Goals

- Novel Design
- Adaptability
- Constructability
- Equity
- Sustainability
Site
Climate Information

Relative Humidity

Temperature
Wind Direction - Seasonally

Wind Rose
Madison Dane Co Regional Arpt WI USA
1 JAN 1:00 - 31 MAR 24:00
Hourly Data: Wind Speed (m/s)
Calm for 6.48% of the time = 140 hours.
Each closed polyline shows frequency of 2.0%. = 43 hours.

Wind Rose
Madison Dane Co Regional Arpt WI USA
1 APR 1:00 - 30 JUN 24:00
Hourly Data: Wind Speed (m/s)
Calm for 10.62% of the time = 232 hours.
Each closed polyline shows frequency of 1.4%. = 31 hours.

Wind Rose
Madison Dane Co Regional Arpt WI USA
1 JUL 1:00 - 30 SEP 24:00
Hourly Data: Wind Speed (m/s)
Calm for 12.50% of the time = 276 hours.
Each closed polyline shows frequency of 1.9%. = 41 hours.

Wind Rose
Madison Dane Co Regional Arpt WI USA
1 OCT 1:00 - 31 DEC 24:00
Hourly Data: Wind Speed (m/s)
Calm for 10.64% of the time = 235 hours.
Each closed polyline shows frequency of 1.2%. = 26 hours.
Thermal Comfort

60% average relative humidity

23° Celsius = 73.4° Fahrenheit
Site Opportunities and Challenges

- Lake Mendota
- Howard Temin Lakeshore Path
- Muir Woods
- Temperature Differences
- Site Access
- Limited Sunlight
<table>
<thead>
<tr>
<th>Room:</th>
<th>Airflow for each room:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty Offices</td>
<td>18.70 (\frac{L}{s})</td>
</tr>
<tr>
<td>Department Chair’s Office</td>
<td>26.51 (\frac{L}{s})</td>
</tr>
<tr>
<td>Senior Administration Office</td>
<td>16.75 (\frac{L}{s})</td>
</tr>
<tr>
<td>Administrative Assistants</td>
<td>11.88 (\frac{L}{s})</td>
</tr>
<tr>
<td>Faculty Lounge</td>
<td>205.0 (\frac{L}{s})</td>
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<tr>
<td>Student Offices</td>
<td>6.95 (\frac{L}{s})</td>
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<tr>
<td>Auditorium</td>
<td>847.55 (\frac{L}{s})</td>
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<tr>
<td>Large Classrooms</td>
<td>276.0 (\frac{L}{s})</td>
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<tr>
<td>Small Classrooms</td>
<td>141.3 (\frac{L}{s})</td>
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<tr>
<td>Seminar Rooms</td>
<td>56.50 (\frac{L}{s})</td>
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<tr>
<td>Instructional Labs</td>
<td>100.0 (\frac{L}{s})</td>
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<tr>
<td>Server Room</td>
<td>59.3 (\frac{L}{s})</td>
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<tr>
<td>Technical Support</td>
<td>13.50 (\frac{L}{s})</td>
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<tr>
<td>Storage Rooms</td>
<td>72.03 (\frac{L}{s})</td>
</tr>
<tr>
<td>Bathroom and Toilets</td>
<td>15.0 (\frac{L}{s})</td>
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## Loads

Based on ASCE 7-16

<table>
<thead>
<tr>
<th>Occupancy of Use</th>
<th>Uniform, L0 pst (kN/m²)</th>
<th>Live Load Reduction Permitted</th>
<th>Multiple-Story Live Load Reduction Permitted</th>
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<tbody>
<tr>
<td>Access floor systems</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Office use</td>
<td>50 (2.4)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Computer use</td>
<td>100 (4.79)</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Assembly areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixes seats</td>
<td>60 (2.87)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Lobbies</td>
<td>100 (5.79)</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Balconies and decks</td>
<td>1,5 times the live load for the area served. Not required to exceed 100 psf (4.79 kN/m²)</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Corridors</td>
<td>100 (4.79)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Libraries</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Reading rooms</td>
<td>60 (2.87)</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Stack rooms</td>
<td>150 (7.18)</td>
<td>No</td>
<td>Yes</td>
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<tr>
<td>Roof</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ordinary flat, pitched, and curved roofs</td>
<td>20 (0.96)</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Schools</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Classrooms</td>
<td>40 (1.92)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Corridors above first floor</td>
<td>80 (3.83)</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>First-floor corridors</td>
<td>100 (4.79)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Labs</td>
<td>60 (2.87)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Wind (dominant lateral) 21
Snow (on roof) 32
Soil pressure (tbd)
Site Soil Conditions

- Water Table Depth = 6.5 ft below grade
- Fill → Silty Clay
  - Overconsolidated
- Bearing capacity = 4 ksf
SYNTHESIS CONCEPT 1
“No house should ever be on a hill or on anything. It should be of the hill. Belonging to it. Hill and house should live together each the happier for the other “ Frank Lloyd Wright
Form Evolution

footprint

evolve into a cube

separates into 2 blocks

space between them transform to an atrium
View From Howard Temin Lakeshore Path
View From Muir Woods
Entrance From Observatory Dr
Sunlight Hours Synthesis
Section 2
Exploded Axonometric
Floor Plan: Level -1

- Atrium
- Auditorium
- Cafe
- Emergency Staircase
- Lobby/Social space
- Mechanical room
- Restrooms
- Seminar room
- Storage
Atrium View (Level -1)
Floor Plan: Level 1

Legend:
- Administrative Assistant
- Department Chair's office
- Faculty office
- Lobby
- Lobby/Social space
- Mechanical shaft
- Restrooms
- Senior Administration Office
- Small classroom
- Student office
Lake View (Level 1)
Daylight Analysis

Daylight factor of 2% at work spaces
Flow

- early morning
  - morning coffee

- morning
  - lecture

- noon
  - lunch break

- afternoon
  - group work with a professor

- late afternoon
  - teamwork
Structural System A - Mass Timber
Foundations

Grade beams

Combined footings
Glulam column 8.5”x9 5/8”
CLT Shear wall 5 ply
Glulam beam 6 3/4”x 24 3/4”
Glulam beam 8 1/2”x 35 3/4”
Glulam beam 8 1/2”x 41 1/4”
Spanning Truss System
Concrete Retaining Wall 12”
Floors = 4” Concrete SOG
Level Mezzanine

- Glulam column 8.5”x9 ⅜”
- CLT Shear wall 5 ply
- Glulam beam 6 ¾”x 24 ¾”
- Glulam beam 8 ½”x 35 ¾”
- Glulam beam 8 ½”x 41 ¼”
- Spanning Truss System
- Concrete Retaining Wall 12”

Floors = CLT Panels 5 ply
(for all subsequent floors)
Level 0

- **Glulam column**: 8.5"x9 5/8"
- **CLT Shear wall**: 5 ply
- **Glulam beam 6**: ¾"x 24 ¾"
- **Glulam beam 8**: ½"x 35 ¾"
- **Glulam beam 8**: ½"x 41 ¼"
- **Concrete Retaining Wall**: 12"
Level 1

- **Glulam column**
  - 8.5”x9 5/8”

- **CLT Shear wall**
  - 5 ply

- **Glulam beam 6**
  - 3/4” x 24 3/4”

- **Glulam beam 8**
  - 1/2” x 35 3/4”

- **Glulam beam 8**
  - 1/2” x 41 1/4”

- **Concrete Retaining Wall**
  - 12”
Connections

Column to Foundations

Beam to Girder

Beam/Girder to Column

Steel bearing plate
Connections

Wall-to-wall

Between floor panels
Auditorium Truss System
Glass Atrium - Secondary Steel
Load Paths - Lateral
Solar Panels Synthesis

- 11000 SF flat rooftop
- Facing south with an angle of 43 degrees.

The annual energy produced by the PV panels is 150000 kWh
Greywater Harvesting

Collecting rainwater
Filtering and greywater brought into the building
Primary System

West Campus Cogeneration Facility

- **Owner(s)**: Madison Gas and Electric and University of Wisconsin-Madison
- **Thermal power station**
- **Primary fuel**: Natural gas
- **Turbine technology**: Steam turbine
- **Cooling source**: Lake Mendota
- **Power generation**
- **Nameplate capacity**: 150 MW
Duct Distribution

- VAV
- 2 centralized systems

Level -1

Level 0

Level 1

Mechanical room
Return
Supply
Floor Sandwich

Level -1, 0 and 1

33"

12' 3"

10'

Timber Beam
Duct system
Ceiling
Finishing Layer
Insulation
Timber
Floor Sandwich

Level Mezzanine

Auditorium

Timber Beam
Duct system
Ceiling

Finishing Layer
Insulation
Timber

33"

12' 3"
10'

27' 3"
25'
SYNTHEISIS SOLUTION B
Structural System B - Peikko

North
Peikko Delta Beams and Hollowcore

<table>
<thead>
<tr>
<th>DELTABEAM® &amp; Hollowcore Depth</th>
<th>DELTABEAM® MAXIMUM CLEAR SPAN (FT)</th>
<th>Hollowcore Span (ft)</th>
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<tbody>
<tr>
<td></td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>8 Inches</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>10 Inches</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>12 Inches</td>
<td>34</td>
<td>30</td>
</tr>
<tr>
<td>14 Inches</td>
<td>39</td>
<td>36</td>
</tr>
<tr>
<td>16 Inches</td>
<td>40</td>
<td>37</td>
</tr>
</tbody>
</table>

Edge beams: EDB 8-15

Internal beams: IDB 8-24, IDB 8-30, IDB 14-24

Hollow core depth 8”

Composite Columns: 10”x10”
Connections

Hollow core slab
8” - 10” - 12” - 14”
(200mm - 250mm - 300mm - 350mm)

Transverse reinforcement for slab continuity

Shop installed reinforcement

DELTABEAM®
Level -1

- **Steel Columns 10''x10''**
- **Beams IDB 8-24**
- **Beams IDB 8-30**
- **Beams EDB 8-15**
- **Concrete Walls 6''**
- **Concrete Retaining Wall 12''**
Level Mezzanine

- Steel Columns 10”x10”
- Beams IDB 8-24
- Beams IDB 8-30
- Beams EDB 8-15
- Truss
- Concrete Walls 6”
- Concrete Retaining Wall 12”
Truss
Level 0

- **Steel Columns 10”x10”**
- **Beams IDB 8-24**
- **Beams IDB 8-30**
- **Beams EDB 8-15**
- **Concrete Walls 6”**
- **Concrete Retaining Wall 12”**
Level 1

- **Steel Columns 10”x10”**
- **Beams IDB 8-24**
- **Beams IDB 8-30**
- **Beams EDB 8-15**
- **Concrete Walls 6”**
- **Concrete Retaining Wall 12”**
Load Path - Lateral
Load Path - Gravity
Primary System

Ground Source Heat Pump

Lake Mendota
Secondary System

Floor heating/cooling system
- 2 centralized systems

Mechanical room
Floor Sandwich

Level -1, 0 and 1
Floor Sandwich

Level Mezzanine

Auditorium
Cost of Four Synthesis Options

Floor Heating System

Steel

- A: 2% $0.5M
- B: 24% $4.9M
- C: 10% $2.1M
- D: 30% $6.2M
- E: 3% $0.6M
- F: 0% $0.1M
- G: 4% $0.8M
- H: 9% $1.9M

- Fees 17% $3.4M
- Total: $20.5M

Timber

- A: 3% $0.5M
- B: 21% $4.1M
- C: 10% $2.0M
- D: 32% $6.2M
- E: 3% $0.6M
- F: 1% $0.1M
- G: 4% $0.8M
- H: 10% $1.9M

- Fees 16% $3.2M
- Total: $19.4M

VAV System

Steel

- A: 3% $0.5M
- B: 28% $4.9M
- C: 12% $2.1M
- D: 22% $3.9M
- E: 3% $0.6M
- F: 1% $0.1M
- G: 5% $0.8M
- H: 11% $1.9M

- Fees 16% $2.9M
- Total: $17.7M

Timber

- A: 3% $0.5M
- B: 25% $4.1M
- C: 12% $2.0M
- D: 23% $3.9M
- E: 4% $0.6M
- F: 1% $0.1M
- G: 5% $0.8M
- H: 11% $1.9M

- Fees 16% $2.7M
- Total: $16.6M
The Circulation
The Beacon Glow

Public Space
Multifunction Space

- book club: wisdom, peaceful, comprehension
- art gallery: radical, impulsive, curious
- special events: energy, excitement, freedom
- hobby club: warmth, sympathy, folksiness
- exhibition: happiness, courage, joy
View From Bottom Of Muir Woods
View From Muir Woods
Entrance From Observatory Dr
Sunlight Hours
Beacon

Sunlight Hours Analysis
Facade Materials - Eco Brick
Exploded Axonometric
Lobby View (Level -1)
Floor Plan: Level 0

Room Legend
- Break Room
- Collaborative/Study Space
- Large classroom
- Mechanical shaft
- Restrooms
- Small classroom
- Student office
Large Classroom View (Level 0)
Student Break Room View (Level -1)
Floor Plan: Level 1

Room Legend

- Admin Assistants
- Break Room
- Department Chair's Office
- Elevator
- Emergency Staircase
- Faculty Lounge
- Faculty Office
- Mechanical shaft
- Restrooms
- Senior Admin
- Shared/Collaborative Space
- Storage
Daylight analysis

Daylight factor of 2% at work spaces
Flow

early morning
morning coffee

morning
lecture

noon
lunch break

afternoon
group work with a professor

late afternoon
teamwork
BEACON SOLUTION A
Structural System A - Mass Timber
Level -2

- Concrete column 10”x10”
- Concrete shear wall 8”
- Concrete beam 8”x24”
- Concrete Retaining Wall 12”

Floors = 4” SOG
Micropiles

- 60ea. 400 Kip Micropiles (approx. 1 /column)

- Designed in compliance with Federal Highway Administration

- 10” in diameter, 50’ in length (40’ of which will carry the skin friction in the clay layer)
Basement

- 300LF of 18’ shoring
- Half of basement below water table
- Additional 9,000CY excavation, soil testing, haul and disposal
- Adds dewatering wells and more drainage/waterproofing
Level -1

- Glulam column 8.5”x9 5/8”
- CLT Shear wall 5 ply
- Glulam beam 6 ¾”x 24 ¾”
- Glulam beam 8 ½”x 35 ¾”
- Glulam beam 8 ½”x 41 ¾”
- Spanning Truss System
- Concrete Retaining Wall 12”

Floors = CLT Panels 5 ply
Level 0

- **Glulam column 8.5”x9 ⅝”**
- **CLT Shear wall 5 ply**
- **Glulam beam 6 ¾”x 24 ¾”**
- **Glulam beam 8 ½”x 35 ¾”**
- **Glulam beam 8 ½”x 41 ¼”**

Floors = CLT Panels 5 ply
Level 1

- Glulam column 8.5”x9 5/8”
- CLT Shear wall 5 ply
- Glulam beam 6 ¾”x 24 ¾”
- Glulam beam 8 ½”x 35 ¾”
- Glulam beam 8 ½”x 41 ¼”

Floors = CLT Panels 5 ply
Load Paths - Lateral
Solar Panels Beacon

- 9000 SF flat rooftop
- Facing south with an angle of 43 degrees

The annual energy produced by the PV panels is 113000 kWh
Greywater Harvesting

Collecting rainwater
Filtering and greywater brought into the building
Duct Distribution

- Central heat plant
- VAV

Mechanical room
- Return
- Supply
Floor Sandwich

Level -2, 0 and 1

Level -1
BEACON SOLUTION B
Structural System B - Peikko System
Level -2

- Steel Columns 10”x10”
- Beams IDB 8-24
- Beams IDB 8-30
- Beams EDB 8-15
- Concrete Walls 6”
- Concrete Retaining Wall 12”
Level -1

Steel Columns 10”x10”
Beams IDB 14-24
Beams IDB 8-24
Beams IDB 8-30
Beams EDB 8-15
Concrete Walls 6”
Concrete Retaining Wall 12”
Level 0

- **Steel Columns 10”x10”**
- **Beams IDB 8-24**
- **Beams IDB 8-30**
- **Beams EDB 8-15**
- **Concrete Walls 6”**
- **Concrete Retaining Wall 12”**
Level 1

- **Steel Columns 10”x10”**
- **Beams IDB 8-24**
- **Beams IDB 8-30**
- **Beams EDB 8-15**
- **Concrete Walls 6”**
- **Concrete Retaining Wall 12”**
Load Path - Gravity
Primary System

Ground Source Heat Pump

Lake Mendota
Secondary System

Floor heating/cooling system

Level -2

Level -1

Level 0

Level 1

Mechanical room
Floor Sandwich

Level -2, 0 and 1

Level -1
Cost of Four Beacon Options

Floor Heating System

Steel

- A 2% $0.4M
- B 26% $5.8M
- C 9% $2.1M
- D 28% $6.3M
- E 3% $0.6M
- F 0% $0.1M
- G 6% $1.3M
- H 9% $1.9M
- Fees 17% $3.7M

Total: $22.2M

Timber

- A 2% $0.5M
- B 25% $5.6M
- C 10% $2.3M
- D 28% $6.3M
- E 3% $0.6M
- F 0% $0.1M
- G 6% $1.3M
- H 9% $1.9M
- Fees 17% $3.7M

Total: $22.3M

VAV System

Steel

- A 2% $0.4M
- B 30% $5.8M
- C 11% $2.1M
- D 21% $4.1M
- E 3% $0.6M
- F 1% $0.1M
- G 7% $1.3M
- H 10% $1.9M
- Fees 16% $3.2M

Total: $19.5M

Timber

- A 3% $0.5M
- B 29% $5.6M
- C 12% $2.3M
- D 21% $4.1M
- E 3% $0.6M
- F 3% $0.1M
- G 7% $1.3M
- H 10% $1.9M
- Fees 16% $3.2M

Total: $19.6M
Timber vs. Steel Schedule

Earthwork
- Excavation
- Order prefab
- Shoring
- Compacting
- Slab on Grade Foundation
- Basement Walls
- Columns -2
- Slab level -2
- Beams level -2

-2 Level
- Slab level -1
- Columns -1
- Beams level -1
- Exterior Walls -1

-1 Level
- Slab level 0
- Columns 0
- Beams Level 0
- Exterior Walls 0

0 Level
- Slab level 1
- Columns 1
- Beams level 1
- Roof slab
- Exterior level 1

1 Level
- Interior Walls
- MEP
- Finishing
- Architectural Finishes
- Owner Move In

Finishing
- Landscape

Landscape
- Landscape

Manager Move In

Winter

Jun 1, 24
Aug 1, 24
Oct 1, 24
Dec 1, 24
Feb 1, 25
Apr 1, 25
Jun 1, 25
Aug 1, 25
Oct 1, 25

Steel
Timber
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<th>ID</th>
<th>Obj #</th>
<th>Name</th>
<th>Duration</th>
<th>Start</th>
<th>End</th>
<th>Planned Duration</th>
<th>Planned Start</th>
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<td>42</td>
<td>Basement</td>
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<td>60 days</td>
<td></td>
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<tr>
<td>2</td>
<td>51</td>
<td>-2 Level</td>
<td>22 days</td>
<td>8/2/2024</td>
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<td>22 days</td>
<td></td>
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<td>3</td>
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<td>22 days</td>
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<tr>
<td>4</td>
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<td>22 days</td>
<td>9/15/2024</td>
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<tr>
<td>5</td>
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<td>1 Level</td>
<td>40 days</td>
<td>10/7/2024</td>
<td>11/13/2024</td>
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<tr>
<td>6</td>
<td>64</td>
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<td>28 days</td>
<td>11/24/2024</td>
<td>12/21/2024</td>
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<tr>
<td>7</td>
<td>541</td>
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<td>28 days</td>
<td>12/22/2024</td>
<td>1/18/2025</td>
<td>28 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>600</td>
<td>0 Finishing</td>
<td>28 days</td>
<td>1/19/2025</td>
<td>2/15/2025</td>
<td>28 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>516</td>
<td>1 Finishing</td>
<td>28 days</td>
<td>3/16/2025</td>
<td>3/15/2025</td>
<td>28 days</td>
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CONSTRUCTABILITY
Site Logistics

- Construction Access
- Public Safety & Bike Path
- Environmental & Water Treatment
Shoring Examples

Soil Nail + Shotcrete Shoring

Soldier Pile + Timber Lagging Shoring
Worker Parking under nearby Library

Typical 5 axle delivery loads maxed at 40k lbs.
Turnaround #2 Radius
Detailed Laydown Area

20' wide path to back trucks in Purposely delianated from N. Park Street

Second lane designated for mass ex or large pours

Yard forklift to service crane & smaller items

Stackable conexes

Crew Break Area

Jobsite Office
Equipment Choices

- CAT 336 Excavator
- 60’ Manlift
- 9k JLG Forklift
- Tracked Crane - GTC-600
- Lo-Drill TR-40
- 10CY Super Dump
- CAT Compactor
Environmental Plan
DECISION
Preliminary STV

Synthesis - Timber

Beacon - Timber

Synthesis - Steel

Beacon - Steel
Windows

<table>
<thead>
<tr>
<th>Double Glazing</th>
<th>Triple Glazing</th>
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<tbody>
<tr>
<td>● Less material use</td>
<td>● More energy efficient</td>
</tr>
<tr>
<td>● Less total weight</td>
<td>● Larger noise reduction</td>
</tr>
<tr>
<td>● Larger light transmittance - more daylight</td>
<td>● Better adjustments between the hot and cold temperatures - less condensation</td>
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</table>
## Material Matrix

<table>
<thead>
<tr>
<th>Metric</th>
<th>Concrete</th>
<th>Steel</th>
<th>Brick</th>
<th>Timber</th>
<th>Glass</th>
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<tr>
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<td>Cost</td>
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<tr>
<td>Up-Skill Labor</td>
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<td><strong>Totals</strong></td>
<td>11</td>
<td>12</td>
<td>16</td>
<td>18</td>
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Legend:
- **Great - 3**
- **Good - 2**
- **Average - 1**
## Schedule Comparison

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<td>Order Prefab</td>
<td>Earthwork</td>
<td>L-1</td>
<td>L.0</td>
<td>L.1</td>
<td>Finishing</td>
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</tbody>
</table>

Computer Manager Move in Winter School Session

Move in
Four Alternative Cost Differences

Division Breakdown
- A Substructure
- B Shell
- C Interiors
- D Services
- E Equipment, etc.
- F Specialty Cons.
- G Building Site
- H General Conditions
- Contractor Fees

Budget: $18.5M
- Synthesis Timber: $16.6M
- Synthesis Steel: $17.7M
- Beacon Timber: $19.6M
- Beacon Steel: $19.5M

Cost Components:
- Contractor Fees
- H General Conditions
- D Services
- C Interiors
- B Shell

Financial Analysis and Comparison
Owner’s Preferences

<table>
<thead>
<tr>
<th>Category</th>
<th>Metric</th>
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</thead>
<tbody>
<tr>
<td>Novel Design</td>
<td>Design/Aesthetic</td>
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<tr>
<td></td>
<td>Innovation</td>
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<tr>
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<td>User Flow and Experience</td>
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<tr>
<td>Adaptability</td>
<td>Modularity/Prefab</td>
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<td>Reusability</td>
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<tr>
<td>Constructability</td>
<td>Cost</td>
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<tr>
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<td>Schedule</td>
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<td>Risk</td>
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<tr>
<td>Equity</td>
<td>Community Engagement</td>
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<td>Accessibility</td>
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<td>Integration to campus/local resources</td>
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<tr>
<td>Sustainability</td>
<td>Carbon Footprint</td>
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<tr>
<td></td>
<td>Renewable Energy</td>
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<td>Water Consumption</td>
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Projected Scores
## Scores Tabularized

<table>
<thead>
<tr>
<th>Category</th>
<th>Metric</th>
<th>Synthesis - Timber</th>
<th>Synthesis - Steel</th>
<th>Beacon - Timber</th>
<th>Beacon - Steel</th>
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<tbody>
<tr>
<td>Novel Design</td>
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<td>Risk</td>
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<td>Community Engagement</td>
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<td>Integration to campus/local resources</td>
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<td>0.89</td>
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<td>Sustainability</td>
<td>Carbon Footprint</td>
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<td>0.74</td>
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<td>Renewable Energy</td>
<td>0.58</td>
<td>0.54</td>
<td>0.56</td>
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<td>Water Consumption</td>
<td>0.43</td>
<td>0.38</td>
<td>0.45</td>
<td>0.39</td>
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</tbody>
</table>

**Winner:**

The table shows the projected scores for different categories and metrics, with the highest score indicating the winner. The winner is indicated by the highlighted row in the table.
Winner!
SPRUCE CRUISE
Midwest Mass Timber - Investing in Growth

- Collaborate with local unions to promote sustainable material
- Consider End of Life and Reusability
- Great potential for northern Midwest Mass Timber Factory
Spruce Cruise Inc.

Forest in Wisconsin
- 260 mil cf of wood harvested in 2013.
- Vacant Paper Mills due to decline in industry.

Factory Work
- Investment in existing timber facilities and labor force to incorporate mass timber

Growth
- Lower transportation costs.
- Opportunity to up-skill local union workers in construction material of the future.
Spruce Cruise Business Plan

For **Mid-Rise Project Developers** who want to construct aesthetically pleasing, structurally safe, and economically feasible projects. **Spruce Cruise Inc.** is a Mass Timber Factory in Northern Wisconsin that provides better supply chain and carbon footprint costs. Unlike CLT factories in the Pacific Northwest, Canada, or Europe.
TEAM PROCESS
Team Development

- Collaboration
  - Integrated pull-planning
  - Solution oriented thinking
  - Connectedness to design options

- Coordination
  - Design comprehension between disciplines
  - Non-Verbal (virtual) communication

- Communication
  - Exchange of ideas
  - Discussion of concepts and solutions
Team Process Evolution

Pull Planning:
- Concept Design
  - Massing & Concepts
  - Sending files through email
- First Concept
  - Revit files sent on drive
  - Each discipline alone
- Peer Review
  - Linking on BIM 360
  - Unaligned projects
- Crit
  - Utilizing VR to check clashes and align projects
- Winter Presentation
  - Hard and soft clash detection done weekly

BIM Evolution:
- 18/01: Concept Design
- 29/01: First Concept
- 09/02: Peer Review
- 19/02: Crit
- 19/03: Winter Presentation
Collaboration in IrisVR Prospect

Big picture - Site

Feel of space

Troubleshooting

In-building discussions
THANK YOU!
# Spruce Cruise Business Model Canvas

<table>
<thead>
<tr>
<th>Key Partners</th>
<th>Key Activities</th>
<th>Value Propositions</th>
<th>Customer Relationships</th>
<th>Customer Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumberjacks</td>
<td>Procure Wood</td>
<td>Provide valuable engineered wood to the Midwest without compromising on transportation costs</td>
<td>High quality wood products and connections</td>
<td>Mid-Rise Construction Projects in the Midwest</td>
</tr>
<tr>
<td>Wood Suppliers</td>
<td>Distribute and support</td>
<td></td>
<td>Convienience and reliability</td>
<td></td>
</tr>
<tr>
<td>Shipping Companies</td>
<td>Engineer Kit of Parts toolset feasible to most projects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UW Schools</td>
<td>Factory in Northern Wisconsin</td>
<td></td>
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</tr>
<tr>
<td>Forrest Health National Laboratory</td>
<td>Open source kit of parts available to all design teams</td>
<td></td>
<td></td>
<td>All engineered wood designers (A-E-CM)</td>
</tr>
<tr>
<td></td>
<td>Testing availability by UW system schools and FHN</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

### Key Resources
- Factory in Northern Wisconsin
- Open source kit of parts available to all design teams
- Testing availability by UW system schools and FHN

### Channels
- Industry word of mouth
- Truck and rail shipping
- Open source website

### Cost Structure
- Material Resourcing
- Factory Initial Cost and
- Supply chain and
- Engineering team

### Revenue Streams
- Guaranteeing the supply of projects
- Having kit of parts only built in our
Spruce Cruise Value Proposition

**Product**
- Cheaper transportation cost for material of the future
- Kit of parts feasible for all projects
- Always available parts that don't need customization
- Design support
- Allows project Owners to build eco-friendly buildings without worrying about cost and lifecycle upkeeping

**Customer**
- Owners that want to be part of the future, while still building a unique building
- The accountability and safety of timber construction
- Modularized buildings all carry the same aesthetic
- Construction materials that do not create a negative carbon footprint on the environment
- Customizable buildings

**Experience**
- Needs
- Wants
- Fears
Site Logistics

- Construction Access
- Public Safety & Bike Path
- Environmental & Water Treatment
Detailed Laydown Area

20' Wide Path to Back Trucks In
Purposely Delineated from North Park Street

Second lane delineated only for mass ex
or large concrete pours

Crane Setup Area #1
once erection begins

GTC-600 (16' wide with tracks extended)

Jobsite Office
40' x 20'

Onsite Parking

Yard forklift used to service crane and smaller items

Stackable Conexes for small tools, BMP materials, etc.

Crew Break Area
Environmental Plan