DRAFT March 2007 Status Report

Revision of Standard Spectral Weighting Function for Calculation of Solar Optical Properties and Solar Heat Gain

March 1, 2007

Submitted to:
NFRC Project Monitoring Task Group, and
NFRC Research Subcommittee

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Introduction

The intent of this research project is to provide a recommended spectrum to NFRC by assessing the impact of potential changes in reference spectra used to weigh the spectral transmission calculations of glazing systems.

Status Report

Task 1 – Selection of Glazing Systems
A list of 38 glazing systems to be considered for analysis in this project is presented in Table 1. A plot of the visible transmittance vs. the Solar Heat Gain Coefficient (SHGC) for each glazing system is presented in Figure 1. Both the Table and the original version of Figure 1 are included in a separate MS EXCEL file for this draft report[1]. In addition, two plots have been added (in this MW WORD file only) to describe the spectral selectivity of the specimens. This is characterized here by the Light-to-Solar-heat-Gain ratio, LSG, which is simply the ratio of the visible transmittance (Tvis) and SHGC. Figure 2 presents the distribution of LSG for the whole sample, in increasing order of LSG. The frequency distribution of LSG (in number of cases per bin of 0.2 LSG) appears in Fig. 3.

The following criteria and objectives were used to develop the proposed specimen list in Table 1:

LSG Ratio: The intent was to select different glazing systems that created the greatest scatter in Figure 1, the "Tvis *vs* SHGC" plot. Hopefully, this will ensure that the broadest range of both non-spectrally selective and spectrally selective glazing systems is chosen.

[1] By sizing the MS WORD and MS EXCEL Windows on your desktop at the appropriate sizes, it is possible to review both this status report and the table or figure at the same time. In addition, moving your cursor over a symbol in Figure 1 helps to identify that point.

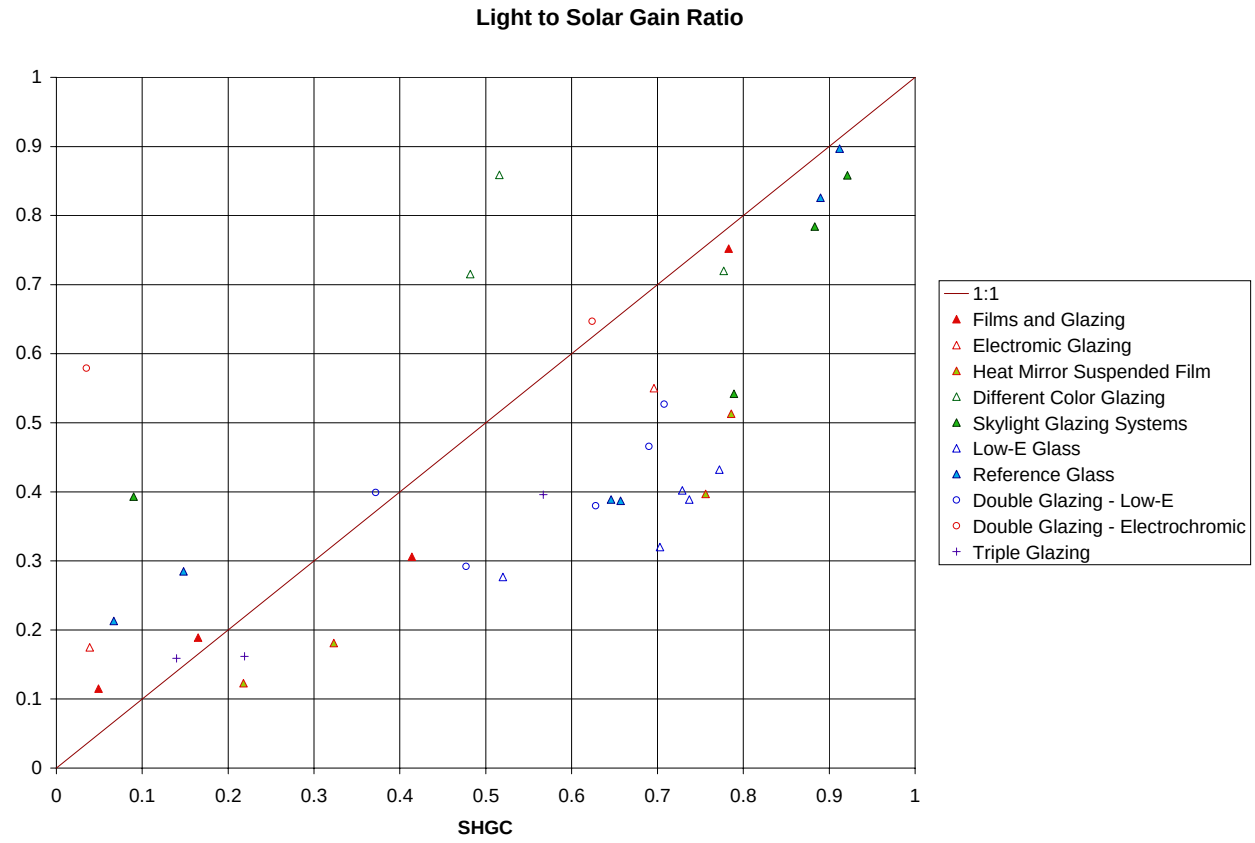

Fig. 1 Visible transmittance (Tvis) *vs* SHGC for the 38 specimens.

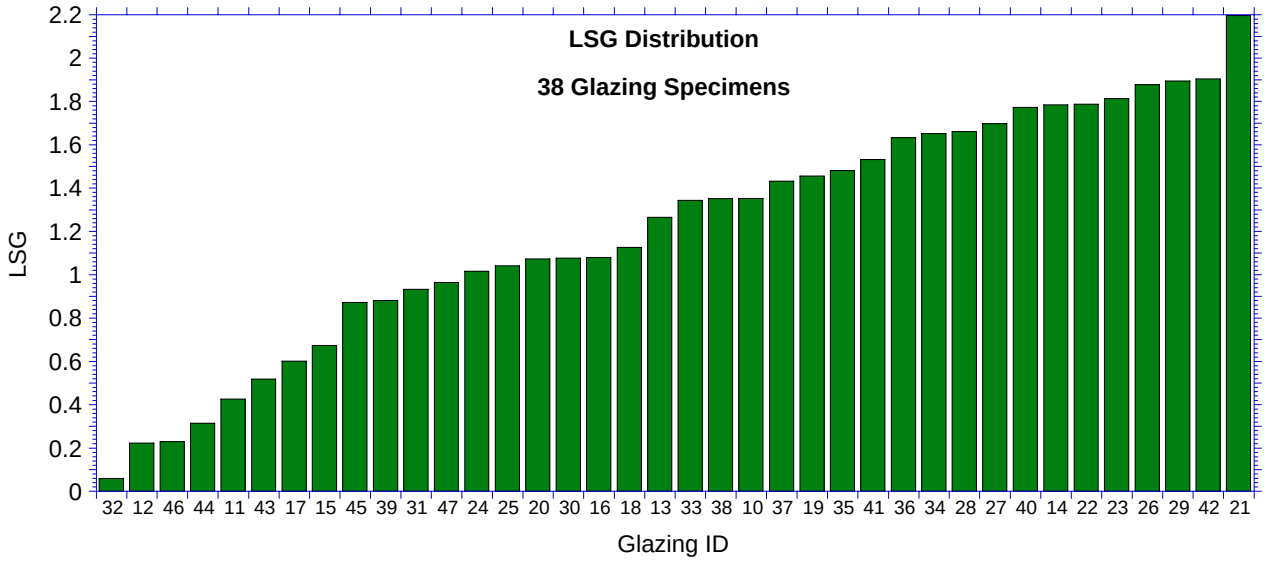

Fig. 2 Distribution of LSG (=Tvis/SHGC) among the 38 specimens, in increasing order of LSG.

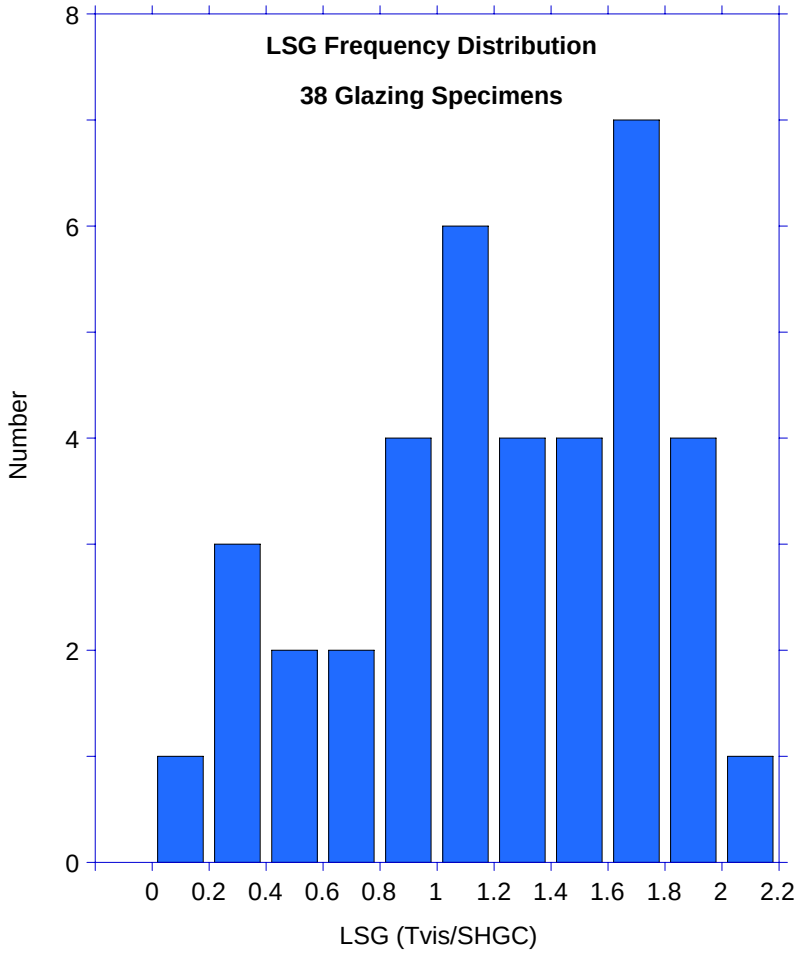

Fig. 3 Frequency distribution of LSG, i.e., number of specimens per bin of 0.2 LSG.

Manufacturer Representation: Although it was impossible to include all manufactures listed in the Glazing Library, there was an effort to have each of the NFRC Members' and major United States manufactures' products represented. To that end, there was also an attempt to include the most common product types.

Center-of-Glass: All of the thermal and optical properties are listed for the center-of-glass region as calculated by WINDOW 5.2.17a. Although edge and spacer effects may affect the U-factor, they do not affect the visible transmittance or solar heat gain of the glazing system, and therefore were omitted from the scope of this analysis.

Sizes & Gas Fill: Except for Heat Mirror, one laminated glazing, and the electrochromic glazing, all the glazing samples have a nominal thickness of 6 mm (between 5.613 to 6.760 mm). The gas fill thicknesses are always 19.5 mm in the double-glazing systems, and 12.7 mm in triple-glazing specimens. The clear glass layer in double- and triple-glazing systems is always the same 6 mm Cardinal IG Float Glass. Air is used as the gas fill in all of the specimens as none of

the gasses used to fill cavities in typical glazing systems are spectrally selective at these thicknesses.

Reference Glazing: Some of the glazing systems were selected because they were used in previous research projects by McCluney (1993, 1996) and McCluney and Gueymard (1993). The results from these reference glazing systems can be used for comparison and verification purposes.

Software and Naming Convention: All of the thermal and optical properties in Table 1 were generated using WINDOW 5.2.17a. OPTICS was not used. The Glass ID, Name, Product Name and other information in Table 1 was directly copied from the Window Library (v14.6) in the WINDOW 5 program.

Recommendations: The original Work Statement requires that a list 20 specimens be provided to the PMTG of which 16 will be selected for analysis. Although the Principle Investigator (PI) may be willing to analyze slightly more than 16 glazing systems, the list of 38 specimens provided in Table 1 needs to be drastically reduced.

Before the final selection of glazing systems, the PI is looking for feedback from the PMTG. If the PI were to make our own selections, we would likely cull-out repetitive or mid-points for each of the glazing categories in Table 1, and we might eliminate all triple glazing systems.

Task 3 – Report CIE Activities and Represent NFRC at CIE TC 2.17 Meetings

Last December we contacted the Chair of CIE TC 2-17, Dr. Gene Zerlaut, informing him of NFRC's interest in adopting a possible new CIE-sanctioned spectrum, and our intention to participate in the development of new reference spectra. The next CIE TC meeting is scheduled for the end of September, but no firm date is known yet due to various schedule conflicts that need to be resolved. This may be an indication that the pace of work may be very slow this year at least. We are therefore concerned that this might hinder our commitment to NFRC.

Consequently, we are now exploring the possibility of developing this standard at ASTM instead. ASTM G-03.09 has produced various reference spectra in the last few years (e.g., ASTM G173 in 2003) and therefore may be the appropriate ASTM Subcommittee to develop this new standard. It is not surprising that ASTM G-03.09 is also chaired by Dr. Gene Zerlaut, and he is just as anxious to develop this standard in ASTM as CIE. The next ASTM G-03.09 meeting is in June 2007.

We are hoping to get guidance from the PMTG on this issue before we commit to developing this new standard at ASTM instead of at CIE, which is stipulated in our Work Statement.

References

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