Fire Protection, Life Safety & Accessibility Solutions

Single Exit Stair

Ontario Building Code
Feasibility Study

Prepared for:

City of Toronto
Toronto Building

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1.0 Executive Summary

This report is a technical feasibility study related to the provision of a single exit serving a specific 4-storey case study residential building. The preparation of this report is based on recommendation #11 from the City Council consideration EX6.14 from July 19, 2023 as follows:

> *City Council direct the Chief Building Official and Executive Director, Toronto Building, in consultation with the Fire Chief and General Manager, Toronto Fire Services and the Chief Planner and Executive Director, City Planning, to facilitate the design and construction of missing middle housing forms, while meeting Building Code objectives, in support of the City's housing strategy and the Expanding Housing Options in Neighbourhoods initiative by:*
>
> a. *hiring a Building Code Consultant for technical consulting services to study the feasibility of supporting egress in multi-residential buildings of up to four stories, including additional life safety and other measures which would meet the objectives and intent of the Ontario Building Code, and report back on these findings to the Planning and Housing Committee in the first quarter of 2024; and*
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> b. *working in partnership with the Chief Planner and Executive Director, City Planning, incorporate any alternative options for compliance into the "Expanding Housing Options in Neighbourhoods" initiative and other missing middle projects in the City of Toronto.*

The purpose of this report is to review and assess the level of fire protection and life safety with respect to the minimum applicable fire protection and life safety requirements of the Ontario Building Code (OBC) and other building code regulations to determine the feasibility of supporting 4-storey residential construction where the storeys above grade are served by a single exit stair enclosure. This study includes the review and presentation of the allowances and limitations provided by the National Fire Protection Association (NFPA) standards and the International Building Code (IBC) towards identifying similar measures and/or conditions that could potentially be adopted in order to permit a single exit.

It is intended that the Feasibility Study Report provides a technical overview of the allowances, limitations, and mitigating features that would require concurrence from Toronto Building and Toronto Fire Services in order to facilitate the consideration of a potential alternative solution to be submitted in the future. This feasibility study does not include the production of an alternative solution. Rather, it is intended that this report identify those aspects that may support and/or may preclude an alternative solution for the provision of a single exit.

In order to ascertain what aspects of an alternative solution might be considered and evaluated, the issues related to compliance with the OBC requirements must first be established. The development of the content of this report included the engagement of the City of Toronto subject matter experts (SMEs) from Toronto Building and Toronto Fire Services to understand the perspective of each as it relates to this proposed concept.

An alternative solution to the OBC to address a single exit is feasible if the provision of a single exit is determined to be an acceptable risk as it relates to the exit being blocked or obstructed in an emergency

situation (i.e., the condition will not perform the same as two exits), and potentially impacting evacuation from the building and/or emergency response operations.

Potential mitigating features incorporated as part of an alternative solution may include features such as:

- sprinklered building,
- restrictions on the number of suites per floor that are served by a single exit,
- maximum area of suites,
- travel distance limitations,
- maximum occupant load,
- limits on occupancy types served by a single exit,
- increased exit stair width (e.g., 1650 mm wide stair), and
- additional provisions/enhancements for fire protection and life safety systems (e.g., increased corridor fire separation performance, provision of corridor or exit stair pressurization, etc.)

It is important to note that measures, such as the provision of sprinkler protection or enhanced corridor protection, will provide a higher degree of fire safety in the building but will not necessarily address every type of emergency that could require the rapid evacuation of the building, such as release of hazardous substances or the presence of intruders. It is expected that this may be mitigated through limitations on the number of suites and occupant load of the building; however, further study of this with the appropriate stakeholders is required.

It is noted that the requirements of *Part 2 – Fire Safety* and *Part 6 – Fire Protection Equipment* of the Ontario Fire Code (OFC) are generally sufficient to address approved alternative solutions, such as an alternative solution to provide a single exit stair. Maintenance of the fire protection and life safety systems in a building having a single exit is of increased importance when compared to a building have two separate exits. While reliability of sprinkler systems has been widely studied, additional review of the reliability of other systems (e.g., fire separations, door hardware, mechanical pressurization systems, etc.) is integral to assessing the overall risk that may be associated with a single exit building as it relates to the perceived redundancy provided by a building with two exits.

Other jurisdictions in North America have assessed this risk and created a regulatory framework for approval. Given the similarities between building construction standards and standards from which fire department operations have been developed, these existing frameworks could potentially be adopted in order to mitigate the risk associated with a single exit stair.

2.0 Introduction

This report is a technical feasibility study related to the provision of a single exit serving a specific 4-storey case study residential building. The preparation of this report is based on recommendation #11 from the City Council consideration EX6.14 from July 19, 2023 as follows:

> *City Council direct the Chief Building Official and Executive Director, Toronto Building, in consultation with the Fire Chief and General Manager, Toronto Fire Services and the Chief Planner and Executive Director, City Planning, to facilitate the design and construction of missing middle housing forms, while meeting Building Code objectives, in support of the City's housing strategy and the Expanding Housing Options in Neighbourhoods initiative by:*
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> a. *a. hiring a Building Code Consultant for technical consulting services to study the feasibility of supporting egress in multi-residential buildings of up to four stories, including additional life safety and other measures which would meet the objectives and intent of the Ontario Building Code, and report back on these findings to the Planning and Housing Committee in the first quarter of 2024; and*
> b. *working in partnership with the Chief Planner and Executive Director, City Planning, incorporate any alternative options for compliance into the "Expanding Housing Options in Neighbourhoods" initiative and other missing middle projects in the City of Toronto.*

The overall goal of this study is to undertake an analysis of the feasibility of supporting egress in multi-family residential buildings of up to four stories, including additional life safety and other measures which would meet the objectives and intent of the OBC.

2.1 Purpose of This Report

The purpose of this report is to review and assess the level of fire protection and life safety with respect to the minimum applicable fire protection and life safety requirements of the Ontario Building Code (OBC) and other building code regulations to determine the feasibility of supporting 4-storey residential construction where the storeys above grade are served by a single exit stair enclosure. This study includes the review and presentation of the allowances and limitations provided by the National Fire Protection Association (NFPA) standards and the International Building Code (IBC) towards identifying similar measures and/or conditions that could potentially be adopted in order to permit a single exit.

It is intended that the Feasibility Study Report provides a technical overview of the allowances, limitations, and mitigating features that would require concurrence from Toronto Building and Toronto Fire Services in order to facilitate the consideration of a potential alternative solution to be submitted in the future. This feasibility study does not include the production of an alternative solution. Rather, it is intended that this report identify those aspects that may support and/or may preclude an alternative solution for the provision of a single exit.

2.2 Process and Research

In order to ascertain what aspects of an alternative solution might be considered and evaluated, the issues related to compliance with the OBC requirements must first be established. The development of the content

of this report included the engagement of the City of Toronto subject matter experts (SMEs) from Toronto Building and Toronto Fire Services to understand the perspective of each as it relates to this proposed concept.

The outcome of the initial engagement included:

- Working Group Session to present the initial analysis of applicable codes, and the initial evaluation of the options available for compliance and confirm the aspects of the Ontario Building Code that would be part of the evaluation for alternative solutions.

This report provides a summary of the information gathered, analysis of the conformance challenges, and the potential approaches to compliance that are intended to address the identified challenges.

2.3 Acknowledgement of the Working Group

This report has been prepared with the invaluable assistance and expertise provided by members of the technical working group and subject matter experts from Toronto Building and Toronto Fire Services – Prevention.

Sponsorship

- Kamal Gogna, CBO (A), Toronto Building
- Dylan Aster, Director, Policy and Strategic Support (A), Toronto Building

Working Group:

- Andrew Wild, Plan Review Mgr., Toronto, Building
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- Josh Heisterkamp, Plan Review Mgr., Toronto Building
- Larry Cocco, Deputy Fire Chief/Director, Toronto Fire Services
- Laura Boyko, Division Chief, Toronto Fire Services – Prevention
- Caroline Bucksbaum, Policy Development Office, Policy and Strategic Support, Toronto Building

2.4 Limitations of This Report

This report was prepared by LMDG Building Code Consultants Ltd. for the City of Toronto.

The material provided in this report is based on LMDG's best judgment in light of the information available to LMDG at the time of preparation. With the exception of the City of Toronto, any use of this report by third parties or any reliance on or decisions to be made based on it are the responsibility of such third parties. LMDG accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions based on this report.

3.0 Application of the Code

The following subheadings provide an outline of the purpose and composition of the OBC and identify which parts of the OBC are applicable to exiting from a 4-storey multi-family residential building as defined by the OBC. The building codes from other jurisdictions included in this evaluation are introduced as their relevance relates to this study.

Additionally, the application of the OFC as it relates to maintenance of existing multi tenant residential apartment buildings is explained as defined by the OFC.

3.1 Ontario Building Code

The concept of a 'safe' building is constantly evolving due to the dynamic nature of the built environment, including construction methods, materials, political influence, and societal risk tolerance.

From a fire protection and life safety perspective, the elements or systems that are identified by the OBC requirements can generally be categorized as providing "passive" protection or "active" protection. Passive fire protection elements are those components or assemblies in a building that provide their required performance as constructed. An example of a passive element is a fire separation. Active fire protection elements require an event to trigger or cause the fire protection element to function, such as a sprinkler system or a fire alarm system.

The Ontario Building Code is published by the Ministry of Municipal Affairs and Housing.

The version of the OBC used for this report is O.Reg. 332/12 as amended by O.Reg. 73/24.

3.1.1 Acceptable Solutions and Alternative Solutions

The Objective-based OBC is made up of two major divisions – Division A and Division B. Division A presents the objectives that the code addresses and the functional requirements (in qualitative terms) that solutions must satisfy. Division B presents the quantitative performance criteria with which solutions must comply (where these are available) and provides deemed-to-comply/prescriptively compliant solutions (i.e., "acceptable solutions") drawn from the current version of the Building Code.

The OBC 2012 explains that compliance with the Code can be achieved by:

- complying with the applicable acceptable solutions in Division B, or
- using alternative solutions that will achieve at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions.

The quantitative performance criteria provided in the Code for the various and multitude of requirements generates an "overall" or an "average" performance level – a sum-of-all-parts, so to speak. Where an "alternative solution" to a Code requirement is considered, it must ensure that the average performance level of the building is not reduced. Meaning, where an alternative solution is proposed to address a decrease in the performance level of a certain aspect or element of the building, some or all of the

remaining aspects or elements of the building would be enhanced (or their performance level increased) in order to achieve at least the same overall performance for the building.

With respect to alternative solutions, the Code also includes an entire list of Objective Statements, including the categories:

- OS – Safety,
- OH – Health,
- OA – Accessibility, and
- OP – Fire and Structural Protection of Buildings.

Included as part of this document is the list of Functional Statements, which are measures – such as those described in the acceptable solutions in Division B – that are intended to allow the building or its elements to achieve the stated objectives. Finally, the OBC includes a list of the objective and functional statements attributed to each code requirement (i.e., Division B) and against each specific code reference.

As described in Division C, Sentence 2.3.1.1.(1), acceptance of alternative solutions is at the discretion of the Chief Building Official.

3.1.2 Definitions

The following are definitions of applicable terms used within the OBC that are relevant to this report as provided in Division A, Article 1.4.1.2 of the OBC and Appendix A-2.2.1.1.(1):

Residential occupancy means an occupancy in which sleeping accommodation is provided to residents who are not harboured for the purpose of receiving special care or treatment and are not involuntarily detained and includes an occupancy in which sleeping accommodation is provided to residents of a retirement home.

Dwelling unit means a suite operated as a housekeeping unit, used or intended to be used by one or more persons and usually containing cooking, eating, living, sleeping and sanitary facilities.

Suite means a single room or series of rooms of complementary use, operated under a single tenancy, and includes,

a) dwelling units,
b) individual guest rooms in motels, hotels, boarding houses, rooming houses and dormitories, and
c) individual stores and individual or complementary rooms for business and personal services occupancies.

Emergency The term “emergency” – in the context of safety in buildings – is often equated to the term “fire emergency”; however, the wording of objectives OS3.7 and OS5.9 makes it clear that the Code addresses any type of emergency that would require the rapid evacuation of the building, such as release of hazardous substances or the presence of intruders.

3.1.3 Application of Part 3 – Fire Protection, Occupant Safety and Accessibility

The requirements of OBC Part 3 are applicable to a 4-storey residential building irrespective of the building footprint.

A building subject to the requirements of OBC Part 3 requires the design and general review of the building to be completed by registered professionals (i.e., architects and/or engineers). Comparatively, a Part 9 residential building (i.e., not exceeding three storeys in building height and 600 m^2 in building area (footprint) can be designed by a designer who has been qualified through the Ministry of Municipal Affairs and Housing and does not require a general review by registered professionals to be completed.

It is noted that an alternative solution to provide a single exit for a 4-storey multi-family residential building should also extend to buildings governed by Part 9 of the OBC (i.e., 3-storey multi-family residential buildings, should a single exit be provided for as an alternative solution).

3.2 Ontario Fire Code

The companion requirements included in this evaluation are those provided in OFC Section 9.5 – "Buildings up to and including 6 Storeys in Building Height with Residential Occupancies" for the mandatory retrofit requirements that are applicable to 4-storey multi-family residential buildings that are existing. As identified by the OFC, "existing" means that the building existed on October 9, 1992, as a permitted and OBC-compliant apartment building at that time. It is noted that Section 9.5 does not apply to a building or part of a building that satisfies the requirements of the Ontario Building Code.

This analysis does not include a detailed review of the OFC requirements related to the maintenance of existing building elements or systems such as those provided in OFC Part 2 and OFC Part 6.

The Ontario Fire Code is published by the Office of the Fire Marshal (OFM) through the Ministry of the Solicitor General.

The version of the OFC used for this report is O.Reg. 213/07 as amended by O.Reg. 319/22.

3.3 Relationship Between the OBC and the OFC

The Ontario Building Code (OBC) and Ontario Fire Code (OFC) each contain provisions that relate to the safety of persons in buildings in the event of a fire and the protection of buildings from the effects of fire. These two codes are developed as complementary and coordinated documents to minimize the possibility of their containing conflicting provisions. Generally, it is expected that buildings comply with both the OBC and the OFC.

The OBC provides requirements related to fire safety and fire protection features that are required to be incorporated in a building at the time of original construction. Building codes typically no longer apply once a building is occupied unless the building is undergoing alteration or change of use. Meaning, the OBC is not intended to be retroactively applied to an existing building that had otherwise been permitted to be constructed at the time.

The OFC provides requirements relative to the ongoing maintenance and use of the fire safety and fire protection features incorporated in buildings. The OFC also provides requirements for:

- the conduct of activities that might cause fire hazards in and around buildings.
- limitations on hazardous contents in and around buildings.
- the establishment of fire safety plans, and
- fire safety at construction and demolition sites.

The OFC, through Part 9 – Retrofit, provides minimum mandatory upgrade/retrofit requirements for certain building types. It is noted that multi-tenant residential occupancies up to and including six storeys in building height are required to meet mandatory upgrade requirements as provided in OFC Section 9.5.

3.4 Comparison of Additional Jurisdictions

A review of the allowances and limitations provided by the following documents has been evaluated towards identifying similar measures that could potentially be adopted in order to permit a similar provision.

In addition to the United States model codes, the Seattle and New York City Building Codes have been reviewed, as both jurisdictions have provided amendments to permit single exits in buildings up to six-storeys in building height.

2024 National Fire Protection Association 101 Life Safety Code (NFPA 101)

The Life Safety Code is the most widely used source for strategies to protect people based on building construction, protection, and occupancy features that minimize the effects of fire and related hazards. The Code covers life safety in both new and existing structures, and is referenced in part by the National Building Code of Canada (NBC) for fixed seating, and the Newfoundland and Labrador Fire Protection Services Regulations for the use and operation of all buildings.

The version of NFPA 101 used for this report is the 2024 edition (September 2023).

2021 International Building Code (IBC)

The IBC is similar to Canada's NBC and provides a model building code for individual states or cities to adopt. For example, the IBC is the model building code for California, New York, and Illinois.

The version of the IBC used for this report is the 2021 edition (October 2020).

2018 Seattle Building Code (SBC)

The SBC has adopted the 2018 International Building Code, with amendments specific to the city.

The version of the SBC used for this report is the 2018 edition (March 2021).

2022 New York City Building Code (NYCBC)

The NYCBC has adopted the 2015 International Building Code, with amendments specific to the city.

The version of the NYCBC used for this report is the 2022 edition (November 2022).

4.0 Understanding the Issues

As identified, this analysis focuses on the challenges related to compliance with the requirements of the OBC as faced by building owners, building operators, and Toronto Building as it relates to plans examination and inspections.

The acceptable solutions provide a range of construction options for a 4-storey residential building, as summarized in the table below:

	Article 3.2.2.45. Group C, up to 4 Storeys, Sprinklered	**Article 3.2.2.44. Group C, up to 4 Storeys, Noncombustible Construction**	**Article 3.2.2.43A., Group C, up to 6 Storeys, Sprinklered, Combustible Construction**	**Article 3.2.2.43. Group C, up to 6 Storeys, Sprinklered, Noncombustible Construction**	**Article 3.2.2.42A. Group C, up to 12 Storeys, Encapsulated Mass Timber Construction**	**Article 3.2.2.42. Group C, Any Height, Any Area, Sprinklered**
Min. No. of Exits	2	1 (exterior exit door permitted for row houses)	2	2	2	2
Max. Building Area	1800 m^2	4500 m^2	2250 m^2	9000 m^2	6000 m^2	Any
No. of Streets Facing	1 street	3 streets	1 street	1 street	1 street	1 street
Construction Type	Combustible	Noncombustible	Combustible	Noncombustible	Encapsulated Mass Timber	Noncombustible
Sprinklered	Yes	No	Yes	Yes	Yes	Yes
Standpipe	Permitted to be waived for row houses conforming to Sentence 3.2.9.1.(1)		Yes	Yes	Yes	Yes
Fire Alarm System	Yes	Yes	Yes	Yes	Yes	Yes
Rating of Floors	1-hour	1-hour	1-hour	1-hour	2-hour	2-hour
Rating of Roof	No rating	1-hour	1-hour	No rating	No rating	No rating

Further to the above, the requirements of OBC Subsection 3.2.5., "Provisions for Firefighting" are generally predicated on the fire protection systems within the building. For example, nonsprinklered buildings will require access openings in the above-grade storeys required to face a street to permit firefighters to fight a fire from the exterior of the building; however, in a sprinklered building, these requirements are waived with exception of the provision of a principal entrance to the building. Additionally, the extent of a building that is required to face a street (i.e., the building face is within 3 m to 15 m of a fire department access route) will also depend on whether the building is sprinklered, the building area, as well as the construction type.

In a 4-storey building, the principal fire department entrance to a building is required to be between 3 m to 15 m of the fire access route. Additional entrances (e.g., for cut-off units such as row houses) are required to be located within 45 m of the fire access route.

As identified, a residential building that is 4-storeys in height with dwelling units above one another is required by the OBC to be provided with two exits regardless of construction type, fire department access provisions, or fire protection/life safety systems that have been included in the building. With this in mind, any alternative solution related to the provision of a single exit in a building is required to demonstrate that the performance of the proposed building would be at least the same as a building with two exits, where both buildings have the generally been designed to include the same fire protection and life safety features. It is this aspect that presents a challenge in the preparation of an alternative solution.

5.0 Analysis of OBC Requirements

5.1 Format of Analysis

Each of the performance requirements of a building identified in the previous section can be attributed to a specific requirement or set of requirements in the OBC. Accordingly, and in consideration of the goal of the evaluation, each aspect of the OBC identified above has been evaluated utilizing the following format:

a) Identification of the OBC requirement including:
    i. Attributed Functional Statements and Objectives
    ii. NBC 2015 Intent Statements (see note below)
b) Evaluation of requirements
c) OFC companion requirement(s)

In addition, a review of the allowances and limitations provided by comparative jurisdictions related to the provision of a single exit for a residential building has been evaluated towards identifying similar measures that could potentially be adopted in order to permit a similar provision.

Note: In consideration that the Ministry of Municipal Affairs and Housing does not publish intent statements to the requirements of the OBC, this evaluation utilizes the intent statements published by the National Research Council of Canada (NRC) for the 2015 National Building Code of Canada (NBC). In each instance, the requirements of the 2015 NBC are the same as those of the OBC.

The following is a list of the building elements or aspects that have been evaluated for a potential alternative solution related to the associated OBC requirements for the number of exits in a building:

1. Number of exits required,
2. Choice of exits from a public corridor,
3. Second means of egress from dwelling units using a public corridor served by a single exit,
4. Dead-end corridors,
5. Dwelling units not permitted to open directly into an exit stair, and
6. Distribution of exit width.

5.2 Number of Exits Required

5.2.1 OBC Requirement

In accordance with Sentence 3.4.2.1.(1), except as otherwise permitted in Article 3.4.2.1., every floor area intended for occupancy is required to be served by at least two exits.

In accordance with Sentence 3.4.2.1.(2), a single exit is permitted for a floor area in a building up to **two** storeys in building height provided:

- the total occupant load served by one exit is limited to 60 persons, and
- the floor area served by a single exit and travel distances to the exit comply with Tables 3.4.2.1.A (not sprinklered) and B. (sprinklered) as summarized in the following table:

OBC Table	Maximum Floor Area (m^2)	Maximum Travel Distance
3.4.2.1.A. (Group C – not sprinklered)	100	15
3.4.2.1.B. (Group C – sprinklered)	150	25

In accordance with Sentence 3.4.2.1.(4), the requirements of Sentences (1) and (2) are permitted to be waived for dwelling units having access to exit conforming to Sentence 3.3.4.4.(1) to (4) and (8). Specifically, in accordance with Sentence 3.3.4.4.(8), dwelling units in a building conforming to Subclause 3.2.2.44.(1)(a)(ii) (4-storey noncombustible row houses) are permitted to be served by an exterior exit doorway located not more than 1.5 m above adjacent ground level without requiring a second means of egress provided a balcony conforming to Sentence 3.3.4.4.(7) is provided as outlined in Sentence 3.3.4.4.(4).

Attributed Functional Statements and Objectives

The table below provides a summary of the attributed Functional Statements and Objectives as identified by Table 3 of Supplementary Standard SA-1.

Sentence	Functional Statement(s)	Objectives
	Safety in Use	
3.4.2.1.(1)	**F05** – To retard the effects of fire on emergency egress facilities. **F06** – To retard the effects of fire on facilities for notification, suppression and emergency response.	• **OS3.7** – To limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to hazards caused by persons being delayed in or impeded from moving to a safe place during an emergency.

Sentence	Functional Statement(s)	Objectives
	F10 – To facilitate the timely movement of persons to a safe place in an emergency. **F12** – To facilitate emergency response.	
	Fire Safety and Fire Protection of the Building	
	F06 – To retard the effects of fire on facilities for notification, suppression and emergency response. **F12** – To facilitate emergency response.	• **OS1.2** – To limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire. The risks of injury due to fire addressed in this Code are those caused by fire or explosion impacting areas beyond its point of origin. • **OP1.2** – To limit the probability that, as a result of its design or construction, the building will be exposed to an unacceptable risk of damage due to fire. The risks of damage due to fire addressed in this Code are those caused by fire or explosion impacting areas beyond its point of origin.

Note: There is no attribution of Functional Statements or Objectives to Sentence 3.4.2.1.(2) and (4) as these are exceptions to the requirements of 3.4.2.1.(1).

Building Code Intent Statements

The following intent statements are attributed to the number of exit requirements:

Sentence 3.4.2.1.(1)
OS3 Safety in Use

Intent 1:

To limit the probability that persons will not have a choice of an alternative exit in the event that one exit is blocked or obstructed in an emergency situation, which could lead to delays in the evacuation or movement of persons to a safe place, which could lead to harm to persons.

Intent 2:

To limit the probability that emergency responders will not have a choice of an alternative exit in the event that one exit is blocked or obstructed in an emergency situation, which could lead to emergency responders being delayed in gaining access to a floor area, which could lead to delays or ineffectiveness in emergency response operations, which could lead to delays in the evacuation or movement of persons to a safe place, which could lead to harm to persons.

OS1 Fire Safety

Intent 1:

To limit the probability that emergency responders will not have a choice of an alternative exit in the case of one exit being blocked or obstructed in a fire situation, which could lead to emergency responders being delayed in gaining access to a floor area, which could lead to delays or ineffectiveness in emergency response operations, which could lead to the spread of fire, which could lead to harm to persons.

OP1 Fire Protection of the Building

Intent 1:

To limit the probability that emergency responders will not have a choice of an alternative exit in the event that one exit is blocked or obstructed in a fire situation, which could lead to emergency responders being delayed in gaining access to a floor area, which could lead to delays or ineffectiveness in emergency response operations, which could lead to the spread of fire, which could lead to damage to the building

Sentence 3.4.2.1.(2)

Intent 1:

To exempt certain floor areas from the requirements of Sentences 3.3.1.3.(9) and 3.4.2.1.(1) concerning multiple exits and allow a single exit on the basis that the floor area served by the exit has a limited occupant load, and a restricted area and travel distance.

Sentence 3.4.2.1.(4)

Intent 1:

To exempt access to exits for dwelling units from the requirements of Sentence 3.4.2.1.(1) or (2), which would otherwise require two exits or one exit, provided some conditions are met, on the basis that:

- *occupants are familiar with their egress routes, and*
- *the dwelling unit design will be constrained in accordance with Sentences 3.3.4.4.(1) to (4), thus limiting the number of occupants.*

5.2.2 Evaluation of Requirements

Under the acceptable solutions of the OBC, two separate exit stairs would be required for a 4-storey multi-family residential building not meeting the exceptions under Sentences 3.3.4.4.(1) to (4) and (8) (i.e., dwelling units having a second, separate means of egress – refer to **Section 5.4** of this report).

Given the intent statements provided for this requirement, there are multiple challenges in demonstrating that an alternative solution for a single exit stair serving a building more than two storeys in building height will perform as well as the acceptable solutions of the OBC. Approval of an alternative solution for a single exit stair becomes essentially contingent on the concept that the provision of a single exit presents an acceptable risk as it relates to the exit being blocked or obstructed in an emergency situation, potentially impacting evacuation from the building and emergency response operations.

5.2.3 Ontario Fire Code Companion Requirements

In accordance with Sentence 9.5.3.2.(1), except as noted in the Table below, each floor area is required to be served by a minimum of two exits.

OFC Permitted Compliance Alternative	**OFC Sentence 9.5.3.2.(2)** A single exit from a basement, first or second floor is deemed to be in compliance with Sentence (1) where the exit does not serve more than four dwelling units, the exit does not serve more than 10 persons and the building is not more than 3 storeys in building height and is not greater than 600 m^2 in building area. **OFC Sentence 9.5.3.3.(3)** Where a building is not more than 3 storeys in building height and not greater than 600 m2 in building area, alternative measures to Sentence (1) may be used if they are approved, and in the opinion of the Chief Fire Official, will provide protection for life safety similar to the protection provided by compliance with Sentence (1). **Rationale:** This alternative compliance is a prescriptively permitted reduction in the required performance level of this aspect of the building in order to address the related construction difficulties associated with constructing a second exit within an existing building. **Impact:** This alternative compliance deems that a single exit is sufficient for low buildings with a limited occupant load and where approved alternative measures are provided.

As identified above, an existing building that has a single exit may be permitted existing condition subject to the conditions above (i.e., height, area, number of dwelling units, and occupant load) and approval by the municipal Chief Fire Official.

5.3 Choice of Exits from a Public Corridor

5.3.1 OBC Requirement

In accordance with Sentence 3.3.1.3.(8), except as permitted by Sentences 3.3.4.4.(5) and (6) (refer to **Sections 5.4** and **5.6** of this report), each suite in a multi-tenant floor area is required to have either an exterior exit doorway, or a doorway into a public corridor or an exterior passageway.

In accordance with Sentence 3.3.1.3.(9), except as otherwise provided in this Section (i.e., dead-end corridors – refer to **Section 5.5** of this report), and by Sentence 3.4.2.1.(2) (single exit – refer to **Section 5.2** of this report), at the point where a egress doorway from a suite in a multi-tenant floor area opens into a public corridor, it must be possible to go in opposite directions to each of two separate exits.

Attributed Functional Statements and Objectives

The table below provides a summary of the attributed Functional Statements and Objectives as identified by Table 3 of Supplementary Standard SA-1.

Sentence	Functional Statement(s)	Objectives
		Fire Safety
3.3.1.3.(8)	**F05** – To retard the effects of fire on emergency egress facilities.	• **OS1.5** – To limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire caused by persons being delayed in or impeded from moving to a safe place during a fire emergency.
		Safety in Use
3.3.1.3.(9)	**F05** – To retard the effects of fire on emergency egress facilities. **F06** – To retard the effects of fire on facilities for notification, suppression and emergency response. **F10** – To facilitate the timely movement of persons to a safe place in an emergency. **F12** – To facilitate emergency response.	• **OS3.7** – To limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to hazards caused by persons being delayed in or impeded from moving to a safe place during an emergency.

Building Code Intent Statements

The following intent statements are attributed to the requirement to provide a choice of exits from a public corridor:

Sentence 3.3.1.3.(8)
OS1 Fire Safety
Intent 1:

To limit the probability that persons leaving a suite in a fire situation will not be protected from fire while evacuating or moving to a safe place, which could lead to harm to persons.

Sentence 3.3.1.3.(9)
OS3 Safety in Use
Intent 1:

To limit the probability of delays in the evacuation or movement of persons to a safe place in the event that one egress route becomes obstructed or inaccessible in an emergency, which could lead to harm to persons.

Intent 2:

To limit the probability that emergency responders will be delayed or ineffective in carrying out their emergency response operations in the event that one egress route becomes obstructed or inaccessible, which could lead to delays in the evacuation or movement of persons to a safe place, which could lead to harm to persons.

5.3.2 Evaluation of Requirements

Under the acceptable solutions of the OBC, a choice of exits would be required where the egress door from a dwelling unit in a 4-storey multi-family residential building opens into the public corridor, other than as permitted for dead-end corridors (refer to **Section 5.5** of this report).

However, if it can be demonstrated that the risk associated with the single exit stair is acceptable, and assuming the dead-end condition otherwise complies with the OBC (i.e., travel in a dead-end corridor is limited to the current provision), then the level of performance set out by the objectives and functional statements of the OBC can be considered to be achieved.

5.3.3 Ontario Fire Code Companion Requirements

In accordance with Clause 9.5.3.1.(1)(c), except as permitted for dead-end corridors (refer to **Section 5.5.3** of this report) each dwelling unit or suite in a floor area is required to have a doorway leading to a public corridor where it is possible to go in opposite directions to separate exits.

5.4 Second Means of Egress from Dwelling Units Using a Public Corridor Served by a Single Exit

5.4.1 OBC Requirement

In accordance with Clause 3.3.4.4.(6)(a), one means of egress from a dwelling unit is permitted to pass through an interior corridor served by a single exit provided the dwelling unit has a second and separate means of egress.

Attributed Functional Statements and Objectives

The table below provides a summary of the attributed Functional Statements and Objectives as identified by Table 3 of Supplementary Standard SA-1.

Sentence	Functional Statement(s)	Objectives
	Safety in Use	
3.3.4.4.(6)	**F05** – To retard the effects of fire on emergency egress facilities. **F10** – To facilitate the timely movement of persons to a safe place in an emergency.	• **OS3.7** – To limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to hazards caused by persons being delayed in or impeded from moving to a safe place during an emergency.

Building Code Intent Statements

The following intent statements are attributed to the requirement for suite fire separations:

Intent 1:

To exempt egress facilities serving a dwelling unit from the requirements of Sentences 3.3.1.3.(8) and (9), and 3.3.1.9.(7) which would otherwise:

- *require a doorway to the exterior, a public corridor or an exterior passageway, or*
- *prohibit a dead-end corridor that is longer than 6 m.*

This is on the basis that there is a second means of egress from the dwelling unit available if the route through a means of egress leading to the exit is impeded, blocked, or untenable.

This is to limit the probability that persons will not have the choice of an alternative egress route in the case where one route is blocked or obstructed in an emergency situation, which

could lead to delays in the evacuation or movement of persons to a safe place, which could lead to harm to persons.

5.4.2 Evaluation of Requirements

Under the acceptable solutions of the OBC, a second, separate means of egress would be required for a dwelling unit in a 4-storey multi-family residential building passing through an interior corridor served by a single exit.

Without the second means of egress from the dwelling unit, this condition would be the same as a dwelling served only by a dead-end corridor. Accordingly, if it can be demonstrated that the risk associated with the single exit stair is acceptable, and assuming the dead-end condition otherwise complies with the OBC (i.e., travel in a dead-end corridor is limited to the current provision), then the level of performance set out by the objectives and functional statements of the OBC can be considered to be achieved.

5.4.3 Ontario Fire Code Companion Requirements

In accordance with OFC Clause 9.5.3.1.(1)(c), one means of egress from a dwelling unit is permitted to pass through an interior corridor served by a single exit provided the dwelling unit has a second and separate means of egress.

5.5 Dead-End Corridors

5.5.1 OBC Requirement

In accordance with Sentence 3.3.1.9.(9), dead-end corridors are required to conform to Sentences (8) to (14).

Applicable to a residential occupancy, in accordance with Sentence 3.3.1.9.(9), except for corridors served by a single exit as described in Sentence 3.3.4.4.(6) (dwelling unit provided with a second means of egress – refer to **Section 5.4** of this report), a dead-end public corridor is permitted provided it is not more than **6 m** long.

In accordance with Sentence 3.3.1.9.(10), dead-end corridors in Sentence (9) are not permitted to contain door openings to service rooms containing fuel-fired appliances or rooms that may be considered as a hazard.

Attributed Functional Statements and Objectives

The table below provides a summary of the attributed Functional Statements and Objectives as identified by Table 3 of Supplementary Standard SA-1.

Sentence	Functional Statement(s)	Objectives
	Safety in Use	
3.3.1.9.(8) and (9)	**F10** – To facilitate the timely movement of persons to a safe place in an emergency.	• **OS3.7** – To limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to hazards caused by persons being delayed in or impeded from moving to a safe place during an emergency.

Note: There is no attribution of Functional Statements or Objectives to Sentence 3.3.1.9.(7) since it is a statement of the scope of Sentences 3.3.1.9.(8) to (14).

Building Code Intent Statements

The following intent statements are attributed to the requirements to limit dead-end corridors. It is noted that the OBC and NBC requirements for dead-end corridors differ, such that only the intent applicable to the OBC requirements has been included:

> *Intent 1:*
>
> *To limit the probability that persons will enter a dead end portion of a corridor during an emergency situation and be prevented from retracing their steps as a result of crowd pressure or untenable conditions, which could lead to delays in the evacuation or movement of persons to a safe place, which could lead to harm to persons.*

5.5.2 Evaluation of Requirements

The OBC requirements for dead-end corridors will limit the configuration of the public corridor served by a single exit proposed as part of an alternative solution. The 6 m limit as well as the limits on door openings to service rooms or rooms that contain a fire hazard (e.g., common laundry rooms) is considered to be appropriate for any alternative solution, such that no alternative solution to these provisions has been contemplated as part of this report.

5.5.3 Ontario Fire Code Companion Requirements

In accordance OFC Sentence 9.5.3.1.(2), access to exits through a dead-end public corridor is deemed to be in compliance with OFC Clause 9.5.3.1.(1)(c) (refer to **Section 5.3.3** of this report) where the distance along the dead-end does not exceed 6 m plus the width of the corridor, measured from any door along the corridor to a point where a choice of two directions of exit travel is available, and self-closing devices are provided on suite entrance doors opening onto the dead-end portion of the corridor.

OFC Permitted Compliance Alternative	**OFC Sentence 9.5.3.1.(4)** Existing dead-end public corridors are deemed to be in compliance with OFC Clause 9.5.3.1.(2)(a) where additional fire protection measures are approved that, in the opinion of the Chief Fire Official, will provide protection for life safety similar to the protection provided by compliance with Clause (2)(a). **Rationale:** This alternative compliance is a prescriptively permitted reduction in the required performance level of this aspect of the building in order to address the related construction difficulties associated with alleviating a dead-end condition within an existing building. **Impact:** This alternative compliance deems that a dead-end exceeding 6 m plus the width of the corridor sufficient is acceptable where approved alternative measures are provided.

5.7 Dwelling Units not Permitted to Open Directly into an Exit Stair

5.7.1 OBC Requirement

In accordance with Sentence 3.3.4.4.(5), a doorway from a dwelling unit is not permitted to open directly into an exit stairway in a building more than 3 storeys in building height. Where an exit is permitted to open directly into an exit stair (i.e., for a building not more than 3 storeys in building height), the dwelling unit is required to have a second, separate means of egress.

Attributed Functional Statements and Objectives

The table below provides a summary of the attributed Functional Statements and Objectives as identified by Table 3 of Supplementary Standard SA-1.

Sentence	Functional Statement(s)	Objectives
	Safety in Use	
3.3.4.4.(5)	**F05** – To retard the effects of fire on emergency egress facilities. **F10** – To facilitate the timely movement of persons to a safe place in an emergency.	• **OS3.7** – To limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to hazards caused by persons being delayed in or impeded from moving to a safe place during an emergency.

Building Code Intent Statements

The following intent statements are attributed to the requirement for dwelling units to not open directly into an exit stairway:

> *Intent 1:*
>
> *To exempt a doorway serving a dwelling unit from the requirements of Sentences 3.3.1.3.(8) and (9), which would otherwise require a doorway to the exterior, a public corridor or an exterior passageway, on the basis that there is a second means of egress from the dwelling unit available if the route through the exit stair is impeded, blocked, or untenable.*
>
> *This is to limit the probability that persons will not have the choice of an alternative egress route in the case where one route is blocked or obstructed in an emergency situation, which could lead to delays in the evacuation or movement of persons to a safe place, which could lead to harm to persons.*

5.7.2 Evaluation of Requirements

The OBC requirements for dwelling units to not open directly into an exit stairway will require the provision of a public corridor served by a single exit (i.e., a dead-end corridor is required) as part of an alternative solution. The limitation of 6 m is considered to be appropriate for any alternative solution, such that no alternative solution to these provisions has been contemplated as part of this report.

5.7.3 Ontario Fire Code Companion Requirements

In accordance with OFC Clause 9.5.3.1.(5)(a), a doorway from a dwelling unit is permitted to open into an exit stairway provided the dwelling unit has access to a second and separate exit or the building is permitted to be served by a single exit (refer to **Section 5.2.3** of this report).

5.8 Distribution of Exit Width

5.8.1 OBC Requirement

In accordance with Sentence 3.4.3.2.(6), where more than one exit is required, every exit is limited to contributing not more than one-half of the required exit width.

Attributed Functional Statements and Objectives

The table below provides a summary of the attributed Functional Statements and Objectives as identified by Table 3 of Supplementary Standard SA-1.

Sentence	Functional Statement(s)	Objectives
	Safety in Use	
3.4.3.2.(6)	**F10** – To facilitate the timely movement of persons to a safe place in an emergency.	• **OS3.7** – To limit the probability that, as a result of the design or construction of the building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to hazards caused by persons being delayed in or impeded from moving to a safe place during an emergency.

Building Code Intent Statements

The following intent statements are attributed to the requirement for exits to provide not more than one-half of the required exit width:

> *Intent 1:*
>
> *To limit the probability that an excessive portion of the required exiting capacity will be concentrated at one location, which could lead to insufficient width in other exits to permit efficient egress in an emergency situation if the exit becomes obstructed or inaccessible, which could lead to delays in the evacuation or movement of persons to a safe place, which could lead to harm to persons.*

5.8.2 Evaluation of Requirements

Under the acceptable solutions of the OBC, as two exits are required, in a 4-storey multi-family residential building, each exit is limited to contributing not more than one-half of the required exit width.

However, if it can be demonstrated that the risk associated with the single exit stair is acceptable, and assuming provided exit width otherwise complies with the OBC, then the level of performance set out by the objectives and functional statements of the OBC can be considered to be achieved. It should also be noted that a single 1100 mm wide exit stair will have the capacity to serve 137 persons per storey (based on a capacity factor of 8 mm/person). On this basis, the capacity of a single exit stair is not likely to be a limiting factor when evaluating the performance of a 4-storey residential building.

5.8.3 Ontario Fire Code Companion Requirements

No OFC companion requirements are provided for this requirement.

5.9 Comparative Jurisdictions

The following table summarizes the allowances and limitations in comparative jurisdictions related to the provision of a single exit for a residential building. The intent of this comparison is to identify similar measures that could potentially be adopted in order to permit a similar provision.

As illustrated, there are jurisdictions in North America that have acknowledged the concept of additional storeys being served by a single exit and have either adopted the requirements of the IBC or NFPA 101 for three and four storeys respectively or, in jurisdictions such as Seattle or New York, have created a specific regulatory framework to permit buildings that exceed three or four storeys to be provided with a single exit. Meaning, many jurisdictions in the United States have assessed that there are measures that can be added to a building to sufficiently address the risk associated with a single exit from a floor area, under specific conditions. These measures, as noted in the table below, include:

- sprinklered building,
- restrictions on the number of suites per floor that are served by a single exit,
- maximum area of suites,
- travel distance limitations,
- maximum occupant load,
- limits on occupancy types served by a single exit, and
- additional provisions/enhancements for fire protection and life safety systems (e.g., increased corridor fire separation performance, provision of corridor or exit stair pressurization, noncombustible construction, etc.)

	OBC		NFPA 101	IBC	Seattle Building Code	NYC Building Code	
	2-storey	4-storey				Option 1	Option 2
Min. No. of Exits	1	2 (except as permitted for noncombustible row houses)	1	1	1	1	1
Building Height (storeys)	2	4	4	3	6	6	4
Sprinklered	Not req'd	Yes (except as permitted for noncombustible row houses)	Yes	Yes	Yes	Yes	Yes
Travel Distance	- 6 m dead-end - 15 m to an exit (25 m sprinklered)	- 6 m dead-end - 25 m to an exit (15 m non-sprinklered)	10.7 m from dwelling unit entrance door to an exit	38.1 m	- 6.096 m from dwelling unit entrance door to an exit - 38.1 m travel distances	38.1 m	
Floor Area (footprint)	100 m^2 (150 m^2 sprinklered)	Varies (refer to **Section 4.0)**	—	—	—	185.8 m^2	232.3 m^2

	OBC		NFPA 101	IBC	Seattle Building Code	NYC Building Code	
	2-storey	4-storey				Option 1	Option 2
Occupant Load or No. of Dwelling Units per Storey	60 persons total	Limited based on available exit capacity	4 dwelling units	4 dwelling units	4 dwelling units	—	3 dwelling units
Exit Stair Fire Separation	¾-hour	1-hour (2-hour for EMTC or large building areas)	1-hour	1-hour (connecting less than 4 storeys)	2-hour (connecting more than 4 storeys)	2-hour (connecting more than 4 storeys)	1-hour (connecting less than 4 storeys)
Exit Stair Opening Protection	¾-hour	¾-hour (1½-hour for EMTC or large building areas)	1-hour	1-hour	1½-hour	1½-hour	1-hour
Corridor Rating	¾-hour (1-hour at dwelling units for 4-storey multi-family residential)		1-hour	½-hour	½-hour	½-hour	
Suite-to-Suite Rating	¾-hour (1-hour at dwelling units for 4-storey multi-family residential)	1-hour	½-hour	1-hour	1-hour	1-hour	
Additional Measures	—	Standpipe system permitted to be waived for row houses conforming to Sentence 3.2.9.1.(1) (i.e., constructed in compliance with Articles 3.2.2.44. or 3.2.2.45.)	Exit stairway does not serve more than one-half storey below the level of exit discharge	—	- Pressurized exit stair and elevators - 1-hour fire-resistive construction - Limited to 2 single exit conditions per property - Other occupancies within the building must not communicate with the residential occupancy or with the exit stair	- Type I or II construction (fire-resistive / noncombustible)	- Type I or II construction (fire-resistive / noncombustible) - Each dwelling unit has one window facing the street - The stairway extends to the roof surface

6.0 Feasibility of Alternative Solution to Provide a Single Exit Stair

An alternative solution to the OBC to address a single exit is feasible if the provision of a single exit is determined to be an acceptable risk as it relates to the exit being blocked or obstructed in an emergency situation (i.e., the condition will not perform the same as two exits), impacting evacuation from the building and emergency response operations.

The following sections summarize the significant considerations for the development of an alternative solution to provide a single exit stair.

6.1 Concept of Acceptable Risk

An alternative solution must address the same issues as the applicable acceptable solutions in Division B, and their attributed Objectives and Functional Statements set out in **Section 5.0** of this report. The design must perform as well as a design that would satisfy the applicable acceptable solutions in Division B. Division B defines the boundaries between acceptable risks and the "unacceptable" risks referred to in the Objectives.

As an example of how the concept of acceptable risk is evaluated under the OBC, while dwelling units in 4-storey residential buildings generally require access to two fire-separated exit stairs, further to the allowance of Sentence 3.4.2.1.(4) (refer to **Section 5.2** of this report), the OBC considers a 4-storey noncombustible row house having a single exterior exit doorway, a single interior stairway, and a balcony conforming to Sentence 3.3.4.4.(7) as an acceptable risk as it relates to egress of occupants and access to the building by emergency responders.

For noncombustible row house as described above, egress for occupants is via a single unenclosed egress stair, or by fire department rescue at a balcony, and access to the upper floor areas by the fire department is by either via the unenclosed stair or window openings or balcony doors. In this case, due to the limited number of occupants, familiarity of occupants with the building egress, and construction of the building being designed to limit fire spread, the configuration is considered to be an acceptable risk to both occupants and emergency responders for a 4-storey building. While these considerations differ from a multi-dwelling unit building, it outlines how the risks associated with a certain building configuration can be mitigated through the fire protection and life safety features that are incorporated in the design.

6.2 Potential Mitigating Features

Further to the comparative jurisdictions evaluation in **Section 5.9** of this report, there is variability towards the approach to mitigating the risk associated with a single exit stair. Potential mitigating features to an alternative solution may include features such as:

- sprinklered building,
- restrictions on the number of suites per floor that are served by a single exit,
- maximum area of suites,
- travel distance limitations,
- maximum occupant load,
- limits on occupancy types served by a single exit,

- increased exit stair width (e.g., 1650 mm wide stair), and
- additional provisions/enhancements for fire protection and life safety systems (e.g., increased corridor fire separation performance, provision of corridor or exit stair pressurization, etc.)

It is understood that certain features, such as the requirement to provide noncombustible construction under the NYCBC, are unlikely to be feasible for construction in the City of Toronto. As such, is important that the overall safety and performance of the building be evaluated as opposed to an approach where the most restrictive of each jurisdiction is selected.

It is also important to note that measures such as the provision of sprinkler protection or enhanced corridor protection will provide a higher degree of fire safety in the building but may not necessarily address every type of emergency that would require the evacuation of the building, such as release of hazardous substances or the presence of intruders. It is expected that egress/exiting issues that may be associated with other emergency scenarios may be mitigated through limitations on the number of suites and occupant load of the building; however, further study of this with the appropriate stakeholders is required.

6.3 Additional Considerations

As previously addressed in **Section 3.2** of this report, Parts 2 and 6 of the OFC address maintenance of existing building elements or systems in approved buildings. These requirements are generally considered to be sufficient to address approved alternative solutions, such as an alternative solution to provide a single exit stair.

It is noted that maintenance of the fire protection and life safety systems in a building having a single exit is of increased importance when compared to a building having two separate exits. While reliability of sprinkler systems has been widely studied, additional review of the reliability of other systems (e.g., fire separations, door hardware, mechanical pressurization systems, etc.) is integral to assessing the overall risk. Detailed fire statistics to allow for the comparison of the performance of multi-family residential buildings having one or two exits were not readily available. As such, this may be an area of further study to better assess the overall reliability.

Our review of the Seattle and New York City Fire Codes did not uncover additional measures to address the risk of single exit buildings as it relates to maintenance of fire protection and life safety systems.

It is noted that the OFC does not currently provide a retrofit compliance path for a single exit serving a 4-storey building. Accordingly, as with all alternative solutions, maintenance and documentation of the approved condition is required (e.g., via the approved Fire Safety Plan).

It is understood that Fire Department operations generally follow the same NFPA standards in Canada and the United States. However, confirmation should be provided as to whether Fire Department operations in Toronto do deviate significantly from these standards.

It may be necessary for Toronto Fire to develop new, or modify existing, operations and/or procedures and to retrain staff to respond to incidents at 4-storey residential buildings served by a single exit stair.

Similarly, for Toronto Building, there could be resource and financial implications associated with the potential for a significant number of alternative solution submissions for single exit buildings. Additional staff training is expected to be required to facilitate the building permit process for these buildings.

7.0 Summary

In our opinion, an alternative solution to the OBC to address a single exit for a 4-storey multi-family residential building is feasible if the provision of a single exit is determined to be an acceptable risk as it relates to the exit being blocked or obstructed in an emergency situation (i.e., the condition will not perform the same as two exits), impacting evacuation from the building and emergency response operations.

Potential mitigating features to an alternative solution may include features such as:

- sprinklered building,
- restrictions on the number of suites per floor that are served by a single exit,
- maximum area of suites,
- travel distance limitations,
- maximum occupant load,
- limits on occupancy types served by a single exit,
- increased exit stair width (e.g., 1650 mm wide stair), and
- additional provisions/enhancements for fire protection and life safety systems (e.g., increased corridor fire separation performance, provision of corridor or exit stair pressurization, etc.).

It is important to note that measures such as the provision of sprinkler protection or enhanced corridor protection will provide a higher degree of fire safety in the building but will not necessarily address every type of emergency that could require the rapid evacuation of the building, such as release of hazardous substances or the presence of intruders. It is expected that this may be mitigated through limitations on the number of suites and occupant load of the building; however, further study of this with the appropriate stakeholders is required.

It is noted that while the requirements of Part 2 and 6 of the OFC are sufficient to address approved alternative solutions, such as an alternative solution to provide a single exit stair, though it is acknowledged that maintenance of the fire protection and life safety systems in a building having a single exit is of increased importance when compared to a building have two separate exits. While reliability of sprinkler systems has been widely studied, additional review of the reliability of other systems (e.g., fire separations, door hardware, mechanical pressurization systems, etc.) is integral to assessing the overall risk that may be associated with a single exit building as it relates to the perceived redundancy provided by a building with two exits.

Other jurisdictions in North America have assessed this risk and created a regulatory framework for approval. Given the similarities between building construction standards and standards from which fire department operations have been developed, these existing frameworks could potentially be adopted in order to mitigate the risk associated with a single exit stair.

It may be necessary for Toronto Building and Toronto Fire to review their current policies and procedures to facilitate this alternative solution approach.