RidgeRS and global teamwork

With Lauren Scammell and Gitte Sørensen as owners.

Bedriye (MEP)

Kristian (A)

Annenmarie (SE)

Milos (CM)

Maryanne (SE)
TARGET VALUE DESIGN

RidgeRS
LOCAL & NATURAL – biomimicry & materials

SANDSTONE – Nevada state rock

BRISTLECONE PINE – Nevada state tree
LOCAL – community & labor

One of the mottos of the University of Nevada Reno:
„A Nevada education stresses conceptual, hands-on learning.“
LOCAL – social aspect

More than just a studying and working place …
The power of team workflow and using new technologies for achieving higher standards in building design.
Where is The Ridge?

There is some existing slope, but not much.

„We‘re RidgeRS, so let‘s make some slope!“
## SOIL PROFILE

<table>
<thead>
<tr>
<th>Depth of Excavation</th>
<th>Soil Type</th>
<th>Thickness</th>
<th>Bearing Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 inches (0 ft.)</td>
<td>Stony Sandy Loam and Heavy Loam</td>
<td>19 inches (1.58 ft.)</td>
<td>1,500 psf.</td>
</tr>
<tr>
<td>19 inches (1.58 ft.)</td>
<td>Sandy Clay Loam</td>
<td>10 inches (0.83 ft.)</td>
<td>1,500 psf.</td>
</tr>
<tr>
<td>29 inches (2.42 ft.)</td>
<td>Clay and Clay Loam</td>
<td>27 inches (2.25 ft.)</td>
<td>1,500 psf</td>
</tr>
<tr>
<td>56 inches (4.67 ft.)</td>
<td>Very Gravelly Sandy Loam and Very Gravelly Loam</td>
<td>28 inches (2.33 ft.)</td>
<td>5,000 psf</td>
</tr>
<tr>
<td>84 inches (7 ft.)</td>
<td>Volcanic Rock</td>
<td>Unknown</td>
<td>8,000 psf</td>
</tr>
</tbody>
</table>

- Grade at 5,580 ft. Elevation: 0 inches (0 ft.)
- Water Table: 48 inches (4.0 ft.)
- Water Table: 56 inches (4.67 ft.)
- Pre-draining: (-)  
  Retaining walls: (-)  
  Higher building: (+)  

Note: Construction and excavation depths are indicated by arrows.
- Highly seismic area
- Large fluctuation in temperatures (daily and seasonally)
- High desert winds – average windspeed 60mph
- "Rain shadow"

Weekly wind speeds/frequency  Monthly heating/cooling needs
CONCEPT 1:
PINE CONE
Pine Cone concept evolution
Circulation Flow to Main Entry and Social Plaza

Student Union & Events Center Primary Adjacency

Direct Path for foot traffic from parking structure
Pine Cone Concept Development

Pine cone Biomimicry - Combining local TVD with Sustainable TVD

**Initial Idea:** pine cone formal inspiration for solar shading

**Evolution to entire building form**

Diffused natural lighting all year

Overlapping forms inspired by the pine cone
Pine Cone Water Collection/Reuse

Concept Evolution…On-site Water Collection System

- Collected Rain Water
- Gray Water brought into building

Cistern and filter buried in terrain adjacent to main plumbing core
Architectural Target Values

- Biomimicry
- Sustainability
- Social/Collaborative Space
- Local/Community Atmosphere
- Functional Exterior and Warm Interior
FLOOR PLAN

GROUND LEVEL 01

Open Floor Plan Area – Collaboration Space

- Lg. Classrooms: 1,600 SF
- Sm. Classrooms: 1,040 SF
- Seminar Rooms: 800 SF
- Lab: 1,000 SF
- Student Offices: 1,050 SF
- Storage: 200 SF
- Vert. Circ. & WC: 570 SF
- Mechanical: 120 SF
- Social Space: 2,000 SF

Egress
AUDITORIUM AND ATRIUM
ENTRY FROM SOCIAL PLAZA South East Side
STRUCTURAL SYSTEMS
# PINE CONE LOADS

## Gravity:

<table>
<thead>
<tr>
<th></th>
<th>Roof Level – Steel Option:</th>
<th>Roof Level – Concrete Option:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead Load</td>
<td>70 psf</td>
<td>120 psf</td>
</tr>
<tr>
<td>Live Load</td>
<td>20 psf</td>
<td>20 psf</td>
</tr>
<tr>
<td>Snow Load</td>
<td>10.5 psf</td>
<td>10.5 psf</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Other Levels – Steel Option:</th>
<th>Other Levels – Concrete Option:</th>
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</thead>
<tbody>
<tr>
<td>Dead Load</td>
<td>70 psf</td>
<td>120 psf</td>
</tr>
<tr>
<td>Live Load</td>
<td>50–100 psf</td>
<td>50–100 psf</td>
</tr>
</tbody>
</table>

## Lateral:

### Wind Estimates

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Wind Speed</td>
<td>100 mph</td>
</tr>
<tr>
<td>Wind Base Shear</td>
<td>89 k</td>
</tr>
</tbody>
</table>

### Earthquake Estimates

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Profile D</td>
<td></td>
</tr>
<tr>
<td>Steel Base Shear</td>
<td>619 k</td>
</tr>
<tr>
<td>Concrete Base Shear</td>
<td>827 k</td>
</tr>
</tbody>
</table>

EARTHQUAKE LOADS WILL GOVERN DESIGN
**FOUNDATIONS AND RETAINING WALL**

Shallow Mat Foundation (5 ksi concrete)
- Placed 5’ below grade
- Bearing Capacity = 5000 psf
- Steel Option – ~18” thick
- Concrete Option – ~ 24” thick
- Additional reinforcement placed under cantilevered walls (higher loads)

**Retaining Wall Location**

14’ Gravity Retaining Wall
Beams (W12x26)
Typ. Span: 20’

Girders (W12x 50)
Typ. Span: 20’

Auditorium Beam (W18x104)
Typ. Span: 40’

Gravity Columns: W12x67
Curved Wall – 12”

Composite Floor System:
3” LW concrete slab on 2” deck
Typ. Span: 10’
Composite Floor System:
3” LW concrete slab on 2” deck
Typ. Span: 10’
PINE CONE – STEEL

Level 02

Beams (W12x26)
Girders (W12x50)
Auditorium Beam (W18x104)
Auditorium Beam (W24x107)
Cantilever Beam (W24x107)
Cantilever Columns (W12x87)

Composite Floor System:
3” LW concrete slab on 2” deck
Typ. Span: 10’
• Open floor plan is a challenge for location of braced frames or walls
• Architect’s and engineer’s preference is braced frames (BRBF)
• Possibility remains for braced frames in center of building
20’ Cantilever Solution – Moment Frame Prefab
- Reduces welding on site (cost + time issue)
- Creates additional lateral load on system ~ 35 k
- Creates moment in column

(f) All welded

Moment Connection

Shear Tab Connection
PINECONE – STEEL challenges

- Roof Beams are sloped (have maximum slope of 3/18)
- Roof Beams designed for combination of axial and moment
- Columns will have horizontal load applied (acting as beam-column)
PINE CONE – CONCRETE

Level 00

- Columns 15”x15”
- Shear walls 1’
- Gravity wall 1’
- Beam
  - Typ. span 20’: 10”x12”
  - Typ. span >20’: 14”x18”
  - Typ. span 40’: 22”x28”
- Roof: 2’x3’

RC slab 8”, hollow core 6”
Typical span 20’

MEP overlaid in thin black
columns 15”x15”
shear walls 1’
gavity wall 1’
beam
typ. span 20’ 10”x12”
typ. span >20’ 14”x18”
typ. span 40’ 22”x28”
cantilever 16”x20”

RC slab 8”, hollow core 6”
typical span 20’
PINE CONE – CONCRETE

Level 02

- **columns 15”x15”**
- **shear walls 1’**
- **gravity wall 1’**
- **beam**
  - typ. span 20’ 10”x12”
  - typ. span >20’ 14”x18”
  - typ. span 40’ 22”x28”
- **roof** 2’x3’

**MEP overlaid in thin black**

- RC slab 8”, hollow core 6”
- typical span 20’
Lateral system:
- core and shear walls

Raft foundation: 24”, strengthen in high stressed areas
PINE CONE – CONCRETE

challenges

slab (poured concrete) 10"
cantilever: 16”/18” span 19’
cantilever are supported by shear walls
gravity walls (pink) stiffen cantilever
3 independent parts of roof

one girder 2’x3’ for the whole span supported on shear walls
slab: hollow core 12”
A → interaction ← SE

Size of girder can be reduced if roof is supported by additional columns/walls (pink)
MEP & SUSTAINABLE SOLUTIONS
Climate conditions

99% heating design
Temperature: 14.9F

1% cooling design
Temperature: 92.5F

Average humidity: 60%

Indoor design conditions

RH: 50% for comfort
Design temp setpoint for heating: 68F
Design temp setpoint for cooling: 74F
<table>
<thead>
<tr>
<th>Concepts</th>
<th>Area</th>
<th>Total ventilation requirements</th>
<th>ACH (average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pine Cone</td>
<td>2853.52 m² (30715 sqft)</td>
<td>7331.98 L/s (15535.6 cfm)</td>
<td>1.29 h⁻¹</td>
</tr>
<tr>
<td>Hardscape</td>
<td>2945.95 m² (31711 sqft)</td>
<td>6526.2 L/s (12827.2 cfm)</td>
<td>1.46 h⁻¹</td>
</tr>
</tbody>
</table>
Cooling & heating load assumptions

Heating design temperatures

Outdoor design temp.: 14.9F
Indoor design temp.:  68.0F

• Wall: \( U = 0.11 \text{ W/}(\text{m}^2\text{K}) \)
• Roof: \( U = 0.28 \text{ W/}(\text{m}^2\text{K}) \)
• Doors: \( U = 1.82 \text{ W/}(\text{m}^2\text{K}) \)
• Floors: \( U = 0.6 \text{ W/}(\text{m}^2\text{K}) \)
• Window: \( U_{\text{tot}} = 0.97 \text{ W/}(\text{m}^2\text{K}) \)

Cooling design temperatures & internal loads

Outdoor design temp.: 92.5F
Indoor design temp.:  74.0F

• 10 W/m\(^2\) lighting load

• 80 W appliance (computer) load

• Heat production from occupants: 151.2 W
  \( (\Phi = 70\text{ W/}m^2 \times 1.2 \text{ met} \times A_s , \ A_s = 1.8\text{m}^2) \)
## Cooling & heating load summaries

### Total cooling load

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Total cooling load</th>
<th>Total airflow, $Q_{\text{tot}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pine Cone</td>
<td>156.95 kW</td>
<td>11890.15 L/s</td>
</tr>
<tr>
<td>Hardscape</td>
<td>180.89 kW</td>
<td>13703.48 L/s</td>
</tr>
</tbody>
</table>

### Total heating load

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Total heating load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pine Cone</td>
<td>105.7 kW</td>
</tr>
<tr>
<td>Hardscape</td>
<td>65.55 kW</td>
</tr>
</tbody>
</table>
The air velocities for the connecting ducts are chosen to be between 2.0–3.0 m/s, for distributions ducts it is set to 4.0–6.0 m/s, for main ducts it is 6.0 m/s and the air velocities in ducts of shafts is set to 8–9 m/s.

<table>
<thead>
<tr>
<th>Chosen options</th>
<th>Velocity</th>
<th>Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main ducts</td>
<td>7 m/s</td>
<td>19.68 inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.64 feet</td>
</tr>
<tr>
<td>Distribution ducts between rooms</td>
<td>5 m/s</td>
<td>12.4 inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.03 feet</td>
</tr>
<tr>
<td>Distribution ducts to room</td>
<td>3 m/s</td>
<td>7.87 inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.65 feet</td>
</tr>
<tr>
<td>Connecting ducts</td>
<td>2 m/s</td>
<td>3.94 inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.52 feet</td>
</tr>
<tr>
<td>Shafts</td>
<td>8 m/s</td>
<td>24.80 inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.06 feet</td>
</tr>
</tbody>
</table>
MECHANICAL SYSTEM & SHAFTS

Mechanical ventilation with heat recovery

Shafts with insulation

VAV – ventilation system is chosen, which is optional for offices and classrooms → energy saving
Vertical shaft

Supply

Exhaust

Vertical shaft

Supply

Vertical shaft

Exhaust

One above the other

Beside
All dimensions are in feet.
## ORIENTATIONS

<table>
<thead>
<tr>
<th></th>
<th>1st orientation</th>
<th>2nd orientation</th>
<th>3rd orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>454,028 kWh</td>
<td>449,479 kWh</td>
<td>447,070 kWh</td>
</tr>
<tr>
<td>Fuel</td>
<td>16,968 therms</td>
<td>17,027 therms</td>
<td>16,097 therms</td>
</tr>
<tr>
<td>CO2 – conc.</td>
<td>92 tons/yr</td>
<td>84 tons/yr</td>
<td>78 tons/yr</td>
</tr>
<tr>
<td>HVAC, Lightning,</td>
<td>449,152 kWh</td>
<td>444,605 kWh</td>
<td>442,196 kWh</td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1st orientation → Good
2nd orientation → Good
3rd orientation → Best

3rd orientation has low el, fuel and HVAC consumption and also low CO₂ emission than the other two orientations.
3rd orientation – Pine Cone
Mechanical shaft
Mechanical shaft
DUCT NETWORK | PINE CONE - AUDITORIUM

Main duct
Connecting duct
Only Exhaust

Deck
Exhaust

Outside
Connecting duct
Main duct
Only Supply

Section
Auditorium
CONCEPT 2: HARDSCAPE
Hardscape concept evolution
Circulation Flow to:
- Main Entry - 1
- Social - 2
- Auditorium Lobby - 3

Student Union & Events Center
Primary Adjacency

Events Plaza and Auditorium
Lobby Adjacency

Circulation through Entry Atrium
Orientation Evolution

Original Focus:
- Social Plaza adjacency to Student Union

Concern:
- Solar Orientation

New Access Concept:
- Social Plaza on south side
- Entry plaza on north side
- Circulation through the atrium

Added Bonus:
- Auditorium Entry adjacent to the events plaza to the north
Local Biomimicry – Sandstone texture

Sandstone texture as a sun shading and aesthetic inspiration
Future Biomimicry Development

Sandstone texture inspires an integrated structural and architectural system

It is possible…

**Precedent:** 0-14 Tower, Dubai

The idea is still in early development, but offers some exciting potential
Green Roof – Mimicking the local Environment

Green Roof Will be both functional and Social

Stormwater Mitigation
Reduce Heating/cooling load
Higher R-Value
Increased usable space
Green Technologies

Sustainable natural planter systems to treat stormwater/gray water

Added Target Values:
- Sustainability
- Local Community
- Biomimicry
Architectural Target Values

- Biomimicry
- Structural Aesthetics
- Social/Collaborative Space
- Local/Community Atmosphere
- Functional Exterior and Warm Interior
FLOOR PLANS

GROUND LEVEL 00

- Auditorium: 3,000 SF
- Sm. Classrooms: 1,000 SF
- Seminar Rooms: 400 SF
- Social Space: 2,400 SF
- Lab: 1,000 SF
- Storage: 190 SF
- Student Offices: 580 SF
- Vert. Circ & WC: 500 SF
- Mechanical: 130 SF

Main Entry

Lobby

Egress

Auditorium Entry

Atrium
ENTRY and SOCIAL PLAZA on south side
STRUCTURAL SYSTEMS
## Hardscape Loads

### Gravity:

<table>
<thead>
<tr>
<th>Level</th>
<th>Steel Option</th>
<th>Concrete Option</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Roof Level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dead Load</td>
<td>100 psf</td>
<td>150 psf</td>
</tr>
<tr>
<td>Live Load (Green Roof)</td>
<td>50 psf</td>
<td>50 psf</td>
</tr>
<tr>
<td>Snow Load</td>
<td>10.5 psf</td>
<td>10.5 psf</td>
</tr>
</tbody>
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<tr>
<th>Level</th>
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<tbody>
<tr>
<td><strong>Other Levels</strong></td>
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<td></td>
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<tr>
<td>Dead Load</td>
<td>70 psf</td>
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<td>50–100 psf</td>
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### Lateral:

#### Wind Estimates

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Basic Wind Speed</td>
<td>100 mph</td>
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<tr>
<td>Wind Base Shear</td>
<td>89 k</td>
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</tbody>
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### Earthquake Estimates

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<td>Concrete Base Shear</td>
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**Earthquake Loads Will Govern Design**
FOUNDATIONS AND RETAINING WALLS

Shallow Mat Foundation (5 ksi concrete)
- Placed 5’ below grade
- Bearing Capacity = 5000 psf
- Steel Option – ~18” thick
- Concrete Option – ~ 24” thick
- Additional reinforcement placed under cantilevered walls

Retaining Wall Location

14’ Gravity Retaining Wall
**HARDSCAPE - STEEL**  
**Level - 01**

**Beams (W12x26)**  
Typ. Span: 20’

**Girders (W12x50)**  
Typ. Span: 20’

**Gravity Columns:**  
W12x67  
3” LW concrete slab on 2” deck  
Typ. Span: 10’
Beams (W12x26)
Typ. Span: 20’

Girders (W12x 50)
Typ. Span: 20’

Auditorium Trusses:
60’ Span loaded at 2 points
Beams (W12x26)
Typ. Span: 20’

Girders (W12x50)
Typ. Span: 20’

Gravity Columns:
W12x67
3” LW concrete slab on 2” deck
Typ. Span: 10’
Braced Frame System – BRBF

• Structure hidden behind “sandstone” façade
• Performance advantage over conventional CBF
• Also utilize sloped wall as stiffening element
HARDSCAPE – STEEL challenges

TVD: NATURAL

60 Auditorium Span – Series of Lightweight HSS Steel Trusses
• utilize a minimum of material
• sustainable, recycled steel
• potential for biomimicry aesthetic

Optimal spacing from nature

[Diagram of insect wing with labels: Nodus, Pterostigma]
Load Path for Sloped Columns

• Larger axial force in sloped columns (10’ trib width)
• Lateral tensile force created in beams
  • ~ 30 k max for Office Level Beam
• Can utilize braces to transmit lateral force to column if necessary

Brace Locations
HARDSCAPE – CONCRETE

Level -01

- MEP overlaid in thin black
- columns 15”x15”
- shear walls 1’
- gravity wall 1’
- beam:
  - typ. span 20’ 10”x12”
  - typ. span >20’ 14”x18”
- auditorium 22”x28”

RC slab 8”, hollow core 6”
typical span 20’
HARDSCAPE – CONCRETE

Level 00

columns 15”x15”
shear walls 1’
gridity wall 1’
beam
typ. span 20’ 10”x12”
typ. span >20’ 14”x18”
auditorium 22”x28”
prestressed 18”/22”

RC slab 8”, hollow core 6”
typical span 20’

MEP overlaid in thin black
**HARDSCAPE – CONCRETE**

**Level +01**

- **columns 15”x15”**
- **shear walls 1’**
- **gravity wall 1’**
- **beam**
  - typ. span 20’ 10”x12”
  - typ. span >20’ 14”x18”
  - auditorium 22”x28”
  - prestressed 18”/22”

**MEP overlaid in thin black**

- RC slab 8”, hollow core 6”
- typical span 20’
Raft foundation: 24”, strengthen in high stressed areas

Fixing sloped columns
Use ‘sandstone’ façade for structural design
MEP & SUSTAINABLE SOLUTIONS
**ENERGY ANALYSIS FROM VASARI**

Energy analysis for three different orientations

<table>
<thead>
<tr>
<th></th>
<th>1st orientation</th>
<th>2nd orientation</th>
<th>3rd orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electricity</strong></td>
<td>9 kWh/sf/yr</td>
<td>9 kWh/sf/yr</td>
<td>9 kWh/sf/yr</td>
</tr>
<tr>
<td><strong>Fuel</strong></td>
<td>32 kBtu/sf/yr</td>
<td>33 kBtu/sf/yr</td>
<td>19 kBtu/sf/yr</td>
</tr>
<tr>
<td><strong>CO₂ - Conc.</strong></td>
<td>25 tons/yr</td>
<td>29 tons/yr</td>
<td>19 tons/yr</td>
</tr>
<tr>
<td><strong>HVAC, Lightning, Equipment</strong></td>
<td>261.621 kWh</td>
<td>262.743 kWh</td>
<td>274.946 kWh</td>
</tr>
</tbody>
</table>

1st orientation → Good
2nd orientation → Good
3rd orientation → Best
Mechanical shaft
Mechanical shaft

DUCT NETWORK | HARDSCAPE 00

Exhaust
Supply
CONSTRUCTION MANAGEMENT
CONSTRUCTION SITE ACCESS

1 mile from highway

1.2 miles (5 mins) to the hospital

Bus stop next to the site (US 395)

Easy access with one way traffic direction flow
Easy construction site access.
One way traffic direction – more space for construction process.
EXCAVATIONS POSSIBILITES STUDY
1st STAGE – EXCAVATION AND LANDSCAPING

Establish mountainous "lookalike" landscaping

TVD: LOCAL

TVD: NATURAL

WASTE RECYCLING AREA

SITE TRAILERS

ECO RESTROOMS

GENERATOR (bio-diesel)
Parking:

Parking for workers provided in the neighboring parking building.

Bus access also exist with bus stops next to the site.
2nd STAGE – CONSTRUCTION SITE LOGISTIC

HARDSCAPE

TVD: LOCAL

TVD: NATURAL
CONSTRUCTION SITE VISUALIZATION

PINE CONE
MATERIALS, CONSTRUCTION METHODS & EQUIPMENT
LOCAL PROVIDERS – Steel & Concrete Fabricators

- **Martin Iron Works, Inc.**
  - approx. 1.4 miles / 4 mins

- **A-1 Steel, Inc.**
  - approx. 6.2 miles / 10 mins

- **Blue Mountain Steel, Inc.**
  - approx. 38.3 miles / 42 mins
  - (legal problems On October 06, 2011, the company filed for reorganization under Chapter 11 of the federal Bankruptcy Act)

- **ConXtech**
  - approx. 229 Miles / 4 hours

- **Weigl Concrete & Construction**
  - approx. 1.1 miles / 3 mins

- **Quality Concrete Construction, LLC**
  - approx 11.7 miles / 14 mins
<table>
<thead>
<tr>
<th>Provider</th>
<th>Distance</th>
<th>Time</th>
<th>Notes</th>
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<tbody>
<tr>
<td>A&amp;K Earth Movers, Inc.</td>
<td>11.7 miles</td>
<td>15 mins</td>
<td>(engineering office)</td>
</tr>
<tr>
<td>Atlas Contractors, Inc.</td>
<td>7.0 miles</td>
<td>11 mins</td>
<td>*also earthworks</td>
</tr>
<tr>
<td>Q&amp;D Construction</td>
<td>4.2 miles</td>
<td>8 mins</td>
<td></td>
</tr>
<tr>
<td>Sierra Nevada Construction, Inc.</td>
<td>7.5 miles</td>
<td>11 mins</td>
<td>*also earthworks</td>
</tr>
</tbody>
</table>
CONSTRUCTION SITE EQUIPMENT

Looking into the future!

VOLVO Gryphin Wheel Loader
- Fully independant wheels
- Zero–emission electric hybrid engine
- Noiseless electrical wheel motors
- Inteligent cab glass

VOLVO SfinX Excavator
- Runs on fuel cells (a most environmentally friendly power system)
- Separate wheel motors
- Drive–by–wire
CONSTRUCTION SITE EQUIPMENT

Equipment rental

Wheel Loader
JCB 436ZX
Horsepower: 150 hp
Operating Weight: 31,458 lb.
Bucket Capacity Heaped: 3.5 cu. yd.
Powered By: Diesel

Excavator
John Deere 120
Power: 89 hp
Operating Weight: 28,840 lb.
Bucket Capacity: 0.79 cu. yd.
Powered By: Diesel

Dozer
John Deere 650J
Power: 90 hp
Blade Capacity: 2.6 cu. yd.
Powered By: Diesel

Mini-Excavator
Kubota KX161-3 5.5 Ton
Power: 42 hp
Operating Weight: 11,345 lb.
Powered By: Diesel

Roller
Wacker RD12A 35IN Double Drum Vibratory Roller
Operating Weight: 2,171 lb.
Vibration Frequency: 4,200 vpm
Centrifugal Force: 3,400 lb.
Powered By: Gasoline
CONSTRUCTION SITE EQUIPMENT

5 United Rentals branches within a 97.4 mile radius

TVD: LOCAL
CONSTRUCTION SITE EQUIPMENT

Equipment rental

Mobile Hydraulic Crane
Grove TM 9120 120 Ton

Concrete Pump

American Ready Mix Offers Mixed Concrete & Concrete Products
American Ready Mix
Sparks, NV - Ready Mix Concrete
Also serving Greater Reno, Sparks, Carson City, Dayton, Lake Tahoe, Spanish Springs & Virginia City

TVD: LOCAL
COST ESTIMATIONS
&
SCHEDULING
**Target Value:** Renting labs for the whole period of construction.

**Pros and cons:**

(+) easier transition for students who use labs

(+ ) easier scheduling – faster construction

(–) more expensive

$450 per day > 365 days (max. construction time) > $164,250

Cost: $165,000
BUDGET vs. INFLATION

Proposed inflation rates in US from 2012 to 2015
(Source: Trading Economisc)

Budget loss on inflation

PROJECT BUDGET vs. INFLATION

<table>
<thead>
<tr>
<th>Year</th>
<th>Budget</th>
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</thead>
<tbody>
<tr>
<td>2012</td>
<td>$8,500,000</td>
</tr>
<tr>
<td>2013</td>
<td>$8,317,420</td>
</tr>
<tr>
<td>2014</td>
<td>$8,136,766</td>
</tr>
<tr>
<td>2015</td>
<td>$7,961,744</td>
</tr>
</tbody>
</table>
BY-PASSING INFLATION

$8,500,000 donation

- $500,000 inflation *

- $165,000 lab rent

- $335,000 contingency

> Target Value: $7,500,000

*IDEA:
With investments into safe „risk free“ plans we can bypass inflation-based budget loss.

Ask mentors
Axel Seifert and Matthias Ehrlich

> Investment in government bonds

$8,500,000 donation

- $500,000 inflation

- $165,000 lab rent

- $335,000 contingency

> Target Value: $8,000,000

POSSIBLE TARGET VALUE TREATED AS ANOTHER CONTINGENCY FACTOR
RS Means – Square Foot Cost Estimator

Building cost:

**CONCRETE STRUCTURE**
$6,773,500

**STEEL STRUCTURE**
$6,913,000
Estimation process

RS Means – **Square Foot Estimator**  
*(College, Classroom, 2–3 Story with Decorative Concrete Block.)*

**Past years** Ridge teams estimates comparison  
*(Setting up average building cost estimated value.)*

Estimations for **dewatering process** and **green roof**  
*(All building concepts need dewatering. Green roof for Hardscape concept.)*

**Material take-offs** for all 4 concepts  
*(Based on estimates provided by SEs and estimates from Revit models.)*

Decision on using **precast concrete**  
*(70% of construction targeted at using precast.)*

**Modified cost estimate**
## Modified cost estimate

### Concrete Structure

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dewatering</td>
<td>$183,750</td>
<td>2%</td>
</tr>
<tr>
<td>Substructure</td>
<td>$320,500</td>
<td>4%</td>
</tr>
<tr>
<td>Shell</td>
<td>$1,100,000</td>
<td>15%</td>
</tr>
<tr>
<td>Interiors</td>
<td>$1,085,000</td>
<td>14%</td>
</tr>
<tr>
<td>Services</td>
<td>$2,224,000</td>
<td>29%</td>
</tr>
<tr>
<td>Special Construction PV and shading</td>
<td>$400,000</td>
<td>5%</td>
</tr>
<tr>
<td>Special Construction Landscaping</td>
<td>$100,000</td>
<td>1%</td>
</tr>
<tr>
<td>Contractor Fees</td>
<td>$1,231,500</td>
<td>16%</td>
</tr>
<tr>
<td>Architectural Fees</td>
<td>$616,000</td>
<td>8%</td>
</tr>
<tr>
<td>Contingency</td>
<td>$300,000</td>
<td>4%</td>
</tr>
</tbody>
</table>

**Building cost**

- **Concrete Structure**: $7,560,750
- **Steel Structure**: $7,976,250

### Steel Structure

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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<td>4%</td>
</tr>
<tr>
<td>Shell</td>
<td>$1,500,000</td>
<td>19%</td>
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<tr>
<td>Interiors</td>
<td>$1,062,500</td>
<td>13%</td>
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<tr>
<td>Services</td>
<td>$2,224,000</td>
<td>28%</td>
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<tr>
<td>Special Construction PV and shading</td>
<td>$400,000</td>
<td>5%</td>
</tr>
<tr>
<td>Special Construction Landscaping</td>
<td>$100,000</td>
<td>1%</td>
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<tr>
<td>Contractor Fees</td>
<td>$1,257,000</td>
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<tr>
<td>Architectural Fees</td>
<td>$628,500</td>
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<tr>
<td>Contingency</td>
<td>$300,000</td>
<td>4%</td>
</tr>
</tbody>
</table>

**Building cost**

- **Concrete Structure**: $7,560,750
- **Steel Structure**: $7,976,250

### Hardscape

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Dewatering</td>
<td>$183,750</td>
<td>2%</td>
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<tr>
<td>Substructure</td>
<td>$320,500</td>
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<tr>
<td>Shell</td>
<td>$1,200,000</td>
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<tr>
<td>Interiors</td>
<td>$1,085,000</td>
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<tr>
<td>Services</td>
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<tr>
<td>Special Construction Green roof</td>
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<tr>
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<tr>
<td>Contractor Fees</td>
<td>$1,231,500</td>
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<tr>
<td>Architectural Fees</td>
<td>$616,000</td>
<td>8%</td>
</tr>
<tr>
<td>Contingency</td>
<td>$300,000</td>
<td>4%</td>
</tr>
</tbody>
</table>

**Building cost**

- **Concrete Structure**: $7,610,750
- **Steel Structure**: $7,976,250

---

**Without estimate’s contingency factor**

- **Concrete Structure**: $7,310,750
- **Steel Structure**: $7,676,250
Going into details – structure estimates

- Pine Cone: $7,560,750
- Hard scape: $7,610,750

Budget levels:
- Concrete: $7,976,250
- Steel: $7,976,250
**Goal:** Enclose the building between May and October to avoid snow slowing the construction.

**May 1st 2015** – suggested start of construction of structure, enclosure, exterior systems

predraining, earthwork can be executed before
March 15 2015

MAIN CONSTRUCTION START SHIFT DUE TO BETTER CONDITIONS

Owners have agreed.
Timeline – Milestones

DEWATERING
START
(May 2015)

DEWATERING
END
(October 15 2015)

BUILDING
CONSTRUCTION
START
(approx. 4 months)

BUILDING
ENCLOSED
(April 2016)
Erection sequence of the building

construction site establishment > excavations & landscaping > structure erection

structural system establishment > enclosure process > construction finish & final landscaping
TEAM PROCESS
Team Process

MAIN MEETING

SUBGROUPS

SCHEDULING

Transparency is key – Agile IPD made possible in subgroup meetings
Interactions on team meetings

3DICC Used For: Walkthroughs, Team Meetings, TVD, Team Energy, Present to Owner

(Thanks to Riam Firouz.)
BIM IMPLEMENTATION AND MANAGEMENT
BIM MANAGER – NEW ROLE

TVD: **TEAM PROCESS**

- Everybody agrees on using Revit in the early stages
- Prepare Revit **project templates**
- Prepare user **guidelines** on how to use templates
- Prepare **tutorials** (linking, view depth)
- Establish **sharing/linking** of models
BUILDING MODELS

SITE MODEL

Pushing coordinates to the model

DROPBOX AS A SERVER

ARCHITECTURAL MODEL

STRUCTURAL MODEL
LINKED MODELS
## the DECISION MATRIX

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<th>HARDSCAPE</th>
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<td>concrete</td>
<td>steel</td>
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# LEED POTENTIAL – PINE CONE CONCEPT

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<th>Sustainable Sites</th>
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<td>4</td>
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<td>Innovation &amp; Design Process</td>
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<td>6</td>
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Projected Value of LEED Gold Certification
THANK YOU.

Renate Fruchter, Gitte Sørensen, Lauren Scammell, Greg Luth, Axel Seifert and Matthias Ehrlich, Henry Tooryani, David Bendet, Glenn Katz, Frank Scheiber, Guido Morgenthal