TWO-HOUR FIREWALLS

BACKGROUND

Historically, firewalls used to subdivide buildings into smaller units have been built using one of two types of construction: masonry block or solid concrete. These materials have been required for firewall construction by the Alberta Building Code since at least 1974.

Recently, advances in technology and construction practices have led to the development of proposed firewall assemblies that do not use masonry block or concrete. A provision was added to the Alberta Building Code 2006 in Subsection 3.1.10. that permits the construction of two-hour firewalls using noncombustible materials other than masonry or concrete.

Municipalities and the Safety Codes Council have expressed concern as to how a safety codes officer will evaluate a proposed firewall assembly to determine whether it meets the Code requirements. This STANDATA gives guidance to safety codes officers and designers in how to interpret the requirements in Subsection 3.1.10. for firewall assemblies that are constructed of noncombustible materials other than masonry block or concrete.

DISCUSSION

Sentence 3.1.10.2.(4) states that a two-hour firewall using noncombustible materials need not be constructed of masonry block or concrete. As the new appendix note and the intent statements from the National Research Council indicate, the intent of this Sentence is not to allow any type of construction for a firewall without proper damage protection and testing of the assembly. The appendix note states, "…*it is also necessary to determine through testing whether failure of the damage protection component during a fire affects the performance of the fire-resistive component.*"

The national standard for the evaluation of the fire-resistance rating of wall assemblies referenced in the Alberta Building Code 2006 is CAN/ULC-S101, "Fire Endurance Tests of Building Construction and Materials." Clause 5.2.1.1. of ULC S101 states that once a fire endurance period is determined for a given assembly of materials, the Hose Stream Test shall be conducted on an alternate specimen that has been exposed to fire for no more than one hour. The theory behind this clause is that if a fire has been burning in a building for anything more than one hour, the building will be lost, so whether the fire separation can withstand the application of a firefighter's hose stream after that time is

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Issue of this STANDATA is authorized by the Chief Building Administrator

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irrelevant. This logic may be appropriate for standard fire separations, but is not appropriate in the case of firewalls that are used to subdivide buildings.

Firewalls have traditionally been built using masonry or concrete, which do not require the substitution of an alternate test specimen for the application of the Hose Stream Test in ULC S101. As such, in order to determine an equivalent level of safety in any proposed alternate solution to masonry or concrete, the test procedure for the assembly should be modified so as to not use an alternate test specimen for the application of the Hose Stream Test.

At present, there is no recognised Canadian standard for the evaluation of firewalls constructed of noncombustible materials other than masonry or concrete; consequently, it would be appropriate for a safety codes officer to request professional involvement on a project that is proposing to incorporate this kind of firewall. Firewalls require professional involvement for the structural design aspects, such as lateral stability and prevention of collapse, but there is no requirement for professional involvement on the damage protection aspect. Sentence 2.4.2.1.(8) of Division C gives the safety codes officer the authority to ask for an engineer to be involved in the evaluation of the damage protection features of the firewall.

The design of the damage protection features must be evaluated based on an equivalency to masonry or concrete. Masonry and concrete are inherently resistant to external damage, and any proposed firewall would have to meet or exceed the level of protection from physical damage provided by masonry or concrete. It would be the responsibility of the design professional to ensure that that evaluation has been performed.

All of the other requirements for firewalls in Subsection 3.1.10. and Article 4.1.5.18. still apply with regards to structural design and allowable materials. The commentary entitled “Structural Integrity of Firewalls” in the User’s Guide – NBC 2005, Structural Commentaries (Part 4 of Division B) published by the National Research Council contains additional information for structural designers in regards to impact loads, thermal expansion and structural integrity.

CODE REFERENCES

1. Sentence 3.1.7.1.(1) states:

> **3.1.7.1. Determination of Ratings**
> **1)** Except as permitted by Sentence (2) and Article 3.1.7.2., the rating of a material, assembly of materials or a structural member that is required to have a fire-resistance rating, shall be determined on the basis of the results of tests conducted in conformance with CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials.”

2. Sentence 3.1.10.1.(1) states:

> **3.1.10.1. Prevention of Firewall Collapse**
> **1)** Except as permitted by Sentence (2), the connections and supports for structural framing members that are connected to or supported on a *firewall* and have a *fire-resistance rating* less than that required for the *firewall*, shall be designed so that the failure of the framing systems during a fire will not affect the integrity of the *firewall* during the fire.

3. Article 3.1.10.2. states:

> **3.1.10.2. Rating of Firewalls**
> **1)** A *firewall* that separates a *building* or *buildings* with *floor areas* containing a Group E or a Group F, Division 1 or 2 *major occupancy* shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 4 h, except that where the upper portion of a *firewall* separates *floor areas* containing other than Group E or Group F, Division 1 or 2 *major occupancies*, the *fire-resistance rating* of the upper portion of the *firewall* is permitted to be not less than 2 h.
> **2)** A *firewall* that separates a *building* or *buildings* with *floor areas* containing *major occupancies* other than Group E or Group F, Division 1 or 2 shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 2 h.
> **3)** Except as permitted by Sentence (4), the required *fire-resistance rating* of a *firewall*, except for *closures*, shall be provided by masonry or concrete.
> **4)** A *firewall* permitted to have a *fire-resistance rating* not more than 2 h need not be constructed of masonry or concrete, provided
> a) the assembly providing the *fire-resistance rating* is protected against damage that would compromise the integrity of the assembly, and
> b) the design conforms to Article 4.1.5.18.
> (See Appendix A.)

4. Appendix note A-3.1.10.2.(4) states:

> **A-3.1.10.2.(4) Firewall Construction.** Inherent in the use of a firewall is the intent that this specialized wall construction provide the required fire-resistance rating while also being designed to resist physical damage—arising out of normal use—that would compromise the rating of the assembly. Traditionally, this has been accomplished by prescribing the use of noncombustible materials, which was in fact restricted to concrete or masonry. Sentences 3.1.10.2.(3) and (4) are intended to retain both of the characteristics of firewalls, while permitting greater flexibility in the use of materials and designs. The fire-resistance rating and damage protection attributes of a firewall may be provided by a single fire- and damage-resistant material such as concrete or masonry, by a fire- and damage-resistant membrane on a structural frame, or by separate components—one that provides the fire-resistance rating and another one that protects the firewall against damage.
>
> If the firewall is composed of separate components, the fire-resistance rating of the fire-resistive component needs to be determined for this assembly on its own. In addition, if the damage protection component is physically attached to the fire-resistive component (for example, as a sacrificial layer), then for the purposes of determining

the overall performance of the assembly, it is also necessary to determine through testing whether failure of the damage protection component during a fire affects the performance of the fire-resistive component.

5. Article 4.1.5.18. states:

4.1.5.18. Firewalls
1) *Firewalls* shall be designed to resist the maximum effect due to
a) the appropriate lateral design loads prescribed elsewhere in this Section, or
b) a factored lateral load of 0.5 kPa under fire conditions, as described in Sentence (2).
2) Under fire conditions, where the *fire-resistance rating* of the structure is less than that of the *firewall*,
a) lateral support shall be assumed to be provided by the structure on one side only, or
b) another structural support system capable of resisting the loads imposed by a fire on either side of the *firewall* shall be provided.

6. Sentence 2.4.2.1.(8) of Division C states:

2.4.2. Professional Involvement
2.4.2.1. General
…
8) If the size or complexity of a *project* may give rise to special safety concerns, the *authority having jurisdiction* may require
a) that all or part of the plans and specifications of a *building* be imprinted with a stamp or seal affixed by a
i) *professional engineer* where *engineering work* is involved,
ii) *registered architect* where *architectural work* is involved, or
iii) both a *professional engineer* and *registered architect*, and
b) that *field reviews* during construction of a *building* be performed by a
i) *professional engineer* where *engineering work* is involved,
ii) *registered architect* where *architectural work* is involved, or
iii) both a *professional engineer* and *registered architect*.

INTENT ANALYSIS

In addition to the requirements in the Alberta Building Code 2006, there is additional information available from the National Research Council on the intent statements for Sentence 3.1.10.2.(4).

Intent 1:
To limit the probability that the materials used to construct the assembly providing the fire-resistance rating of a firewall will be easily altered or damaged during use, which could lead to an inability of the firewall to control the spread of fire from an adjacent building to the subject building, which could lead to damage to the subject building.

Intent 2:
To limit the probability that the materials used to construct the assembly providing the fire-resistance rating of a firewall will be easily damaged by falling debris during a fire, which could

lead to an inability of the firewall to control the spread of fire from an adjacent building to the subject building, which could lead to damage to the subject building.

Intent 3:
To exempt certain materials from the application of Sentence 3.1.10.2.(3) if these materials and their application achieve the minimum level of performance required by Sentence 3.1.10.2.(4)

INTERPRETATION

Compliance with Sentence 3.1.10.2.(4) for a two-hour firewall that is constructed of noncombustible materials other than masonry or concrete can be obtained, provided:

1. The fire-resistance rating of the proposed assembly has been evaluated by a testing agency that has been accredited by the Standards Council of Canada for conformance to CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials” and incorporated the damage protection features at the time of testing.
2. The damage protection features must be an integral component of the assembly being tested. External damage protection features such as fencing or other physical barricades would not be appropriate based on the evaluation of Intent Statement #2 from the National Research Council.
3. The Hose Stream Test required by Clause 5.2. of CAN/ULC-S101, “Fire Endurance Tests of Building Construction and Materials” shall be conducted on the original specimen subjected to the fire endurance test referred to in Sentence (1). The duplicate specimen mentioned in Clause 5.2.1.1. shall not be permitted.
4. The structural integrity aspects of the assembly have been designed by a professional engineer licensed to practice in the province of Alberta in accordance with Article 4.1.5.18. and the commentary entitled “Structural Integrity of Firewalls” in the User’s Guide – NBC 2005, Structural Commentaries (Part 4 of Division B) published by the National Research Council of Canada.
5. The damage protection features of the assembly have been designed by a professional engineer licensed to practice in the province of Alberta. The professional engineer must provide evidence to the authority having jurisdiction that the damage protection features will provide the necessary performance required by Clause 3.1.10.2.(4)(a) and will provide an equivalent level of performance as that of masonry or concrete. This evidence could be in the form of calculations, physical tests or research performed by others and must demonstrate to the satisfaction of the authority having jurisdiction that the firewall will be protected from damage due to any hazard present in the building during construction and occupancy, such as:

    a. fall, collapse, or expansion of stored items and building contents such as elevated vessels, racks, or shelving,

b. explosion of contents in the area of the firewall such as pressure vessels or flammable materials,

c. mechanical damage from vehicles, equipment or occupants,

d. fracture, penetration, and fragmentation that can be caused by a fire, sprinkler activation, or fire-fighting efforts,

e. collapse of adjacent roof and wall structures or adjoining buildings, or

f. any other factors that may affect the ability of the structure to comply with the intent of the Alberta Building Code.

This INTERPRETATION is applicable throughout the province of Alberta.