A Guide to Selecting Window and Glazing Options for Florida Buildings

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The amount of energy required to heat or cool a building can be significantly affected by the number, size, orientation, and energy efficiency of glass windows and doors. Heat gains and losses through glass result from solar radiation, or energy, coming directly from the sun (electromagnetic waves); conduction, or heat transfer, from the hot to the cool side of glass; and convection, or infiltration, which occurs when hot air replaces cool air, or vice versa. Glass windows and doors can account for between 30 and 60 percent of a building's total heat gain in the summer. Consequently, considerable energy savings can be obtained through proper design and placement of glass windows and doors.

SOLAR RADIATION

In the summer, most of the heat gain through glass results from solar radiation, or sunlight, rather than from conduction and infiltration. Solar radiation can originate in any combination of direct or diffuse sources. Direct solar radiation results from sunlight hitting the glass. In clear glass, about 8 percent of this energy is reflected back outdoors, a portion is absorbed by the glass (depending upon its composition), and the remainder passes directly indoors.

Diffuse solar radiation is sunlight reflected from other objects such as pavement, lakes, sand, trees, and sky particles. Depending on the surface from which this sunlight is reflected, diffused radiation can equal as much as 30 percent of the total radiation component. Sunlight is short-wave radiation, which passes through clear glass surfaces fairly easily. After striking objects within the building such as the floor, curtains, or furniture, solar energy transforms into long-wave infrared radiation. The heat becomes trapped because it cannot pass back through glass efficiently. This phenomenon is called the "greenhouse effect."

The amount of solar radiation coming through glass areas is directly affected by regional factors such as brightness and the angle of the sun. As much as 270 British thermal units (heat units called BTUs) of direct and diffused solar radiation can enter a home or buildings through each square foot of glass. In other words, if sunlight strikes only 50 square feet of a clear glass window on a west wall, the cooling effect of more than one tone of air conditioning is required to remove the heat gained from this source alone. This is more than eight times the heat gain caused by conduction and infiltration. Even windows facing other directions may have twice as much indirect radiant heat gain than that from conduction and infiltration combined.

The amount of heat gained due to conduction depends on the temperature difference between indoor and outdoor air. The heat gain or loss due to infiltration is affected by the velocity and the direction of air flow through cracks around glass areas (see the window drawings).

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Installing solar screens or tint having a low shading coefficient (S_c) may be an attractive energy-saving option for windows. The lower the shading coefficient, the more efficient the screen or tint is at reducing solar radiation. Clear glass has an S_c of 1, while some of the better solar screens or films have an S_c of 0.2. An S_c of 0.2 would reduce the solar radiation by 80 percent.

The most attractive feature of double-paned or insulated glass is its ability to reduce conductive heat transfer by lowering the "coefficient of heat transmission" (U). The lower the (U) value, the more effective the glass is in reducing conductive heat transfer. Insulated glass also has other benefits, such as reducing airborne noise from traffic or airports and reducing condensation that may occur on particularly cold days.

Installing insulated glass in northern Florida buildings is worthwhile because of the colder winter conditions and the high temperature differences between indoor and outdoor air. In other areas of Florida, insulated glass may not be as cost effective. Costs and benefits should be closely examined before making a decision.

BIBLIOGRAPHY

