VIRACON®

GLASS IS EVERYTHING™

TECH TALK

THE ROLE OF REFLECTIVITY IN GLASS SELECTION

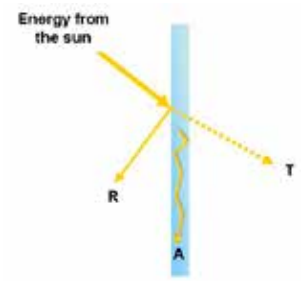
THE ROLE OF REFLECTIVITY IN GLASS SELECTION

This Tech Talk provides information to help understand the role reflectivity plays when selecting glass for a building façade.

introduction

WHAT IS REFLECTIVITY?

The solar spectrum encompasses all energy coming from the sun and is made of three components; visible, infrared and ultraviolet. Visible is light you see when looking at the sun, infrared is the heat you feel on your skin and ultraviolet fades fabrics and deteriorates plastic. When these three components hit glass on a building they are reflected from the surface (R), transmitted through the glass (T) or absorbed into the glass (A).



As building facades become more complex it is increasingly necessary to understand not only what the sun brings through a building façade, but also what happens to light reflected from its surface. Reflectivity, as it will be discussed in this Tech Talk, is the visible portion of the sun's energy being reflected from the glass on the exterior of a building.

REFLECTIVITY AND CODES

Today, codes limiting exterior reflectance of glass products on buildings are intended to minimize hindrances caused by sunlight. For example, a driver's visibility may be impaired if excess sunlight is reflected from a building into their car. In some cities, this has resulted in implementation of codes limiting reflectivity near specific roadways. The codes are intended to minimize the chance of reflected sunlight impairing driver visibility.

Although deterring obstacles caused by sunlight is necessary, the complexity of reflectivity goes well beyond referencing an exterior reflectance percentage limit. A building code written with terminology such as *"glass to have no greater than XX% reflectivity" or "glass shall have a maximum exterior visible reflectivity of XX%"* falls short because it doesn't take into account all characteristics of reflectivity.

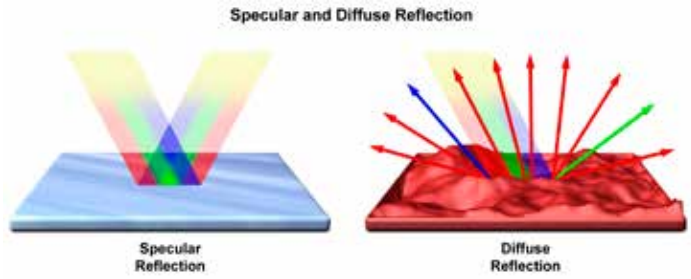
Utilizing a single percentage value in an attempt to control sunlight also needlessly restricts the use of some very energy efficient glass products.

Within a glass product's exterior reflectance value a portion of the reflectance is specular and a portion is diffuse. The specular reflection is much more likely to be a disturbance than the diffuse reflection. Therefore, a single exterior reflectance value is not an accurate predictor for the likelihood of issues to occur. A building code limiting the amount of specular reflectivity would provide a more realistic way to address concerns.

SPECULAR VERSUS DIFFUSE REFLECTION

Specular reflection occurs when the sun's light is directly reflected so the angle of incidence equals the angle of reflection. Since the sun's rays are reflected together, there is less opportunity to reduce reflectivity concerns.

Diffuse reflection occurs when the sun's light is re-directed in multiple directions after hitting a surface. This scattering reduces the amount of light reflecting in a single direction so the potential interference the reflected sunlight is reduced.



Selecting glass to reduce specular and increase diffuse reflection will appear less mirrored and will be more likely to reduce hindrances caused by reflected sunlight.

glass product characteristics

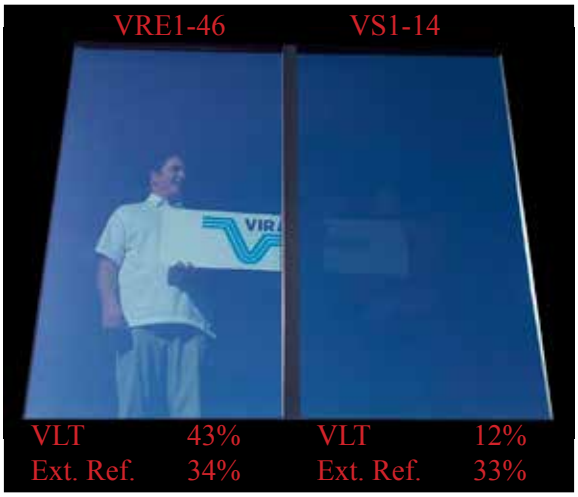
Glass products are typically selected to meet both aesthetic and solar requirements. Reflectivity is often one of many glass features reviewed. Optimal glass selection happens when all features are reviewed simultaneously rather than utilizing a single characteristic to drive glass selection. The all encompassing approach provides the most favorable balance between reflectivity, light transmittance and solar control. It also allows for the use of a wider variety of energy efficient glass products than just selecting glass based on its exterior reflectance value.

COATINGS

Coatings are thin layers of metal applied to glass to improve solar performance. Each coating has unique solar performance as well as light transmittance and exterior reflectivity.

When selecting a coating it is important to consider its visible light transmittance (VLT) along with its exterior reflectivity. Two products with similar color and exterior reflectivity may appear dissimilar due to a difference in VLT. For instance VS1-14 and VRE1-46 both have a silver reflective

appearance but VRE1-46 has more than three times the light transmittance for VS1-14. This VLT difference is enough for the products to have a different appearance.



While visual appearance may be different, when two coatings have a similar exterior reflectance, the specular reflection is similar so the potential for difficulties caused by reflected sunlight is also similar.

TINTED GLASS

Adding a tinted substrate to a glass make-up is similar to coatings in that it reduces the overall exterior reflectivity and improves the solar performance but does not increase the portion of reflectivity that is diffused.

To decrease specular reflectivity the diffuse reflection needs to be increased by silk-screening, adding translucent film or a translucent interlayer to the glass.

SILK-SCREENED AND TRANSLUCENT GLASS

To increase the diffuse portion of the exterior reflectance, a silk-screen pattern can be added to the glass. A silk-screen pattern applied to the second surface, prior to applying a coating, will decrease specular and increase diffuse reflection. A translucent pvb interlayer also provides opportunity to diffuse reflected light.

building design

CURVED FACADES

When sunlight hits a curved façade the reflection becomes even more complex because the curve shifts the reflectivity angles. Concave facades have the potential to concentrate reflected light to a single area creating a hot spot. Convex facades have the potential to scatter light. This can make it difficult to determine how the sun's rays will reflect after they hit the façade and can create unpredicted reflectance.

Modeling the reflectivity of a curved façade during design is the best way to understand how the sunlight will interact with the glass and building façade.

EXTERIOR ELEMENTS

Balconies, canopies, sun shades and fins all alter reflection. If a balcony shadows a portion of the façade, the amount of light reaching the façade is reduced so the amount of light available to be reflected is reduced. In cases like this, even if the reflectivity of the glass is higher, the potential for the glass to reflect sunlight is less of a concern due to the sun being blocked from the glass by the balconies.

SURROUNDING ENVIRONMENT

Another item to consider is the environment around the project. If a building is constructed in an open field with few buildings or trees nearby, the reflection will always be the sky. The appearance of a building in this setting will be greatly affected by the weather conditions but nothing else.

This example shows one building at two times of the day and illustrates how different the reflectivity appears based on sky conditions.

77 CityPoint, Waltham, MA
VRE1-38 and VRE3-38 Insulating

Likewise, a building in the city which is surrounded by other buildings and structures can be much less affected by changing sky conditions.

CONCLUSION

When selecting glass products for a project located in an area where sunlight is a concern or where the building geometry may affect reflectance angles, it is important to carefully review the glazing options. Consider options such as tinted glass to reduce reflectivity, a silk-screen to diffuse the reflectance or possibly a combination of both tinting and silk-screening.

The information contained in this publication is presented in good faith. It is believed to be accurate at the time of publication. Viracon reserves the right to change product specifications without notice and without incurring obligation.

viracon.com

800 Park Drive, Owatonna, MN 55060
800.533.2080