The Weidt Group: Daylighting Design using Radiance

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Annual Radiance Workshop, Montreal
August 11-12, 2005

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Office Building, IA
Conclusions
Introduction to The Weidt Group

- Energy, sustainability and daylighting consulting since 1977
- Integrated daylighting and whole building energy analysis
- Software development
Daylighting Design Tools

- Physical models
- Custom spreadsheet calculations
- DOE-2
- Lumen Micro
- Lumen Designer*
- Lightscape*
- Radiance
Daylighting projects:

Building Types

- Institutions - schools, colleges
- Offices
- Retail stores
- Recreation facilities
Daylighting Projects: Output Parameters

- Illuminance
- Luminance
- Contrast issues
- Uniformity ratios
- Rendered Images
- Sun penetration
- Energy efficiency
Daylighting Projects: Challenges

- Project phase / schedules
- Time used for analysis
- Comprehension of radiance output (making it easy to understand for the clients)
Case Studies

- Diverse projects with distinct tasks
- Unique output requirements
- Different project timeframes

Therefore,

- Specific analysis approach
Case Studies: 
Swimming Pool, New Mexico

- Existing pool
- Glare and contrast issues
- Detailed luminance analysis
- Visual comparison
- Possible solutions
Case Studies: Swimming Pool, New Mexico

In collaboration with The Derringer Group
Case Studies: 
Swimming Pool, New Mexico

In collaboration with The Derringer Group
Case Studies: Swimming Pool, New Mexico

In collaboration with The Derringer Group

**Option 1**
- 65% Surface Reflectance, Skylight Reflector, External Canopy and Trees

**Option 2**
- 90% Surface Reflectance, Skylight Reflector, External Canopy and Trees, Transparent Glass

**Option 3**
- Existing
# Case Studies:
Swimming Pool, New Mexico

Luminance and contrast ratio comparison

<table>
<thead>
<tr>
<th>Location</th>
<th>Base Candela Readings</th>
<th>Base Contrast Ratios</th>
<th>Option1 Candela Readings</th>
<th>Option1 Contrast Ratios</th>
<th>Option2 Candela Readings</th>
<th>Option2 Contrast Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ceiling Left</td>
<td>13.246</td>
<td>1.09</td>
<td>19.69</td>
<td>2.20</td>
<td>31.146</td>
<td>2.38</td>
</tr>
<tr>
<td>2. Ceiling Top</td>
<td>17.542</td>
<td>1.44</td>
<td>29.893</td>
<td>3.34</td>
<td>49.762</td>
<td>3.81</td>
</tr>
<tr>
<td>3. Upper Wall at end</td>
<td>11.993</td>
<td>1.01</td>
<td>13.962</td>
<td>1.56</td>
<td>22.733</td>
<td>1.74</td>
</tr>
<tr>
<td>4. Lower Wall at end</td>
<td>23.091</td>
<td>1.90</td>
<td>6.623</td>
<td>1.35</td>
<td>7.876</td>
<td>1.66</td>
</tr>
<tr>
<td>5. Floor Deck at right</td>
<td>1.253</td>
<td>9.71</td>
<td>1.074</td>
<td>8.33</td>
<td>6.265</td>
<td>2.09</td>
</tr>
<tr>
<td>6. Floor Deck at left</td>
<td>4.117</td>
<td>2.96</td>
<td>1.432</td>
<td>6.25</td>
<td>1.79</td>
<td>7.30</td>
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<tr>
<td>7. Pool surface right</td>
<td>10.024</td>
<td>1.21</td>
<td>24.344</td>
<td>2.72</td>
<td>25.955</td>
<td>1.99</td>
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<tr>
<td><strong>8. Pool surface middle</strong></td>
<td><strong>12.172</strong></td>
<td><strong>1.00</strong></td>
<td><strong>8.95</strong></td>
<td><strong>1.00</strong></td>
<td><strong>13.067</strong></td>
<td><strong>1.00</strong></td>
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<tr>
<td>9. Window right</td>
<td>780.261</td>
<td>64.10</td>
<td>147.854</td>
<td>16.52</td>
<td>86.457</td>
<td>6.62</td>
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<tr>
<td>10. Pool reflection right</td>
<td>767.194</td>
<td>63.03</td>
<td>128.343</td>
<td>14.34</td>
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<tr>
<td>11. Window left</td>
<td>920.239</td>
<td>75.60</td>
<td>173.63</td>
<td>19.40</td>
<td>60.323</td>
<td>4.62</td>
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Case Studies:
Grocery Store, Iowa

- Prototypical buildings
- Bright spaces preferred
- Energy efficiency
- Uniformity & glare
Case Studies:
Grocery Store, Iowa

Skylights

Monitor
Case Studies:
Elementary School, Iowa

- Classroom spaces
- North vs. South monitors
- Uniformity & glare
- Energy efficiency
Case Studies:
Elementary School, Iowa

South facing monitor

North facing monitor
### Case Studies: Elementary School, Iowa

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Sky Conditions</th>
</tr>
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<tbody>
<tr>
<td>March 21, 1200 PM</td>
<td>cloudy sky</td>
<td>Daylight Fact Avg: 4.5</td>
</tr>
</tbody>
</table>

#### South facing monitor

<table>
<thead>
<tr>
<th>Time Slot</th>
<th>Daylight Fact Avg</th>
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<tbody>
<tr>
<td>2:00 PM</td>
<td>4.5</td>
</tr>
<tr>
<td>3:00 PM</td>
<td>4.5</td>
</tr>
<tr>
<td>4:00 PM</td>
<td>4.5</td>
</tr>
<tr>
<td>5:00 PM</td>
<td>4.5</td>
</tr>
</tbody>
</table>

#### North facing monitor

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<tr>
<td>2:00 PM</td>
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Case Studies:
Elementary School, Iowa
Case Studies:
Library, New Mexico

- Optimization of clerestory configurations
- Illuminance in stack areas
- Different sky conditions
- Energy efficiency
Case Studies: Library, New Mexico

Library: Illuminance in footcandles on work-plane on March 21, 12:00 noon

- 3'-8" clerestory (clear)
- 3'-8" clerestory (cloudy)
- 4'-8" clerestory (clear)
- 4'-8" cs(cloudy)

Distance (ft) vs. footcandles

North South

LIBRARY

Stacks

Interior view
Case Studies: Office building

Cloudy sky

Clear sky

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Case Studies: Office building
Case Studies: Architecture Studio, New Mexico

Base section

20 deg cut-off

17.5 deg cut-off
Conclusion

Even though Larry got beat up pretty bad at the jury.....he somehow felt good inside knowing that his project was the only one which could be evaluated by any microcomputer daylighting program.

by Tom McDougal