OSU Teaching and Learning Facility

Portland State University. School of Architecture

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Proposed Methodology

How do different glazing systems impact lighting loads?
- Measure the impact of different glazing systems against use of electric lights
- Create simplified building model in Vasari
- Export through Green Building Studio into EQuest
- Run energy analysis for all of the possible glazing schemes
- Create visual comparison

How do different glazing systems impact overall energy requirements?
- Measure the impact of different glazing systems in terms of overall energy use
- Create simplified building model in Vasari
- Export through Green Building Studio into EQuest
- Run energy analysis for all of the possible glazing schemes
- Create visual comparison

Actual Timeline

Boora Proposal
- Bringing Interior Circulation to the Perimeter
- Circulation Doubles as Informal Space
- Envelope as a “Permeable” Membrane

Design Ambitions
- Increased Student Retention
- Increased Graduation Rates
- More Active Learning Environment
- Spectrum of Learning Objectives
- Meet Campus Historical Requirements

Building Program
- 72K Sq. Feet
- Lecture Halls and Classrooms for 2500 seats
- Honors College Offices

Building Performance Priorities
- Low Energy Use
- Minimal Equipment
- Low Maintenance
- Budget Restraints
**Tools:**

The search for the ultimate performance evaluation software

- **Revit**
  - 3D and 2D parametric form of modeling. Architects and engineers use different forms based on their particular concerns (e.g., volumes vs. wall systems).
  - Several attempts were made to work starting with the Revit model provided by Boora.

- **Revit’s GBxml**
  - Export interface: the primary suggested route for bringing a model from Revit to Ecotect. This proved almost impossible, possibly because Ecotect is no longer supported updated program. GBxml is also the file type used by Green Building Studios.

- **Ecotect**
  - As of 2011 an unsupported platform for light and energy performance analysis. Uses gbxml, format (exportable from Revit).
  - A screenshot of the 3DS Max model in its complex mesh format.

- **3DS Max**
  - Autodesk’s 3D Modeling tool used as a trial for importing the Revit Model into Ecotect.

- **Vasari (beta)**
  - The offspring of Ecotect; a simplified version with fewer daylight evaluation functions. Suggested by PAE after finding that using Revit with Ecotect would not produce the desired analyses.

- **Green Building Studios**
  - Web-based software for analysing energy use and carbon footprint. Origin of the “GB” in gbXML.
  - Exports INP format for use in EQuest.

- **Rhino**
  - An alternative 3D Modeling software known for its ease of use with unconventional shapes and materials.

- **DIVA**
  - Plug-in for Rhino that performs Daylighting and Energy Analysis.

**EQuest**

Freeware overall building energy analysis tool. It ultimately proved to be the most successful attempt at finding usable energy usage data.

**Electric Consumption (kWh)**

- Area Lighting
- Task Lighting
- Misc. Equipment
- Exterior Usage
- Fans

**Annual Electricity Use (kWh x 1,000)**

<table>
<thead>
<tr>
<th>Glazing Coefficients</th>
<th>UVLT</th>
<th>SHGC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double Pane</td>
<td>613</td>
<td>95</td>
</tr>
<tr>
<td>12% Spandrel</td>
<td>611</td>
<td>96</td>
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<tr>
<td>40% White Frit</td>
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<tr>
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<td>606</td>
<td>98</td>
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<tr>
<td>Triple Pane</td>
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<td>99</td>
</tr>
<tr>
<td>40% Gray Frit</td>
<td>600</td>
<td>100</td>
</tr>
</tbody>
</table>

**Gas Consumption (Btu)**

- Water Heating
- HT Pump Supp.
- Space Heating
- Refrigeration
- Heat Reaction
- Space Cooling

**Annual Gas Use (Btu x 1,000,000)**

<table>
<thead>
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<tbody>
<tr>
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<tr>
<td>Triple Pane</td>
<td>328</td>
<td>60</td>
</tr>
<tr>
<td>40% Gray Frit</td>
<td>330</td>
<td>61</td>
</tr>
</tbody>
</table>

**Annual Heating Energy (BTUs x 1,000,000)**

<table>
<thead>
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</thead>
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<td>12% Spandrel</td>
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<tr>
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<tr>
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<td>99</td>
</tr>
<tr>
<td>40% Gray Frit</td>
<td>553</td>
<td>100</td>
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</table>

**Annual Cooling Energy (Watts x 100)**

<table>
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<td>12% Spandrel</td>
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<td>80% White Frit</td>
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<tr>
<td>Triple Pane</td>
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<tr>
<td>40% Gray Frit</td>
<td>276</td>
<td>286</td>
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</tbody>
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**Annual Lighting Load (kWh x 1,000)**

<table>
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<tbody>
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<tr>
<td>40% Gray Frit</td>
<td>1048</td>
<td>1389</td>
</tr>
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**Sample export from Ecotect, Double Pane Glazing, 12 Month University Schedule.**

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**EQuest Model screen shot.**

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