NBC 2015 SUBSECTION 5.9.3 OTHER FENESTRATION ASSEMBLIES
THE INTENT BEHIND THE NEW CODE PROVISIONS

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Presenter: Robert Jutras, P.Eng.
Co-Authors: David Kayll, FMA, P.Eng.
George Torok, CET, BSSO

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CONTEXT

Prior to the 2015 National Building Code:

Minimum performance requirements for glazing systems:

1) Under 2010 NBC Division B 5.10 for windows and doors covered under the scope of AAMA/WDMA/CSA 101/I.S.2/A440 North American Fenestration Standard (“NAFS”), or

2) Under 2010 NBC Sub-sections 5.1 through 5.5, with performance requirements that we effectively left to the expertise of the designer to determine suitability for the design.

CONTEXT

Products covered by NAFS:

- windows (all type of operators and fixed);
- doors (sliding and hinged);
- skylights (modular manufactured units or roof windows) and tubular daylight devices.

Systems outside the NAFS scope:

- curtain walls;
- window walls;
- storefronts;
- commercial skylights.

CONTEXT

This products are defaulted to the second approach.

What is provided by Sub-Sections 5.1 to 5.5 or not:

- high level instruction on performance;
- little guidance on acceptable minimum performance;
- no specific reference to the appropriate standards for assessing consistent performance.

Although, new glazing assembly designs and systems were being introduced and incorporated into the design landscape without clear understanding of how they should perform in the various climate zones within Canada.

CONTEXT

Designers were left to interpret the intent of 2010 NBC Sub-sections 5.1 to 5.5 and create performance criteria for these systems.

CONSEQUENCES

- designers left the decisions on performance to the manufacturer's sales and internal testing reports;
- data may have been reported in many number of formats, e.g., AAMA, ASTM, CGSB, CSA etc.;
- not unusual to find incorrect performance criterial references for these systems relating back to standards that were not written for these systems, e.g., A440 air, water and structural performance criteria applied to curtain wall or window wall systems;
- or reference to outdated standards.

WHAT THE EXPERIENCE HAS SHOWN

- increasing rate of large-scale failures for these systems;
- increased concerns in the design, construction and insurance industries;
- increased use of these systems, in both residential (e.g. mid. to high rise condominium) and commercial buildings.

Therefore, the Standing Committee on Environmental Separation felt that these products need to be reviewed and possibly addressed in Part 5 of the code.

STANDING COMMITTEE FINDINGS

It was recognized that the primary missing guidance in the Code related to:

- Curtain wall systems
- Window wall systems
- Storefront systems

WHAT THE CODE COMMISSION DID IN 2010

The commission struck a Task Group under the Standing Committee for Environmental Separation (NBC Division B Part 5) to tackle the missing guidance on these glazing systems

MANDATE

a) develop a preliminary description of the term window wall for reference for other activities under this Task and for possible inclusion in Appendix A of Part 5;

b) review relevant window wall and/or curtain wall requirements as well as related industry documents on their design, manufacture, use and installation;

MANDATE

c) determine whether the current building code requirements properly address window walls and/or curtain walls and;

   i) if changes to the current requirements (criteria) are not considered necessary, report;

   ii) if changes to the current requirements (criteria) are considered appropriate but there is insufficient information to support requests for changes, identify the areas where information is needed and report;

   iii) if changes to the current requirements are considered appropriate and there is sufficient information to support changes, develop proposed changes and recommend those changes.

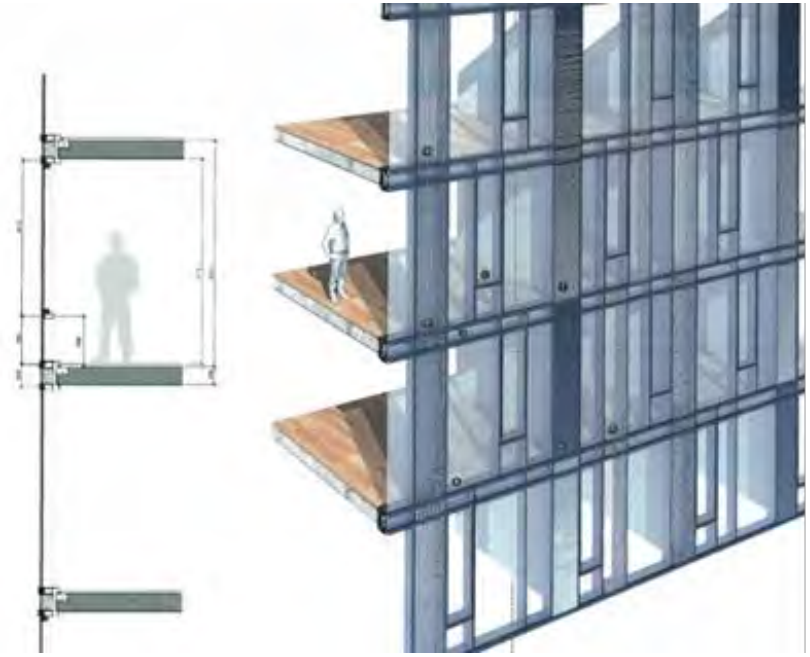
TASK GROUP FIRST UNDERTAKING

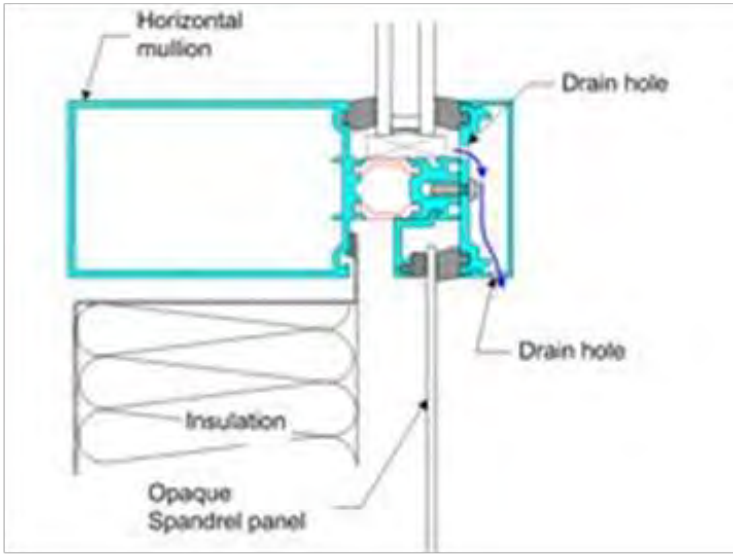
Establish specific terminology of each of:

- window wall;
- curtain wall;
- storefront fenestration;
- glazed architectural structures.

CURTAIN WALL

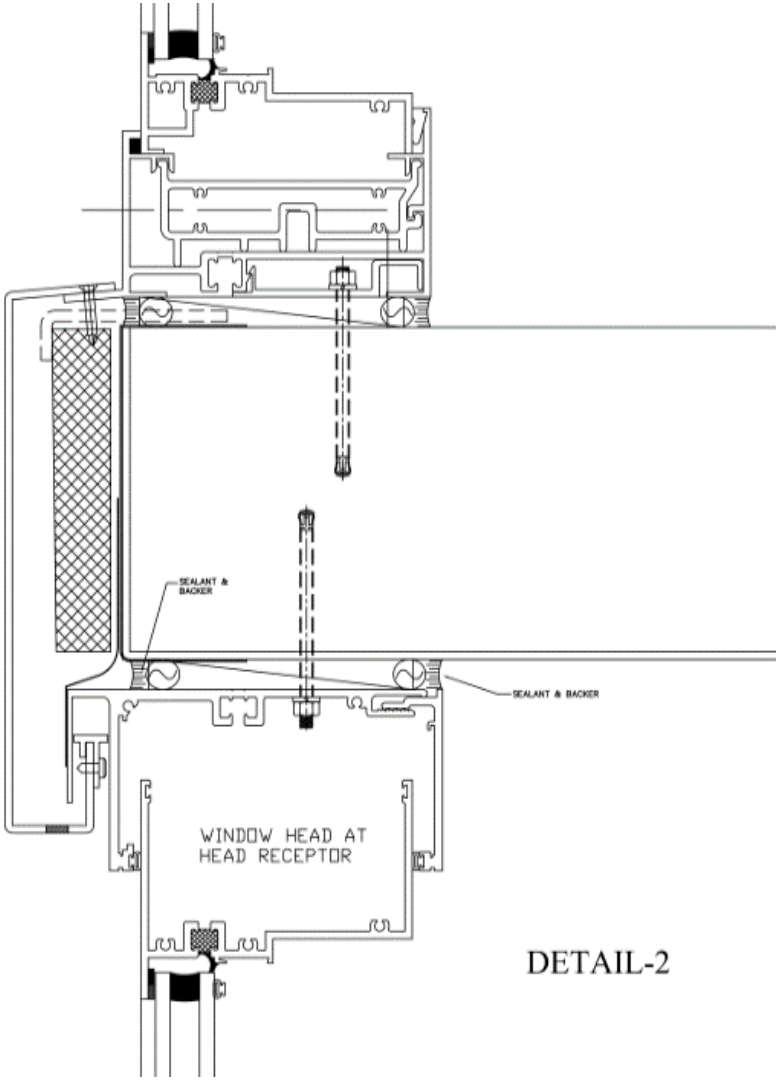
A curtain wall is considered to be a continuous wall cladding assembly (which may include fenestration and opaque portions) that is hung away from the edge of the primary floor structure. Curtain wall assemblies do not generally support vertical loads other than their own weight. Anchorage is typically provided by anchors that connect back to the floor structure. Curtain wall assemblies can be either “stick built” meaning each main unit is assembled on-site, or a “unitized” system, meaning factory-assembled main units are installed and connected together on-site.




Horizontal
mullion
Drain hole
Drain hole
Insulation
Opaque
Spandrel panel

WINDOW WALL

A window wall is considered to be a wall cladding assembly (which may include fenestration and opaque portions) that spans from the top of a primary floor structure to the underside of the next higher primary floor structure. Window wall assemblies do not generally support vertical loads other than their own weight. Primary provision for anchorage occurs at head and sill connections with the adjoining floor structure. Window wall assemblies may include separate or integral floor edge covers.


SEALANT &
BACKER
SEALANT & BACKER
WINDOW HEAD AT
HEAD RECEPTOR

DETAIL-2

STOREFRONT

A storefront is considered to be a non-residential assembly (which may include fenestration and opaque portions) consisting of one or more elements that could include doors, windows and curtain wall framing. Storefronts do not generally support vertical loads other than their own weight. Storefront profiles are typically narrow, rectilinear framing members that hold a combination of pocket glazing and applied glazing stops to securely retain the infills. Vertical framing members typically span the height of one floor or are retained within a structural punched opening.

Storefront assemblies are designed/selected to take into account the anticipated service and exposure conditions, which may be different than those for other portions of the building.

GLAZED ARCHITECTURAL STRUCTURES

Glazed architectural structures are considered glazing assemblies that are supported in a non-traditional manner, such as corner-clamped, point-supported, linear-supported, and edge-clamped glazing. Structural support systems can include, but are not limited to, tension cables, tension rods, steel and glass. Glazed architectural structures do not generally support vertical loads other than their own weight. These assemblies are designed/selected to take into account the anticipated service and exposure conditions, which may be different than those for other portions of the building.

Skylights that are not covered by NAFS are considered glazed architectural structures.

THE CODE REQUIREMENTS

NBC 2015 performance and testing requirements for ‘other fenestration systems”:

- Division B, Part 5 Environmental Separation, Subsection 5.9.3;
- with commentary, to provide insight regarding current design capabilities of Canadian industry and how designs may change in the next few years as the NBC 2015 is adopted or adapted across Canada.

THE CODE REQUIREMENTS

Structural and Environmental Loads:

- Article 5.9.3.2.: no specific requirements are included for structural design;
- reference to Article 5.1.4.1.

Appendix A, Article 5.9.3.2:

- ASTM E330 is identified as the ‘applicable’ test method;
- AAMA 501 Methods of Tests for Exterior Walls;
- AAMA 501.4 Recommended Static Testing Method for Evaluating Curtain Wall and Storefront Systems Subjected to Wind Induced Interstory Drift;

THE CODE REQUIREMENTS

Appendix A, Article 5.9.3.2:

- AAMA 501.6 Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall System.

THE CODE REQUIREMENTS

Heat Transfer:

- Article 5.9.3.3: reference is made to Section 5.3.

Appendix A, Article 5.9.3.3:

- CSA-A440.2, Fenestration Energy Performance for simulation or physical testing to determine U-factor;
- Two physical test methods are identified for assessing condensation resistance:
  - the “Temperature Index” method in CSA-A440.2;
  - AAMA 501.5 Test Method for Thermal Cycling of Exterior Walls.
- Limitation of simulations for condensation evaluation, e.g. NFRC500.

THE CODE REQUIREMENTS

Air Leakage:

- Article 5.9.3.4: reference is made to Section 5.4;
- Specific requirement as per ASTM E 283:
  - fixed glazed and opaque portions the maximum allowable air leakage rate is 0.2 l/s/m2 (0.039 cfm/ft2) at a pressure difference of 75 Pa (1.57 psf);
  - For operable portions the maximum allowable air leakage rate is 1.5 l/s/m2 (0.30 cfm/ft2) at 75 Pa (1.57 psf).
  - no requirement for testing at a 300 Pa (6.27 psf) air pressure differential.

THE CODE REQUIREMENTS

Air Leakage:

Appendix A for Article 5.9.3.4. (2):

- ASTM E783 “Field Measurement of Air Leakage Through Installed Window and Doors” is identified as the “applicable” test method when in-situ air leakage tests are to be performed.

THE CODE REQUIREMENTS

Water Penetration:

- Article 5.9.3.5: reference is made to Section 5.6;
- Specific requirement as per ASTM E 331 or ASTM E 547:
  - test pressure is determined in accordance with CSA-A440S1, the Canadian Supplement to NAFS, using the Driving Rain Wind Pressure (DRWP) for specific locations across Canada (typically airports), for a 1/10 return period probability, modified for terrain condition (open or rough) and building height.

THE CODE REQUIREMENTS

Water Penetration:

Appendix A for Article 5.9.3.5:

- AAMA 501.1 Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure as a test method that can be used to evaluate the performance of “other fenestration assemblies”;
- ASTM E1105 “Field Determination of Water Penetration of Installed Exterior Window, Skylights, Doors and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference” is identified as the “applicable” test method when in-situ water penetration resistance tests are to be performed.

CONCLUSION

Expected Impacts:

- will improve the uniformity of the available test results and performance expectations;
- aim at reducing system failures related to criteria such as condensation, air leakages, water penetration, structural load, etc.;
- help design professionals reduce the occurrence of incorrect and/or non-applicable standards and their specification;
- In addition, the Appendix A clearly identifies and differentiates the standard procedures to be followed for both laboratory testing and in-situ testing.

THANK YOU!

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