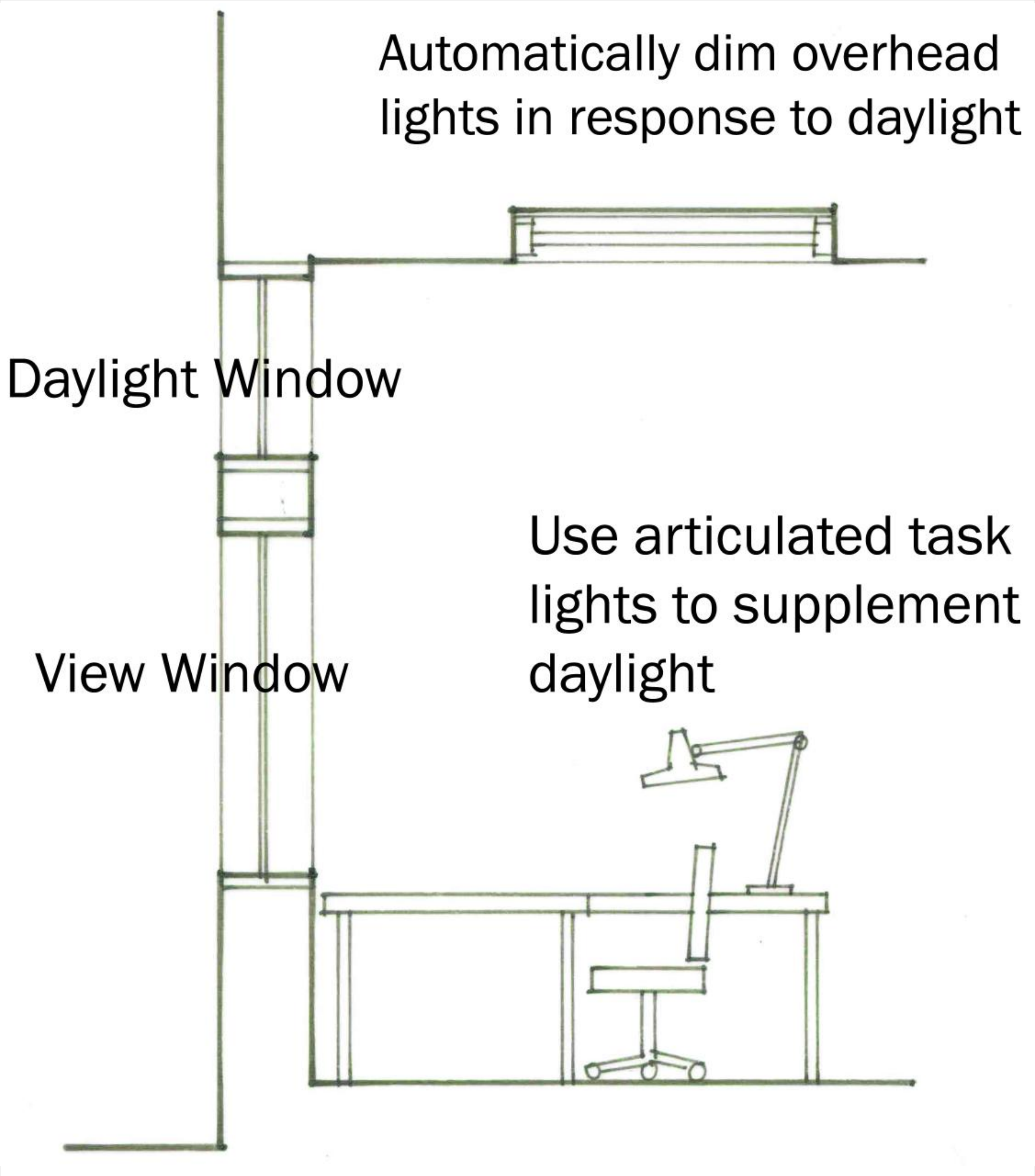
AEDG Implementation Recommendations: Daylighting Good Design Practice

The Advanced Energy Design Guide (AEDG) seeks to achieve 30 percent savings over Standard 90.1-1999. This guide focuses on improvements to small office buildings, less than 20,000 square feet. The recommendations below are adapted from the implementation section of the guide, and should be used in cooperation with the whole document.* The full design guide is available from the ASHRAE website, Advanced Energy Design Guide for Small Office Buildings .

Savings and Occupant Acceptance

Daylighting will only save energy if the electric lighting consumption is reduced, and heat gain and loss through glazing is controlled. In addition, glare and contrast must be controlled so occupants are comfortable and will not override electric lighting controls. See additional comments related to window design and placement.

Occupancy Sensors and Task Lighting



Use of "manual-on" occupancy sensors in daylighted spaces saves energy because electricity is not automatically consumed unnecessarily. Use of local articulated task lights (desk lamps that can be adjusted in three planes) in daylighted spaces increases occupant satisfaction and is an effective supplement for daylighting.

Surface Reflectances

The use of light-colored materials and matte finishes in all daylighted spaces increases efficiency through interreflections and greatly increases visual comfort.

Furniture Partitions

Lower furniture partitions in open plan office areas increase the efficiency of both the day lighting and the electric lighting system, by reducing absorption and unwanted shadows.

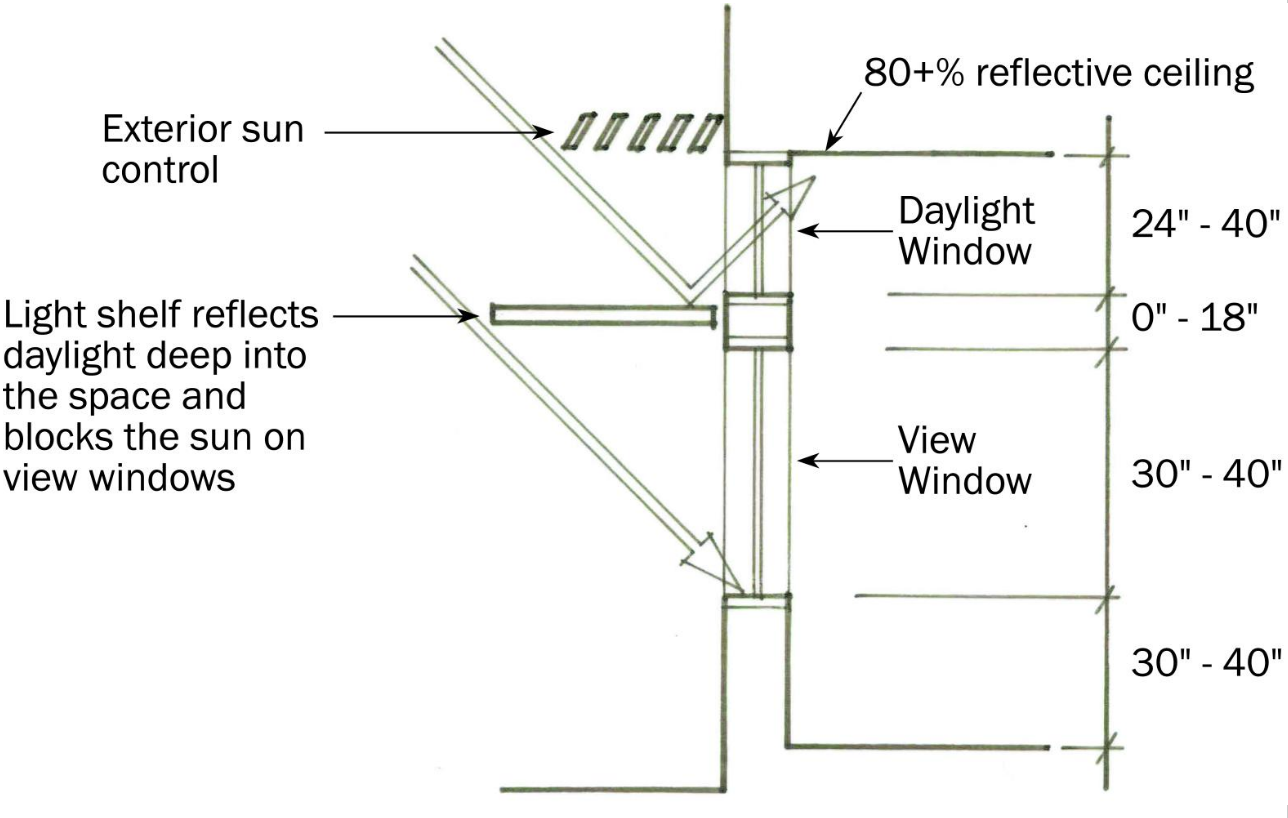
Daylighting is more cost effective if open plan workstations are located on the north and south side of the building since open plan areas are more continuously occupied and achieve lower savings from occupancy sensors. The open configuration also absorbs less light, and inter-reflections provide a more uniform distribution of light deep into the space. The control of heat and glare on the east and west facades is difficult, because daylight and views are blocked in an effort to properly control the low sun angles. By placing private offices on the east and west, occupants can individually control their blinds, and thereby control thermal discomfort and glare.

Control of Direct Sun Penetration

- Shield workspaces from direct sun
- Use interior vertical slat blinds to control glare and low angle sun penetration, particularly on east and west facing glazing
- For "top lighting", use north facing clerestories to control direct sun

- For skylights, use light reflecting baffles and/or diffusing glazing to control direct sun

Daylighting utilizes light from the sky, either in its brightest intensity on a clear sunny day or in a diffuse form on a cloudy or hazy day. Patches of direct sunlight in the employees" view create unacceptable brightness and excessive contrast between light and dark room surfaces. Exterior sun control or overhangs help reduce both glare and heat gain for vertical glazing surfaces.

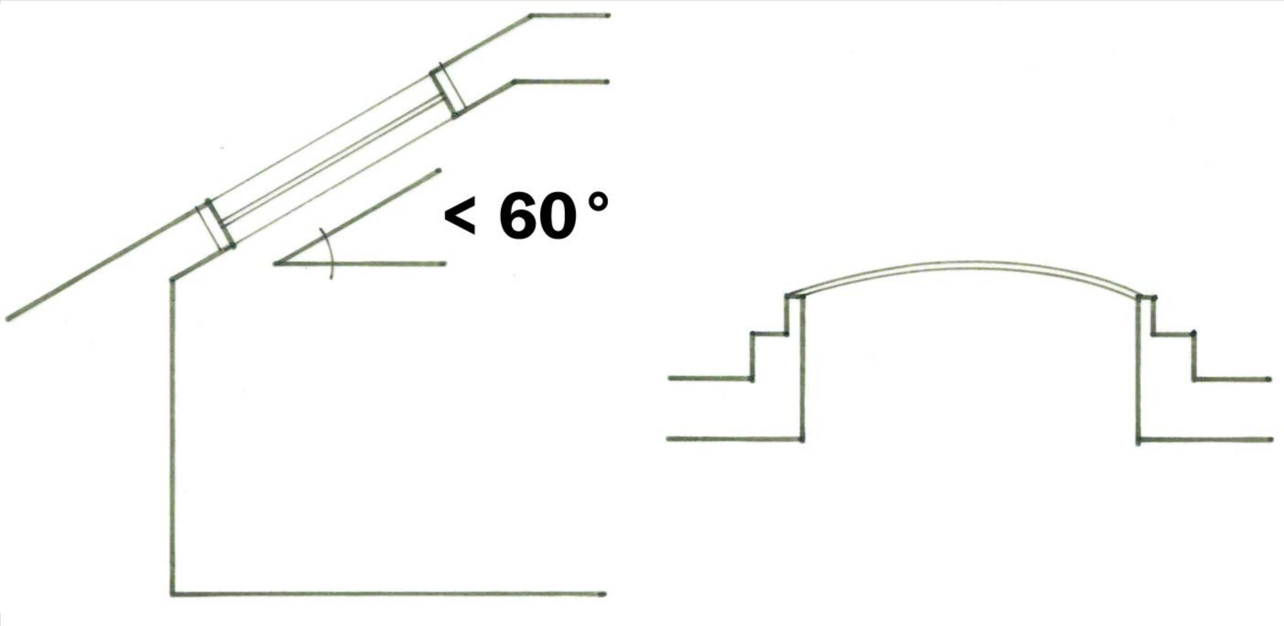


An exterior overhang needs to be deep enough to shield windows above the light shelf (if used) from direct sun. The light shelf should also be deep enough to shield windows below the shelf from direct sun.

Orientation of Workstations to Vertical Glazing

Orient workstations with computer monitors at 90° (±30°) to windows. It is visually stressful for workers to view a computer monitor while simultaneously viewing a bright sunlit scene outside the window, as is dealing with the reflection in a computer screen from a bright window or skylight. Workstations should be oriented to avoid either of these conditions. At the very least, the workers should have the ability to tilt and swivel their computer monitors.

Skylight Thermal Transmittance



Hot Climates

- Reduce thermal gain during the cooling season by using skylights with a low overall thermal transmittance. This overall U-factor includes the glazing only.
- Use north-facing clerestories for skylighting whenever possible in hot climates to eliminate excessive solar heat gain and glare.
- Shade skylights on south-, east-, and west-oriented sloping roofs with exterior sun control such as screens, baffles, or fins.
- Use smaller aperture skylights in a grid pattern to gain maximum usable daylight with the least thermal heat transfer.

Moderate and Cooler Climates

- Reduce summer heat gain as well as winter heat loss by using skylights with a low overall thermal transmittance. The overall U-factor includes the glazing as well as the frame and/or curb. Use a skylight frame that has a thermal break to prevent excessive heat loss/gain and winter moisture condensation on the frame. Insulate the skylight curb above the roof line with continuous rigid insulation.
- Use either north- or south-facing clerestories for skylighting but not east or west. East-west glazing adds excessive summer heat gain and makes it difficult to control direct solar gain. Clerestories with operable glazing may also help provide natural ventilation in temperate seasons when air conditioning is not in use.
- Use skylights with smaller apertures in a grid pattern to gain maximum usable daylight with the least thermal heat transfer. Do not exceed maximum prescribed glazing area.

Interactions

Thermal gains and losses associated with windows should be balanced with daylight-related savings achieved by reducing electric lighting consumption.
