Re-Arch: The Initiative for Renewable Energy in Architecture

Fact Sheet

Technology: Daylighting

Common Uses:

Daylighting takes advantage of available sunlight to meet some or all of a building's illumination needs during daytime hours. "Cool" daylighting refers to utilizing the luminance of the sun without introducing the heat associated with direct sunlight, to minimize cooling needs. To be effective, daylighting must be configured with a lighting control strategy for artificial lighting in the building.

Site Considerations:

Orient the building to maximize daylighting potential, with a thinner massing to maximize perimeter space. "Narrow" is better than "deep" for side-lighting. Deeper configurations require top-lighting or core-lighting, in addition to side-lighting. Account for shading from adjacent buildings and trees and consider the reflectance from adjacent surfaces.

Size Considerations:

Reduce installed lighting as part of the overall daylighting strategy. Concentrate artificial lighting for task, rather than, ambient purposes. Optimally size overhangs on south-facing glazing to reduce cooling loads and prevent glare. Make rooms no deeper than 2 to 2.5 times the head height of the window for side-lighting. Consider a glazing area of 15 to 20% of the daylight zone floor area, or between 25 to 40% of the perimeter wall area.

Design Considerations:

Concentrate on the most utilized spaces and elongate room to maximize side-lighting opportunity. Use continuous rather than "punched" windows and select the right glazing. Maximize south glazing, minimize east and west facing glass, and avoid uncontrolled skylights. Don't count on view glass, due to potential blockage. North facing windows provide diffuse light and south facing windows are easily shaded due to higher sun angles. East and West windows are least favorable. Eliminate direct beam radiation and avoid direct sunlight on task areas. Minimize contrast, select light colors for interior finishes and reflective ceilings. Raised ceiling height at window increases daylight depth. Sloped ceilings bounce light deeper. Raise window head flush with the ceiling plane and minimize the depth and compartmentalization of the ceiling cavity. Consider roof monitors for top-lighting and light-shelves for side-lighting. Use continuous dimming controls if possible, otherwise use stepped dimming.

System Costs:

Daylighting costs can be incrementally higher with sophisticated control systems, dimmable fixtures and ballasts. The energy savings from switched-off artificial lighting can often offset the cost of the extra control measures. Exterior shading devices and light-shelves can add additional cost.

More Information:

There are several books and reference guides that outline basic principles of daylighting design. In addition, there are several web-based sets of guidelines. Many of these have downloadable case studies and design briefs. Several websites have detailed performance data for different occupancy types.

Books and Resources:

- Tips for Daylighting with Windows, Lawrence Berkeley Laboratory, www.lbl.gov
- Daylighting Guide for Canadian Commercial Buildings, Natural Resources Canada, www.advancedbuildings.org
- Guide for Daylighting Schools, Innovative Design, 2004, Lighting Research Center – RPI, www.lrc.rpi.edu
- Window Systems for High-Performance Buildings, Stephen Selkowitz, Eleonor Lee, Dariush Arasteh, Todd Wilmert & John Carmody, Norton, 2003, ISBN 978-0393731217
- Residential Windows: A Guide to New Techonologies and Energy Performance, John Carmody, Stephen Selkowitz, Dariush Arasteh & Lisa Heschong, Norton, 2000, 2007, ISBN 978-0393732252
- Daylighting for Sustainable Design, Mary Guzowski, McGraw-Hill, 1999, ISBN 978-0070254398
- Daylighting Performance and Design, Gregg Ander, Wiley, 2003, ISBN 978-0471262992
- Daylighting: Natural Light in Architecture, Derek Phillips, Architectural Press, 2004, ISBN 978-0750663236
- Daylighting Design and Analysis, Claude Robbins, Van Nostrand Reinhold, 1986, ISBN 978-0442279493

Websites:

- Whole Building Design Guide wbdg.org
- U.S. DOE Energy Efficiency & Renewable Energy eere.energy.gov
- Daylighting Collaborative daylighting.org
- National Renewable Energy Laboratory nrel.gov/docs/fy02osti/30769.pdf
- Lawrence Berkeley Laboratory windows.lbl.gov
- Lawrence Berkeley Laboratory - IEA gaia.lbl.gov/hpbf
- Natural Resources Canada advancedbuildings.org
- Environmental Building News buildinggreen.com
- Energy Design Resources energydesignresources.com
- Iowa DNR Sustainable Initiative iowadnr.com/energy/sustainable/files/model.pdf
- Lighting Research Center – RPI www.lrc.rpi.edu
- Innovative Design innovativedesign.net
- The Weidt Group theweidtgroup.com
- Archi-Physics Solar Tools archiphysics.com
- Heschong Mahone Group h-m-g.com
- Seattle City Light ci.seattle.wa.us/light/conserve/sustainability
- Johnson Controls Corporation johnsoncontrols.com/cg/PersEnv/pe_whitepaper.htm
- Solatube Corporation solatube.com/com_daylightingfacts.php
- Velux Corporation thedaylightsite.com

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