Daylighting in Museums

Radiance Workshop 2005 – 11 August 2005, 9:30 a.m.
Matt Franks – Arup Lighting
Overview

• Why use daylight in museums?
• Conservation Considerations
• Lighting Considerations
• Case Studies:
  • Rothko Chapel, Houston, Texas
  • Seattle Art Museum
Why Use Daylight in Museums?

- Better Color Rendering
- Fuller Spectrum

Foundation Beyeler, Switzerland
Why Use Daylight in Museums?

- Better Color Rendering
- Fuller Spectrum
Why Use Daylight in Museums?

• Connection to the outside

Tate Modern, London, UK

The Nasher Sculpture Center, Dallas, TX
Conservation Considerations

- Exposure to sunlight
- Exposure to diffuse daylight
- Exposure to UV
Conservation Considerations - Direct Sunlight

- Generally, all direct sunlight should be avoided.
- Shading systems can allow diffuse light and block all direct sunlight.

High Museum of Art, Atlanta, Georgia

The Nasher Sculpture Center, Dallas, Texas
## Conservation Considerations - Diffuse Daylight

<table>
<thead>
<tr>
<th></th>
<th>50 lux</th>
<th>100 lux</th>
<th>50 lux</th>
<th>150-200 lux</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Works on Paper</strong></td>
<td>Works on paper with colored media, Any media on a degraded support, Color photo prints and transparencies</td>
<td>Works on paper with black and white media only, Black and white photographs</td>
<td>Thinly covered paintings on unprimed canvas, Paintings in distemper media or gouache, miniatures</td>
<td>Oil and tempera paintings</td>
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<tr>
<td><strong>Paintings</strong></td>
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</table>
## Conservation Considerations - Diffuse Daylight

<table>
<thead>
<tr>
<th>Objects</th>
<th>50 lux</th>
<th>Objects with painted, dyed or polychromed surfaces, Upholstered furniture, Unstable glass</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200 lux</td>
<td>Objects made of material such as leather and wood</td>
</tr>
<tr>
<td></td>
<td>1000-2000 lux</td>
<td>Objects made of inorganic material with unpainted surfaces such as stone, ceramic and metal</td>
</tr>
</tbody>
</table>

Gary Thomson, “The Museum Environment”
Conservation Considerations - Diffuse Daylight

• 650,000 lux-hours maximum recommended for oil and tempera paintings and objects made of wood or leather

• 150,000 lux-hours maximum recommended for textiles, colored works on paper, photographs
Conservation Considerations - Exposure to UV

• Limit by using UV filters in glazing

High Museum of Art, Atlanta, Georgia
Lighting Design Considerations

• Uniformity over vertical flat viewing surface - 2:1 average to minimum is ideal
• Uniformity for 3-D objects not as important
• Minimize glare by reducing reflections and bright surfaces such as unshielded lamps and windows
Rothko Chapel

- Houston, Texas
- Commissioned design by Rothko with Philip Johnson
Rothko Chapel

- Original Design
Rothko Chapel
Rothko Chapel
Rothko Chapel

- Revised Design
Rothko Chapel

- Revised Design
Seattle Art Museum

- Downtown Seattle, Washington
- Allied Works Architecture
- Addition to existing Venturi building, including high-rise tower
Seattle Art Museum
Seattle Art Museum
Seattle Art Museum

- 3D model of site and building
Gallery Analysis

- Top-lit
Gallery Analysis

- Lightbox
Gallery Analysis

- View gallery
Gallery Analysis

• View gallery
Gallery Analysis

- Sidelit gallery
Annual Exposure Study

- Typical art hanging point in gallery
- Daysim add-in
- Hourly illuminance values for typical year
Exterior Illuminance

Seattle Art Museum
Available Exterior Illumination Throughout Year
(All hours)

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
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</thead>
<tbody>
<tr>
<td>10000</td>
<td>8000</td>
<td>6000</td>
<td>4000</td>
<td>2000</td>
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</tr>
</tbody>
</table>

- Hourly Exterior Global Illuminance
Museum Open Hours - 1,500,000+ lux-hours
Seasonal Shading + Switching - 569,000 lh
Automatic Shading + Switching - 555,000 Lh

Interior Illuminance Plot – Hourly Measurements

Vertical Illuminance (Lux)

Month

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Seasonal Shading + Dimming - 501,000 lh

Interior Illuminance Plot – Hourly Measurements

Vertical Illuminance (Lux)

Month

Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
Automatic Shading + Dimming - 464,000 lh

Interior Illuminance Plot – Hourly Measurements

Vertical Illuminance (Lux)

Month

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec