Light Shelves

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Definition

• A light shelf is a passive architectural device that permits daylight to enter deep into a building. Light shelves may be interior or exterior; exterior light shelves may also function as sunshades.
Main Uses

• Highrise office
• Lowrise office
• Institutional

Building Types

• New Construction
• Retrofit
Cost
– Highly dependent on the design.

Benefits
– enhances daylight quality conserves energy by allowing artificial lighting to be dimmed or turned off
– increases occupant comfort and productivity

Limitations
– requires higher than average floor-to-ceiling height to be effective (e.g. 3 m)
– increases maintenance
– requirements window coverings must be coordinated with light shelf design
• Light shelves most effective with direct sunlight. Southern exposed windows benefit the most with lighting, however are challenged by heat gain.
• The light shelf is typically constructed of lightweight material.

• The light shelf upper surface should be matte white or diffusely specular to reflect light up to the ceiling.

• The ceiling should also have a high reflective coefficient to bounce light further into space.

• Light shelves’ lower surface (the surface seen by occupants) is treated to suit the room’s interior design.
Beware of too much reflection: The upper surface should not be shiny or reflective as this results in bright spots of light reflected on the ceiling with resulting glare. The surface of the ceiling should be light in color.

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• The light shelf design should be integrated with the building’s fenestration and should be expected to last as long as possible.

• Ideally it should be demountable so that components can be re-used or recycled in the future.
Typical installations

1. tempered laminated glass light shelves suspended by steel cables

2. fabric light shelves stretched over aluminum tubes

3. assemblies of "off-the-shelf" components for easy retrofitting

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Advantages

• There is a growing body of experience that suggests workplace productivity is increased in work environments that include natural lighting. In addition, the cost of building operation can be reduced in direct proportion to the amount of electricity saved by dimming or turning off perimeter lighting when daylight permits.
• Artificial lighting can be dimmed or turned off without the provision of light shelves, but the daylight will not penetrate as deeply into the space.
• Light shelves allow daylight to penetrate the space up to 2.5 times the distance between the floor and the top of the window.
• Advanced light shelves increase this distance up to four times
Energy Saving Potential

Light shelf systems provide useful daylighting of a zone that lies along the exterior wall.

The width of this zone depends on the:

- height of the top of the window,
- orientation of the window
- latitude of the site
- time of day
- clarity of the sky.
As with any kind of daylighting, the daylight entering the space becomes heat energy.

This increases the cooling load in warm weather and reduces the heating load in cold weather.

Light shelves disperse sunlight fairly efficiently, so the amount of heat energy added to the space is not much greater than would be added by an equivalent amount of electric lighting.
Industry Usage

“Although daylighting is becoming standard practice and glazing technology has become very advanced, light shelves are not common. As data increases on occupant productivity, it is expected that the benefits of light shelves will gain wider recognition. The related requirement for increased ceiling height is critical, and the justification for this increased height depends on several interrelated environmental issues including natural cooling and ventilation, thermal mass and night "flushing" to name a few.”

http://www.advancedbuildings.org/main_t_lighting_light_shelves.htm
Industry Potential

• Due to the relatively low cost of energy in North America, applications of light shelves are in early stages of development. Several current examples range in success. To date there has not been a rigorous effort to develop a coordinated design rationale.
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