TEAM CENTRAL

JEFFERSON HANG
MOAFAK KATA
DEBBIE DUAN
ZUZANNA KOLTOWSKA
ANDREW LONG

OWNERS: JOANNA HUEY & DIMITRA IOANNIDOU
TEAM PROCESS

• Facebook – One Stop Hub for all ICT tools & surveys
TEAM PROCESS

- Documentation – Box
- Communication – Skype
  - Quick Reminders
  - Notifications
- Collaboration – GoToMeeting
- Coordination – Google Calendar
  - Team Deadlines and Milestones
- Task List – Integrated Project Delivery
  - Individual Work Transparent
  - List Individual Deadlines

Team Central: “have fun and win”
Team Central: “have fun and win”
Good Construction Weather
Low Threat of Weather Delay
Water Management Required

Team Central: "have fun and win"
ENVIRONMENT: “CONCRETE DESERT”
Team Central: “have fun and win”
BIG IDEA: JOSHUA TREE

ADJUSTED TO DRY WARM CLIMATE

SYMMETRY

CORE

COLLECTIVITY

MODULARITY
BIG IDEA: CACTUS MICROCLIMATE

Niches Create Microclimate

Team Central: “have fun and win”
BIG IDEA: THICK SKIN

Glass “Clima” Fascade as Architecture Mimicry Solution
Team Central: “have fun and win”
1st FLOOR PLAN

- SMALL CLASSROOM
- SEMINAR ROOMS
- STUDENT OFFICES
- INSTRUCTIONAL LAB
- REST ROOMS
- VERTICAL SHAFT
- GREEN ROOF
- CIRCULATION

100 ft

98 ft

N
2nd FLOOR PLAN

- DEAN’S OFFICE
- SENIOR ADMINISTRATION
- FACULTY OFFICES
- ADMINISTRATION
- VERTICAL SHAFT
- RESTROOMS
- CIRCULATION

FACULTY LOUNGE 600sqft

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
Excludes self weight of beams, metal decking (5” slab-35 psf), and concrete slabs (150pcf~8”)

<table>
<thead>
<tr>
<th>DEAD LOADS</th>
<th>PSF</th>
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<tbody>
<tr>
<td>Floor Covering</td>
<td>1</td>
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<tr>
<td>Partitions/Walls</td>
<td>15</td>
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<tr>
<td>Ceiling</td>
<td>5</td>
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<tr>
<td>Mechanical</td>
<td>3</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>

Reflective Roof (20 psf) with solar panels (3psf) = 23psf

Green Roof = 100psf

Classrooms = 80 psf

Gathering Areas = 100psf
Risk Category III  
Seismic Design Category D  

\[ F_x = 292.4 \text{ kip} \]  
\[ F_x = 191.4 \text{ kip} \]  
\[ F_x = 101.3 \text{ kip} \]  

\[ V = 585.15k \]  

\[ S_s = 2.256g \]  
\[ S_1 = 0.823g \]  

15 ft Sandy Soil  
5 ksf bearing capacity  

Water Table
## Lateral Resisting Systems

### Main Sources:
- FEMA 454
- NEHRP Technical Briefs

<table>
<thead>
<tr>
<th>System</th>
<th>Expected Behavior During Strong Earthquake</th>
<th>Post EQ Repair</th>
<th>Post EQ Repair Cost</th>
<th>Non-linear Lateral Drift</th>
<th>Cyclic Behavior</th>
<th>Energy Dissipation</th>
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<tbody>
<tr>
<td>Special Moment Frame</td>
<td>Plastic hinges form at reduced beam sections</td>
<td>Potential Extensive Repair</td>
<td>Medium to High</td>
<td>Medium to Large</td>
<td>Stable to Semi-Stable</td>
<td>Medium</td>
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<tr>
<td>Eccentrically Braced Frame</td>
<td>Permanent deformation and structural damage to shear link</td>
<td>Moderate Repair</td>
<td>Low to Medium</td>
<td>Low to Medium</td>
<td>Stable</td>
<td>Medium to High</td>
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<tr>
<td>Buckling Restrained Braced Frame</td>
<td>Inelastic deformation in steel core</td>
<td>Minimum to Adequate Repair</td>
<td>Low to Medium</td>
<td>Low to Medium</td>
<td>Stable</td>
<td>Medium to High</td>
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<tr>
<td>Concrete Special Moment Frame</td>
<td>Plastic hinges form at the end of beams</td>
<td>N/A</td>
<td>Medium to High</td>
<td>Medium to Large</td>
<td>Stable to Semi-Stable</td>
<td>Medium</td>
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<tr>
<td>Cast-in-Place Concrete Structural Wall</td>
<td>Ductile flexural yielding at base of wall, without shear failure (for slender walls, $h_w/l_w &gt; 2$)</td>
<td>Moderate Repair</td>
<td>Medium to High</td>
<td>Medium</td>
<td>Stable to Unstable</td>
<td>Medium to High</td>
</tr>
<tr>
<td>Precast Concrete Shear Walls</td>
<td>Yielding in slotted bolt connection -- connection bolt slip and dissipates energy through friction</td>
<td>Minimum Repair</td>
<td>Low</td>
<td>Low to Medium</td>
<td>Stable</td>
<td>Medium to High</td>
</tr>
</tbody>
</table>
Strip Footing
• Connects spread footing with retaining wall base (10’ width)
• 15” thick

Spread Footing
• 15” thick based on 400k applied from largest column
• 9’x9’
Retaining Wall

- Height: 20'
- Depth: 6'
- Thickness: 3'
- Soil depth: 12''

Spread Footing

- Size: 9' x 9'
- Depth: 15''
- Length: 10'
- Width: 15''
STEEL: BASEMENT

Typ. Beam: W14x26
Typ. Girder: W18x35
Typ. Column: W14x68

BRBF
Planar Truss
Vert. Shaft
STEEL: 1ST FLOOR

Typ. Beam: W14x26
Typ. Girder: W18x35
Typ. Column: W14x68

29 ft Vert. Shaft

BRBF

INSTRUCTIONAL LABS 5000 SQFT
SMALL CLASSROOMS 500 SQFT
STUDENT OFFICES 850 SQFT
RESTROOMS 300 SQFT
MEETING ROOMS 300 SQFT
Typ. Beam: W14x16
Typ. Girder: W18x44
Typ. Column: W14x48
Auditorium

• 45’ x 75’

  Steel Truss (45’)

• 1 Way Post Tensioned Slabs
  (22.5’ span, 2 spans)
CONCRETE: 1\textsuperscript{ST} & 2\textsuperscript{ND} FLOOR

- **14”x14” Columns**

- **Post Tensioned Girders**
  - 16” Depth

- **Post Tensioned Beams**
  - 12” Depth

- **Special Concrete Moment Frames**
  - $R = 8$
  - Resist Base Shear = 586 kips
  - Bay Length ~ 29’
1-Way Post Tensioned Slabs
Span (Typ ~ 24 ft) – 9” Thick
Tendons
0.5” Diameter- 7 Wire Strand
270 ksi Strength
CONCRETE: GRAVITY LOAD PATH

- Tendons
- Applied Loads
- Load Path
BASEMENT HVAC

Vegetated Roof

- Supply
- Return
- Exhaust
- Girders
- Beams
Double Glazed Facade

1ST AND 2ND FLOORS HVAC CM
BASEMENT FLOOR PLAN

- LARGE CLASSROOMS
- SEMINAR ROOMS
- STUDENT OFFICES
- INSTRUCTIONAL LAB
- REST ROOMS
- VERTICAL SHAFT
- CIRCULATION
VIEW FROM THE TUNNEL
Strip Footing
• Connects spread footing with retaining wall base (10’ width)
• 15” thick based on 400k applied from largest column

Spread Footing
• 15” thick
• 8’x8’
Typ. Beam: W16x26
Typ. Girder: W18x40
Typ. Column: W14x68
STEEL: 1ST FLOOR

- Typ. Beam: W14x22
- Typ. Girder: W18x35
- Typ. Column: W14x48

BRBF
Vert. Shaft
Typ. Beam: W12x19
Typ. Girder: W14x30
Typ. Column: W14x48

- BRBF
- Vert. Shaft
- Planar Truss
STEEL: GRAVITY LOAD PATH

Dimensions:
- 10 ft
- 16 ft
- 12 ft
- 14 ft

Distances:
- 23 ft
- 25 ft
- 25 ft
- 25 ft
- 25 ft
- 25 ft
- 25 ft
- 10 ft
STEEL: LATERAL LOAD PATH

25 ft  25 ft  23 ft  25 ft

14 ft  14 ft  14 ft
Grid Layout

- Symmetric Grid (23’ and 25’ spans)
- Repetitive Construction
- Adjusted for Flexible Spacing

- 14”x14” Columns
- Post Tensioned Girders -16” Depth
- Post Tensioned Beams -12” Depth
- Atrium
CONCRETE: 1ST FLOOR

Auditorium

• 49’x73’

• 1 Way Post Tensioned Slabs
  - 3 spans: 25’-23’-25’
  - 8” thickness

• 24’ PT Cantilevers
  - 16”/20” Depth
Auditorium Roof

- 49’x73’
- 1 Way Post Tensioned Slabs
  - 3 spans: 25’-23’-25’
  - 8” thick
- 75’ Steel Truss
- Supported by 24’ PT Cantilevers
  - 16”/20” Depth
Precast Shear Walls

- Base Shear = 936 kips
- R = 5

<table>
<thead>
<tr>
<th>Location</th>
<th>Type</th>
<th>Length</th>
<th>Thickness</th>
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<tbody>
<tr>
<td>Grid1</td>
<td>Coupled Shear Wall</td>
<td>9'-4'-9'</td>
<td>14”</td>
</tr>
<tr>
<td>Grid 10</td>
<td>Shear Wall</td>
<td>15’</td>
<td>14”</td>
</tr>
<tr>
<td>Grid C</td>
<td>Shear Wall</td>
<td>25’</td>
<td>14”</td>
</tr>
<tr>
<td>Grid E</td>
<td>Shear Wall</td>
<td>25’</td>
<td>14”</td>
</tr>
</tbody>
</table>

CONCRETE: LATERAL SYSTEM
CONCRETE: GRAVITY LOAD PATH

- Tendons
- Applied Loads
- Load Path
1-Way Post Tensioned Slabs

- Spans typically 25’ long – 8” thick
- Better transition from slab to shear walls
- Increased floor to ceiling height

Tendons
- 0.5” Diameter
- 7 Wire Bundle
- 270 ksi Strength

Tendon Profile
2ND FLOOR HVAC

Supply
Return
Exhaust
Girders
Beams
Concrete Option

Steel Option

Floor to ceiling height
11’ 9”

Floor to floor height

Floor to ceiling height
10’ 10”

Team Central: "have fun and win"
Team Central: "have fun and win"
TEAM CENTRAL

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SITE ACCESS

Existing Parking

CONSTRUCTION PERSONEL ENTRANCE

EXISTING STREET OVERPASS

Existing Parking

JOB SITE

CONSTRUCTION EQUIPMENT ENTRANCE

Spaulding Field

Experimental Technologies Center

University of California, Los Angeles

Ronald Reagan UCLA Medical Center

CM
SITE LOGISTICS

Mobile Crane Positioning

Concrete Pump Truck Positioning
SITE LOGISTICS

Mobile Crane Positioning

Concrete Pump Truck Positioning
Team Central: “have fun and win”

**EQUIPMENT**

**Putzmeister 47Z-Meter**
- 128’ Horizontal Reach
- 19.4 cu. Ft. Hopper

**John Deere 330 LC**
- 2.3 cu. Ft. Bucket
- 26.5’ Max Dig Depth

**Grove RT530E-2**
- 30 UST Capacity
- 29ft-95ft Boom Length

**Lull 1044C-54**
- 38’ Reach, 54’ Lift
- 10,000 lb Capacity

**Bobcat 763**
- 1,500 lb Capacity
- 46 HP
LOCAL RESOURCES

Team Central: "have fun and win"

13.5 mi
Equipment

12.5 mi
Concrete

17.5 mi
Mechanical

2.5 mi
Concrete Contractor

21.0 mi
Steel Fabricator

15.0 mi
Glazing
1. Roof Ready for Specialty Covering
   – Green Roof
   – Solar Panels

2. Large Spanning Members in Auditorium
   – Site Coordination

3. Computer Rooms Enclosed and Finished

DON’T MISS THE DEADLINE!
SCHEDULE: STEEL

Auditorium
Aug. 27th

Roof
Nov. 1st

Computer Room
Feb. 5th

219 Days
SCHEDULE: CONCRETE

Auditorium: Sept. 23rd

Roof: Dec. 13th

Computer Room: April 10th
SCHEDULE: STEEL

Auditorium: Sept. 3rd

Roof: Oct. 25th

Computer Room: Jan. 27th

204 Days
SCHEDULE: CONCRETE

Auditorium
Sept. 7th

Roof
Jan. 13th

Computer Room
March 21st

238 Days
CONSTRUCTION SCHEDULE

• Start Date:
  Monday, July 27th, 2015

• Construction Complete Date:
  – Flower Steel: April 28th, 2016
  – Flower Concrete: July 6th, 2016
  – Double Diamond Steel: April 11th, 2016
  – Double Diamond Concrete: May 23rd, 2016

Team Central: “have fun and win”
## Construction Estimate

### Steel: $7,750,000

<table>
<thead>
<tr>
<th>Category</th>
<th>Cost</th>
<th>Percentage</th>
<th>Rate per SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Substructure</td>
<td>$335,000.00</td>
<td>4.3%</td>
<td>$11.51</td>
</tr>
<tr>
<td>B Shell</td>
<td>$1,460,000.00</td>
<td>18.8%</td>
<td>$50.17</td>
</tr>
<tr>
<td>C Interiors</td>
<td>$1,160,000.00</td>
<td>15.0%</td>
<td>$39.86</td>
</tr>
<tr>
<td>D Services</td>
<td>$2,250,000.00</td>
<td>29.0%</td>
<td>$77.32</td>
</tr>
<tr>
<td>E Equipment and Furnishings</td>
<td>$ -</td>
<td>0.0%</td>
<td>-</td>
</tr>
<tr>
<td>F Special Construction</td>
<td>$165,000.00</td>
<td>2.1%</td>
<td>$5.67</td>
</tr>
<tr>
<td>G Sitework</td>
<td>$1,560,000.00</td>
<td>20.1%</td>
<td>$53.61</td>
</tr>
<tr>
<td>H General Conditions</td>
<td>$820,000.00</td>
<td>10.6%</td>
<td>$28.18</td>
</tr>
<tr>
<td><strong>Building Total</strong></td>
<td><strong>$7,750,000.00</strong></td>
<td><strong>/SF=</strong></td>
<td><strong>$266.32</strong></td>
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</table>

### Concrete: $7,567,000

<table>
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<th>Category</th>
<th>Cost</th>
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<th>Rate per SF</th>
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<tr>
<td>A Substructure</td>
<td>$322,000.00</td>
<td>4.3%</td>
<td>$11.07</td>
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<td>B Shell</td>
<td>$1,290,000.00</td>
<td>17.0%</td>
<td>$44.33</td>
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<tr>
<td>C Interiors</td>
<td>$1,160,000.00</td>
<td>15.3%</td>
<td>$39.86</td>
</tr>
<tr>
<td>D Services</td>
<td>$2,250,000.00</td>
<td>29.7%</td>
<td>$77.32</td>
</tr>
<tr>
<td>E Equipment and Furnishings</td>
<td>$ -</td>
<td>0.0%</td>
<td>-</td>
</tr>
<tr>
<td>F Special Construction</td>
<td>$165,000.00</td>
<td>2.2%</td>
<td>$5.67</td>
</tr>
<tr>
<td>G Sitework</td>
<td>$1,560,000.00</td>
<td>20.6%</td>
<td>$53.61</td>
</tr>
<tr>
<td>H General Conditions</td>
<td>$820,000.00</td>
<td>10.8%</td>
<td>$28.18</td>
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<tr>
<td><strong>Building Total</strong></td>
<td><strong>$7,567,000.00</strong></td>
<td><strong>/SF=</strong></td>
<td><strong>$260.03</strong></td>
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</table>
## Construction Estimate

### STEEL: $7,640,000

<table>
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<th>Item</th>
<th>Cost</th>
<th>%</th>
<th>Rate</th>
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<tr>
<td>A Substructure</td>
<td>$310,000</td>
<td>4.1</td>
<td>$9.39</td>
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<tr>
<td>B Shell</td>
<td>$1,570,000</td>
<td>20.5</td>
<td>$47.58</td>
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<tr>
<td>C Interiors</td>
<td>$1,240,000</td>
<td>16.2</td>
<td>$37.58</td>
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<td>D Services</td>
<td>$2,130,000</td>
<td>27.9</td>
<td>$64.55</td>
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<td>E Equipment and Furnishings</td>
<td>-</td>
<td>0.0</td>
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<tr>
<td>F Special Construction</td>
<td>-</td>
<td>0.0</td>
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<tr>
<td>G Sitework</td>
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<td>$24.85</td>
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<td>H General Conditions</td>
<td>$7,640,000</td>
<td>/SF= 231.52</td>
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### CONCRETE: $7,538,000

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<th>%</th>
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<td>3.7</td>
<td>$8.42</td>
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<td>19.6</td>
<td>$44.85</td>
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<tr>
<td>C Interiors</td>
<td>$1,260,000</td>
<td>16.7</td>
<td>$38.18</td>
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<tr>
<td>D Services</td>
<td>$2,130,000</td>
<td>28.3</td>
<td>$64.55</td>
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<td>E Equipment and Furnishings</td>
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<tr>
<td>F Special Construction</td>
<td>-</td>
<td>0.0</td>
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</tr>
<tr>
<td>G Sitework</td>
<td>$1,570,000</td>
<td>20.8</td>
<td>$47.58</td>
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<tr>
<td>H General Conditions</td>
<td>$820,000</td>
<td>10.9</td>
<td>$24.85</td>
</tr>
<tr>
<td>Building Total</td>
<td>$7,538,000</td>
<td>/SF= 228.42</td>
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</table>
Team Central: “have fun and win”
Total Project Cost = $8.5M

Construction Budget = $7.5M = $6.86M (2012)

Contingency = 4%

Target Cost = $6.6M
**Target Value = $6.6M**

<table>
<thead>
<tr>
<th>Substructure</th>
<th>Value</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
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<td>$647,656</td>
<td>10%</td>
</tr>
<tr>
<td>B Shell</td>
<td>$1,750,126</td>
<td>27%</td>
</tr>
<tr>
<td>C Interiors</td>
<td>$740,055</td>
<td>11%</td>
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<td>D Services</td>
<td>$1,911,346</td>
<td>29%</td>
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<td>E Equipment &amp; Furnishings</td>
<td>$398,487</td>
<td>6%</td>
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<td>F Special Construction</td>
<td>$468,813</td>
<td>7%</td>
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<td>G Building Sitework</td>
<td>$350,010</td>
<td>5%</td>
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<td>H General Conditions</td>
<td>$333,507</td>
<td>5%</td>
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<td><strong>SUM</strong></td>
<td><strong>$6,600,000</strong></td>
<td><strong>100%</strong></td>
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*Team Central: “have fun and win”*
### Square footage:

<table>
<thead>
<tr>
<th>Description</th>
<th>Area 1</th>
<th>Area 2</th>
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<tbody>
<tr>
<td>GFA</td>
<td>29,206 ft²</td>
<td>33,018 ft²</td>
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<tr>
<td>Structural area</td>
<td>4,965 ft²</td>
<td>6,716 ft²</td>
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<tr>
<td>Useable area</td>
<td>24,241 ft²</td>
<td>26,302 ft²</td>
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<tr>
<td>Assignable area</td>
<td>19,053 ft²</td>
<td>18,672 ft²</td>
</tr>
<tr>
<td>Non-assignable area</td>
<td>5,188 ft²</td>
<td>763 ft²</td>
</tr>
<tr>
<td>Restrooms</td>
<td>600 ft²</td>
<td>508 ft²</td>
</tr>
<tr>
<td>Mechanical rooms</td>
<td>475 ft²</td>
<td>618 ft²</td>
</tr>
<tr>
<td>Circulation area</td>
<td>4,113 ft²</td>
<td>6,504 ft²</td>
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SPACE PERFORMANCE

ft²

Owners
requirements

Team Central: "have fun and win"
<table>
<thead>
<tr>
<th>Required ft²</th>
<th>Actual ft²</th>
<th>Difference</th>
<th>in %</th>
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<tbody>
<tr>
<td>18,000</td>
<td>19,826</td>
<td>1,826</td>
<td>110%</td>
</tr>
<tr>
<td></td>
<td>19,511</td>
<td>1,511</td>
<td>108%</td>
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</table>

Team Central: “have fun and win”
<table>
<thead>
<tr>
<th></th>
<th>Gross Floor Area</th>
<th>Useable area</th>
<th>Structural area</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>29206 ft²</td>
<td>24241 ft²</td>
<td>4965 ft²</td>
</tr>
<tr>
<td>Assignable area</td>
<td>19053 ft²</td>
<td>Non-assignable area</td>
<td>5188 ft²</td>
</tr>
<tr>
<td>Restrooms</td>
<td>600 ft²</td>
<td>Mechanical rooms</td>
<td>475 ft²</td>
</tr>
<tr>
<td>Ciculation area</td>
<td>4113 ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Area</td>
<td></td>
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</tr>
<tr>
<td>----------------------</td>
<td>---------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Floor Area</td>
<td>33018 ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Useable area</td>
<td>26302 ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assignable area</td>
<td>18672 ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-assignable area</td>
<td>7630 ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restrooms</td>
<td>508 ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical rooms</td>
<td>618 ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulation area</td>
<td>6504 ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural area</td>
<td>6716 ft²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### CONCEPT 1

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Coefficient</th>
<th>Goal</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Useable area/GFA</td>
<td>0.8300</td>
<td>max.</td>
<td></td>
</tr>
<tr>
<td>Assignable area/useable area</td>
<td>0.7860</td>
<td>max.</td>
<td></td>
</tr>
<tr>
<td>Assignable area/GFA</td>
<td>0.6524</td>
<td>&gt;0.6</td>
<td></td>
</tr>
<tr>
<td>Non-assignable area/assignable area</td>
<td>0.2723</td>
<td>min.</td>
<td></td>
</tr>
<tr>
<td>Circulation area/useable area</td>
<td>0.1697</td>
<td>min.</td>
<td></td>
</tr>
<tr>
<td>Circulation area/assignable area</td>
<td>0.2159</td>
<td>min.</td>
<td></td>
</tr>
</tbody>
</table>

### CONCEPT 2

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Coefficient</th>
<th>Goal</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Useable area/GFA</td>
<td>0.7966</td>
<td>max.</td>
<td></td>
</tr>
<tr>
<td>Assignable area/useable area</td>
<td>0.7099</td>
<td>max.</td>
<td></td>
</tr>
<tr>
<td>Assignable area/GFA</td>
<td>0.5655</td>
<td>&gt;0.6</td>
<td></td>
</tr>
<tr>
<td>Non-assignable area/assignable area</td>
<td>0.4086</td>
<td>min.</td>
<td></td>
</tr>
<tr>
<td>Circulation area/useable area</td>
<td>0.2473</td>
<td>min.</td>
<td></td>
</tr>
<tr>
<td>Circulation area/assignable area</td>
<td>0.3483</td>
<td>min.</td>
<td></td>
</tr>
</tbody>
</table>

Very Good, Good, OK, Bad

Team Central: “have fun and win”
<table>
<thead>
<tr>
<th>Effective Solar Panel</th>
<th>449 Piece</th>
<th>362 Piece</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar energy per year</td>
<td>241,337.5 kWh</td>
<td>194,575 kWh</td>
</tr>
<tr>
<td>PV initial costs</td>
<td>$538,800</td>
<td>$434,400</td>
</tr>
<tr>
<td>Government incentives</td>
<td>$80,820</td>
<td>$65,160</td>
</tr>
<tr>
<td>Final PV initial costs</td>
<td>$457,980</td>
<td>$369,240</td>
</tr>
<tr>
<td>TOTAL O+M Cost</td>
<td>-$112,177</td>
<td>-$90,441</td>
</tr>
<tr>
<td>TOTAL Income</td>
<td>$1,327,356</td>
<td>$1,070,163</td>
</tr>
<tr>
<td>TOTAL Net operating income</td>
<td>$1,215,180</td>
<td>$979,722</td>
</tr>
<tr>
<td>TOTAL Cash flow</td>
<td>$5,581,160</td>
<td>$4,499,733</td>
</tr>
<tr>
<td>Break-Even-Point (BEP)</td>
<td>After 8 years</td>
<td>After 8 years</td>
</tr>
</tbody>
</table>

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Efficiency of PV-System

- BEP
- O+M Costs
- Cashflow

Years

$-Value

$1,000,000.00
$800,000.00
$600,000.00
$400,000.00
$200,000.00
$0.00

-$200,000.00
-$400,000.00
-$600,000.00

$-600,000.00
$-400,000.00
$-200,000.00
$0.00

$200,000.00
$400,000.00
$600,000.00
$800,000.00
$1,000,000.00

Years

1 3 5 7 9 11 13 15 17 19 21 23 25
CONCRETE LIFE CYCLE COSTS LC FM

- Construction Costs: $7,561,000; 54%
- O&M: $5,968,000; 43%
- Risk Costs: $454,000; 3%
# Rent Calculation

<table>
<thead>
<tr>
<th>Year</th>
<th>O+M Cost</th>
<th>CC-C1-Concrete</th>
<th>Income PV-Present Value</th>
<th>Current Rent</th>
<th>Current Rent per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>-$239,000</td>
<td>-7,561,000</td>
<td>$58,000</td>
<td>-$483,000</td>
<td>-$40,000</td>
</tr>
<tr>
<td>2014</td>
<td>-$243,000</td>
<td>-$302,000</td>
<td>$57,000</td>
<td>-$489,000</td>
<td>-$41,000</td>
</tr>
<tr>
<td>2015</td>
<td>-$248.280,04</td>
<td>-$302,000</td>
<td>$57,000</td>
<td>-$495,000</td>
<td>-$41,000</td>
</tr>
<tr>
<td>2016</td>
<td>-$253.245,64</td>
<td>-$302,000</td>
<td>$56,000</td>
<td>-$450,000</td>
<td>-$42,000</td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Graph

- **O+M Costs**
- **Income-PV**
- **Decreasing Income**
- **Increasing Costs**
- **Years**
STEEL LIFE CYCLE COSTS

- Construction Costs: $7,597,000; 52%
- O&M: $6,682,000; 46%
- Risk Costs: $304,000; 2%
## Rent Calculation

<table>
<thead>
<tr>
<th>Index</th>
<th>2%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2013</td>
</tr>
<tr>
<td>O+M Cost</td>
<td>-$267,000</td>
</tr>
<tr>
<td>CC-C2-Steel</td>
<td>-$7,597,000</td>
</tr>
<tr>
<td>Income PV-Present Value</td>
<td>$47,000</td>
</tr>
<tr>
<td>Current Rent</td>
<td>-$524,000</td>
</tr>
<tr>
<td>Current Rent per Month</td>
<td>-$44,000</td>
</tr>
</tbody>
</table>

**Notes:**
- Decreasing Income
- Increasing Costs

**Graph:**
- O+M Cost
- Income PV (Years 1-26)
REQUIRED:
Silver

Technology:
Solar Panels
Waste Management
Green Roof
Thermal Comfort
Low Flush Fixtures
Water Reuse

LEED Total Score: 69 Points
- Platinum: 52-69 Points
- Gold: 39-51 Points
- Silver: 33-38 Points
- Certified: 26-32 Points

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<table>
<thead>
<tr>
<th>DECISION MATRIX - CRITERIA</th>
<th>LCFM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Costs</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Life Cycle Costs</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Constructability</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Design</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Space efficiency</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Thermal comfort</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Resource consumption</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Public accessibility</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Feasibility of Conversion</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Fire Protection</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Operability of building services</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Durability/ Adaptation of the selected building products, systems and structures of the planned useful life</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Aesthetics</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Uniqueness</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Natural Light</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Spatial distribution</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Quality of spaces</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Interior atmosphere</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Public quality</strong></td>
<td></td>
</tr>
</tbody>
</table>

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**DECISION MATRIX - RESULTS**

<table>
<thead>
<tr>
<th>Concrete</th>
<th>Steel</th>
<th>Concrete</th>
<th>Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>85,67%</td>
<td>85,03%</td>
<td>85,08%</td>
<td>85,33%</td>
</tr>
</tbody>
</table>

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Team Central: “have fun and win”
Special Thanks to:

– Renate Fruchter – Organizer
– Joanna Huey and Dimitra Ioannidou – Owners
– Discipline Mentors