



NFRC Request for Proposal

Project: Complex Fenestration Product - Visible Transmittance Rating
Committee: Research and Technology Committee
Subcommittee: Research Subcommittee
Issue Date: **October 4, 2011**
Proposal Due Date: **November 21, 2011**

Dear Bidder,

This project is intended to inform NFRC's efforts to provide an independent, accredited means for many Complex Fenestration Products to obtain NFRC-certifiable VT visible light transmittance ratings. Please consider the RFP below and return a proposal (Adobe PDF via email is preferred) by November 21, 2011 to Ray McGowan (240-821-9510 or rmcgowan@nfr.org) with any questions.

All bidders will bid by the NFRC Agreement in the NFRC 703-NFRC Research Program Manual, appendix G. If government funding is used for the project then the bidder shall bid by form K requirements (staff will provide upon request).

Regards,

Ray McGowan
Senior Program Manager
National Fenestration Rating Council

NFRC Request for Proposal

Complex Fenestration Product- Visible Transmittance Rating

NFRC Project Number: 05-105-AR

Submitted to: Research and Technology Committee/Research Subcommittee

Submitted by/Proponents: Complex Product VT Rating Research Project Task Group

BACKGROUND

Appropriate visible light transmittance measurements (and resulting performance ratings, when available) are essential for effective and efficient lighting design, and are now needed for compliance with the latest building codes. There have been many recent developments in national and state energy conservation codes and green construction codes which now require daylighting in many buildings, and which define Visible Transmittance and specify punitive default VT ratings for glazed fenestration products that cannot achieve an NFRC-certified VT rating,

There are many such products presently specifically excluded from certification within NFRC 200, Section 2.2.2,

“Products and Effects Not Covered (VT):

It is the intent of this procedure to add the following products to the scope once a visible transmittance (VT) test procedure and/or advanced calculation methods have been developed. This may be accomplished through the issuance of a technical interpretation, addendum, and/or by a revision to this document.

- A. Products with shading systems, either between the glazing or attached to the inside or outside of the fenestration aperture;
- B. [not applicable]
- C. Products with non-specular transmittance and reflectance properties, such as translucent fiberglass and glass blocks;
- D. Fenestration systems whose glazings depart from being parallel, such as with curved glass, complete bay windows, corrugated or patterned glass, glass blocks, etc. ... ;
- E. Fenestration systems with angular selectivity, ... ;
- F. Tubular daylighting devices. “

The NFRC TDD Task Group, and many of its individual members through participation in other standards organizations, has since been actively supporting several efforts to further explore ways to provide useful design and product performance measurements. One result of their efforts has been the issuance of IESNA LM-81, a standard for photometric

performance measurement of TDDs using goniophotometry. Another project NFRC encouraged was a screening study to compare an integrating sphere with two very different goniophotometer-based proprietary “light labs” owned and operated by member companies.

Based on this activity, this RFP has introduced a goniophotometric option to the integrating sphere technology that has been the previous focus of VT rating efforts. It has strong appeal because it promises to yield distribution data as well as aggregated VT data, and can simulate year-round variations in that data. This is the true future of more useful daylight quantification.

Comments submitted on several NFRC ballots have been addressed in this RFP. where it was clear the Task Group could improve the document to deal with the stated concerns.

This RFP is a necessary complement to a parallel active research project being conducted by LBNL and financed by the DOE and the five major TDD manufacturers. That project will develop data for light transmittance performance on several types of TDDs, in an effort to quantify the sensitivity of that category of toplighting to different incident angles and different sun azimuths. Such data is being gathered to address concerns raised on an earlier NFRC ballot outlining an annual average VT rating method, as a fair and accurate way to compare products in this unique category. Use of that method, once refined and approved, will need data from devices covered under this RFP to produce credible ratings needed for certified VT labeling for TDDs.

It is expected that other excluded products will be able to use the TDD research results, and the devices that will emerge from this effort, to hasten rating method development appropriate to those categories.

OBJECTIVES:

1. The primary objective of this RFP is to design, construct and validate apparatus specifically targeted to become the prototype independent, NFRC-accredited resource for certified VT ratings of Complex Fenestration Products.
2. Supplemental proposals offering practical and NFRC accredited-ready devices for quantifying useful light distribution (in a photometric data file) are also encouraged, as a secondary objective.

SCOPE AND APPROACH:

Task 1: Determine/Define Proposed Visible Transmittance Test Apparatus

Research performed to date indicates that there are at least two currently viable but dissimilar systems that can achieve the narrow purpose of furnishing fair, accurate, and credible VT ratings:

- integrating sphere using ASTM E1175, and
- hemispherical goniophotometer, as per LM-81 approved by IESNA

The potential bidder shall propose to construct either or both of these systems. In addition, the bidder may offer any suitable alternate method not identified above.

The bidder shall provide sufficient objective supporting data to be furnished to justify serious consideration of all methods offered. Such data shall include assessments of the following:

- Accuracy
- Repeatability
- Speed of data acquisition

Deliver a description and justification of the proposed method(s) to the NFRC Project Monitoring Task Group (PMTG) for review and approval.

The selected design must include a means for separating direct beam from diffuse sky illumination. The apparatus must be able to accommodate the installation of both round and square test specimens of a variety of sizes.

Project Review: At the conclusion of Task 1 and prior to beginning Task 2, the PMTG, in conjunction with the Research Subcommittee, shall review the results from Task 1 to evaluate the findings and cost estimates. In the event the PMTG determines that the findings do not support the project's anticipated objectives or it is no longer feasible to continue the project, the PMTG may vote to recommend that NFRC discontinue its participation in the project.

Task 2: Build Visible Transmittance Test Facility

Construct the system or systems according to PMTG-approved specifications and design. Submit a report to the PMTG regarding experiences in constructing the system, including as-built drawings and photographs upon completion of this task. Include this documentation in the final report.

Task 3: Develop and Evaluate Calibration Protocol

Develop a calibration protocol for the system or systems utilizing known standards and best practices. Verify the calibration of the apparatus by demonstrating that it can accurately measure the VT of at least three non-complex reference samples having transmittances determined accurately and separately that cover the range of transmittance anticipated in this research project. The selection of these reference sample test specimens shall be approved by the PMTG. Document and evaluate the calibration methodology developed in the final report.

Task 4: Validation of Test Method for VT based on test methods defined by NFRC for different Complex Fenestration Products

4.A Selection of Test Specimens

Select representative complex fenestration products to test with the new equipment and procedure. As many NFRC-certified products as possible should be tested.

Descriptions or diagrams shall be provided to the PMTG indicating how each type of test specimen will be installed and supported in the test apparatus. The PMTG shall approve the test specimens prior to the actual tests.

4.B Measurement of Visible Illuminance

Two hemispherical photometric sensors (responsive over the visible spectrum only) shall be used to simultaneously measure the incident irradiation on the plane of the test specimens over the duration of each test. One photometric sensor shall be shielded from direct beam illuminance to measure the diffuse radiation. The other shall not be so shielded. The ratio of their outputs shall be recorded and reported for each test measurement.

4.C Measurement of Visible Transmittance

For the integrating sphere method, the test methodology will likely involve measurements of the flux entering the sphere both before and after the test specimen is placed over the port. Typically, the specimen transmittance is calculated as the ratio of the sensor signal with the sample in the port to the average of that signal with the port empty before and after the specimen installation, multiplied by a correction factor to correct for the change in sphere efficiency resulting from the placement of the specimen in the entrance port. A description of the test methodology shall be included in the final report including any recommended revisions to ASTM E 1175.

For other methods, follow established data-gathering instructions such as the IESNA LM-81 procedure for goniophotometer methods.

4.D Dome Skylight Testing Methodology

For methods accommodating that product type, develop and explore methodologies to measure the VT of skylights with dome glazing that does not require that a full-sized product be installed in the apparatus. Document, justify, and evaluate this proposed methodology for inclusion in NFRC or ASTM methods.

Task 5: Conclusions and Recommendations

Based on the findings from the previous tasks, produce a final report detailing the validation data obtained, analysis of the data and the suitability of the facility for obtaining certified VT ratings and/or photometric data for each type of complex fenestration product tested.

Task 6: Peer Review Paper

Following NFRC acceptance of the final report, prepare a peer reviewed manuscript and submit to the PMTG and, following the approval of that group, for publication in a recognized national technical journal.

DELIVERABLES:

Task 1

Present to the PMTG a sufficiently detailed conceptual proposed design for the test facility, and advise if the facility could accommodate other complex fenestration products typically found within the NFRC program. Proposal must contain a breakout price for Task 1 should the project terminate following a review of the results of this task.

Duration: 2 months.

Task 2

Immediately following acceptance by the PMTG of the design, construct the facility utilizing the general design criteria of Task 1 plus any recommendations provided by the PMTG. Construction should be complete within six months after the acceptance of the design by the PMTG. Submit a report to the PMTG regarding experiences in constructing the facility including as-built drawings and photographs upon completion of this task.

Duration: 6 months.

Task 3

Upon completion of the construction of the facility, commence work to calibrate and validate the test apparatus, the goal being to establish its credibility for use in VT measurements within the NFRC program. After the PMTG approves the proposed reference samples, verify and report the calibration results from the apparatus.

Duration: 2 months.

Task 4

Select and test a selection of most (or all) of the TDD models listed in the NFRC CPD, and representative shading and glazing systems specimens covering as broad a range of types as the apparatus will allow. At least six of these test specimens shall be homogenous to allow smaller samples to be tested using LBNL's integrating sphere for comparison (*at LBNL's discretion*). Report the results of comparisons of the visible transmittance values determined experimentally with the integrating sphere and/or goniophotometer in the contractor's facility with any other visible transmittance measurement results that might be available. In addition, report to the PMTG on proposed methodologies to measure the VT of dome skylights without having to test a full-size product.

Duration: 5 months.

Task 5

Upon completion of the construction of the facility and testing of the calibration standards and test specimens, a final report shall be written detailing the findings and results along with a recommendation for any further research needed. The report shall include recommendations for incorporation of any new methodologies into the NFRC rating procedures, along with any reasons one or more of the methods evaluated may not be acceptable to NFRC.

Duration: 2 months.

Task 6

Prepare one or more manuscripts following acceptance of NFRC research report. Submit a draft for review to the PMTG, and the revised manuscript to a peer-reviewed technical journal.

Secure the test facility and convey ownership of it to NFRC, store it for a period of up to 6 months, until NFRC decides on its disposition, which is anticipated to be offering the equipment for sale to commercial testing companies. Facilitate the delivery, at the expense of the purchaser of the facility, of the equipment developed under this research contract, to the successful bidder for that equipment.

Duration: 3 months

ESTIMATED COSTS

- **Task 1 - \$10,000**
- **Tasks 2 and 3, and Task 4 for TDD products - Construction and Validation of each apparatus:**
 - **\$70,000-\$90,000**
- **Tasks 4, 5 & 6 for Complex Fenestration Products testing:**
 - **Est. \$TBD for each additional product category to be sponsored by stakeholders**

If at any time during this project it is determined the technical data is flawed or the project is not feasible then the PMTG may vote to discontinue the project. Payments shall be made based on work performed to that date.

ESTIMATED DURATION:

20 months

PARTIAL PAYMENT SCHEDULE:

- Task 1 price will be paid in advance (after contract is signed)
- 33% of remainder of total proposal upon approval to begin task 2
- 30% of remainder upon completion of task 3 and task 4 for TDDs
- 17% of remainder upon completion of task 4 for all other product types, and task 5
- balance upon completion of task 6 and RSC-RTC-Board approval

POTENTIAL CO-SPONSORS:

Fenestration manufacturers' in-kind contributions, U.S. Department of Energy, U.S. EPA (ENERGY STAR)

SOLE SOURCING:

Not required.

TERMS:

Any prospective bidder shall submit a proposal that identifies the total cost of performing all the documented requirements in this RFP. Any terms of payment and final ownership of equipment shall also be outlined in the proposal. A schedule outlining all RFP tasks shall be included with the bid submittal including all associated dates and times.

NFRC RESOURCES:

NFRC Staff Labor: Not to exceed 25 hours over project period.

NFRC Consultant Labor: Not to exceed 10 hours over project period.

NFRC STAFF CONTACT:

Ray McGowan, National Fenestration Rating Council
6305 Ivy Lane, Suite 140
Greenbelt, MD 20770-6323
Phone: 240-821-9510
Facsimile: (301) 589-3884
E-mail: rmcgowan@nfr.org