Team MISSION STATEMENT

To design for the operation of a smart and flexible building for the smart and adaptive user equipped with the ability to control their local environment based on their unique needs considering EVERY USER GROUP fundamental to a rich educational environment

STUDENT
Students of the University of Wisconsin Madison studying...

(1) Water sciences & engineering
(2) Other fields

FACULTY
Professors and research staff involved in water sciences & engineering
Visiting professors from UW, other universities
Mentors from industry

COMMUNITY
Locals and Nonlocals attending building-hosted events, and conferences
Campus visitors, runners, walkers, bikers, sightseers enjoying the lake side
Father of Future Student “Mílan”

Played by
Jean Carlos, ARCH

As
Father of Future Son
attending UW Madison
Professor in CM “Professor H”

Played by Julia Hedenström, CM

As CM Professor teaching at Porosity
Community Member “Francis”

Played by
Florent Ilazi, CM

As
Urban Designer & Consultant on Porosity
Industry Eng. “Cortéz” & “Stark”

Played by
Curtis Fong, MEP
Andraz Starc, SE

As
Professional Engineers
Urbanist / Madisonian "Francis"

Played by
Florent Ilazi, CM

As
Urban Designer
& Consultant on Porosity
Project Scale GLOBAL
DANE COUNTY, WI

WISCONSIN, U.S.
Project Scale SITE

- Vehicle
- Pedestrian
Project Site **ACCESS**
Project Site SURROUNDINGS
Decision Matrix VALUE CRITERIA

theConnection
Conc + Steel + GeoX + VRF

Porosity
Timber + CoGen + Radiant

Porosity
Conc + 3Dprint + CoGen + VRF

Porosity
Conc + Steel + CoGen + Radiant

Well-Being
Innovative
Space Efficiency
Nature
Education
Community
Sustainable
Rent
Life Cycle Cost
Risk
Operation Ease
Capital Cost

Well-Being
Innovative
Space Efficiency
Nature
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Life Cycle Cost
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Capital Cost

BEST VALUE
## Decision Matrix - WINTER WINNER

<table>
<thead>
<tr>
<th>theCONNECTION</th>
<th>POROSITY</th>
<th>BEST VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Camouflage” CoGen + Radiant</td>
<td>“Natural” CoGen + Radiant</td>
<td>83%</td>
</tr>
<tr>
<td>“Architectural” GeoX + VRF</td>
<td>“Industrial” CoGen + VRF</td>
<td>72%</td>
</tr>
</tbody>
</table>

**WINTER WINNER**

- **Best Value**: 83%

### Decision Matrix

<table>
<thead>
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<th>POROSITY</th>
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</thead>
<tbody>
<tr>
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<td>“Industrial” CoGen + VRF</td>
</tr>
</tbody>
</table>

- **63%**
- **62%**
- **83%**
- **72%**
Father of Future Student, “Mílan”

Played by
Jean Carlos, ARCH

As
Father of Future Son
attending UW Madison
Educational PHILOSOPHY

Finding the Right Problem

Finding the Right Solution

Alternatives

Divergence Convergence Divergence Convergence

Time

Human Centered
Stakeholder integration

Theo van Doesburg
Le Corbusier
Steven Holl
C. F. Møller
Level 0 SMALL CLASSROOMS

- Cafe
- Cores
- Bicycle Parking
- Private Work
- Semi Private
- Small Classroom
- Storage and leisure
- Stairs
Level 0 SEMINAR ROOMS

- Cafe
- Cores
- Bicycle Parking
- Private Work
- Semi Private
- Seminar Rooms
- Storage and leisure
- Stairs
Bike Racks to Building Display. Entering Building
Performance **NET ENERGY USE**

**Energy USE**
- Equipment: 53%
- Heating: 17%
- Cooling: 11%
- Lighting: 9%
- Ventilation: 10%

**Energy USE**
- Electric Grid: 29%
- Solar PV: 71%
Performance SUSTAINABILITY

STV Analysis

63% Below
Carbon (kgCO2e)

67% Below
Water (kgH2O)

79% Below
Energy (MJ)

Targets

Project
Performance SUSTAINABILITY

U.S. GREEN BUILDING COUNCIL
LEED GOLD
USGBC

Energy and Atmosphere

Innovation

Sustainable Sites

Location & Transportation

Indoor Environmental Quality

Water Efficiency

Materials & Resources

Regional Priority

78/110

21/33

7/10

14/16

15/16

11/11

7/13

2/4
Welcome to the Porosity Building

How will you shape your environment?

FIND A SPACE

RESERVE A SPACE
FIND Your Space

Select A Space Type

Private Pod
- Semi-Private Space
- Collaborative Space
- Instructional Lab
- Seminar Room
- Conference Room
- Small Classroom
- Large Classroom
- Auditorium
- Lockers
- Bathroom
- Stairs
- Mechanical Rooms
- Storage Rooms

Select a Level

Level 1 | Level 2 | Level 3

See Space Schedules
FIND Your Space

Select A Space Type
Semi-Private Space
Collaborative Space
Instructional Lab
Seminar Room
Conference Room
Small Classroom
Large Classroom
Auditorium
Lockers
Bathroom
Stairs

See Space Schedules
CEE 222A at 9:30AM

Select a Level
Level 1
Level 2
Level 3
Video Insert
Level 0 OPEN PLAN
Level 0 **OPEN PLAN**
Level 0 SEMINAR ROOMS
Level 0 **SMALL CLASSROOM**
Welcome to the Porosity Building

Please Login with your UWM ID# or as a Guest Below to control your space

5892241

LOG IN

LOG IN AS GUEST

*Also Available via the Building Touchscreen Displays Located Throughout Building
Reserve Your Space

Select a Space Type
- Private Pod

Select a Level
- Level 1
- Level 2
- Level 3

Select an Available Space
- Space 203 Available Until 11:15 AM

*Also Available via the Building Touchscreen Displays Located Throughout Building
Daylighting STRATEGY

Open Atria Every Floor
Daylighting ANALYSIS
Daylighting ANALYSIS
Walkthrough INSERT
Control Your Space

LOAD PRESETS

**Lighting**
- Power: 80%
- Color: 5500K

**Climate**
- Temperature: 85°F

**Windows**
- % Open: 25%

**Satisfaction**
- 5/5

SAVE TO UWM ID#

SUBMIT

*Also Available via the Building Touchscreen Displays Located Throughout Building*
Level 1  AUDITORIUM CONFIG.

- Cores
- Auditorium
- Interactive Boards
- Seminar Room
- Semi Private
- Private Pods
- Storage and leisure
- Stairs
Level 1  LARGE CLASSROOM + EXPO

- Cores
- Exposition Hall
- Interactive Boards
- Seminar Room
- Large Classroom
- Private Pods
- Semi Private
- Stairs
Level 1 PRIVATE EVENT + CLASS

- Cores
- Exposition Hall
- Interactive Boards
- Seminar Room
- Large Classroom
- Private Pods
- Semi Private
- Stairs
Level 1  RENTABLE SPACE

- Cores
- Exposition Hall
- Interactive Boards
- Seminar Room
- Large Classroom
- Private Pods
- Semi Private
- Stairs
RC Walls, 4000 psi:
- 12" Retaining Wall
- 8" Shear Walls

RC Columns, 4000 psi:
- 12 x 12"
- 14 x 14"

RC Beams, 4000 psi:
- 8 x 22" Internal Beam
- 8 x 22" Perimeter Beam

RC Slab, 4000 psi:
- Holedeck H XL 50
- 6" Slab
- 4' x 4' x 22" Drop Panel
Mechanical LEVEL 1

Radiant Floor Tubing in Every Zone
Radiant Ceiling Panel in Heating
Radiant Ceiling Panel in Cooling
Energy Recovery Ventilator
Supply Duct
Return Duct
Not Shown
Strategy USER CONTROL

PoE + + BMS

sensors

user
Strategy **SIMULTANEOUS H/C**

- Radiant Ceiling Panels
- Radiant Manifolds
- Radiant Floor Tubing

* Representative – Not an actual section.

CoGen Plant Steam & CHW

CoGen Supply & Return

HXs

* Representative – Not an actual section.
Walkthrough INSERT
Ground Level
Private event and Large Classroom

- Cores
- Exposition Hall
- Interactive Boards
- Seminar Room
- Large Classroom
- Private Pods
- Semi Private
- Stairs
Professor in CM “Professor H”

Played by Juliia Hedenström, CM

As CM Professor teaching at Porosity
Walkthrough Segment (Collaborative Space to Locke)
File Storing LOCKERS
Walkthrough Segment (Locker to Cafe)
Walkthrough INSERT
Walkthrough Segment (Cafe to Seminar Room)
Still Render Segment (Seminar Room)
Played by
Andraz Starc, SE

As
Structural Engineer

Structural Engineer “Stark”
Concrete

→ Working areas, classrooms
→ Contact with hill
→ Structural platform for timber mezzanine/roof
→ Rough, defining

Timber

→ Public areas, private workpods
→ Connection with hill
→ Human, kind, soothing, natural
Public
→Celebrated from the exterior
→Attractor

Private
→Celebrated from the interior
→Connector
Structural LEVEL 0

RC Walls, 4000 psi:
- 12“ Retaining Wall
- 8“ Shear Walls

RC Columns, 4000 psi:
- 12 x 12 “
- 14 x 14 “

Mat Foundation, 4000 psi:
- 14“ Reinforced Concrete Slab Stud Rails
Structural LEVEL 1

RC Walls, 4000 psi:
- 12" Retaining Wall
- 8" Shear Walls

RC Columns, 4000 psi:
- 12 x 12"
- 14 x 14"

RC Beams, 4000 psi:
- 8 x 22" Internal Beam
- 8 x 22" Perimeter Beam

RC Slab, 4000 psi:
- Holedeck H XL 50
- 6" Slab
- 4' x 4' x 22" Drop Panel
Structural MEZZANINE

CLT Panels, Grade E4:
- 5-layer (6-7/8"") CLT Wall
- 5-layer (6-7/8"") CLT Lintel
- 5-layer (6-7/8"") CLT Slab

Glulam Columns, SP 24F-V4:
- 8-1/4 x 8-1/2"
- 6-3/4 x 16-1/2" [slanted]
- 6-3/4 x 6-7/8" [diagonal]

Glulam Beams, SP 24F-V4:
- 8-1/2 x 15-1/8"
- 6-3/4 x 13-3/4"
- 6-3/4 x 11"

Built-Up Diagonal Columns, Sawn Lumber, No.1 Douglas Fir-Larch
- 4 5x5"
Structural ROOF LEVEL

CLT Panels, Grade E4:
- 5-layer (6-7/8“) CLT Wall
- 5-layer (6-7/8“) CLT Lintel
- 3-layer (4-1/8“) CLT Slab

Glulam Columns, SP 24F-V4:
- 8-1/4 x 8-1/2 “
- 6-3/4 x 16-1/2“ [slanted]
- 6-3/4 x 6-7/8“ [diagonal]

Glulam Beams, SP 24F-V4:
- 8-1/2 x 15-1/8“
- 6-3/4 x 13-3/4“
- 6-3/4 x 11“
- 8-1/2 x 13-3/4“
- 6-3/4 x 24-3/4“ [Rafter]
- 6-3/4 x 12-3/8“
- 8-1/2-3/4 x 24-3/4“

Built-Up Diagonal Columns, Sawn Lumber, No.1 Douglas Fir-Larch
- 4 5x5“
Structural BUILDING LOADS

Bearing Capacity 4000 KSF

Wind Load Distribution [kips]

- 46.8
- 40.6
- 46.0

<table>
<thead>
<tr>
<th>Building Area</th>
<th>Uniform Load [psf]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>40</td>
</tr>
<tr>
<td>Office</td>
<td>50</td>
</tr>
<tr>
<td>Roof</td>
<td>20 (100*)</td>
</tr>
<tr>
<td>Stairs</td>
<td>100</td>
</tr>
<tr>
<td>Auditorium</td>
<td>100</td>
</tr>
<tr>
<td>Corridors</td>
<td>100</td>
</tr>
<tr>
<td>Storage</td>
<td>250</td>
</tr>
<tr>
<td>Snow</td>
<td>30</td>
</tr>
<tr>
<td>Wind</td>
<td>21</td>
</tr>
</tbody>
</table>
Structural LOAD PATHS
Holedeck WHAT?

- Voided bidirectional concrete slabs
- Embed services and plumbing systems
- Similar to waffle slabs, only with voids where concrete is not fully utilised
Holedeck **WHY?**

- **Aesthetics**
- **Reduced building height**
- **Long spans**
- **MEP integration**
- **Acoustic performance**
- **Reduced CO2 footprint**
- **Fast and easy construction**
- **Reduced material consumption**
- **Leed points**

Architect approves! ✓

MEP approves! ✓

CMs approve! ✓
**Holedeck ANALYSIS**

**DEFLECTIONS HOLEDECK H XL 50**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IMMEDIATE [Elastic]</td>
<td>0.22</td>
<td>in</td>
</tr>
<tr>
<td>IMMEDIATE [Cracked]</td>
<td>0.36</td>
<td>in</td>
</tr>
<tr>
<td>IMMEDIATE LIVE [Cracked]</td>
<td>0.11</td>
<td>in</td>
</tr>
<tr>
<td>LONG TERM [CR + Creep &amp; Shrinkage]</td>
<td>0.81</td>
<td>in</td>
</tr>
<tr>
<td><strong>Allowed:</strong></td>
<td>1.07</td>
<td>in</td>
</tr>
</tbody>
</table>

- Diagram showing deflections and dimensions.
- Table listing deflection values for different conditions.
- SAFE logo present.
Typical reinforcement layout

Reinforced Concrete Beam 12" x 24"

Depth of Slab

RibSpacing

2' 2'

SE approves! ✓
**Structural LEVEL 1**

**RC Walls, 4000 psi:**
- 12“ Retaining Wall
- 8“ Shear Walls

**RC Columns, 4000 psi:**
- 12 x 12“
- 14 x 14“

**RC Beams, 4000 psi:**
- 8 x 22“ Internal Beam
- 8 x 22“ Perimeter Beam

**RC Slab, 4000 psi:**
- Holedeck H XL 50
- 6“ Slab
- 4’ x 4’ x 22“ Drop Panel
Mechanical Engineer “Cortéz”

Played by Curtis Fong, MEP
As Mechanical Engineer
Strategy **USER CONTROL**

- PoE + + BMS

- sensors

- user
Challenge INTERIOR CLIMATES
Solution **SIMULTANEOUS H/C**

- Radiant Ceiling Panels
- Radiant Manifolds
- Radiant Floor Tubing

CoGen Plant  Steam & CHW

CoGen Supply & Return

HXs

* Representative – Not an Actual Section.
Solution **SEPARATE AIR SYSTEM**

- **Energy Recovery Ventilators**
- **Retractable Seating Diffusers**
- **Holedeck Integration**
- **High Ceilings**

**Displacement Ventilation**

**Supply Shaft**

*Representative – Not an actual section.*
Duct Integration **HOLEDECK**

- Radiant Floor Tubing in Every Zone
- Radiant Ceiling Panel in Heating
- Radiant Ceiling Panel in Cooling
- Energy Recovery Ventilator
- Supply Duct
- Return Duct

Not Shown
HVAC DISTRIBUTION TREE
Mechanical LEVEL 0

Radiant Floor Tubing in Every Zone
Radiant Ceiling Panel in Heating
Radiant Ceiling Panel in Cooling
Energy Recovery Ventilator
Supply Duct
Return Duct (Not Shown)
Mechanical LEVEL 1

- Radiant Floor Tubing in Every Zone
- Radiant Ceiling Panel in Heating
- Radiant Ceiling Panel in Cooling
- Energy Recovery Ventilator
- Supply Duct
- Return Duct

Not Shown
Mechanical MEZZANINE

- Radiant Floor Tubing in Every Zone
- Radiant Ceiling Panel in Heating
- Radiant Ceiling Panel in Cooling
- Energy Recovery Ventilator
- Supply Duct
- Return Duct

Not Shown
Professor in CM “Professor H”

Played by
Julia Hedenström, CM

As
CM Professor
teaching at Porosity
Walkthrough Segment (Seminar Room to East Stairs)
Still Render Segment (East Stairs)
Urbanist / Madisonian “Francis”

Played by
Florent Ilazi, CM

As
Urban Designer
& Consultant on Porosity
Walkthrough Segment (East Stairs to South Patio)
Walkthrough Segment (South Patio to Mid-Jump
Still Render Segment (Mid-Jump @ Roof)
Structural Engineer “Stark”

Played by
Andraz Starc, SE

As
Structural Engineer
 Structural RETAINING WALL

\[ M_{\text{max}} = 26.5 \text{ kip-ft/ft} \]
Soil Pressures: Nonlinear LC considering Uplift

$S_{\text{max}} = 3125 \text{ psf} < 4000 \text{ psf}$ ✓

Possible Uplift
Punching Shear DESIGN

Detail (corner): Peikko 4x ARMATA Stud Rails

F = 356 kips
F = 129 kips
Structural Level 0

RC Walls, 4000 psi:
- 12" Retaining Wall
- 8" Shear Walls

RC Columns, 4000 psi:
- 12 x 12"
- 14 x 14"

Mat Foundation, 4000 psi:
- 14" Reinforced Concrete Slab Stud Rails
Mechanical Engineer “Cortéz”

Played by Curtis Fong, MEP

As Mechanical Engineer
Passive Design **EXTERIOR SKIN**

LAKE

HILL
Walkthrough INSERT
Structural Engineer "Stark"

Played by
Andraz Starc, SE

As
Structural Engineer
CLT Slab & Glulam Beams

5-layer CLT Slab (orthotropic behaviour → attention to orientation)

\[ M_{\text{max}} = 90.9 \text{ kip-ft} \]
\[ U_{\text{l+d, max}} = 0.87 \text{ in} \]

Glulam SP 24F-V4
Max: 8-1/2 x 15-1/8"
**Post to Beam Connector:**

Pitzl HVP 88318

- $F_v,_{\text{max}} = 14,4\; \text{kip}$
- $F_{R,d} = 16,4\; \text{kip}$

**Post Base:**

Simpson Strong-Tie CPS7 Standoff Base

- $8'' 	imes 8''$

**Glulam Beam:**

- $8-1/2\; \times\; 15-1/8$

**Glulam Column:**

- $8-1/2\; \times\; 8-1/4$

**Epoxy Anchoring:**

Composite Plastic Standoff designed for increased concrete surface area

**Details:**

- $\Phi5\; \text{mm} \; [L=\; 100\; \text{mm}]$
- Self-tapping screws
CLT Walls – lateral resistance:

- Wind Load →

Connections:

- Reinforced Angle Brackets

- CLT to concrete
  - $F_{33,R} = 8.4\, \text{kip/bracket (shear)}$

- CLT to CLT
  - $F_{33,R} = 10.3\, \text{kip/bracket (shear)}$

Decision: 1 bracket per 2 ft
Roof EVOLUTION

Winter presentation solution:

- Structural solution: ✓
- SE + MEP Integration: ×
- Porosity & Impact on User Experience: ×
GOAL: Integration of natural ventilation and developing a structural system that:
- Work with proposed idea of roof chimneys → **SE+MEP Integration**
- Improves user experience in the building → **A+SE Integration**
- Fast assembly on site → **SE+CM Integration**
- Works with big idea → **Porosity**

Call For Intense Collaboration
Roof EVOLUTION

Dark Horse Exercise:

“Natural forms act in the direction of minimum effort” – S. Z. Makowski

Idea:
Timber Space Truss

Enabling Detail:
Steel Tension & Compression Rings
Roof - PRELIMINARY ANALYSIS

Dynamo for SAP2000
CORE studio | Thornton Tomasetti

Dynamo for SAP2000
CORE studio | Thornton Tomasetti
Roof - PRELIMINARY ANALYSIS

H=2 ft

H=2.5 ft

H=3 ft

H=3.5 ft
Etabs Model
Roof - FINAL SOLUTION

<table>
<thead>
<tr>
<th>Space Truss</th>
<th>Auditorium Roof</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top &amp; Bottom Chord</td>
<td>Rafters</td>
</tr>
<tr>
<td>4x6” Sawn Lumber</td>
<td>Glulam 6-3/4 x 24-3/4”</td>
</tr>
<tr>
<td>Verticals &amp; Diagonals</td>
<td>Joists</td>
</tr>
<tr>
<td>4x4” Sawn Lumber</td>
<td>Glulam 6-3/4 x 12-3/8”</td>
</tr>
<tr>
<td>Steel Members</td>
<td>Slab</td>
</tr>
<tr>
<td>HSS 4x0,250”, ASTM A572</td>
<td>3-layer CLT Slab</td>
</tr>
<tr>
<td>Slab</td>
<td></td>
</tr>
<tr>
<td>3-layer CLT Slab</td>
<td></td>
</tr>
</tbody>
</table>
Roof - FINAL SOLUTION

### Space Truss

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<th>Material</th>
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<tr>
<td>Top &amp; Bottom Chord</td>
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</tr>
<tr>
<td>Verticals &amp; Diagonals</td>
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<td>Steel Members</td>
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<tr>
<td>Slab</td>
<td>3-layer CLT Slab</td>
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### Auditorium Roof

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<tr>
<td>Rafters</td>
<td>Glulam 6-3/4 x 24-3/4”</td>
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<tr>
<td>Joists</td>
<td>Glulam 6-3/4 x 12-3/8”</td>
</tr>
<tr>
<td>Slab</td>
<td>3-layer CLT Slab</td>
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Structural ROOF LEVEL

CLT Panels, Grade E4:
- 5-layer (6-7/8"") CLT Wall
- 5-layer (6-7/8"") CLT Lintel
- 3-layer (4-1/8"") CLT Slab

Glulam Columns, SP 24F-V4:
- 8-1/4 x 8-1/2"
- 6-3/4 x 16-1/2" [slanted]
- 6-3/4 x 6-7/8" [diagonal]

Glulam Beams, SP 24F-V4:
- 8-1/2 x 15-1/8"
- 6-3/4 x 13-3/4"
- 6-3/4 x 11"
- 8-1/2 x 13-3/4"
- 6-3/4 x 24-3/4" [Rafter]
- 6-3/4 x 12-3/8"
- 8-1/2-3/4 x 24-3/4"

Built-Up Diagonal Columns, Sawn Lumber, No.1 Douglas Fir-Larch
- 4 5x5"
Mechanical Engineer “Cortéz”

Played by
Curtis Fong, MEP

As
Mechanical Engineer
Mixed-Mode Ventilation STRATEGY

\[ A_1 = 70 \text{ ft}^2 \]
\[ \Delta p_1 = 10.1 \text{ Pa} \]
Mixed-Mode Ventilation STRATEGY

Run One Exhaust Fan with VFD @ Low Speed

- $A_4 = 210 \text{ ft}^2$, $\Delta p_4 = -10.1 \text{ Pa}$
- $A_1 = 70 \text{ ft}^2$, $\Delta p_1 = 10.1 \text{ Pa}$
- $A_2 = 70 \text{ ft}^2$, $\Delta p_2 = 6.4 \text{ Pa}$
- $A_3 = 70 \text{ ft}^2$, $\Delta p_3 = 2.9 \text{ Pa}$
Duct Integration **SPACE TRUSS**

- Radiant Floor Tubing in Every Zone
- Radiant Ceiling Panel in Heating
- Radiant Ceiling Panel in Cooling
- Energy Recovery Ventilator
- Supply Duct
- Return Duct
Strategy NET ZERO WATER

6x6” Gutter + 5”φ Downspouts
Performance **NET ZERO WATER**

**Tracking Tank Water Quantity - 2016 [Dry Year]**

- Current Tank Water Quantity [gal]
- Precipitation Depth [in]

- **Total Precipitation (Rain & Snow) [in]**
- **Collection Tank Storage Quantity [gal]**

**Driest Condition**
Structural Engineer “Stark”

Played by
Andraz Starc, SE

As
Structural Engineer
A-SE Coordination

Built Up Columns, Sawn Lumber
(4 5x5” elements, connected at ¼ to ensure lateral stability of individual elements)

→ Additional lateral resistance
→ Improved Aesthetics
→ Less obstruction for the view
→ Visual distinction between public and private spaces
Mechanical Engineer “Cortéz”

Played by
Curtis Fong, MEP

As
Mechanical Engineer
Auditorium VENTILATION
Auditorium VENTILATION

Energy Recovery Ventilators
Retractable Seating Diffusers
Holedeck Integration
High Ceilings

Displacement Ventilation Supply Shaft

12'

* Representative – Not an Actual Section.
Bathroom slide/rendering
BMS NOTIFICATION

Presentation @ Main Auditorium

Calendar

Press for more

Saturday, January 4

12:42

slide to unlock
Urbanist / Madisonian “Francis”

Played by Florent Ilazi, CM

As Urban Designer & Consultant on Porosity
Walkthrough INSERT
- WELCOME -

Construction Management Team Presents:

POROSITY

By Francis and Professor H

12 May 2017
Madison, Wisconsin
Construction CHALLENGES + FOCUS

CHALLENGES
- Creating Value for Owners
- Adding Value to Community with Minimal Disruption
- Tight Site and Winter Conditions

FOCUS

Owner

Community

Workers
Owner VALUE FOR MONEY

Reduction in Floor Area
- Less Material Needed
- Faster Build Time = Lower Risk/Cost

Space Truss
- Natural Ventilation
- Natural Sunlight

Multiple Revenue Sources
- Rentable Spaces
- Cost Efficient Cafe
## Cost Breakdown TVD

<table>
<thead>
<tr>
<th>Description</th>
<th>Estimated Value</th>
<th>Target Value</th>
<th>Value Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL</strong></td>
<td>$8,763,157</td>
<td>$10,000,000</td>
<td>$1,236,843</td>
</tr>
<tr>
<td>A Substructure</td>
<td>$471,667</td>
<td>$655,760</td>
<td>$184,093</td>
</tr>
<tr>
<td>B Shell</td>
<td>$2,093,290</td>
<td>$2,908,022</td>
<td>$814,732</td>
</tr>
<tr>
<td>C Interiors</td>
<td>$790,125</td>
<td>$1,270,134</td>
<td>$480,009</td>
</tr>
<tr>
<td>D Services</td>
<td>$3,275,197</td>
<td>$3,051,633</td>
<td>$(223,565)</td>
</tr>
<tr>
<td>E Equipment and Furnish</td>
<td>$229,878</td>
<td>$178,274</td>
<td>$(51,604)</td>
</tr>
<tr>
<td>F Specialty Construction</td>
<td>$198,000</td>
<td>$439,012</td>
<td>$241,012</td>
</tr>
<tr>
<td>G Building Sitework</td>
<td>$451,000</td>
<td>$578,994</td>
<td>$127,994</td>
</tr>
<tr>
<td>H General Conditions</td>
<td>$1,254,000</td>
<td>$918,171</td>
<td>$(335,829)</td>
</tr>
</tbody>
</table>
Cost Breakdown % OF TOTAL

- D Services: 37%
- B Shell: 24%
- C Interiors: 9%
- A Substructure: 6%
- H General Conditions: 14%
- G Building Sitework: 5%
- F Specialty Construction: 2%
- E Equipment and Furnishing: 3%
Target Value Design

TVD - TARGETS BY CLUSTER

Target  Estimate  Delta

A Substructure  $\text{N/A}$  $\text{N/A}$  $\text{N/A}$
B Shell  $\text{N/A}$  $\text{N/A}$  $\text{N/A}$
C Interiors  $\text{N/A}$  $\text{N/A}$  $\text{N/A}$
D Services  $\text{N/A}$  $\text{N/A}$  $\text{N/A}$
E Equipment and Furnishing  $\text{N/A}$  $\text{N/A}$  $\text{N/A}$
F Specialty Construction  $\text{N/A}$  $\text{N/A}$  $\text{N/A}$
G Building Stewwork  $\text{N/A}$  $\text{N/A}$  $\text{N/A}$
H General Conditions  $\text{N/A}$  $\text{N/A}$  $\text{N/A}$
City RESIDENTS

NOISE REDUCTION
PATHWAY IN FUNCTION
SMART MATERIAL TRANSPORTATION
Professor in CM “Professor H”

Played by
Julia Hedenström, CM

As
CM Professor
teaching at Porosity
Workers SAFETY & ENVIRONMENT

SAFETY FIRST
- Protective equipment
- Unauthorized entry forbidden

ENVIRONMENTAL AWARENESS
- Recycle areas
- Concrete washout
- Silt fences
Schedule CONSTRUCTION

Milestone 1: Foundation Complete
Milestone 2: Hole Deck
Milestone 3: Shell Enclosure
Milestone 4: Commissioning
Milestone 5: Project Hand-over
DEFINITION

A quality assurance process working with project stakeholders to meet the *Owner's Project Requirements* and ensure *successful operation throughout the life cycle*.

**STANDARD practice**

Cx of innovative equipment from design throughout operation

**INNOVATIVE practice**

*Adaptive and collaborative* Cx of even non-mechanical features with facility personnel from design through operation
Site Layout

- Entrance & Exit
- Office Trailer
- Recycle Area
- Material Laydown
- Truck & Crane
- Pathway
- Safety/Silt Fence

FACULTY
Site EFFICIENCY

FLOW IN & OUT OF SITE

ENTRANCE & EXIT
Site EQUIPMENT

CAT EXCAVATOR 336D2
Maximum digging depth: 25 ft
Maximum reach: 36 ft
Price: $2500/month

JOHN DEERE DUMP TRUCK 410E
Payload: 80 000 lb
Price: $1500/month

CAT TH514C
Maximum lift height: 45 ft
Load when down/up: 7000 lb/4000 lb
Maximum forward reach: 30 ft
Price: $600/month
# TOWER CRANE vs MOBILE CRANE

<table>
<thead>
<tr>
<th>TEREX CTT 91-5</th>
<th>GROVE Crane TMS700B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jib length: 165 ft</td>
<td>Boom extension: 35-110 ft</td>
</tr>
<tr>
<td>Efficiency</td>
<td>High mobility</td>
</tr>
</tbody>
</table>
Site LOGISTICS
Site LOGISTICS
Team VALUE

CORE VALUES

Coordinated Design
Innovation through Collaboration
Empathy in Teamwork
Celebrate Diversity
Stakeholder Oriented

TEAM GOALS

Collaborative Resonance
Natural Communication
Share experiences between disciplines

PROCESS

Shared vision to achieve a common goal

VISION

We envision a culturally globalized future where urban spaces are integrated to natural spaces. Our future city will provide an engaging user experience by promoting sensible user interfaces where occupants with diverse backgrounds and preferences get to connect with their environment.
Team **PROCESS**

- **Input**
  - Idea!
  - Sketch
  - Slack
  - Feedback

- **Output**
  - More Sketches
  - BIM
  - Review

- **Reality!**
Lessons LEARNED

**Florent:** “If you want to go fast, go alone. If you want to go far, go together.”

**Julia:** ””

**Curtis:** “Assume you know nothing. Always ask for help and learn more.”

**Andraz:** ””

**Jean:** ””
Thank You!
Put material that you want to keep but not put in the presentation after this slide
Extra place holder for francis’s icons..
Team Walkthroughs
Clash Detection
Lessons Learned
THANK YOU
Night View from the Muir views
Challenge COLD CLIMATE

Dry Bulb Temperatures [°F]

Comfort Range
Mezannine Level
Mezannine Level Retracted
Wearable Technology
Building interphase
Welcome to the Porosity Building

Please Login with your UWM ID# or as a Guest Below to control your space

UWM ID#

LOG IN

LOG IN AS GUEST

Reserve Your Space

Select a Space Type

Private Pod

Semi-Private Space
Collaborative Space
Instructional Lab
Seminar Room
Conference Room

Select a Level

Level 1 Level 2 Level 3

Select an Available Space

Space 303 Available Until 11:15 AM

Control Your Space

LOAD PRESETS

Lighting

Power 50%
Color 5500K

Climate

Temperature 80F

Windows

% Open 25%

Satisfaction 5/5

SAVE TO UWM ID#

*Also Available via the Building Touchscreen Displays Located Throughout Building
Architectural LEVEL 0

Radiant Floor Tubing in Every Zone
Radiant Ceiling Panel in Heating
Radiant Ceiling Panel in Cooling
Energy Recovery Ventilator
Supply Duct
Return Duct
Architectural LEVEL 1

Radiant Floor Tubing in Every Zone
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Architectural MEZZANINE

Radiant Floor Tubing in Every Zone
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Supply Duct
Return Duct
Not Shown
Mechanical LEVEL 0

- Radiant Floor Tubing in Every Zone
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Not Shown
Duct Integration

HOLEDECK

- Radiant Floor Tubing in Every Zone
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Not Shown
Duct Integration SPACE TRUSS

- Radiant Floor Tubing in Every Zone
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- Energy Recovery Ventilator
- Supply Duct
- Return Duct

Not Shown
How are the people approaching the building. Walkthrough
North West Elevation
Design thinking
What type of innovation challenges do you think are worth working on in the world?
What type of obstacles have you experienced though innovating in your personal life?
What type of environment do you think is most conducive to innovating?
Collaboration

What is Collaboration?
When two or more people with shared values work together in order to advance knowledge and make meaningful contributions to our world. Interdependency cross-disciplinary teamwork, use effectively collaboration technologies,
Divergent Thinking

- Coming up with ideas
- Explore possibilities
- Possible solution to a problem
- Abstract thinking
- Composition of ideas
- Extraction of ideas
- Alternatives
- Environment
- Come in Use metaphors

Convergent Thinking

- Waking up
- Look at all the
- Reflecting on Ideas
- Extended thinking
- Abstract
- Fine at thinking
- Challenge the
- Specifications
- Allocate information to
- Materials and Concrete Productions
Divergent and Convergent Thinking
Space Design

- Movable White annotation boards compartmentalizing space
- Post its
- working surfaces
- seatings and tables
- Interior vegetation
- Perforated metal panels
- white board

- Tilted desk
- Adjustable height
- Adjustable lighting directional
- Pixar light
- Movable

- Recycling Space
- Chairs and tables with wheels
- Microsoft Surface
- Que esten activos en su cuerpo
- Projectors
- Washable Marker Trays
- Permanent Markers trays
- Yarn
- Tape
- Paper
- Carryable whiteboards
- Movable TVs
- Floor electricity and Wall height
- electricity
Clear Desk Policy

http://spacestor.com/projects/12972/
Small Classroom Configuration
How are the floor plans being dynamic
Auditorium VENTILATION
U.S. GREEN BUILDING COUNCIL
LEED GOLD
USGBC

Energy and Atmosphere
21/33

Innovation
1/6

Water Efficiency
11/11

Sustainable Sites
7/10

Materials & Resources
7/13

Location & Transportation
14/16

Regional Priority
2/4

Indoor Environmental Quality
15/16

78/110
Performance **NET ENERGY USE**

**Energy Use**
- Heating: 54%
- Cooling: 16%
- Lighting: 10%
- Equipment: 11%
- Ventilation: 9%

**Energy Production**
- Photovoltaics: 94%
- Net Energy Use: 6%
12'' Retaining Wall
8'' Shear Walls

RC Walls, 4000 psi:
- 12“ Retaining Wall
- 8“ Shear Walls

RC Columns, 4000 psi:
- 12 x 12 “
- 14 x 14 “

RC Beams, 4000 psi:
- 8 x 22 “ Internal Beam
- 8 x 22 “ Perimeter Beam

RC Slab, 4000 psi:
- Holedeck H XL 50
- 6“ Slab
- 4‘ x 4‘ x 22“ Drop Panel
Mechanical LEVEL 0

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Not Shown
STV Analysis

Performance SUSTAINABILITY

63% Below
Carbon (kgCO2e)

67% Below
Water (kgH2O)

79% Below
Energy (MJ)

Targets
Project
STV Analysis

- 63% Below Carbon (kgCO2e)
- 67% Below Water (kgH2O)
- 79% Below Energy (MJ)

Targets and Project
Effective Commissioning

DEFINITION

Commissioning is an all-inclusive, quality assurance-based process for working with project stakeholders to verify and document that all of the commissioned systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

STANDARD practice

Quality integration throughout design
NOT post-construction perfunctory inspection task
Proactive quality assurance for standard and innovative equipment
Continual commissioning and performance measurement

INNOVATIVE practice

Co-development of Cx manual for ongoing maintenance with facility operations personnel
Commissioning of both conventional and non-mechanical features
Adaptive occupant manual (App) for dynamic operating conditions