Weimar, Germany

Annual Climate Conditions:

\[ T_{\text{high}} = 70^\circ \text{F} \]
\[ T_{\text{low}} = 25^\circ \text{F} \]
\[ \text{Precipitation}_{\text{avg}} = 23 \text{ in. (light)} \]
\[ \text{Wind Speed}_{\text{high}} = 26 \text{ mph (light)} \]

Prevailing Wind Direction: West, South-West
Site Hazard - Flooding

Average Rainfall in Germany

Ilm River Flooding History

<table>
<thead>
<tr>
<th>Date</th>
<th>Flood Height [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.12.1925</td>
<td>1.85</td>
</tr>
<tr>
<td>01.01.1926</td>
<td>2.20</td>
</tr>
<tr>
<td>05.11.1940</td>
<td>2.00</td>
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<tr>
<td>14.03.1947</td>
<td>2.50</td>
</tr>
<tr>
<td>29.12.1947</td>
<td>2.30</td>
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<tr>
<td>10.06.1961</td>
<td>1.80</td>
</tr>
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<td>12.03.1981</td>
<td>2.50</td>
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<td>11.06.1981</td>
<td>3.00</td>
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<tr>
<td>13.04.1994</td>
<td>2.80</td>
</tr>
<tr>
<td>04.01.2003</td>
<td>2.00</td>
</tr>
<tr>
<td>Average</td>
<td>2.20</td>
</tr>
</tbody>
</table>
Pebble
Perspective View from N-E
Mezzanine
E-W Section

11.5 m: Atrium Roof
9.5 m: Top Floor, faculty area
4.3 m: Classrooms low
1.4 m: Auditorium high
0 m: Mechanical room
12 m: Roof
9 m: Top Floor, faculty area
6 m: Mezzanine Floor, students area
3 m: Ground Floor, entrances
0 m: River Level
Atrium
Pebble – Steel
S-W Perspective
## Loads

**DEAD LOADS:**
- MEP: 5 psf
- CLADDING: 20 psf
- MISC: 12 psf
- SELF-WEIGHT: 80 to 100 psf

**LIVE LOADS:**
- ROOF: 20 psf
- SNOW: 9 psf
- GREEN ROOF: 25 psf
- CLASSROOM: 50 psf
- OFFICE: 50 psf
- AUDITORIUM: 60 psf
- LABORATORY ROOM: 100 psf
- CORRIDOR: 100 psf
- STORAGE: 120 psf
- PARTITIONS: 20 psf

---

Average wind load = 12 mph  
Design wind load = 60 mph  
Wind controls design as the region has very little seismic activity  
Steel Solution: MRF  
Concrete Solution: Shear Wall
Being Native: German Sections

- Fy of German Steel: 66.7 ksi
- All sections are hot rolled
- IPBv: Wide Flange heavy sections
- IPBI: Wide Flange light sections
- All dimensions in mm

<table>
<thead>
<tr>
<th>Member</th>
<th>Section</th>
<th>d</th>
<th>bf</th>
<th>tw</th>
<th>tf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column</td>
<td>IPBv 280</td>
<td>310</td>
<td>288</td>
<td>18.5</td>
<td>33</td>
</tr>
<tr>
<td>Girder</td>
<td>IPBI 320</td>
<td>310</td>
<td>300</td>
<td>9</td>
<td>15.5</td>
</tr>
<tr>
<td>Filler Beam</td>
<td>IPBI 200</td>
<td>190</td>
<td>200</td>
<td>6.5</td>
<td>10</td>
</tr>
<tr>
<td>Perimeter Beam</td>
<td>IPBI 240</td>
<td>230</td>
<td>240</td>
<td>7.5</td>
<td>12</td>
</tr>
<tr>
<td>Cantilever</td>
<td>IPBv 240</td>
<td>270</td>
<td>248</td>
<td>18</td>
<td>32</td>
</tr>
</tbody>
</table>
South Pebble – Basement

- Slanted Girders: IPBl 320
- Columns: IPBv 280
- Joist: Vulcraft 28LH05
- Filler Beam: IPBl 200
- Curved Perimeter beam: IPBl 240

Dimensions:
- 13442mm
- 20050mm
East Pebble – 1st Floor

Girders:
- IPBl 320

Columns:
- IPBv 280

Beams:
- IPBv 240
- IPBl 240
- IPBL 200

Filler Beam:
- IPBI 200

Curved Perimeter beam:
- IPBI 240

Dimensions:
- East 6368mm
- Pebble: 4385mm
- 1st Floor: 35066mm

Legend:
- Orange: Girders
- Blue: Columns
- Yellow: Filler Beam
- Red: Cantilever Beams
- Brown: Curved Perimeter beam
Challenges

Laterally unsupported columns
Challenges

W14x 74, Curved about strong axis

Column in double curvature
Double Curved Column

- Truss constructed using lightweight HSS pipe sections (HSS2.500X0.250)
- Under load of 10 kips:
  - Displacement X: 0.1”
  - Displacement Y: 0.08”

Pre-tensioned cable

Disp X | 0.1063
Disp Y | -0.0757
Proposed way of supporting the curved perimeter beam

- Moment Demands of about 250 kip-ft if unsupported

Curved Façade

- FRP panels
- Post tensioned Steel Cable
- Direction of tension

Diagram showing the components and direction of tension in a curved façade.
Foundation Detail

Tension Piles
10m deep,
1m φ,
Spacing 2.5 m
Pebble - Concrete
1st Floor

- **Columns**
  - (40cm x 40cm)

- **Curved columns**
  - (40cm x 50cm)

- **Girder**
  - (30cm x 30cm)
  - max. length: 5 m

- **Prestressed Girder**
  - (30cm x 60cm)
  - max. span: 13 m

- **Shear Walls**
Mezzanine

- Columns
  (40cm x 40cm)
- Curved columns
  (40cm x 50cm)
- Girder
  (30cm x 30cm)
  max. length: 5m
- Shear walls
Tension cables
max. length: 41,00 m
Polycarbonate Façade
Concrete Façade
Bauhaus 2.0
Sections

NW-SE

10,000mm: Faculty Offices
6,500mm: Student Offices

10,000mm: Faculty Lounge
6,500mm: Seminar Rooms
3,000mm: Ground Floor

NE-SW

13,800mm: Roof
10,000mm: Classrooms
6,500mm: Classrooms
3,000mm: Ground Floor
1,000mm: Auditorium
Perspective View from N-E
Interior View - Faculty Office
Interior View - Atrium
Bauhaus 2.0 – Steel
1st Floor

- **Girders:**
  - IPBI 320

- **Columns:**
  - IPBv 280

- **Filler beam:**
  - IPBI 240
2\textsuperscript{nd} Floor

- **Girders:**
  - IPBI 320

- **Columns:**
  - IPBv 280

- **Filler beam:**
  - IPBI 240
3rd Floor

Girders:
- IPBI 320

Columns:
- IPBv 280

Cantilever Beams:
- IPBv 240

Filler Beam:
- IPBI 240
Bauhaus 2.0 – Concrete
1st Floor

- shear walls
- prestressed girders 40x40cm
- girders 40x30 cm
- columns 40x40 cm
2nd Floor

- **Shear walls**
- **Prestressed girders 40x40cm**
- **Girders 40x30 cm**
- **Columns 40x40 cm**

Dimensions:
- 17500 mm
- 17120 mm
- 27500 mm
- 8000 mm
3rd Floor

- **Shear walls**: Green
- **Prestressed girders 40x40cm**: Red
- **Girders 40x30 cm**: Orange
- **Columns 40x40 cm**: Blue

Dimensions:
- 17500 mm
- 17120 mm
- 27500 mm
- 8000 mm
NW-SE Section

foundation with piles
Site Access

Delivery Limitations

1. 3.3m
2. 4m
Pebble Flood Analysis

Normal Water Level

1.4m Flood

33-yr (1.7m) Flood

100-yr (2m) Flood

Courtesy of River 2010
Bauhaus 2.0 Flood Analysis

1.4m Flood

33-yr (1.7m) Flood

100-yr (2m) Flood

Normal Water Level

Courtesy of River 2010
Flood Control

Sand Bags
• Labor Intensive
• Costly
• Risky
• Last Resort Measure
Pebble Site Layout

- Silt Fence
- 30m
- Parking (350 m²)
- Material (700 m²)
- Material (700 m²)
- Porta Potties
- Trailers
- Dumpster
- Crane
- Material (700 m²)
- Temporary Road
- Chain Link Fence
- Interior Worker Heating Space
Bauhaus 2.0 Site Layout

- **Porta Potties**
- **Parking (350 m²)**
- **Material (500 m²)**
- **Material (800 m²)**
- **Crane**
- **Trailers**
- **Chain Link Fence**
- **30m Silt Fence**
- **Temporary Road**
- **Interior Worker Heating Space**
Pebble Site Layout - Flood

Aqua Barrier
Bauhaus 2.0 Site Layout – Flood
Crane Selection

Liebherr LTM 1030

– 35 Tons
– Boom 30m
Steel: 231 Days

Concrete: 251 Days

Δ = 20 Days
## Target Value

### Today's Money (2010)
- **Budget:** $7,500,000
- **Investment Rate:** 4% (Money Market Account)
- **Inflation Rate:** 2%
- **Real Interest Rate:** 1.96%

### 2015's Money
- **Budget:** $8,184,846

<table>
<thead>
<tr>
<th>TARGET VALUE:</th>
<th>River Team 2010</th>
<th>Pebble</th>
<th>Bauhaus 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Cost Breakdown</strong></td>
<td><strong>$7,500,000</strong></td>
<td><strong>$8,184,846</strong></td>
<td><strong>$8,200,000</strong></td>
</tr>
<tr>
<td>Substructure</td>
<td>5% $409,242</td>
<td>5% $409,242</td>
<td>4% $327,394</td>
</tr>
<tr>
<td>Shell</td>
<td>20% $1,636,969</td>
<td>26% $2,128,060</td>
<td>19% $1,555,121</td>
</tr>
<tr>
<td>Interiors</td>
<td>18% $1,473,272</td>
<td>16% $1,309,575</td>
<td>20% $1,636,969</td>
</tr>
<tr>
<td>Services</td>
<td>34% $2,782,848</td>
<td>30% $2,455,454</td>
<td>32% $2,619,151</td>
</tr>
<tr>
<td>Equipment &amp; Furnishings</td>
<td>2% $163,697</td>
<td>2% $163,697</td>
<td>3% $245,545</td>
</tr>
<tr>
<td>Special Construction</td>
<td>1% $81,848</td>
<td>1% $81,848</td>
<td>1% $81,848</td>
</tr>
<tr>
<td>Building Sitework</td>
<td>7% $572,939</td>
<td>7% $572,939</td>
<td>7% $572,939</td>
</tr>
<tr>
<td>Indirect Cost</td>
<td>13% $1,064,030</td>
<td>13% $1,064,030</td>
<td>14% $1,145,878</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100% $8,184,846</td>
<td>100% $8,184,846</td>
<td>100% $8,200,000</td>
</tr>
<tr>
<td><strong>Rounded Total</strong></td>
<td>$8,200,000</td>
<td>$8,200,000</td>
<td>$8,200,000</td>
</tr>
</tbody>
</table>

### Typical University Building Cost in Germany, 2009
- € 4,224,943 | 1385 euros/m² | Concept 1 = 3050 m²
- $5,914,920 | 1939 USD/m² | Concept 1 = 3050 m²
- € 4,859,965 | 1385 euros/m² | Concept 2 = 3509 m²
- $6,803,951 | 1939 USD/m² | Concept 2 = 3509 m²

1 Euro = 1.4 USD
## Estimating Process

The process begins with creating a Revit Architecture model. The output is a DWFX file, which is then used to generate an Autodesk Quantity Takeoff Excel (.xls) file for estimating costs.
# Building Cost

<table>
<thead>
<tr>
<th>Construction Cost Breakdown</th>
<th>Pebble Target Value</th>
<th>Pebble-Steel</th>
<th>Pebble-Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substructure</td>
<td>$409,242</td>
<td>$500,000</td>
<td>$450,000</td>
</tr>
<tr>
<td>Shell</td>
<td>$2,128,060</td>
<td>$2,500,000</td>
<td>$1,950,000</td>
</tr>
<tr>
<td>Interiors</td>
<td>$1,309,575</td>
<td>$1,500,000</td>
<td>$1,375,000</td>
</tr>
<tr>
<td>Services</td>
<td>$2,455,454</td>
<td>$2,550,000</td>
<td>$2,550,000</td>
</tr>
<tr>
<td>Equipment &amp; Furnishings</td>
<td>$163,697</td>
<td>$220,000</td>
<td>$220,000</td>
</tr>
<tr>
<td>Special Construction</td>
<td>$81,848</td>
<td>$200,000</td>
<td>$175,000</td>
</tr>
<tr>
<td>Building Sitework</td>
<td>$572,939</td>
<td>$650,000</td>
<td>$600,000</td>
</tr>
<tr>
<td>Indirect Cost</td>
<td>$1,064,030</td>
<td>$1,150,000</td>
<td>$1,150,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$8,184,846</strong></td>
<td><strong>$9,270,000</strong></td>
<td><strong>$8,470,000</strong></td>
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</table>

<table>
<thead>
<tr>
<th>Construction Cost Breakdown</th>
<th>Bauhaus Target Value</th>
<th>Bauhaus-Steel</th>
<th>Bauhaus-Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substructure</td>
<td>$327,394</td>
<td>$400,000</td>
<td>$425,000</td>
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<tr>
<td>Shell</td>
<td>$1,555,121</td>
<td>$1,550,000</td>
<td>$1,150,000</td>
</tr>
<tr>
<td>Interiors</td>
<td>$1,636,969</td>
<td>$1,250,000</td>
<td>$1,250,000</td>
</tr>
<tr>
<td>Services</td>
<td>$2,619,151</td>
<td>$2,350,000</td>
<td>$2,350,000</td>
</tr>
<tr>
<td>Equipment &amp; Furnishings</td>
<td>$245,545</td>
<td>$220,000</td>
<td>$220,000</td>
</tr>
<tr>
<td>Special Construction</td>
<td>$81,848</td>
<td>$150,000</td>
<td>$150,000</td>
</tr>
<tr>
<td>Building Sitework</td>
<td>$572,939</td>
<td>$550,000</td>
<td>$550,000</td>
</tr>
<tr>
<td>Indirect Cost</td>
<td>$1,145,878</td>
<td>$1,050,000</td>
<td>$1,050,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$8,184,846</strong></td>
<td><strong>$7,520,000</strong></td>
<td><strong>$7,145,000</strong></td>
</tr>
</tbody>
</table>
Building Cost

Bauhaus 2.0

- Indirect Cost: $1,050,000 to $1,145,878
- Building Sitework: $550,000 to $572,939
- Special Construction: $150,000 to $81,848
- Equipment & Furnishings: $220,000 to $245,545
- Services: $2,350,000 to $2,619,151
- Interiors: $1,250,000 to $1,156,969
- Shell: $1,150,000 to $1,555,121
- Substructure: $425,000 to $327,394

Colors:
- Bauhaus-Concrete
- Bauhaus-Steel
- Bauhaus Target Value
Local Businesses

“Native” = within 30 km radius

1. LOXAM (Equipment Rentals)
2. EUROLAM® (Glaziers)
3. Farbgestaltung (Paint and interiors)
4. Siloplan GmbH (Floors)
5. (Concrete)
6. Eisen Fischer (Steel)
Building Program Comparison

- Presettings Owner
  - Pebble
  - Bauhaus 2.0

Bar chart showing comparisons between different building programs, with categories such as Faculty Offices, Department Chair’s Office, Administrative Assistants, Faculty Lounge, Student Offices, Auditorium, Large Classrooms, Small Classrooms, Seminar Rooms, Instructional Labs, Server Room, Technical Support, Storage Rooms, and Café.
<table>
<thead>
<tr>
<th>Risk #</th>
<th>Risk name</th>
<th>Description</th>
<th>Consequences</th>
<th>Risk Allocation</th>
<th>Responsibility</th>
<th>Risk Management</th>
<th>Probability</th>
<th>Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Planning phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Dimensioning risk</td>
<td>wrong sizing of components (supports, girders, ...)</td>
<td>replanning, time schedule -&gt; increasing costs</td>
<td>X</td>
<td>A, E</td>
<td>good communication with engineers, very careful planning, quality management</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Requirement risk</td>
<td>incorrectly predicted user requirements (quantity, quality, functionality,...)</td>
<td>additional costs, schedule -&gt; increasing costs</td>
<td>X</td>
<td></td>
<td>requirements fixed in contract, good documentation, requirement analysis</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Financing risk</td>
<td>capital for intermediate or long-term financing cannot be applied</td>
<td>Risk for whole project, scheduling risk</td>
<td>X</td>
<td>X</td>
<td>all</td>
<td>well-thought finance plan, good documentation</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Permission risk</td>
<td>permission takes longer than expected</td>
<td>time schedule -&gt; increasing costs</td>
<td>X</td>
<td>all</td>
<td>good communication within team, go for partial permissions, stay in contact with authorities</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Risk of amendment and changing of standards</td>
<td>revise planning/calculations</td>
<td>time schedule -&gt; increasing costs</td>
<td>X</td>
<td>all</td>
<td>good documentation, forecasting</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Construction phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Flooding risk</td>
<td>flood occurs</td>
<td>additional costs for replacements and fine for site runoff</td>
<td>X</td>
<td>all</td>
<td>install flood protection systems, reduce damages caused by a flood</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Subsoil risk</td>
<td>contamination, soil conditions diverted</td>
<td>decontamination, new foundation concept, additional</td>
<td>X</td>
<td>X</td>
<td>C+E</td>
<td>effective research on soil conditions</td>
<td>1</td>
</tr>
</tbody>
</table>
## Risk Management

### Flooding risk

<table>
<thead>
<tr>
<th>Damage</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>□</td>
</tr>
<tr>
<td>MEDIUM</td>
<td>□</td>
</tr>
<tr>
<td>LOW</td>
<td>□</td>
</tr>
</tbody>
</table>

### PEBBLE

**Aqua Barrier**
- Windows above water level
- Impermeable facade material

### BAUHAUS

**Elevation**
- Windows above water level
- Problems with auditorium
Energy

Heating load calculation

<table>
<thead>
<tr>
<th>CONCEPT</th>
<th>HEATING REQUIREMENT (area-related)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pebble - Steel</td>
<td>10,62 kWh/(m²*a)</td>
</tr>
<tr>
<td>Pebble – Concrete</td>
<td>29,37 kWh/(m²*a)</td>
</tr>
<tr>
<td>Bauhaus – Steel</td>
<td>34,81 kWh/(m²*a)</td>
</tr>
<tr>
<td>Bauhaus - Concrete</td>
<td>35,82 kWh/(m²*a)</td>
</tr>
</tbody>
</table>

Seasonal irregularities
Energy

Block heating system

- Heating and electricity
- Subsidies by government
- Feed-in tariffs
- Sustainable

<table>
<thead>
<tr>
<th>CONCEPT</th>
<th>ANNUAL ENERGY COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pebble – Steel</td>
<td>$13,440/yr</td>
</tr>
<tr>
<td>Pebble – Concrete</td>
<td>$15,960/yr</td>
</tr>
<tr>
<td>Bauhaus – Steel</td>
<td>$25,200/yr</td>
</tr>
<tr>
<td>Bauhaus - Concrete</td>
<td>$24,080/yr</td>
</tr>
</tbody>
</table>
Water Supply

Water costs: $5,460/yr

→ Reduced by:

New costs: $3,080/yr

→ 44% savings
# O&M Costs

<table>
<thead>
<tr>
<th></th>
<th>Pebble – Steel [$/a]</th>
<th>Pebble –Concrete [$/a]</th>
<th>Bauhaus – Steel [$/a]</th>
<th>Bauhaus-Concrete [$/a]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaning costs</td>
<td>27.020</td>
<td>24.384</td>
<td>35.381</td>
<td>35.381</td>
</tr>
<tr>
<td>Energy costs</td>
<td>13.440</td>
<td>15.960</td>
<td>25.200</td>
<td>24.080</td>
</tr>
<tr>
<td>Water costs</td>
<td>3.080</td>
<td>3.080</td>
<td>3.080</td>
<td>3.080</td>
</tr>
<tr>
<td>Public dues</td>
<td>5.320</td>
<td>5.320</td>
<td>5.320</td>
<td>5.320</td>
</tr>
<tr>
<td><strong>OPERATION TOTAL</strong></td>
<td><strong>48.860</strong></td>
<td><strong>48.744</strong></td>
<td><strong>68.981</strong></td>
<td><strong>67.861</strong></td>
</tr>
<tr>
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## Total LCC

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Strengths:

• Alternate Transportation
• Smart Material Choices
• Innovated Design
• Natural Ventilation

Weakness

• Optimum Energy Performance
Bauhaus 2.0 - LEED

Strengths:
- Alternate Transportation
- Smart Material Choices

Weakness
- Green Energy Solutions
- Traditional Design
Interactive/Collaborative Meetings

Pre-Meeting Agendas

Real-Time Meeting Minutes

Weekly Meeting Leaders Rotation

Manager

Recorder

Meeting Order

New Weekly Tasks
“I need Something Stat!”

OK!

I’ve Put it in the X Folder Under My Discipline.

Thanks! Now I can finish my model accurately.
## Task Tracking

### Work Distribution Chart

#### Week 1

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Pebble
A: Concept inspired by Ilm River
Inviting native people in
Natural daylight
Natural ventilation

E: Tension piles as used in Germany

C: Use of local materials
Rent from local companies
Heat room during winter
Diverting excavated material to
local projects

L: Rainwater collection
Renewable Energy

Bauhaus 2.0
A: Relation to context
Reinterpretation of native arch.

E: Similar structure to surroundings

C: Use of local materials
Rent from local companies
Heat room during winter
Diverting excavated material to
local projects

L: Renewable Energy
Lower operating cost, more
money for the school
## Concept Decision Matrix

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<td></td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>OC:low heating effort</td>
<td></td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Low replacement costs</td>
<td></td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

| TOTAL | 244 | 231 | 238 | 241 |
Spider Web Comparison

**Pebble - Steel**

- Energy Efficient
- Low Flood Risk
- Constructability
- Cost Predictable
- Regular Grid
- Aesthetic Experience

**Pebble - Concrete**

- Energy Efficient
- Low Flood Risk
- Constructability
- Cost Predictable
- Regular Grid
- Aesthetic Experience

**Bauhaus 2.0 - Steel**

- Energy Efficient
- Low Flood Risk
- Constructability
- Cost Predictable
- Regular Grid
- Aesthetic Experience

**Bauhaus 2.0 - Concrete**

- Energy Efficient
- Low Flood Risk
- Constructability
- Cost Predictable
- Regular Grid
- Aesthetic Experience
What Worked?
What to Improve?

**What worked?**
Stepping out of the comfort zone
Innovative Solutions for the Big Ideas – following through with full potential

**What Needs Improvement?**
Tracking of IPD commitment lists – equal participation
Communication with owners and mentors
More interdisciplinary interaction