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:

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-q.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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