th>
<th>Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Substructure</td>
<td>$217,000</td>
<td>$217,000</td>
</tr>
<tr>
<td>B Shell</td>
<td>$1,603,000</td>
<td>$2,638,000</td>
</tr>
<tr>
<td>C Interiors</td>
<td>$500,000</td>
<td>$801,000</td>
</tr>
<tr>
<td><strong>D Services</strong></td>
<td><strong>$1,915,000</strong></td>
<td><strong>$208,000</strong></td>
</tr>
<tr>
<td>E Equipment and Furnishing</td>
<td>$42,000</td>
<td>$42,000</td>
</tr>
<tr>
<td>F Specialty Construction</td>
<td>$-</td>
<td>$-</td>
</tr>
<tr>
<td>G Building Sitework</td>
<td>$-</td>
<td>$-</td>
</tr>
<tr>
<td>H General Conditions</td>
<td>$1,864,000</td>
<td>$1,202,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$6,139,000</strong></td>
<td><strong>$5,106,000</strong></td>
</tr>
</tbody>
</table>
TVD Total Cost

Canyon Idea:
- Steel: $4,200,000
- Concrete: $1,000,000
- Total: $5,200,000

Oasis Idea:
- Steel: $5,200,000
- Concrete: $0
- Timber: $1,000,000
- Total: $6,100,000
# Weighting Process

<table>
<thead>
<tr>
<th>1. Expression of Big Idea</th>
<th>14%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Site Connection</td>
<td>7%</td>
</tr>
<tr>
<td>3. User Comfort</td>
<td>9%</td>
</tr>
<tr>
<td>4. Water Challenge</td>
<td>8%</td>
</tr>
<tr>
<td>5. Sustainability</td>
<td>10%</td>
</tr>
<tr>
<td>6. Floor to Ceiling Height</td>
<td>5%</td>
</tr>
<tr>
<td>7. Structural Strength (Seismic Performance)</td>
<td>8%</td>
</tr>
<tr>
<td>8. Cost</td>
<td>5%</td>
</tr>
<tr>
<td>9. Constructability</td>
<td>6%</td>
</tr>
<tr>
<td>10. Duration of Build</td>
<td>2%</td>
</tr>
<tr>
<td>11. Innovation</td>
<td>12%</td>
</tr>
<tr>
<td>12. Interdisciplinary Integration</td>
<td>13%</td>
</tr>
</tbody>
</table>

### Owner Percentages

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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</thead>
<tbody>
<tr>
<td>Total</td>
<td>17</td>
<td>11</td>
<td>15</td>
<td>9</td>
<td>18</td>
<td>8</td>
<td>14</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>Percentage</td>
<td>13%</td>
<td>8%</td>
<td>11%</td>
<td>7%</td>
<td>14%</td>
<td>6%</td>
<td>11%</td>
<td>3%</td>
<td>2%</td>
<td>0%</td>
<td>17%</td>
<td>8%</td>
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</tbody>
</table>

### Team Percentages

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>62</td>
<td>33</td>
<td>40</td>
<td>35</td>
<td>47</td>
<td>47</td>
<td>38</td>
<td>24</td>
<td>42</td>
<td>11</td>
<td>56</td>
<td>58</td>
</tr>
<tr>
<td>Percentage</td>
<td>14%</td>
<td>7%</td>
<td>9%</td>
<td>8%</td>
<td>10%</td>
<td>5%</td>
<td>8%</td>
<td>5%</td>
<td>6%</td>
<td>2%</td>
<td>12%</td>
<td>13%</td>
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</tbody>
</table>
## Decision Diagram Results

<table>
<thead>
<tr>
<th></th>
<th>Average Weighting</th>
<th>Canyon Steel</th>
<th>Canyon Concrete</th>
<th>Oasis Steel</th>
<th>Oasis Timber</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Expression of Big Idea</td>
<td>14%</td>
<td>3.26</td>
<td>3.54</td>
<td>2.18</td>
<td>2.31</td>
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<tr>
<td>2. Site Connection</td>
<td>7%</td>
<td>1.74</td>
<td>1.88</td>
<td>1.23</td>
<td>1.23</td>
</tr>
<tr>
<td>3. User Comfort</td>
<td>9%</td>
<td>2.19</td>
<td>2.19</td>
<td>2.02</td>
<td>2.11</td>
</tr>
<tr>
<td>4. Water Challenge</td>
<td>8%</td>
<td>1.30</td>
<td>1.30</td>
<td>1.30</td>
<td>1.30</td>
</tr>
<tr>
<td>5. Sustainability</td>
<td>10%</td>
<td>2.47</td>
<td>1.65</td>
<td>2.58</td>
<td>2.27</td>
</tr>
<tr>
<td>6. Floor to Ceiling Height</td>
<td>5%</td>
<td>1.21</td>
<td>1.21</td>
<td>1.21</td>
<td>0.88</td>
</tr>
<tr>
<td>7. Structural Strength (Seismic Performance)</td>
<td>8%</td>
<td>1.83</td>
<td>2.25</td>
<td>1.83</td>
<td>1.67</td>
</tr>
<tr>
<td>8. Cost</td>
<td>5%</td>
<td>1.05</td>
<td>0.84</td>
<td>1.11</td>
<td>1.42</td>
</tr>
<tr>
<td>9. Constructability</td>
<td>6%</td>
<td>1.48</td>
<td>1.07</td>
<td>1.48</td>
<td>1.60</td>
</tr>
<tr>
<td>10. Duration of Build</td>
<td>2%</td>
<td>0.55</td>
<td>0.39</td>
<td>0.55</td>
<td>0.63</td>
</tr>
<tr>
<td>11. Innovation</td>
<td>12%</td>
<td>2.33</td>
<td>2.95</td>
<td>2.33</td>
<td>2.33</td>
</tr>
<tr>
<td>12. Interdisciplinary Integration</td>
<td>13%</td>
<td>2.93</td>
<td>3.05</td>
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<td>1.91</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>22.36</strong></td>
<td><strong>22.31</strong></td>
<td><strong>20.36</strong></td>
<td><strong>19.65</strong></td>
</tr>
</tbody>
</table>
Special Thanks to...

**Mentors:**
- Renate Fruchter (Super Mentor and Super Owner)
- Prof. Guido Morgenthal (BUW)
- Armin Dariz (SOFiSTiK)
- Greg Luth (Gregory P. Luth & Associates)
- Eduardo Miranda (Stanford)
- Luis Rivera (Arup)
- Flavia Grey (AEC Alumni)
- Erik Kneer (Holmes Culley)
- Mark Barlett (Skanska USA)
- Fernando Castillo Cohen (AEC Alum)
- Josh Odelson (AEC Alum)
- Willem Kymmel (UCS Chico University)
- Michael Lauring (AAU)

**Owners:**
- Maria Frank
- Mike Muller
- Ana Sofia
- Enrique Hernandez Delgado