LIGHTING CONDITIONS IN BUILDINGS

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Improved Design
Parameters Improved

- Building envelope
- Windows
- Accessability
- Interior layout
- PV's added
- Shading device
- Glare issues
- Daylight harvesting
Design Builder

Energy consumption

- Dynamic energy simulation program
- Detailed building model
- Facade options / Building materials
- Renderings
- Energy use
- Daylight
- HVAC system
- Building regulations
- BREEAM
Energy Consumption

Energy savings: -52%

Predicted Percentage Dissatisfied

- 21-26%
- Up to 62%

Current conditions

- 17-20%
- 24-28%

Improved model
Daylight Harvesting

- Increased reflectances of interior surfaces
- Increased reflectances of balconies' surfaces
- Placing of light shafts
- Removing of wall between staircase and hallway
- Placing of difussive glass partition walls
Ecotect

- Variety of building modeling options
- Analyse electrical lighting conditions
- Daylighting
- Solar irradiation
- Shading
- Reflections
- Sun path diagram
- Used for Daysim/Radiance

Continuous Daylight Autonomy

Current case

Improved model
Shading Devices

- Placing a static shading device: balconies
- Adjusting the depth of the static shading device
- Placing a dynamic shading device: venetian blinds

Solar Shading

- Effects of different sunshading devices analysed
- Without shading device: DF > 20%
- With static shading device: DF > 10%
- With static + dynamic device: DF < 10%
Parametric Study – Hallway

<table>
<thead>
<tr>
<th>Description</th>
<th>DF</th>
<th>DA_v.</th>
<th>Energy need</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base case</td>
<td>0.04%</td>
<td>4.10%</td>
<td>93.49 kWh/m²</td>
</tr>
<tr>
<td>Fixed light-well + stairs</td>
<td>1.01%</td>
<td>59.20%</td>
<td>52.99 kWh/m²</td>
</tr>
<tr>
<td>Skylight placed accordingly</td>
<td>1.45%</td>
<td>61.20%</td>
<td>50.36 kWh/m²</td>
</tr>
<tr>
<td>Fixed light-well + stairs</td>
<td>2.18%</td>
<td>66.00%</td>
<td>42.21 kWh/m²</td>
</tr>
<tr>
<td>Skylight placed from one end to the other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stairs in straight line from 1st to 4th floor</td>
<td></td>
<td></td>
<td>55%</td>
</tr>
<tr>
<td>Skylight placed from one end to the other</td>
<td></td>
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</tbody>
</table>

Design Builder – Radiance

Glare Assessment
Light Patches

December 21st

March 21st

June 21st

Glare Assessment – Critical Cases

December 21st - 15:00
1. 4:1
2. 2:1
3. 19:1
DGP: 25%
DGP: 0.61%

March 21st - 12:00
1. 2:1
2. 2:1
3. 14:1
DGP: 33%
DGP: 0.61%

March 21st - 15:00
1. 3:1
2. 3:1
3. 6:1
DGP: 26%
DGP: 0.63%

20:1 Window – adjacent walls
5:1 Computer screen – general surroundings
3:1 Computer screen – desk
THANK YOU
QUESTIONS?

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