WINTER PRESENTATION

atlantic
five time zones: 2020
OUR TEAM

MARIA DTU MEP

BRANDON STANFORD SE

EBRAHIM UW-MAD CM

SHUANG TSINGHUA CM

ISABELLA UQ A

LEWIS UQ SE
OUR PROJECT
PROJECT GOALS

SUSTAINABILITY

LEED - Energy efficiency, NetZero Carbon

ADAPTABILITY - Flexibility

RESILIENT - Prepared

COLLABORATION

INCLUSION - Democratic

INTERACTION - Learning

INTEGRATED - Collaborative workflow

SMART - Connected, liveable space

TECHNOLOGY

DISASSEMBLY - Modularity

PREFABRICATION - Assembly & disassembly
CHALLENGES

Five time zones & 24/7 Connected

Communication

Scheduling

Integration
shall I go with this slope? max. 16ft?

Lewis Healy 10:15 AM
so the second image is the same face just with a different slope?

Lewis Healy 10:22 AM
or is the second image looking in the other direction

Brandon Byers 11:46 AM
Hey team, my computer is not working again so I gotta run home and use my Mac. We can use my zoom account to meet, but I’ll be another 10-15 minutes

👍 1 ❤️ 0 😄
COLLABORATION AND COORDINATION
<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
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</thead>
<tbody>
<tr>
<td>CONCEPT WORKSHOP</td>
<td>SUB-GROUP MEETING</td>
<td>SUB-GROUP MEETING</td>
<td>STAND UP REPORT</td>
<td>TEAM DOWNLOAD</td>
<td>TEAM UPDATE</td>
<td>RETHINK IDEAS</td>
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<tr>
<td>TEAM BRAINSTORMING</td>
<td></td>
<td>TEAM BRAINSTORMING</td>
<td></td>
<td>OWNER</td>
<td>OWNERS (bi-weekly)</td>
<td></td>
</tr>
</tbody>
</table>
TEAM PROGRESS

Weekly Sub-Meetings

Number of Sub-Meetings

Team Process Presentation Peer Review Crit Winter Quarter

Week 2 Week 3 Week 4 Week 5 Week 6 Week 7 Week 8

SE-SE CM-CM CM-SE CM-ARC SE-ARC SE-MEP ARC-MEP CM-MEP
CURRENT SNAPSHOT  SUB-GROUP MEETINGS
SITE CONTEXT

BUILDING SITE

MEMORIAL LIBRARY

MUIR WOODS

MEMORIAL TERRACE

LAKE MENDOTA
SITE CONTEXT CHALLENGES & OPPORTUNITIES
CLIMATE ANALYSIS

Continental Climate Heating Dominated

Heating: 93% of year hours T<70F

Cooling: 7% of year hour T>75F

Annual Temperature range: 37F - 56F

Max T = 95 F
Min T = -20 F

Annual Relative Humidity: 73%
INDOOR CLIMATE & PEOPLE IN MADISON

Indoor Temperature design: 77 F (67-82F - Ashrae 55)
Relative Humidity: 50% (30-60% - Ashrae 55)

 Doesn’t mind the cold. Comfortable 67F - 82F

Visiting Madison. Prefers warmer temperature

Grew up in Madison. Prefers cooler temperatures.

Studies in Madison. Doesn’t mind the cold for short periods.
PROJECT HAZARDS

Climate Change - Driving Force

+ Extreme hot days
+ Precipitation
+ Heavy precipitation events

Consequences

Overheating

Flooding - Rain/Lake level

Solutions

Building Structure

Water Management & Mitigation

Urban Planning
**SUN PATH AND SHADING**

**SUMMER**
- 5am
- 12pm

**WINTER**
- 8am
- 12pm
FINDING A FORUM
AN EDUCATIONAL COMMUNITY
CONCEPT 1: FINDING A FORUM
A FORUM

a place where ideas and views can be exchanged, a place for community and gathering
finding a forum is the action of carving, planning and designing for togetherness and community to create a nourishing and inspiring learning environment.
PROCESSION ENTRY AT SOUTH FORUM
LEVEL 1 UPON ENTERING BUILDING AT SOUTH
INTERIORS FINISHES AND MATERIAL PALETTE

CARBON-NEUTRAL RESILIENT FLOORING

EXPOSED CLT FLOORING

ECHOPANEL

PERFORATED PLYWOOD CEILING IN OFFICES

RED MAPLE

FABRICS FOR JOINERY AND FURNITURE SELECTIONS
LEVEL 2  CO-WORKING
LEVEL 2 A CLASSROOM WITH A VIEW
FIRST FLOOR DESCENDING STAIR
FIRST FLOOR PLAN

LINE OF GROUND FLOOR FOOTPRINT
GROUND FLOOR MEZZANINE VISUALISATION
GROUND FLOOR MEZZANINE VIEW FROM “BALCONY”
PROCESSION FROM WOOD TO LAKE
CENTRAL STAIR: A CONNECTIVE THREAD
Rooms are extruded from the form of the building.

Memorial library

Amphitheatre

A double-height “balcony”

Hasler Laboratory

Lakeside plaza
AT THE URBAN SCALE

Amphitheatre

Public plaza
STRUCTURAL SYSTEM KEY DRIVERS

- **Climate Change**
  - More sustainable building systems
  - More efficient production and construction

- **Site Constraints**
  - Single access point
  - Smaller trucks, cranes

- **Rapid Delivery Time**
  - Limited time for working outdoors
  - Building needs to be assembled quickly

- **Weather**
  - Snow
  - Temperature Variants

- **Resilience - Disassembly**
  - Design for disassembly
  - Rebuild structure into new structures
## Structural System Key Drivers

<table>
<thead>
<tr>
<th>Material</th>
<th>Elephant</th>
<th>Truck</th>
<th>Snowfall</th>
<th>Time</th>
<th>Puzzle</th>
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</thead>
<tbody>
<tr>
<td>Timber</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Concrete</td>
<td>☒️</td>
<td>☒️</td>
<td>☒️</td>
<td>☒️</td>
<td>☒️</td>
</tr>
<tr>
<td>Steel</td>
<td>☒️</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Green check mark (✔️) indicates a positive aspect.
- Red cross (☒) indicates a negative aspect.
- Yellow bar (---) indicates a neutral aspect.
- Blank space (-----) indicates no data available.
ENGINEERED TIMBER...CAN WE DO IT BETTER?
HYBRID FIBRE-REINFORCED TIMBER (HFT) PANELS
## HFT vs CLT

<table>
<thead>
<tr>
<th></th>
<th>Mass</th>
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<tr>
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<td><strong>CLT</strong></td>
<td>240 kg</td>
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<td>0%</td>
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</tr>
</tbody>
</table>
### Structural System

#### Option A: CLT

- Mass: 77 kg
- kg CO2-eq: 15
- Transport Costs: -30%
- Installation Cost: -20%
- Construction Cost: +10%
- Structural Material Reduction: -33%

#### Option B: HFT

- Mass: 240 kg
- kg CO2-eq: -420
- Transport Costs: 0%
- Installation Cost: 0%
- Construction Cost: 0%
- Structural Material Reduction: 0%
SITE CONDITIONS AND NATURAL LOADING

- Wind 21 psf
- Snow 32 psf
- High Water Table -6.5'
TYPICAL LOADINGS AND CLASSIFICATIONS

- Auditorium: 100 psf
- Terrace: 100 psf
- Corridor: 100 psf
- Labs: 60 psf
- Office: 50 psf
- Equipment: 30 psf
- Facade: 12 psf
- Floor DL: 100 psf
- Classroom: 40 psf
TYPICAL MATERIALS SUMMARY

- 6.9" CLT
- 5" x 11" GL
- 8" x 10" GL
- 8" RC
- 3' x 3' RC
- 10' x 20' CLT, 7 PLY (10'"
- 10' x 4' HFT PANELS, 1' DEEP
- 10" x 12" GL
- 10" x 10' x 3' RC
- 5" x 11" GL
STRUCTURAL GRIDS SECOND FLOOR

- Glulam
- Structural Wall
- Transfer Truss
- HFT/CLT Panel Spanning Direction
- Glulam Column
- Building Footprint
STRUCTURAL SYSTEM LOAD PATH

GRAVITY

LATERAL
STRUCTURAL SYSTEM CONNECTION DETAILS

Glulam - Glulam
AFT Concealed Beam Hanger

CLT - CLT
X-RAD Connector

HFT - Glulam

HFT - HFT
**Soldier Pile**
- W16x89
- 10 feet on center
- 60 feet piles, 25 feet above grade

**Concrete Lagging**
- Prefab monoliths between piles
- 5’ x 10’ x 1’
### Structural System

#### Option A: CLT

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</table>

#### Option B: HFT

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</table>
A E M C

MEP FORUM INTEGRATION

GROUND FLOOR - DUCT DISTRIBUTION

186 ft²

GROUND FLOOR MEZZANINE - DUCT DISTRIBUTION

214 ft²

SUPPLY
RETURN
MECHANICAL SHAFT
VERTICAL DUCT
MECHANICAL ROOM
MEP FORUM INTEGRATION

FIRST FLOOR - DUCT DISTRIBUTION

SECOND FLOOR - DUCT DISTRIBUTION

SUPPLY
RETURN
MECHANICAL SHAFT
VERTICAL DUCT
MECHANICAL ROOM
DAYLIGHT ANALYSIS

30% of area Daylight Factor >2%

63% of area Daylight Factor >2%

81% of area Daylight Factor >2%

GROUND FLOOR

FIRST FLOOR

SECOND FLOOR
### PRIMARY SYSTEM - Heating & Cooling

#### Decision Matrix

<table>
<thead>
<tr>
<th>CRITERIA RATING</th>
<th>UW CP</th>
<th>Geo Heat Pump</th>
<th>Weight Factor</th>
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<tbody>
<tr>
<td>Initial Cost</td>
<td>4</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Life Cycle Cost (O&amp;M)</td>
<td>4</td>
<td>4</td>
<td>4</td>
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<tr>
<td>Aesthetics</td>
<td>4</td>
<td>4</td>
<td>3</td>
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<tr>
<td>Structural Integration</td>
<td>5</td>
<td>3</td>
<td>4</td>
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<tr>
<td>Noise</td>
<td>4.5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Operational Reliability</td>
<td>5</td>
<td>4.5</td>
<td>4</td>
</tr>
<tr>
<td>Environmental Impact</td>
<td>3.5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Scale of 1-5, with 5 indicating a superior efficiency

- **UW Central Plant**
- **Geothermal Heat Pump**

- Efficiency
- Net Zero
- Resilience
PRIMARY SYSTEM - Heating & Cooling

Schematic

**UW CENTRAL PLANT** (backup) → Steam + Chilled water

**HEAT PUMP** → Hot water + Chilled water

4 pipe modular chiller water system

HOT WATER (supply ~110°F)
Heating Coils in AHU
Domestic hot water
Terminal heating devices

CHILLED WATER (supply ~42°F)
Cooling Coils in AHU
Terminal cooling devices

**CONVERTOR ALWAYS LOADED**

**2 small CW heat pumps**

**2 small HW heat pumps**
## Decision Matrix

### Secondary System - Heating & Cooling

<table>
<thead>
<tr>
<th>Criteria Rating</th>
<th>Weight Factor</th>
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<tbody>
<tr>
<td><strong>Owner</strong></td>
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<tr>
<td>Initial Cost</td>
<td>4</td>
</tr>
<tr>
<td>Life Cycle System Cost (O&amp;M)</td>
<td>5</td>
</tr>
<tr>
<td>Aesthetics</td>
<td>3</td>
</tr>
<tr>
<td>Structural Integration</td>
<td>4</td>
</tr>
<tr>
<td>Noise</td>
<td>3</td>
</tr>
<tr>
<td>Operational Reliability</td>
<td>4</td>
</tr>
<tr>
<td>Environmental Impact</td>
<td>5</td>
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<tr>
<td>Occupant/Space Control</td>
<td>3</td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td></td>
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<tr>
<td>Indoor Quality</td>
<td>5</td>
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<tr>
<td>Thermal Comfort</td>
<td>4</td>
</tr>
<tr>
<td>Efficiency</td>
<td>4</td>
</tr>
<tr>
<td>Sustainability</td>
<td>5</td>
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**System**

<table>
<thead>
<tr>
<th>System</th>
<th>Source</th>
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<tbody>
<tr>
<td>VAV+DCV</td>
<td>Air</td>
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<tr>
<td>Diffuse Ceiling + DCV</td>
<td>Refrigerant</td>
</tr>
<tr>
<td>UFAD</td>
<td></td>
</tr>
<tr>
<td>VRF</td>
<td></td>
</tr>
<tr>
<td>Radiant</td>
<td></td>
</tr>
<tr>
<td>Convection</td>
<td></td>
</tr>
<tr>
<td>Perimeter FCU</td>
<td></td>
</tr>
<tr>
<td>ACB</td>
<td></td>
</tr>
</tbody>
</table>

Scale of 1-5, with 5 indicating a superior efficiency.
AHU - heated and cool air to each floor  
Auditorium - separate system design  

INDOOR AIR QUALITY provided by air change  

THERMAL COMFORT handled by water-based heating/cooling  

Energy Recovery  
Rotary Heat Exchanger  

No frost!
HVAC SOLUTION I

Mixing Ventilation + Variable Air Volume

Mixing ventilation + VAV - Diffuser
Heating/Cooling handled by air - ceiling
Temperature, CO2 control

Simple
No hydronic system
Occupant Comfort
Economical

12.5 ft height

15 ft height
HVAC SOLUTION 2

Perforated diffused ceiling + Perimeter underfloor convection + ACB

Air supply - Perforated Diffused Ceiling
Heating/cooling handled by water - Floor

Energy demand reduction
Acoustics
Better Thermal Comfort
Easy access

ACB for high heat load rooms

12.5 ft height

15 ft height
CONCEPT 2: WEAVING
A “woven” building combines Wisconsin’s history of textiles and weaving with cutting edge technology and visible, innovative structural systems and tectonic.
PROCESSION SOUTHERN ENTRY
PROCESSION GLIMPSES OF LAKE AT THE NORTH
LEVEL 2 CLASSROOM - A CONSTANT VIEW
A CONNECTIVE THREAD
SECOND FLOOR PLAN
LEVEL 01 CO-WORKING SPACE
LEVEL 01 FACULTY LOUNGE
FIRST FLOOR PLAN

LINE OF BUILDING FOOTPRINT
GROUND FLOOR CLASSROOM
GROUND FLOOR PLAN
A UNIFIED WHOLE
INTERIOR & EXTERIOR THRESHOLD
INITIAL DESIGN FACADE GENERATION
A WOVEN BUILDING VIEW FROM THE LAKE
AN INTEGRATED, WOVEN SKIN

Varying density on faces based on daylight requirements

Fenestration in facade

Facade weaves in and out
A SCULPTURAL & CONNECTIVE THREAD
INTERTIORS  FINISHES AND MATERIAL PALETTE

- CARBON-NEUTRAL RESILIENT FLOORING
- EXPOSED CLT FLOORING
- ECHOPANEL
- PERFORATED PLYWOOD CEILING IN OFFICES

- RED MAPLE
- FABRICS FOR JOINERY AND FURNITURE SELECTIONS
- ECHOPANEL FOR OFFICES
STRUCTURAL SYSTEM

OPTION A CLT

OPTION B HFT

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**MATERIALS SUMMARY**

- **6.9” CLT**
- **10’ x 20’ CLT, 7 PLY (10”)**
- **4’ x 10’ HFT Panels, 1’ Deep**
- **4” Thick Timber Panel**
- **5’ x 2’**
- **5” x 11” GL**
- **8” x 10” GL**
- **8” x 10” GL**
- **10’ x 10’ x 3’ RC**
- **8” RC**
- **3’ x 3’ RC**
- **10’ x 10’ x 3’ RC**
- **92**
STRUCTURAL GRIDS  GROUND FLOOR

- Glulam
- Structural Wall
- Transfer Truss
- HFT/CLT Panel Spanning Direction
- Glulam Column
- Building Footprint
STRUCTURAL GRIDS FIRST FLOOR

- Glulam
- Structural Wall
- Transfer Truss
- HFT/CLT Panel Spanning Direction
- Glulam Column
- Building Footprint
STRUCTURAL GRIDS SECOND FLOOR

- Glulam
- Structural Wall
- Transfer Truss
- HFT/CLT Panel Spanning Direction
- Glulam Column
- Building Footprint
LOAD PATH

GRAVITY

LATERAL
STRUCTURAL SYSTEM WOVEN FACADE COLUMNS

Woven Facade - Panel Connections
Finger Joints Connecting Panels

Woven Facade - Panel Connections
Inserted panels with screws

Woven Facade - Foundation Connection
Steel base plate bolted into concrete strip footing

A E M C
STRUCTURAL SYSTEM

OPTION A CLT

OPTION B HFT

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MEP WEAVING INTEGRATION

GROUND FLOOR - DUCT DISTRIBUTION

GROUND FLOOR MEZZANINE - DUCT DISTRIBUTION

ROOM COLOURS
- AMENITIES
- AUDITORIUM
- CIRCULATION
- CLASSROOM
- FACULTY LOUNGE
- FACULTY OFFICE
- LARGE CLASSROOM
- OFFICE
- MEETING ROOM
- STUDENT OFFICE
- SUPPORT
- VERTICAL CIRCULATION
- WORKSPACE

298 ft²
67 ft²

SUPPLY
RETURN
MECHANICAL SHAFT
VERTICAL DUCT
MECHANICAL ROOM

GROUND FLOOR - DUCT DISTRIBUTION
GROUND FLOOR MEZZANINE - DUCT DISTRIBUTION
MEP WEAVING INTEGRATION

FIRST FLOOR - DUCT DISTRIBUTION

SECOND FLOOR - DUCT DISTRIBUTION

ROOM COLOURS
- Amenities
- Auditorium
- Circulation
- Classroom
- Faculty Lounge
- Faculty Office
- Large Classroom
- Office
- Restroom
- Student Office
- Support
- Vertical Circulation
- Workspace

SUPPLY
RETURN
MECHANICAL SHAFT
VERTICAL DUCT
MECHANICAL ROOM
DAILY ANALYSIS

28% of area Daylight Factor >2%
42% of area Daylight Factor >2%
56% of area Daylight Factor >2%

GROUND FLOOR
FIRST FLOOR
SECOND FLOOR
HVAC SOLUTION 1

Variable Refrigerant Flow - 2 pipe system

Heating/Cooling handled by refrigerant
Multiple compressors - water source loop

Energy Efficient
Installation Flexibility
Quiet operation
Indoor Comfort

Different Speeds vs on/off operation
HVAC SOLUTION 2

Perforated diffused ceiling + Radiant packed tubing + ACB

Air supply - Perforated Diffused Ceiling
Heating/Cooling handled by water - Floor/Ceiling

Energy demand reduction
Acoustics
Improved Heat transfer
Indoor Comfort

ACB for high heat load rooms
HVAC AUDITORIUM

Perforated diffused ceiling + Fan Coil Unit

Heating/cooling handled by air - Ceiling
Air supply - Perforated Diffused Ceiling

Energy demand reduction
Acoustics
Indoor comfort
ENERGY & SUSTAINABILITY

WATER

Management & Mitigation
Green roof, Rain gardens ... Urban Planning

Reuse
Harvest: Toilet Flushing and Irrigation
Potential: 34 inch/year

Reduce
Waterless urinals
Dual flush toilets
0.25 gpm sinks

Water reduction 40-50%
ENERGY & SUSTAINABILITY

SOLAR

Avg Monthly Solar Radiation: 4.55 kWh/m2/day

PV + Green Roof

Sustainability
Reduction of GHG emissions
Enhance of PV function

ThyssenKrup - Elevator

Non machinery Elevator
LED Lighting
Auto Light Shut-Off
Auto Exhaust Fan Shut-Off

Building architecture
Co2 reduction
Cost

Results

<table>
<thead>
<tr>
<th></th>
<th>Scenario 1 Annual</th>
<th>Scenario 2 Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kilowatt Hour</td>
<td>USD</td>
</tr>
<tr>
<td>Cab Exhaust Fan</td>
<td>$70</td>
<td>$70</td>
</tr>
<tr>
<td>Cab Lighting</td>
<td>$202</td>
<td>$202</td>
</tr>
<tr>
<td>Module Room Cooling</td>
<td>$5</td>
<td>$5</td>
</tr>
<tr>
<td>Elevator</td>
<td>$450</td>
<td>$450</td>
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<tr>
<td>Energy Consumption</td>
<td>$767</td>
<td>$767</td>
</tr>
<tr>
<td>Number of Movements Per Hour / Day</td>
<td>1 / 86</td>
<td>1 / 86</td>
</tr>
</tbody>
</table>

Potential Savings of Scenario D: 1482 Metric Tons of CO2 reduction
STV - SUSTAINABLE TARGET VALUE

CLT - Cross-laminated timber
HFT - Hybrid Fiber Timber

Less Environmental impact
Smaller CO2 footprint
Lightweight + Reuse

<table>
<thead>
<tr>
<th>IMPACT</th>
<th>TARGET</th>
<th>PROJECT</th>
<th>%</th>
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<tbody>
<tr>
<td>Carbon (kgCO2e)</td>
<td>6,737</td>
<td>3,676</td>
<td>55</td>
</tr>
<tr>
<td>Energy (MJ)</td>
<td>158,937</td>
<td>46,298</td>
<td>29</td>
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<tr>
<td>Water (kgH2O)</td>
<td>1,026,871</td>
<td>191,828</td>
<td>19</td>
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</table>

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PROJECT LOCATION OVERVIEW

Lake Mendota

Hasler Limnology Lab

College Library
SITE CHARACTERISTICS
EXCAVATION STAGE

- Construction Footprint: 22900 SF
- Site Storage: 700 SF
- Excavation: 6 FT
- Shoring: Soldier Beams and leggings
- Dewatering: Sump Pump
- Number of Personnel: 5-8
Dynamic Site Layout Planning - Forum

Foundation Stage

- Construction Footprint: 22900 SF
- Site Storage: 1500 SF
- Assembly Area: 1000 SF
- Number of Personnel: 10-12
- Concrete Pump Area: 500 SF
- Parking Area: 5 Spots
- Trailers: 2
- Waste Sorting: onsite

Image of the site layout plan with labeled areas such as Pump room, Dumpster, Mobile crane, Semi-flatbed truck, Forklifts, Barge, Cars, Pedestrian Tunnel, Tower Crane, Fence, Excavator, Washing Zone, Bathrooms, Personnel Parking, Silt Fencing, Site Access, Excavation Shoring, Concrete mixer and pump, Assembly Area, Crews and personnel route, Material Storage/Laydown, Excavation Zone, etc.
DYNAMIC SITE LAYOUT PLANNING - FORUM

CONSTRUCTION STAGE

- Construction Footprint: 22900 SF
- Site Storage: 2300 SF
- Assembly Area: 1800 SF
- Number of Personnel: 18 - 22
- Concrete Pump Area: 500 SF
- Mobile Crane Setup: 300 SF
- Parking Area: 9 Spots
- Waste Sorting: onsite
DYNAMIC SITE LAYOUT PLANNING - WEAVING

HASLER LAB PERSONNEL ROUTE

- Pump room
- Dumpster
- Mobile crane
- Semi-flatbed truck
- Forklifts
- Barge
- Cars
- Pedestrian Tunnel
- Tower Crane
- Fence
- Trailer
- Silt Fencing
- Pedestrian
- Site Access
- Dump Truck
- Heavy Equipment Route
- Concrete mixer and pump
- Excavator
- Washing Zone
- Bathrooms
- Personnel Parking
- Excavation Shoring
- Assembly Area
- Crews and personnel route
- Material Storage / Laydown
- Excavation Zone
DYNAMIC SITE LAYOUT PLANNING - WEAVING

EXCAVATION STAGE

- Construction Footprint: 15000 SF
- Site Storage: 750 SF
- Excavation: 6 FT
- Shoring: Soldier Beams and leggings
- Dewatering: Sump Pump
- Number of Personnel: 5-8

Pump room
Dumpster
Mobile crane
Semi-flatbed truck
Forklifts
Barge
Car
Pedestrian Tunnel
Tower Crane

Fence
Trailer
Silt Fencing
Pedestrian
Site Access
Broom
Personnel Parking
Excavator
Washing Zone
Bathrooms
Dump Truck
Heavy Equipment Route
Concrete mixer and pump
Assembly Area
Crews and personnel route
Material Storage / Laydown
Excavation Zone

Lake Mendota
Hasler Lab
College Library

North
DYNAMIC SITE LAYOUT PLANNING - WEAVING

EXCAVATION STAGE

- Construction Footprint: 15000 SF
- Site Storage: 750 SF
- Excavation: 6 FT
- Shoring: Soldier Beams and leggings
- Dewatering: Sump Pump
- Number of Personnel: 5-8

Diagram:

- Pump room
- Dumpster
- Mobile crane
- Semi-flatbed truck
- Forklifts
- Barge
- Pedestrian Tunnel
- Tower Crane
- Fence
- Excavator
- Trailer
- Silt Fencing
- Washing Zone
- Pedestrian
- Site Access
- Bathrooms
- Pedestrian Parking
- Dump Truck
- Excavation Shoring
- Concrete mixer and pump
- Heavy Equipment Route
- Assembly Area
- Material Storage / Laydown
- Excavation Zone
- Crews and personnel route
- College Library
- Hasler Lab
- Lake Mendota
- Heavy Equipment Route
- Parking
- Excavator
- Concrete mixer and pump
DYNAMIC SITE LAYOUT PLANNING - WEAVING

FOUNDATION STAGE

- Construction Footprint: 15000 SF
- Barge Size: 6825 SF
- Site Storage: 1500 SF
- Assembly Area: 1000 SF
- Number of Personnel: 10-12
- Concrete Pump Area: 600 SF
- Lake Mendota Depth: 85 FT
- Waste Sorting: offsite
**Construction Stage**

- Construction Footprint: 22,900 SF
- Barge Size: 6,825 SF
- Site Storage: 4,500 SF
- Assembly Area: 2,325 SF
- Number of Personnel: 18 - 22
- Tower Crane Reach: 140-160 FT
- Parking Area: 9 Spots
- Waste Sorting: offsite

---

**Site Layout**

- Pump room
- Dumpster
- Mobile crane
- Semi-flatbed truck
- Forklifts
- Barge
- Cars
- Pedestrian Tunnel
- Tower Crane
- Fence
- Excavator
- Trailer
- Washing Zone
- Silt Fencing
- Bathrooms
- Pedestrian Parking
- Site Access
- Excavation Shoring
- Heavy Equipment Route
- Concrete mixer and pump
- Assembly Area
- Parking
- Excavation
- Excavation Zone
- Shoring
- Concrete mixer and pump
- Crews and personnel route
- Material Storage / Laydown
SITE LAYOUT SELECTION CRITERIA

The criteria is a combination of the previous factors

Proximity Calculation

Site Utilization

Intersection Point Criterion (IPC)

Site Layout 2
Liebherr 202 ec-b 10 Litronic

- Maximum Element Weight: 20,000 lb
- Maximum Distance: 150 ft
- Crane Ability: 20,000 lb
- Crane Boom Length: 213 ft
- Main Use: Structural and MEP
LTM 1100 Structural Crane

- Maximum Element Weight: 20,000 lb
- Maximum Distance: 72 ft
- Crane Ability: 22,000 lb
- Crane Boom Length: 148 ft
- Main Use: Structural and MEP
Terex RT 230 Exterior Crane

Maximum Element Weight: 5 kips
Maximum Distance: 60 ft
Crane Ability: 5,800 lb
Crane Boom Length: 92 ft
Main Use: Exterior/Façade
EQUIPMENT SELECTION - OTHER EQUIPMENT

CAT 336FL
Excavator

John Deere 410E
Dump Truck

Hecha H-2000
Forklift
EQUIPMENT SELECTION - OTHER EQUIPMENT

J&J Boatworks Barge

Dongfeng WL5250 Concrete Mixer
HEALTH AND SAFETY MEASURES

Overhead Scaffolding

Noise Reduction Walls

Weekly Safety Meetings

Safety Signs

Safety Trainings
HEALTH AND SAFETY MEASURES - TECHNOLOGY

Helmet Detection

Fatigue Wristband

RFID Equipment Tracking

Wearable GPS Sensor
CONSTRUCTION SEQUENCE

Mobilization → Excavation → EarthWork Support → Foundation → Milestone 1 → SOG

Service Installation Phase 1 → Flooring Panels SF → Columns/Beams SF → Flooring Panels FF → Columns/Beams FF

Columns/Beams TF → Flooring Panels TF → Services Installation Phase 2 → Exteriors FF → Exteriors SF
CONSTRUCTION SEQUENCE

Interiors FF → Interiors SF → Exteriors TF → Milestone 2 → Interiors TF → FFE & Computer Labs

Project Close out → Substantial Completion
## Construction Schedule

### Forum CLT

<table>
<thead>
<tr>
<th>Schedule (Weeks)</th>
<th>Finish Foundation Stage</th>
<th>Finish Skin and Facade (Winter Season)</th>
<th>Substantial Completion</th>
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<tbody>
<tr>
<td>Site Preparation</td>
<td>3</td>
<td>28 weeks</td>
<td></td>
</tr>
<tr>
<td>Prefabrication</td>
<td>4</td>
<td>31 weeks</td>
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<tr>
<td>Substructure</td>
<td>3</td>
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<tr>
<td>Prefabrication</td>
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<tr>
<td>MEP</td>
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<tr>
<td>Skin and Facades</td>
<td>4</td>
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<tr>
<td>Interiors and Finishing</td>
<td>8</td>
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<tr>
<td>FFE &amp; Computer Labs</td>
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### Weaving CLT

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<td>Skin and Facades</td>
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<td>FFE &amp; Computer Labs</td>
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## Construction Schedule

### Finish Foundation Stage

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### Finish Skin and Facade (Winter Season)

- **30 Weeks**

### Substantial Completion

#### 27 Weeks
COST CALCULATION EVOLUTION

Assemblies

Model Based Quantities

Quotes and Prices from Suppliers/Mentors

In-depth Estimation
TVD COMPARISON

FORUM (HFT)

WEAVING (HFT)
# Construction Comparison

<table>
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<tr>
<th>Criteria</th>
<th>Cost</th>
<th>Time</th>
<th>Constructability</th>
<th>Attract Contractors and Clients</th>
<th>Minimize Waste</th>
<th>Prefabrication</th>
<th>Score</th>
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- ✓: Yes
- ✗: No

- 1 = Prefabrication
- 2 = Minimize Waste
- 3 = Attract Contractors and Clients
CONCEPT SELECTION

Tangible

Intangible

Decision
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TANGIBLE TOTAL SCORES

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**INTANGIBLE TOTAL SCORES**

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## SELECTION MOVING FORWARD

### CHALLENGE FOR THE TEAM

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<th>Score</th>
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### OVERALL SCORES

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<tr>
<td>FORUM</td>
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</table>
TEAM MOVING FORWARD

CHALLENGES
- Computer
- Natural/Biological
- Temporal

SOLUTIONS
- Alternate mediums
- Regular Scheduling
- Better Metrics
- Global Workforce!

NEXT QUARTER GOALS
- Spend more time in VR
- Allocate more time for team-based innovation
- Regular team BIM clash detection
THANK YOU