

# NFRC Component Modeling Approach (CMA): White Paper

## COMMERCIAL FENESTRATION ENERGY RATINGS

ASHRAE 90.1, Section 5.8.2, requires fenestration energy performance to be determined using NFRC 100 and 200. The performance indices (U-factor, SHGC and VT) generated must come from a laboratory accredited by a national authority such as the National Fenestration Rating Council, Inc. (NFRC). The primary exception to this rating requirement allows for manufacturers to assign default values from an ASHRAE appendix. However, these defaults are unlikely to meet the ASHRAE prescriptive requirements.

Anecdotal evidence indicates many fenestration manufacturers are not providing energy performance values according to the Section 5.8.2 requirement. For example, in some instances, manufacturers may only be providing the center of glass values for the IG unit. Others may make simple calculations to include frame performance with IG performance. And still others may follow AAMA 507, which piggybacks on the NFRC 100 and 200 standards.

The AAMA 507 procedure generates IG performance according to NFRC 100 and 200, but combines it with the frame thermal performance in an overly simplified manner that is unlikely to be accurate. In addition, no third party verification is required, which is not the case in the NFRC rating procedure. Recently, several AAMA 507 proponents attempted to add this procedure to the IECC as an alternate to NFRC 100 and 200 but that effort failed largely because of the missing third party verification that code bodies prefer. Any fenestration performance lacking the actual NFRC 100 and 200 generated indices is unlikely to be accurate.

The NFRC currently offers a commercial fenestration rating procedure that has been largely ignored by the industry. The primary reason for this is its lack of expediency necessary for commercial projects. NFRC's current rating system works well in the residential market since common products are mass produced and are rated by product line or model. However, commercial projects are highly specialized with specific product



designs for individual buildings requiring project-based ratings. The NFRC recognizes the difficulty this presents and has nearly completed a new rating procedure more amenable to the commercial fenestration industry. This new rating procedure is called the Component Modeling Approach.

## NFRC'S NEW COMMERCIAL FENESTRATION ENERGY RATING PROCEDURE

The NFRC's Component Modeling Approach (CMA) program will address the needs of the nonresidential fenestration market while still maintaining consistent, credible and reliable performance ratings. Though the current nonresidential program offered by the NFRC (Site-Built program) provides consistent and reliable energy performance ratings for code enforcement purposes, it does not address the issues

associated with preliminary project bidding and/or design needs, project customization, or the need for size-specific product ratings. These are issues specific to the commercial market which will be addressed by the CMA program.

The NFRC Site-Built Program is currently referenced in the State of California energy code (Title 24) and partially meets the needs of the commercial fenestration industry. This program will remain as an alternative program to CMA at this time. However, the State of California will be revising its energy code in 2009 and will reference NFRC's CMA program. NFRC's current residential Product Certification Program will also continue to be administered for the residential industry segment. NFRC is developing a new CMA Product Certification Program to ensure accurate, credible ratings for the new CMA method.

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### **NFRC'S NONRESIDENTIAL OR CMA PRODUCT CERTIFICATION PROGRAM**

NFRC's current nonresidential/site-built certification program was developed in 1999. It was designed to address field-glazed or field-assembled fenestration products. The program parallels NFRC's residential Product Certification Program by using current computer simulation and modeling tools, accredited laboratories and licensed certification agencies. A standardized specimen is used for validation testing. And in lieu of the NFRC label, a Label Certificate form was developed to communicate and verify fenestration system performance and third-party certification for building code compliance purposes.

In 2002, the Component Modeling Approach (CMA) procedure was developed to address some of the process limitations of the Site-Built program. The CMA product certification program is currently under final development and is targeted for implementation in 2009.

### **CMA PROCEDURE: HOW IT WORKS**

Briefly, component performance data are used for obtaining overall product performance employing NFRC's CMA Software Tool (CMAST).

The three primary components used are:

- Glazing: Glazing optical spectral and thermal data from the International Glazing Database (IGDB);
- Frame cross-sections: Thermal performance data of frame cross-sections; and
- Spacer: Keff (overall conductivity) of spacer component geometry and materials.

### **CMA PROCEDURE: HOW CMA WILL IMPROVE NONRESIDENTIAL PRODUCT CERTIFICATION**

The scope of the CMA program is to develop a new nonresidential certification and rating procedure for fenestration products that will yield accurate energy performance data for use in code compliance and for meaningful building energy analysis. The certification and rating program shall be credible, simple, cost effective, fair, uniform and useful.

The CMA program will allow for different segments of the fenestration industry to obtain standardized energy performance ratings for fenestration components and component systems including glass, spacers and frames. These systems will reside

in electronic libraries that will be easily accessed by those who wish to determine and/or obtain NFRC energy performance ratings (U-factor, SHGC, VT) for entire window, storefront and curtainwall systems.

CMA outputs will include a standardized bidding tool for building specifications, exporting capabilities for energy analyses and an NFRC Label Certificate for code enforcement and specification confirmation.

### **CMA CERTIFICATION PROGRAM OVERVIEW**

1. Program rates whole fenestration products according to NFRC 100 and 200.
2. The three components (glazing, spacers and frames) that make up a fenestration product shall have performance values that are NFRC-approved and maintained in an NFRC Approved Component Library database.
3. An Approved Calculation Entity (ACE) shall calculate the values for the fenestration system using the CMAST and the approved component library.
4. A Specifying Authority seeking product certification shall contract with an ACE. The Specifying Authority specifies the fenestration products and systems and specifies suppliers to be used on a project to meet design and performance requirements. This Specifying Authority is responsible for taking any corrective actions necessary if the final assembly does not conform to the product rating.
5. Once the energy indices for a fenestration system(s) has been generated for a specified project, the Specifying Authority agrees to an NFRC License Agreement and is then issued a CMA Label Certificate for the project which lists the certified systems and their ratings.
6. The Approved Calculation Entity (ACE) shall use the CMA Software tool on behalf of the Specifying Authority to generate a label certificate for a specified project.
7. The ACE is an entity approved by NFRC to carry out certified energy calculations of fenestration products using the CMA.
8. CMAST calculates the energy performance indices (U-factor, SHGC and VT) prior to generating the label certificate.
9. Information from the label certificate will be maintained in the NFRC Certified Products Directory.

10. NFRC-licensed agencies will review ACE calculations for accuracy and will conduct random documentation audits of projects that were granted label certificates.

### **NFRC'S CMA CERTIFICATION VS. AAMA 507**

- CMA offers third-party certification by way of its product certification program. AAMA 507 does not.
- In the CMA program, the NFRC ACE generates a Label Certificate directly from CMAST. In AAMA 507, the manufacturer generates a Certificate of Compliance (a template is provided in AAMA 507) with no third-party oversight.
- The CMA methodology uses performance data for a specified glazing and framing system whose components have been simulated per NFRC 100 and 200 to obtain a whole product U-factor, SHGC and VT rating. The AAMA 507 methodology, on the other hand, uses U-factor, VT, and SHGC values obtained from simulations conducted per NFRC 100 and NFRC 200 and the manufacturer interpolates among different actual system sizes and glass/spandrel options to arrive at an overall glazing system U-value, VT and SHGC for a configuration required by a given contract.
- CMA offers public access to information about product performance that is critical to market transformation and is required by ASHRAE, CA Title 24 and IECC. AAMA 507 does not.

### **CMAST FUNCTIONALITIES**

In general, CMAST

- Has client-based and web-based functionalities.
- Allows for access to a central database of NFRC-approved components maintained on the central server.
- Provides energy performance ratings at NFRC standard size and actual size.
- Allows for the saving and storage of data:
  - Frame and glazing assemblies;
  - Spacer Keff ;
  - Fenestration systems; and
  - Project information.
- CMAST will be able to:
  - Maintain libraries of component data;
  - Define projects;
  - Assemble components; and
  - Calculate whole product ratings.

- Assemblies generated in the software prior to whole product calculation:
  - Center of Glazing assembly;
  - Spacer and edge seal assembly; and
  - Frame assembly.
- Program and Technical documents approved – November 2008.
- CMAST deployment – January 2009.
- Six-month Pilot Project to begin in February 2009 and conclude in August 2009.
- Full implementation of program – August 2009.

## SOFTWARE OUTPUTS

- Project data and fenestration system performance data for a project can be exported for use in bidding, energy analysis, determining specifications, etc.
- Product Certification and issuance of an NFRC Label Certificate for code compliance.
- Public directory of approved components, certified products and other label certificate information.

## SOFTWARE DEVELOPMENT AND PROGRAM TIMELINE

- CMAST development project began in May 2007.
- Fensize, the precursor of the CMA software was designed in 2002 by current CMAST contractor, D. Charlie Curcija.
- CMAST Prototype Testing (client based) – July 2008 .
- Alpha testing (network/synchronization) – October 2008.

## OUTCOMES

- User-Friendly Tool – Established component libraries and user-friendly CMA software application allows general user to assemble components, configure whole products and obtain performance calculations.
- Building Energy Analyses – Fenestration energy performance data for projects can be readily exported for use in EnergyPlus.
- Bidding Tool – Product calculations can be exported for bidding purposes and determining specifications.
- Code Compliance – Label certificate issuance is expeditious and cost-effective.
- The CMA Product Certification Program provides for a uniform, standardized and accurate rating methodology that incorporates third-party oversight and quality control.
- Information access – A public directory of approved components, certified products

and other label certificate information is available on-line in real time for quick and easy access and verification as required by ASHRAE, IECC and CA Title 24.

## WHAT DOES THE COMMERCIAL FENESTRATION INDUSTRY GAIN BY THIS PROGRAM?

- The commercial fenestration industry will have access to a uniform, user-friendly, standardized tool for obtaining the energy performance ratings of commercial fenestration products.
- Standardized energy performance ratings will greatly assist in marketing the energy efficiency of commercial fenestration products similar to the highly successful ENERGY STAR Windows program. Communicating standardized and validated performance ratings will improve the opportunity for the industry to market and install high-performance, value-added fenestration products in much the same way that the residential fenestration market has been transformed.

## WHAT DO NFRC STAKEHOLDERS GAIN BY THIS PROGRAM?

- Code officials will now have the code required means to enforce energy codes.
- Architects will be empowered to design more energy efficient buildings.
- Building owners will have lower operating costs with higher performance envelopes.
- Consumers will have a more comfortable and productive work environment.

## CONCLUSION

The NFRC will release CMAST in January of 2009 and will have the software available for public use the latter half of 2009. NFRC encourages the fenestration industry to begin developing more accurate fenestration ratings using this tool. NFRC staff and some its members are eager to assist new users to begin this process. Jessica Ferris, CMA Program Manager of the NFRC staff is the primary contact for CMA matters. She can answer questions and assist new users on the application of the new CMA procedure. In early 2009, several selected projects in California will begin using the tool as part of NFRC's CMA pilot project. NFRC hopes to gain insight on the operation of the new procedure and will continuously improve the process as it does with all of its other rating procedures.

*For more information on the NFRC go to [www.nfrc.org](http://www.nfrc.org).*

## ABOUT NFRC

The National Fenestration Rating Council, Inc. (NFRC) is the only nationally recognized leader in providing energy performance rating procedures and certification, and labeling programs for windows, doors, skylights and related attachment products. NFRC develops and administers comparative energy and related rating programs that serve the public by providing fair, accurate and credible energy performance information on fenestration products.

NFRC provides:

- Standardized methods for determining energy performance;
- A "level playing field" for comparing fenestration products; and
- Accurate third-party product certification information on fenestration performance.

Incorporated in 1990, the NFRC is a not-for-profit, 501(c)(3) organization. NFRC resides in Greenbelt, Maryland with fourteen employees including an Executive Director who reports to the Board of Directors and a Deputy Executive Director who is responsible for the day-to-day administration.

In addition to its Board of Directors, NFRC has voting members. Membership is open to organizations and individuals with an interest in the production, regulation, specification, use or promotion of, or development of technology related to the energy performance of fenestration products, and may include corporations, associations, other businesses and not-for-profit organizations, and government agencies.

Committee members are selected from the membership and are responsible for the establishment of NFRC procedures and programs which are presented to the Board of Directors for final approval before implementation. Subcommittees are formed from the membership at the discretion of the appropriate Committee Chairperson and with the approval of the Board of Directors. Subcommittees are responsible for tasks given to them by the Committee as they relate to the development of specific programs or procedures. Task groups are formed by Chairpersons of the Subcommittees and are comprised of NFRC Members and non-Members that are responsible for researching and developing specific issues assigned to them by the Subcommittee Chair.