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From **Discovery**
to **Innovation...**

2010 NATIONAL MODEL CONSTRUCTION CODES

Spatial Separations

Philip Rizcallah, P.Eng
NRC Canadian Codes Centre
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National Research
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Canada

Introduction



- Presentation is part of a series on the 2010 National Model Construction Codes
- Model codes developed by Canadian Commission on Building and Fire Codes
- These codes must be adopted by provincial/territorial authorities to become law

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This presentation is part of a series of 13 on the 2010 National Model Construction Codes.

It is important to note that the model codes, which are developed by the Canadian Commission on Building and Fire Codes, must be adopted by provincial/territorial authorities to become law.

This may mean that code requirements enacted by legislation within your province or territory might differ from what is presented here.

Please check with your local authority.

Nature of Technical Changes



- Fire department response times
- *Limiting distance*
- Glazed openings and *unprotected openings*
- Protection of *exposing building face*
- Projections



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Today's presentation will focus on the technical changes to Parts 3 and 9 related to spatial separations.

The topics will be presented in 5 categories:

Introduction of fire department response times in Parts 9 and qualification in Part 3

Limiting distance requirements between buildings and homes

Limitations and conditions on glazed openings, unprotected openings and glazing within the exposing building face. (glazed opening is used in Part 9 for houses and refers to windows, sidelights etc.)

Construction requirements (combustible vs. noncombustible) for the exposing building face

Protection and limitations on projections within the exposing building face

Edmonton Fire – Residential Buildings



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Why is spatial separation an important consideration when constructing buildings in proximity to one another?

Well, recent events in Canada have propelled this issue to the forefront. Particularly a rash of fires in Alberta which started in a building under construction and then quickly spread to adjoining properties (there were over 70 homes destroyed in this fire). This not only lead to a number of changes related to spatial separations but also was a catalyst for new fire code changes related to safety at demolition and construction sites.

This was a catalyst in the formation of a joint Parts 3 and 9 Task Group on Spatial Separations.

Edmonton Fire continued...



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In the above photos it becomes very evident what can occur when a fire begins to impinge on adjacent properties. In this particular case over 70 homes were destroyed.

One of the important principles of fire protection is that the probability that one person's property could damage or negatively impact another's be minimized. You will see as we start to go through these changes that the objective of the spatial separation requirements is to reduce the likelihood of fire spread between buildings.

As will be shown in the upcoming slides reducing fire spread between buildings can be accomplished in a number of ways:

1. Limiting how close a building can be to a property line
2. Limiting the area of windows and openings in the exposing building face
3. Designing fire compartments to limit the overall area of the exposing building face
4. Introducing sprinklers

Nature of Technical Changes



- Fire department response times
- *Limiting distance*
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So let's start with the dependency on fire department response times and the impact that it will have on the design criteria.

Limiting Distance (LD)



- Clarification of relationship between fire department response time and LD (between *buildings* and property lines):
 - **10-min response time**
 - Harmonization between Part 3 and Part 9 language on LD **when the 10-min is exceeded**
- Authority having jurisdiction should be consulted at onset of project

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Fire department response time is a critical element in determining the limiting distance requirements in the NBC.

Consistency in the application of this requirement has been established in both Parts 3 and 9 of the Code.

Limiting distance is based on the ability of the fire department to arrive quickly to reduce the likelihood of the fire spread between buildings.

If the building is completely sprinklered this 10-min response time is no longer an issue.

Nature of Technical Changes



- Fire department response times
- *Limiting distance*
- Glazed openings and *unprotected openings*
- Protection of *exposing building face*
- Projections



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Let's look at the impact on limiting distance.

Exposing Building Face



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The above picture illustrates an exposing building face. Assuming this boxed in portion highlights the side of the house which exposes an adjacent property.

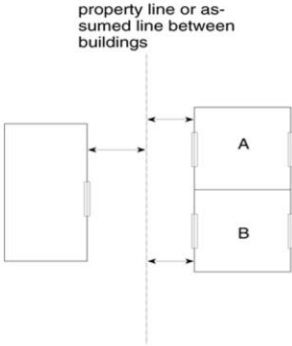
Unprotected Openings (Glazed Openings)



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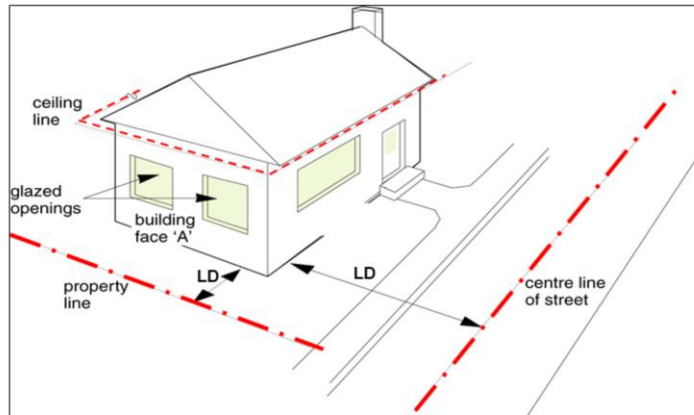
The above picture illustrates unprotected openings (in this case glazed openings in an exposing building face), as well as a vent.

Limiting Distance (LD)



The limiting distance is defined as the distance between the exposing building face to either a property line, a centre line of a street or an imaginary line between two buildings on the same property.

Glazed Openings & LD (Unprotected Openings)



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The above picture illustrates unprotected openings (in this case glazed openings in an exposing building face), as well as a vent. It shows it in relation to a property line or a street line, otherwise referred to as limiting distance.

Limiting Distance (LD)



- Value equal to half the actual *limiting distance* must be used where:
 - 10-min fire department response cannot be met in 90% of calls to the *building*
- AND
 - any *storey* in the *building* is not *sprinklered*



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The specified 10-min time is to be measured from receipt of notification by the fire department until the first fire department vehicle arrives at the building. This recognizes that other times cannot be addressed by the Code or would vary considerably on a case-by-case basis. The proposed reliability rate of 90% is generally consistent with that specified in NFPA 1710, "Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments," which specifies that certain time limits be met in 90% of all calls to the building. This provides some flexibility in meeting the 10-min time limit.

The total time from the start of a fire until fire suppression by the fire department depends on the time taken for a series of actions. The NBC is only concerned with the time from receipt of notification of a fire by the fire department until the arrival of the first fire department vehicle at the building. It specifies a 10-min time limit which must be met in more than 90% of the calls to the building served by the fire department. This reliability level and provision for flexibility is essentially consistent with NFPA 1710 standard.

Where the 10-min limit cannot be met by the fire department at least 90% of the time, a value corresponding to half the actual limiting distance is to be used in requirements that depend on limiting distance to define other criteria.

For new subdivisions, legal agreements may be made for the construction of fire stations to serve those areas. The fire department response time in those subdivisions may temporarily exceed 10 minutes until the fire station is constructed.

Nature of Technical Changes



- Fire department response times
- *Limiting distance*
- **Glazed openings and *unprotected openings***
- Protection of *exposing building face*
- Projections



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Let's look at how glazed openings, unprotected openings and glazing is addressed in Parts 3 and 9 of the NBC.

Unprotected openings include windows, doors and openings for electrical and mechanical services.

Part 9 also uses the term glazed openings, which refer to windows and glazed portions of doors.

The area of unprotected openings or glazed openings allowed on a building face is based on the distance from an exposing building face to the property line, the centerline of a street or a public thoroughfare or an imaginary line between buildings.

Area of Unprotected Openings



- **Area limits where $LD \leq 2$ m**

- Buildings

- $Area = 0.24 [(2 * LD) - 1.2]^2$

| LD (m) | Maximum Area of Individual Unprotected Openings, m ² |
|--------|---|
| 1.2 | 0.35 |
| 1.5 | 0.78 |
| 2.0 | 1.88 |

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The existing limits on unprotected openings assume an even distribution of smaller openings, rather than concentration of larger openings. Concentration of the allowable unprotected opening area into larger unprotected openings, or concentration of smaller unprotected openings in a small area of the exposing building face, increases the exposure of the adjacent building, especially at smaller limiting distances.

The impact of a large unprotected opening or a local concentration of small unprotected openings on the fire exposure to an adjacent building is especially significant at limiting distances of 2 m or less. Except for buildings that are sprinklered, where the limiting distance is 2 m or less, individual unprotected openings in an exposing building face shall be no greater than that shown in the table or by the equation. This would apply to both Part 3 and 9 buildings.

In all cases there is an overriding condition that no unprotected openings or glazed openings be permitted less than 1.2 m from the lot line.

Area of Unprotected Openings



- **Area limits where $LD \leq 2$ m**
 - Part 9 homes:
 - ... individual glazed openings or group of glazed openings in *exposing building face* to not exceed 50% maximum allowable
 - Exceptions
 - *Buildings* and houses:
 - Exception for openable windows (bedroom egress)
 - Sprinklered buildings and houses

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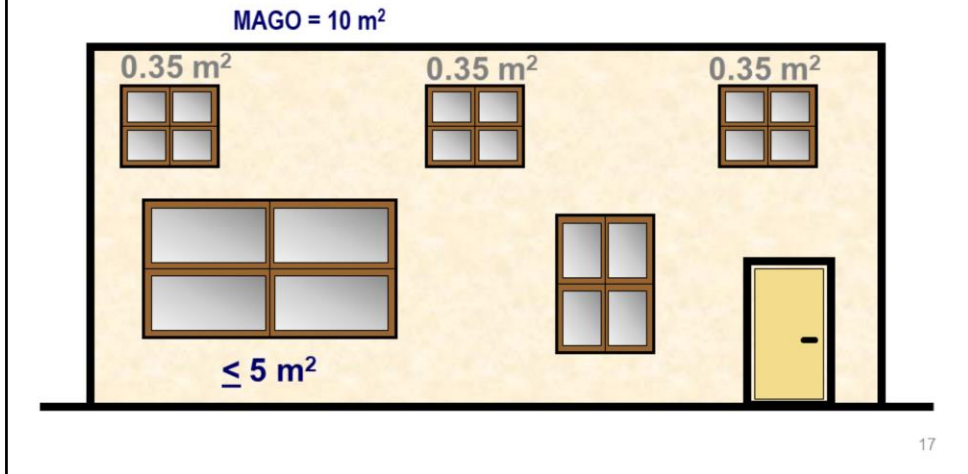
Exceptions are provided for sprinklered buildings and openable bedroom windows with an unobstructed openable area of 0.35 m squared where the window is required to fulfill the requirements for egress from bedrooms.

In the case of homes, individual glazed openings or a group of glazed openings in an exposing building face cannot exceed 50% of the maximum allowable aggregate area of glazed openings. This is permitted based on the smaller size of homes and will also allow flexibility in design.

Area of Glazed Openings



- **Area limits where $LD \leq 2$ m: Houses**

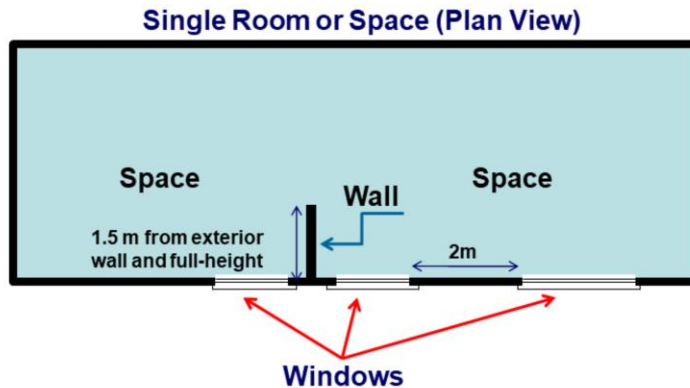


The above elevation view illustrates the concept of openings in an EBF where the opening or group of openings in one area cannot exceed 50% of the mau. The bedroom windows are not calculated into this limit.

Unprotected Openings



- Spacing where $LD \leq 2 \text{ m}$



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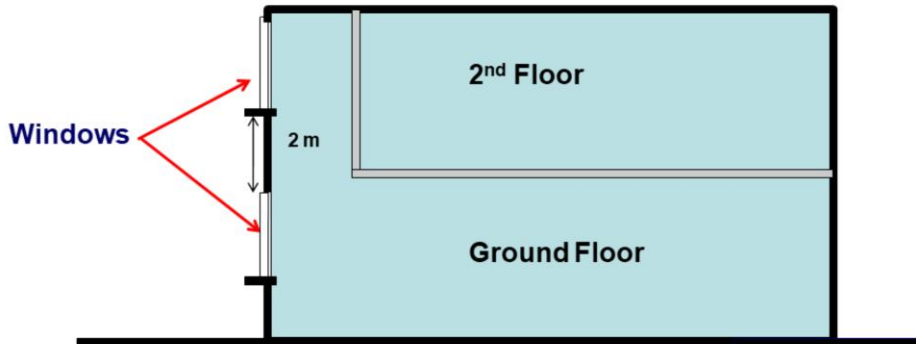
For the purposes of considering whether the exposing building face serves a single room or space:

Where two or more adjacent spaces having a full height separating wall extending less than 1.5 m from the interior face of the exterior wall. The exposing building face can be treated as serving two spaces, in this case the clearance between the windows on the left and centre do not have to comply with the 2-m clearance requirement.

Unprotected Openings



- Spacing where $LD \leq 2 \text{ m}$ (Sectional View)



... two or more stacked spaces that are on the same storey

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This diagram illustrates the vertical 2-m clearance within the same space.

Nature of Technical Changes



- Fire department response times
- *Limiting distance*
- Glazed openings and *unprotected openings*
- **Protection of *exposing building face***
- Projections



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Let's move on to the protection of exposing building face.

Construction of Exposing Building Face



- New change to existing table on cladding
 - Maximum Area of Unprotected Openings (MAUO) > 25 to 50%
 - Cladding required to be noncombustible
 - (2005 NBC MAUO between 25 and 100% was permitted to be combustible)

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In addition to the risk posed to other buildings from heat radiation from unprotected openings, combustible cladding can also pose a threat to adjacent buildings. Where the maximum area of unprotected openings falls between 25 and 50% of the exposing building face, the minimum required fire-resistance rating shall be 45 minutes.

The type of construction is permitted to be of combustible or noncombustible, and the type of cladding must now be noncombustible. This requirement applies to both Parts 3 and 9 buildings.

Construction of Exposing Building Face (Part 3)



- MAUO > 25-50% exception for *noncombustible* cladding where:
 - LD > 5 m
 - **Sprinkler** (including attic)
- OR
- Conforms to special rules controlling cladding in Part 9
 - e.g. - wood siding
 - plywood
 - hardboard
 - vinyl siding

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There are exceptions to the noncombustible cladding requirements where the maximum allowable unprotected opening falls between 25-50% of the area of the exposing building face:

The limiting distance is greater than 5 m.

The building or fire compartment is sprinklered (including attic space)

The cladding conforms to the requirement of Part 9 requiring application over gypsum sheathing.

Construction of Exposing Building Face (Part 9)



- Part 9 Buildings
 - MAUO 25-50% exception for *noncombustible* cladding where:
 - LD > 5 m
 - LD > 2.5 m (aspect ratio)
 - **Sprinkler**
 - OR
 - Conforms to special rules controlling cladding in Part 9
 - e.g. - wood siding
 - plywood
 - hardboard
 - vinyl siding

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There are slight differences between Parts 3 and 9 in the exceptions to the noncombustible cladding requirements where the maximum allowable unprotected opening falls between 25-50% of the area of the exposing building face.

Noncombustible cladding is not required where:

1. The limiting distance is greater than 5 m.
2. The limiting distance is greater than 2.5 m and the width to height ratio of the exposing building face conforms to a newly established Table of height to width aspect ratios
3. The building or fire compartment is sprinklered (the difference from Part 3 is that the sprinkler system can conform to NFPA 13R and not have the attic space sprinklered).
4. The cladding conforms to the requirement of Section 9.27. requiring application over gypsum sheathing.

Construction Aspect Ratio (Part 9)



- Part 9 Buildings

Area and Ratio of W-H where $LD \geq 2.5$ m

| Maximum Ratio of Width to Height of Exposing Building Face | Maximum Area of Exposing Building Face (m ²) |
|--|--|
| 1:1 | 88 |
| 2:1 | 102 |
| 3:1 | 129 |
| 4:1 | 161 |
| 5:1 | 195 |

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The limiting distance is greater than 2.5 m and the width to height ratio of the exposing building face conforms to a newly established Table of height to width aspect ratios.

This table captures the one and two storey type buildings and was based on engineering calculations on expected radiant heat values for a given surface area.

Construction of Exposing Building Face



- Part 9 Houses
 - Where $LD \geq 0.6$ and < 1.2 m:
 - Exposing building face (EBF) with 45-min *fire-resistance rating*
 - Conditions on cladding
 - Metal or noncombustible
 - CAN/ULC S134
 - OR
 - Conforms to special rules controlling cladding in Part 9
 - e.g.
 - wood siding
 - plywood
 - hardboard
 - vinyl siding

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In the case of houses where the limiting distance is equal to or greater than 0.6 m and less than 1.2 m the exposing building face and any wall above enclosing an attic or roof shall have a 45-min fire-resistance rating.

In addition the cladding must be metal or noncombustible, applied over gypsum board, or tested to CAN/ULC-S134, “Fire Test of Exterior Wall Assemblies.”

Nature of Technical Changes



- Fire department response times
- *Limiting distance*
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- Protection of *exposing building face*
- **Projections**



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Last section will deal with projections.

Combustible Projections



- Roof soffits cannot be built above EBF, where $LD < 0.45$ m
- Roof soffits not to project to < 0.45 m from property line where $LD > 0.45$ m



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Diagram shows a situation that will no longer be permitted

Projecting roof soffits shall not be constructed above the exposing building face where the exposing building face has a limiting distance of not more than 0.45 m.

The face of roof soffits above the exposing building face shall not project to less than 0.45 m from the property line where the exposing building face has a limiting distance of more than 0.45 m.

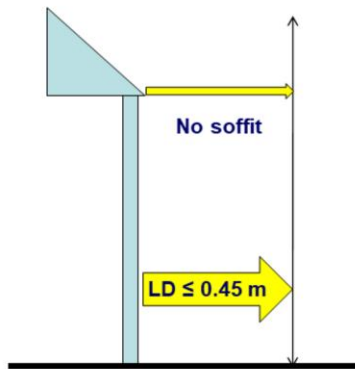
The following slide will illustrate this point a little clearer.

Combustible Projections – Roof Soffits



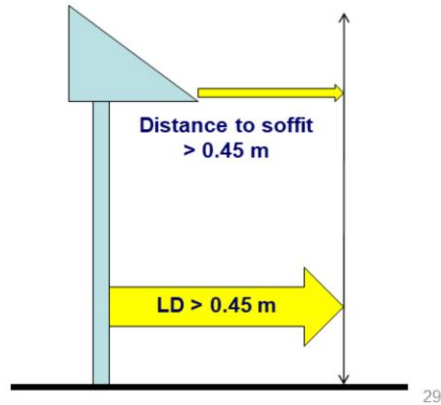
- $LD \leq 0.45$ m

- Roof soffits cannot be constructed $LD \leq 0.45$ m



- $LD > 0.45$ m

- Roof soffits cannot project to ≤ 0.45 m from property line



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Projecting roof soffits shall not be constructed above the exposing building face where the exposing building face has a limiting distance of not more than 0.45 m.

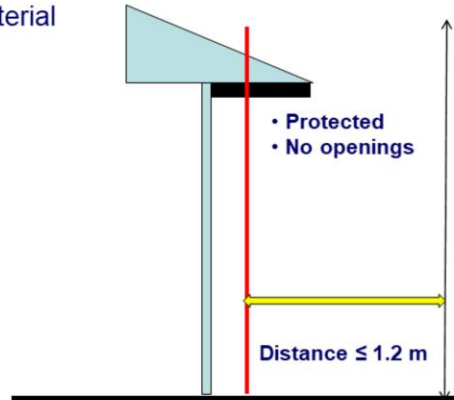
The face of roof soffits above the exposing building face shall not project to less than 0.45 m from the property line where the exposing building face has a limiting distance of more than 0.45

The diagram illustrates the fact that the soffit can never project to closer than 0.45 m to a property line.

Combustible Projections – Roof Soffits



- Where soffits project within < 1.2 m
 - No openings, and
 - Protected by acceptable material

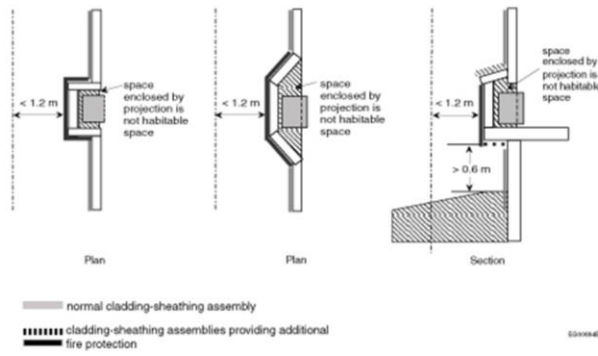


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Where roof soffits project to less than 1.2 m from the centre line of lane or public thoroughfare, or to an imaginary line between two buildings or fire compartments on the same property, they shall:

- a) have no openings, and
- b) be protected by
 - i. not less than 0.38 mm thick sheet steel,
 - ii. unvented aluminum conforming to CAN/CGSB-93.2-M, "Prefinished Aluminum Siding, Soffits and Fascia, for Residential Use,"
 - iii. not less than 12.7 mm thick gypsum soffit board or gypsum ceiling board installed according to CSA-A82.31-M, "Gypsum Board Application,"
 - iv. not less than 11 mm thick plywood,
 - v. not less than 12.5 mm thick OSB or waferboard, or
 - vi. not less than 11 mm thick lumber.

Projections



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The following slide shows the protection requirements for a projection (i.e. fire place) on the side of a home. In this case where the projection is less than 1.2 m to the property line, the exposing building surface must have a fire-resistance rating.

Where a projection extends within 0.6 m of the property line, it must be protected

to the same degree as an exposing building face that has a limiting distance of less than 0.6 m. Where a projection extends to less than 1.2 m but not less than 0.6 m of the property line, it must be protected to the same degree as an exposing building face that has a limiting distance of less than 1.2 m.

Protection is also required on the underside of the projection where the projection is more than 0.6 m above finished ground level, measured at the exposing building face.

Summary



- New requirements introduced to Parts 3 and 9 addressing concerns related to spatial separations
 - Clarified Fire Department Response Time
 - Limitations on % of unprotected openings (EBF)
 - Requirements for noncombustible cladding (EBF)
 - Limits on projections (EBF)
 - Protection of projections (EBF)

ead from slide



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Questions?

Send them to us at codes@nrc-cnrc.gc.ca

Thank you!