Communication and Interaction

- **box** – Permanent files
  - E_CF_Presentation_MAR11_v3.ppt

- **Google docs** – Co-editing

- **facebook** – Inspire, broadcast + forward
Meeting Protocol

- Facilitator and Minutes taker

Improvements
- Preparing Files for Meetings
Lake Merced Weather

Moderate Climate

Low Precipitation

Max. volume in February.
68 total rain days / year.
Lake Merced Weather

- 2950 annual hours of sunshine
- Winds from SW, max. 89 km/h
- 85% humidity in mornings due to fog
Climate Conditions

Mostly heating needed year round
HVAC Design Strategies

- 40%: Solar gains
- 50%: Internal gains
Wind Analysis

L-shape Footprint

Double Diamond Footprint
HVAC Requisites

**Mixed-mode**, including:
- Passive solar heating
- Natural ventilation

- Comfort temperatures: 68 – 75 F
- Heating capacity: 498,750 Btu/h
- Cooling load: 93.75 ton
- Cooling air volume: 15,562 – 17,696 cfm
Earthquake Information

\[ S_S = 2.177 \text{ g} \]
\[ S_{DS} = 1.451 \text{ g} \]

For information on how the \( S_S \) and \( S_{DS} \) values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

http://geology.com/articles/images/san-andreas-fault-map.jpg
# Lateral Loads

<table>
<thead>
<tr>
<th></th>
<th>Base shear (kips)</th>
<th>Overturning Moment (kip-ft)</th>
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<tbody>
<tr>
<td>L- steel (BRBF)</td>
<td>435</td>
<td>5440</td>
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<tr>
<td>L- timber (shear walls)</td>
<td>733</td>
<td>9160</td>
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<tr>
<td>DD- steel (shear walls)</td>
<td>1325</td>
<td>16570</td>
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<tr>
<td>DD- timber (shear walls)</td>
<td>600</td>
<td>7530</td>
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</table>

From ASCE 7-10
## Live Load Requirements

<table>
<thead>
<tr>
<th>Room Function Type</th>
<th>Total Area (Sq-Ft)</th>
<th>Minimum Live Load (psf)</th>
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</thead>
<tbody>
<tr>
<td>Faculty Offices</td>
<td>3600</td>
<td>50</td>
</tr>
<tr>
<td>Faculty Lounge</td>
<td>1000</td>
<td>100</td>
</tr>
<tr>
<td>Student Offices</td>
<td>1200</td>
<td>50</td>
</tr>
<tr>
<td>Auditorium</td>
<td>3000</td>
<td>100</td>
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<tr>
<td>Classroom</td>
<td>3600</td>
<td>40</td>
</tr>
<tr>
<td>Storage Rooms</td>
<td>1000</td>
<td>150</td>
</tr>
</tbody>
</table>

Based on California Building Code.  
Soil Profile

- USGS Soil Type C
- Well sorted fine to medium sand
- Water table: 14ft below grade
- Friction angle = 40 degrees
- Ka = 0.217, Ko = 0.357, Kp = 4.599
- Unit weight = 116 pcf, saturated = 135 pcf

(from Lindeburg, Civil Engineering Reference Manual for the PE Exam, 8th ed.)
L-Shape
LOCATION ON SITE

LAKE MERCED

SPORT FACILITIES

PARKING

CAMPUS

LOCATION ON SITE

N

LAKE MERCED

SPORT FACILITIES

PARKING

CAMPUS

LOCATION ON SITE

N

LAKE MERCED

SPORT FACILITIES

PARKING

CAMPUS
Inspirations + Big Idea
Façade Materials

WOODEN CLADDING
WOODEN SHADING PANELS
SHADING BY TIMBER STRUCTURE
GLASS + SEMI TRANSLUCENT PANELS/ CUSTOM CURTAINWALLS
Exterior Views

view from east side
main entrance from Campus, view on atrium
Exterior Views

view from west side
second entry, cafeteria
Exterior Views

view from south side

cafeteria
Exterior Views

view from north side

emergency exit
Basement

Auditorium

MEP + Storage

Server Room

Instructional Labs

Pacific
Ground Floor

- LARGE CLASSROOM
- SMALL CLASSROOM
- CAFETERIA
- WC
- SMALL CLASSROOM
- LARGE CLASSROOM
- FACULTY OFFICES
- ATRIUM

Floor Plan: Pacific
Sections

SECTION „A”

FACULTY LOUNGE
STUDENT OFFICES
SMALL CLASSROOM
CAFETERIA
LARGE CLASSROOM
CORRIDOR
AUDITORIUM

SECTION „B”

FACULTY OFFICE
FACULTY LOUNGE
FACULTY OFFICES
CORRIDOR
FACULTY OFFICES
CORRIDOR
INSTRUCTIONAL LABS
Sections

SECTION „C”

ATRIUM

ELEVATOR

DEPARTMENT CHAIR’S OFFICE

CORRIDOR

Level 2
16’ - 0”

Groundfloor
0’ - 0”

Level -1
-15’ - 0”

Current Section
Solar Radiation

Orientation | East | South | North | West
---|---|---|---|---
30 degrees | 129.5 BTU/hr | 120 BTU/hr | 65 BTU/hr | 120 BTU/hr
Wind Simulation
L - Shadows (Jan-Jun)
L - Shadows (Jul-Dec)
Steel
 Structural Grid

- Two structurally separated buildings
- Largest span 29’
Two Structure Approach

- Rigid basement
- 2 stories fully flexible
- 3 stories fully flexible
Load Path

Regular Path

Above Auditorium
Foundation Design

Strip Footings
- Width = 7.5 ft
- Depth = 2.16 ft

Square spread footings
- 11 ft x 11 ft
- Depth = 20 in
Floor Sandwich

- Roof thickness = 5.25”
  - 2” roof deck + Novacem concrete + 8 0.75” shear studs on each side
- Ecospan thickness = 12” (including MEP system)
2nd Floor

- Beam: W16x31
- Girder: W21x50
- Cantilevers: Vierendeel Truss W21x57
1st floor

- Beam: W16x31
- Girder: W21x50
- Load supporting wall built on top of auditorium to distribute load
Basement

- Beam: W16x31
- Girder: W21x50
- King post truss above auditorium
  - 4’ deep
  - A for rod = 16 in²
Lateral Resistance Design

- Buckling Restrained Bracing Frame (BRBF)
- Shear Walls

Shear Walls
HVAC Zones - Basement

Zone B1

Zone B2

Zone B3

Zone B4

4 zones
HVAC Zones - Ground Floor
HVAC Zones - Second Floor A

12 zones

Zone S24
Zone S23
Zone S5
HVAC Zones - Second Floor B

12 zones
HVAC – L Steel

Supply

- VAV with reheat
  - cooling / heating
- Auditorium + Atrium + Cafeteria: Displacement Ventilation
- Instructional Labs: UFAD
- All others: Overhead Mixing

Return

- Ducted
Timber L-Shape

- Same structural grid as steel
  - Maximizes freedom for architecture
  - Can potentially combine solutions to optimize cost/construction
Timber System – Floors & Beams

- LVL Webs
- CLT Upper & Lower Section
- Integrated PT
Timber System – Floors & Beams

- PT Beams
- Timber Slab
- 18 – 22”
- 21-27 ft
- <29 ft
Timber System – Floor Sandwich

Electrical/Plumbing

Air Ventilation

18 - 22” Timber Slab

8 - 10” Open Void
L-Shape – Floors

- One-way analysis based on beam analogy
  - Deflection governs design
- Dimensions:
  - 22” deep for 27’ span
  - 18” deep for 21’ span
- Weight: 1/2 to 2/3 of concrete decks
L-Shape – Beams

- Post-tensioned LVL-Shape – Beams
- L sections
- Integrated with floor system
- Only between columns
  - 29”x16” long span
  - 23”x16” shorter spans
Lateral
• Pinned rocking walls

Columns
• Built up LVL sections
  • 16”x19” to accommodate seismic system
  • 16”x16” elsewhere
Floor System Prefabrication

- On-site prefabrication: 27 ft x 29 ft
- Off-site prefabrication: 27 ft x 10 ft

Source: http://www.archiexpo.com
Source: http://www.greenfab.com
L-Shape – Air

Supply
- Metal radiant ceiling panels + DOAS
- Auditorium:
  Ventilation seats
- Atrium + Cafeteria: Displacement Ventilation
- Instructional Labs: traditional UFAD
- All others:
  timber slab UFAD

Return
- Ducted
Double Diamond
Location on Site
Inspirations + Big Idea

ICONIC BUILDING/
LOCAL SYMBOL/
SAN FRANCISCO FOG/
TRANSPARENCY/
BLUR/
CLOUDS/
FLOW/
FLOATING/
ELEVATED/
ON PEDESTAL/
CANTELIVER/
Façade Materials

GLASS + METAL CORRUGATED PANELS FOR SHADING + EXPOSED STRUCTURE
Exterior Views
MAIN ENTRANCE
SOUTH SIDE

MAIN ENTRANCE

WEST SIDE
VIEW ON LAKE MERCED
Ground Floor

Pacific

Current Section
2nd Floor
Sections

SECTION "B"

SECTION "A" LONGITUDINAL
Solar Radiation
Wind Simulation

Note: These results are experimental and have not been fully validated.
DD - Shadows (Jan-Jun)
DD - Shadows (Jul-Dec)
Double Diamond - Air

**Supply**
- VAV
  - cooling / heating
- Auditorium + Atrium + Cafeteria:
- Displacement Ventilation
- All others: Traditional UFAD

**Return**
- Plenum
- Air handling luminaires
HVAC Zones - Ground Floor

Zone G1

Zone G2

Zone G3

Zone G4

Zone G5

5 Zones
HVAC Zones - Second Floor

36 Zones
HVAC Zones - Second Floor
DD Steel - Structural Grid

- Huge cantilevers 43’
- Largest span 38’
Load Path

• Large Cantilevers
• Cable Systems
Load Path

- Lateral Movement controlled by shear walls
Foundation Design

Strip Footings
- Width = 7.5 ft
- Depth = 2.16 ft

Piles
1st floor

- Beam: W18x175
- Girder: W21x73 camber required
- Columns
2nd floor

Beam: W18x175

Girder: W21x73 camber required
Cantilevers

- Vierendeel Truss: Beam: W21x166
  Column: W21x257
Cantilevers

- Shear walls to stop vibration
  - Post-tensioning
- Deflections < 2 in

- 200 ft
- 10 ft
- 15 ft
Cantilever Connections

- Regular prefabricated modules
- Assembled on site with bolts
Cable Systems

- Cables running within walls to pull floors up
- Cable cross area = 4 in$^2$
Lateral Resistance Systems

Shear Walls
Floor Sandwiches

- 1’ for under floor distribution system
- 2’ for Ecospan systems
DD – Timber Cantilevers
Timber Cantilevers

- Full Height Built up Beams
- Web openings for corridors/doors
- Shear Walls
Full Height Beams

Built up timber beams
- Cross-laminated timber
- Full story height

Beam analogy:
Corridors and doors can be treated like penetrations
Connection Details

Timber Shear Wall Stiffens Connection

Epoxied Rod (Shear)
2nd Floor Plan

- Post-tensioned timber units similar to L-Shape
- Side units do not require PT.
Double-Diamond – Columns/Lateral

Lateral
- Timber Shear Walls
  - Integrated with cantilever beam system
- 20’x16” CLT walls with post-tensioning

Columns
- Built up LVL sections
  - 16”x16” gravity columns

Shear walls run in both directions (transverse not shown)
Structural Health Monitoring

- 40’ cantilevers
- Long-term building maintenance
- Seismic recordings
DD Timber - Air

- **Supply**
  - VAV
    - provide cooling / heating
  - Auditorium + Atrium + Cafeteria: Displacement Ventilation
  - Instructional Labs: UFAD
  - All others: Overhead Mixing

- **Return**
  - Ducted
Natural Ventilation

- Operable windows (manual / mechanical)
- Solar chimneys
- Trickle ventilation
Construction Method A

Foundation *1
- **L-shape steel and timber**
  - Retaining wall or diaphragm walls
  - Square and strip footings cast in place or prefab
  - Basement slab cast to support basement walls
- **Double Diamond steel and timber**
  - No basement
  - Strip footings with piles
  - Cast in place or Prefabricated

Structure *2
**L-shape and Double Diamond**
- **Timber**
  - Erect frame → attach beams and columns
  - Prefabricated connections
- **Steel**
  - Erect steel columns → construct steel beam and slab
  - Complex connections pre-assembled
  - DD Cantilevering; columns can support the cantilever during construction → removed

*1. http://konkrete.in/photo-gallery *
*2. http://r204design.com/ideas/be-prepared/ *
**Construction Method B**

**Roof** *3*
- L-shape and Double Diamond Steel:
  - Concrete slab
  - Green sedum covering
- L-shape and Double Diamond Timber:
  - Wood beams and fibreglass
  - Green sedum covering

**Exterior walls** *3*

**Glass panels:**
- Stick system
  - Assembly and fabrication on site.
- Unitized system
  - Glazed and assembled in factory.

http://www.enclos.com/service-technology/custom-curtainwall/
Construction Method C

**Floor L-shape and DD**

**Timber**
- Custom design by SE and MEP
- Prefab floor slab integrated installations

**Steel**
- Prefabricated vulcraft steel decking
  - Decks from CA and joists from Utah.
- MEP installed
- Concrete cast on top

**Interior walls** *4

*For all alternatives*
- Timber stud with gypsum board
  - Prefabricated with installations
  - Built on site.
- Opportunities prefab Double Diamond

Site Access Analysis

- Winston Dr.
- Construction site
- Adjacent facilities
- N State Dr.
Site Access Analysis

Construction site

Adjacent facilities

Usable Access

Unusable Access

Re-route plan for adjacent facilities
Site Layout Plan L-Shape
Site Layout Plan Dual Gates

- Office In & out
- Scaffolding stockpile
- Truck queue
- Field office
- Workmen trailer
- Workshop
- Material storage
- Workmen trailer
- Material storage
- Waste
- Trades workshop
- Mobile crane
- Neutral gate
- Parking
- Eq. Parking

Picketing
Site Layout Plan DD

- Mobile crane
- Truck queue
- Scaffolding
- Office In & out
- Workmen trailer
- Field office
- Parking
- Eq. Parking
- Reserved gate
- Construction In & out
- Waste
- Trades workshop
- Material storage
- Material storage
- Trades workshop
3D Layout Plan
Steel Access

1. Global Steel Fabricators, Inc.
   Shortest Distance: 30 Miles

2. SCAFCO Steel Stud Manufacturing Company

3. Simpson Strong-Tie

4. UPS Structural Connectors
   Longest distance: 50 Miles
Wood Access

1. Beronio Lumber
   Shortest distance: 7 Miles

2. Big Creek

3. Channel Lumber
   Longest distance: 25 Miles
Machinery

- **Stationary Tower Crane**
  - Capacity: 44000 lbs
  - Cost: $304/hr

- **CAT Excavator 323E L/LN**
  - Capacity: 1.7 CY
  - Cost: $1967HR

- **Wheel Loader Volvo L70**
  - Capacity: 6.5 CY, 15 400 lbs
  - Cost: $230/hr
### Scheduling

#### Main Costs - L-Shape

<table>
<thead>
<tr>
<th>Activity</th>
<th>UOM</th>
<th>QTY</th>
<th># Crews</th>
<th>Expected production rate</th>
<th>Duration(days)</th>
<th>Duration(weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Basement excavation</td>
<td>CY</td>
<td>5,400</td>
<td>1</td>
<td>500</td>
<td>11</td>
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<tr>
<td>Foundation</td>
<td>CY</td>
<td>150</td>
<td>1</td>
<td>20</td>
<td>8</td>
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</tr>
<tr>
<td>Steel Structure</td>
<td>Ton</td>
<td>110</td>
<td>1</td>
<td>10</td>
<td>8</td>
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<tr>
<td>Concrete Slabs</td>
<td>CY</td>
<td>990</td>
<td>2</td>
<td>28</td>
<td>18</td>
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<tr>
<td>Roof</td>
<td></td>
<td></td>
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<td></td>
<td>15*</td>
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<tr>
<td>Exterior Walls</td>
<td>SF</td>
<td>7,800</td>
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<td>Interior Walls</td>
<td>SF</td>
<td>17,500</td>
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<td>Flooring/Finishes</td>
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<td></td>
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<td>30*</td>
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<tr>
<td>MEP</td>
<td>Ea</td>
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<td></td>
<td></td>
<td>60</td>
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<tr>
<td><strong>Total Duration</strong></td>
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<td></td>
<td></td>
<td>186</td>
<td>38</td>
</tr>
</tbody>
</table>

* can overlap with other activity

#### Main Costs - Double Diamond

<table>
<thead>
<tr>
<th>Activity</th>
<th>UOM</th>
<th>QTY</th>
<th># Crews</th>
<th>Expected production rate</th>
<th>Duration(days)</th>
<th>Duration(weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization</td>
<td></td>
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<td>Piles</td>
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<tr>
<td>Foundation</td>
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<tr>
<td>Structure</td>
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<tr>
<td>Concrete Slabs</td>
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<tr>
<td>Roof</td>
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<td>15*</td>
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<td>Exterior Walls</td>
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</tr>
<tr>
<td>Interior Walls</td>
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<tr>
<td>Flooring/Finishes</td>
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<td>MEP</td>
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<tr>
<td><strong>Total Duration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>186</td>
<td>38</td>
</tr>
</tbody>
</table>

* can overlap with other activity

#### Main activity durations & crew sizes

- **L Steel**
  - **Mobilization and grading**: 35 days
  - **Basement excavation**: 11 days
  - **Foundation**: 8 days
  - **Steel Structure**: 8 days
  - **Concrete Slabs**: 18 days
  - **Roof**: 15 days
  - **Exterior Walls**: 16 days
  - **Interior Walls**: 30 days
  - **Flooring/Finishes**: 30 days
  - **MEP**: 60 days
  - **Total Duration**: 186 days, 38 weeks
"Achieve a healthy building through a healthy approach during the design and construction phase"

- Address risks
  - High consequence risks; falling, squeezing and run-over
  - Low consequence risks often most dangerous in the long run; dust, noise, chemical exposure from paint/coatings, slipp and fall etc.
  - Encourage reports of risks and accidents

- Breaks, hydration and nourishment

- Design for safety

- Fire and safety rounds

- Education
  - Workers exposed to risky situations;
    - using personal lifts, electric hand tools, welding, traffic and lifting heavy elements.
Environment

- **Establishment savings**:1:
  - **Heat Recovery in trailers (FTX)**
    Savings of 264 kWh/year (ca 6 %), a bit less in California.
  - **Prescence Control**
    Sensors that regulates ventilation, heat and lighting.
    Savings of 650 kWh/year (ca 15 %).
  - **Insulation**
    Savings of ca 900 kWh/year (ca 21 %), a bit less in California.
  - **Decreased Flushing in taps and toilets**
    Savings of ca 240 kWh/year (ca 6 %).
- **Reduce waste by careful estimation of needed resources**
- **Use of local resources and materials**
- **Good recycle systems on site** 2
Sustainability Challenges

Current Status  Decision Matrix  Certified Petal
CM Summary

Schedules

<table>
<thead>
<tr>
<th>Foot Print</th>
<th>L-shape</th>
<th>DD-shape</th>
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</thead>
<tbody>
<tr>
<td>Structure type</td>
<td>Steel (38 weeks)</td>
<td>Timber (51 weeks)</td>
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TVD

<table>
<thead>
<tr>
<th>Foot Print</th>
<th>L-shape</th>
<th>DD-shape</th>
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</thead>
<tbody>
<tr>
<td>Structure type</td>
<td>Steel ($9 030 000)</td>
<td>Timber ($9 630 000)</td>
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</table>

CM Decision Matrix

<table>
<thead>
<tr>
<th>Concept</th>
<th>Time</th>
<th>TVD</th>
<th>Tot.</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-Shape Timber</td>
<td>2</td>
<td>3</td>
<td>5</td>
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<tr>
<td>L-Shape Steel</td>
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<tr>
<td>DD Timber</td>
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<td>2</td>
<td>3</td>
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<tr>
<td>DD Steel</td>
<td>3</td>
<td>1</td>
<td>4</td>
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</table>
# Structural Comparison

<table>
<thead>
<tr>
<th></th>
<th>Seismic Weight</th>
<th>Construction &amp; Supply</th>
<th>Seismic Performance</th>
<th>Structural Efficiency</th>
<th>Long-term Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
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<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
<td>🟢</td>
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<tr>
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</tr>
<tr>
<td>Timber</td>
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<td>🟢</td>
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</tbody>
</table>
## HVAC Comparison

<table>
<thead>
<tr>
<th></th>
<th>Thermal Comfort</th>
<th>User Control</th>
<th>Prefab Opportunity</th>
<th>Complexity</th>
<th>Maintenance</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAV + Overhead</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Red" /></td>
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<tr>
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<td><img src="#" alt="Yellow" /></td>
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</tbody>
</table>
STV Comparison

Steel

135% kgCO₂

Carbon

230% kgCO₂

Water

Energy

Timber

81% kgCO₂

Carbon

82% kgCO₂

Water

Energy
Table: ESTIMATE AND TARGET VALUE - L Steel

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Estimated Value</th>
<th>Target Value</th>
<th>Value Delta</th>
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<tbody>
<tr>
<td>TOTAL</td>
<td>9 000 000</td>
<td>9 800 000</td>
<td>800 000</td>
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<tr>
<td>A Substructure</td>
<td>280 000</td>
<td>640 000</td>
<td>360 000</td>
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<tr>
<td>B Shell</td>
<td>3 100 000</td>
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<td>100 000</td>
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<tr>
<td>C Interiors</td>
<td>1 100 000</td>
<td>1 100 000</td>
<td>0</td>
</tr>
<tr>
<td>D Services</td>
<td>3 500 000</td>
<td>3 500 000</td>
<td>0</td>
</tr>
<tr>
<td>E Equipment and Furnishing</td>
<td>140 000</td>
<td>160 000</td>
<td>20 000</td>
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<tr>
<td>F Specialty Construction</td>
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<td>270 000</td>
<td>70 000</td>
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<tr>
<td>G Building Sitework</td>
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<td>-30 000</td>
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<tr>
<td>H General Conditions</td>
<td>440 000</td>
<td>630 000</td>
<td>190 000</td>
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TVD L-Shape Timber

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<th>CATEGORY NAME</th>
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<th>[PERCENTAGE]</th>
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<tr>
<td>G Building Sitework</td>
<td>$313,530</td>
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<td>$465,000</td>
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<td>A Substructure</td>
<td>$324,603</td>
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<tr>
<td>F Specialty Construction</td>
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<tr>
<td>E Equipment and Furnishing</td>
<td>$195,500</td>
<td>2%</td>
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</table>

**ESTIMATE AND TARGET VALUE - L Timber**

<table>
<thead>
<tr>
<th>CATEGORY NAME</th>
<th>ESTIMATED VALUE</th>
<th>TARGET VALUE</th>
<th>VALUE DELTA</th>
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</thead>
<tbody>
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<td>9 600 000</td>
<td>9 800 000</td>
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<tr>
<td>E Equipment and Furnishing</td>
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<tr>
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<tr>
<td>G Building Sitework</td>
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**Target** $9 800 000

**Estimated** $9 600 000
TVD DD Steel

TVD - TARGETS BY CLUSTER

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<tr>
<th>Cluster</th>
<th>Estimated Value</th>
<th>Target Value</th>
<th>Value Delta</th>
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<tbody>
<tr>
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<tr>
<td>C Interiors</td>
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<tr>
<td>D Services</td>
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<td>E Equipment and Furnishing</td>
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<tr>
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<tr>
<td>G Building Sitework</td>
<td>250 000</td>
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<td>800 000</td>
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<tr>
<td>H General Conditions</td>
<td>440 000</td>
<td>630 000</td>
<td>190 000</td>
</tr>
</tbody>
</table>

Target: $9 800 000
Estimated: $10 000 000

G Building Sitework $252,030
F Specialty Construction $204,700
E Equipment and Furnishing $135,500
D Services $3,531,555
C Interiors $1,235,950
H General Conditions $440,000
A Substructure $150,977

Target: $9 800 000
Estimated: $10 000 000
### TVD DD Timber

#### TVD - TARGETS BY CLUSTER

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<th>Estimated Value</th>
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<th>Value Delta</th>
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<td>1,200,000</td>
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<td>D Services</td>
<td>3,600,000</td>
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<td>-100,000</td>
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<td>E Equipment and Furnishing</td>
<td>140,000</td>
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<td>H General Conditions</td>
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</table>

**Target**

- $9,800,000

**Estimated**

- $9,700,000
Decision Matrix

- Personal Preference
- Architecture
- Occupant Health
- Social Responsibility
- Economic Prosperity
- Environmental Stewardship
L-Shape Timber