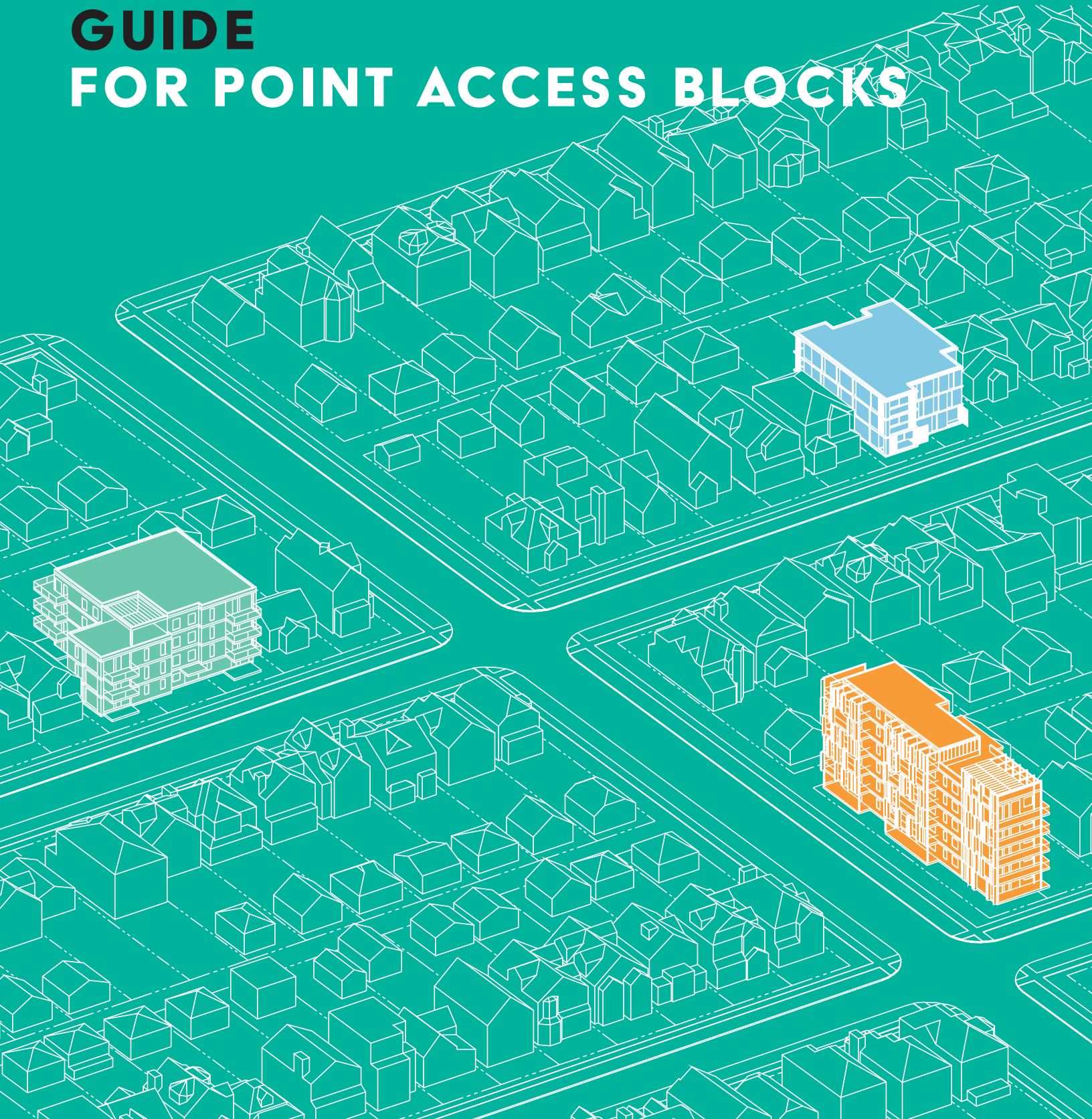


09

BUILDING CODE GUIDE FOR POINT ACCESS BLOCKS



2.01/ SECTION OVERVIEW

1.1 Introduction and Scope

The scope and purpose of this section is to illustrate the framework and supporting technical rationale for alternative solutions to be developed, prepared and submitted for PAB buildings. The guide is intended to inform project stakeholders for what they should consider in developing an alternative solution for PAB buildings. The guide does not replace the requirement for professional responsibility with the acceptance of any submitted alternative solution subject to the appropriate review and approval by the AHJ.

The guide is not intended to constrain an alternative solution to rigidly defined risk mitigation measures. Rather a problem definition is provided to inform what risk mitigation measures could be appropriate to demonstrate compliance within the National Building Code – 2023 Alberta Edition. Example risk mitigation measures are provided, however they should be reviewed and confirmed as appropriate for the proposed building.

The guide does not contemplate acceptability of a PAB beyond the NBC(AE). Additional evaluation may be required to satisfy insurer or other project stakeholder requirements. The guide is underpinned by detailed risk analysis conducted by LMDG Building Code Consultants Ltd. The risk analysis is presented in an accompanying Technical Report.

1.2 Building Scope

The building types for which this guide is intended are multi-storey multi-unit residential buildings. The risk analysis does not constrain building height, building area, or construction materials, however exemplar building types of up to 6-storeys are presented in the Design Guide.

Each exemplar building shows single exit stair conditions serving floor areas containing only Group C major occupancy, specifically dwelling units. If other major occupancies are present, they are to comply with the applicable acceptable solutions for exit design and do not communicate directly with the Group C major occupancy.

The guide assumes that the PAB buildings intended for an alternative solution meet the constraints of the applicable construction article for the building risk profile (i.e...height, area, & use) and are not subject to further / additional alternative solutions.

2.02/ REGULATORY FRAMEWORK

2.1 Structure of the Building Code

Within the province of Alberta, the Safety Codes Act is the legislative instrument that governs the development and implementation of safety regulations, including the Building Code. Within this framework, Alberta Municipal Affairs has elected to adopt the latest edition of the National Building Code of Canada (NBCC 2020) with alterations to the content to reflect provincial specific requirements. The subsequent current applicable Building Code, at the time of guide development, is the National Building Code – 2023 Alberta Edition (NBC(AE)).

The NBC(AE) is an objective-based code with the following five targeted objectives:

- Safety
- Health
- Accessibility
- Fire and Structural Protection of Buildings
- Environment

The NBC(AE) is made up of three major divisions - Division A, Division B, & Division C. Division A presents paths to compliance, the above listed objectives, and functional requirements (in qualitative terms) that solutions must satisfy. Division B presents deemed-to-comply solutions that are subdivided into ten parts with Part 3 outlining Fire Protection, Occupant Safety and Accessibility. Division C provides administrative provisions and expectations for professional responsibility.

Compliance with the NBC(AE) is demonstrated via satisfying the objectives and associated functional statements. The acceptable solutions outlined in each part are deemed-to-comply solutions, which if adopted demonstrate that the applicable objectives and functional statements have been met. Alternative solutions present a parallel path to compliance through meeting the applicable objectives and functional statements by alternate means.

2.2 Alternative Solutions

As buildings become more complex, the application of Division B Part 3 'acceptable solutions' can lead to unintended consequences and grey areas for which best practice and sound engineering practice is a supporting requisite to maintain safety. The preface of the NBC-AE speaks to this directly:

The NBC(AE) is not a textbook on building design or construction. The design of a technically sound building depends upon many factors beyond simple compliance with building regulations. Such factors include the availability of knowledgeable practitioners who have received appropriate education, training and experience and who have some degree of familiarity with the principles of good building practice and experience using textbooks, reference manuals and technical guides.

Compliance with the NBC-AE can be demonstrated through:

- complying with the applicable acceptable solutions in Division B, or
- Developing and submitting 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.

However, the NBC-AE does not provide specific performance criteria relative to achieving the objectives of the Code. The performance of alternative solutions in general is defined in Division A Clause A 1.2.1.1.(1)(b), which states that:

An effort must be made to demonstrate that an alternative solution will perform as well as a design that would satisfy the applicable acceptable solutions in Division B – not “well enough” but “as well as”.

The anchoring of alternative solutions to the level of performance of one or more acceptable solutions constrains how risk can be demonstrated to a comparative basis.

2.3 Acceptable Solution Identified for Departure

For buildings where PAB are contemplated, the applicable acceptable solution is:

NBC(AE) Division B, Part 3, Sentence 3.4.2.1.(1) Minimum number of exits

Except as permitted by Sentences (2) to (4), every floor area intended for occupancy shall be served by at least 2 exits.

For clarity, sentences 2 – 4 referenced above relate to specific exemptions that permit PAB buildings. This includes buildings up to 2 storeys in height with limitations on occupant loads, floor areas, & travel distance as well as exemptions for occupancy specific relaxations.

The objective and functional attributions of **NBC(AE) Sentence 3.4.2.1.(1)** are listed below:

Table 2-1 Functional and Objective Statements

Acceptable Solution	Functional Statements	Objectives
3.4.2.1.(1)	F10, F12, F05, F06	OS3.7
	F12, F06	OS1.2
	F12, F06	OP1.2

The solution is required to be benchmarked against the objectives and functional statements of Sentence 3.4.2.1.(1) such that building occupants (persons and emergency responders) and the building are not subject to an unacceptable level of risk of injury or damage by fire spread beyond the point of origin or hazards delaying egress to a place of safety in an emergency.

2.4 Acceptable Solution Discussion

The acceptable solutions within the NBC(AE) should be considered as complimentary in nature that provide overlapping levels of resilience for fire & life safety. To simplify, fire safety should be viewed holistically as a multi-layered and interconnected system of applicable acceptable solutions to define levels of performance and acceptable risk, as opposed to independent consideration for individual prescriptive requirements in isolation.

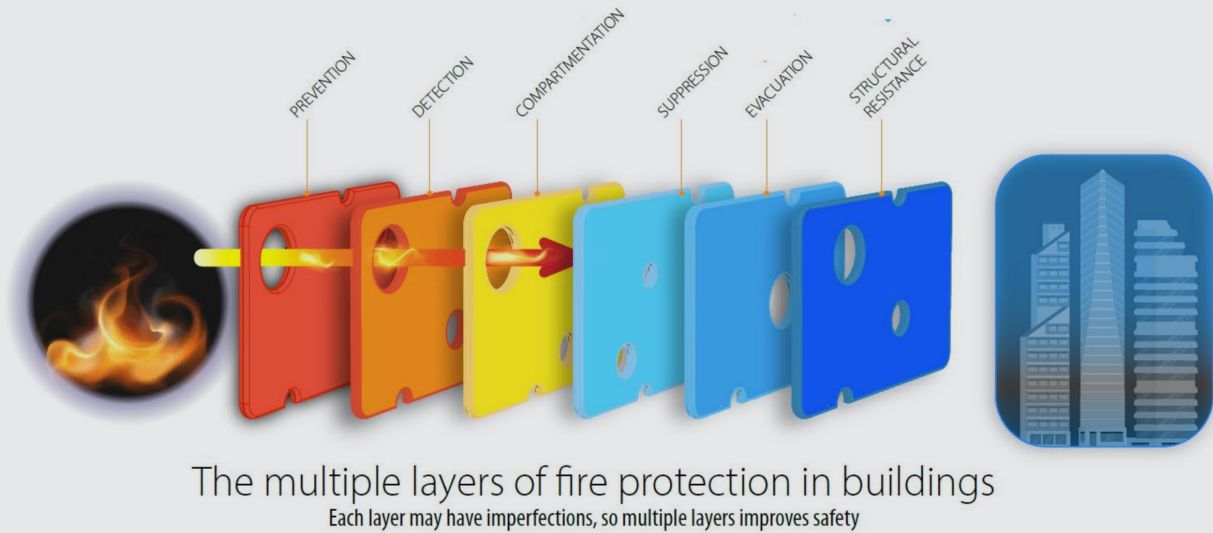


Figure 1 Layers of fire protection¹

To place this into PAB context, there are multiple acceptable solutions that assume at least two exit stairs are provided within a building. These include, but not limited to:

- Exit separation
- Exit discharge
- Crossover floor provisions

Strictly speaking, the above listed provisions are not departed from when only a single exit stair is provided. What they serve to illustrate is that PAB block buildings should be viewed as a complete fire safety strategy with a lens of how all aspects of the design work together to demonstrate safety.

¹ Bonner, M; Caracci, L; Rein, G; Examining the fire risk in London dwellings using the London Fire Brigade incident database; 2023; Fire and Materials; Wiley; 193-207

2.03/ ALTERNATIVE SOLUTIONS

3.1 Problem Definition

The divergence from a multiple exit stair design to a PAB relates to resilience. The underlying assumption being that if one or more exit stairs are provided in a building, at least one will remain tenable to support evacuation and firefighting operations.

Historical research has demonstrated that current building height and area limits for single exit stair design has been arrived at anecdotally and originates from observations during the early 1900's. The considerations at the time did not include Firefighting tactics nor occupants with mobility challenges. Current expectations for Building Code compliance should include mobility challenged occupants and Firefighting operations however this should be viewed in the context of available information and benchmarked against two stair building scenarios.

For a PAB building, if the risk of failure of a PAB is sufficiently low (within comparative tolerable limits), then equivalency is considered to be met with a multiple stair design. Accordingly, the fundamental principle to which an alternative solution requires to address is:

What would cause a single stair to fail?

Or to place in the context of an alternative solution:

Will the PAB building provide an equivalent level of resilience to the exit stair as a code compliant two-stair building?

3.2 Risk Mitigation

If an alternative solution is able to address and appropriately mitigate the potential loss of a single exit stair to the same probability as the loss of two exit stairs then the objectives and functional statements are be considered to be satisfied. The risk assessment, conducted within the LMDG report.....identifies the three main components that could lead to stair failure:

1. The presence of smoke within the corridor,
2. A means for smoke to flow into the stair, and
3. An impetus for smoke movement (diffusion or pressure differential)

In relation to bullet point 1, mitigation measures exist that could reduce the likelihood of occurrence of smoke in the corridor. These could include fuel load management and maintenance of equipment and infrastructure. In reality, these are difficult to effectively manage throughout the life cycle of a building and should in fact be captured implicitly within a well-maintained PAB or two-stair building. As the NBC(AE) assumes that a fire will occur, the aforementioned risk mitigation measures cannot be completely relied upon and should not form the basis for an alternative solution regarding PAB design.

The remaining bullet points (items 2 & 3) relate to compartmentation and smoke management that are considered to directly influence and affect the reliability of a PAB design. A subsequent list of indicative risk mitigation measures has been derived that may, when appropriately assessed, support a PAB alternative solution. Depending on the proposed design, a single application of or combination of the following risk mitigation measures may be appropriate.

PAB buildings up to six storeys (no high building measures)

1. Compartmentation / vestibule
2. Exterior passageway
3. Smoke management via pressurisation or ventilation

Please note that the above risk mitigation measures incorporate the below assumptions:

- No other alternative solutions are present within the building
- The exit capacity is not exceeded i.e. 137 people per floor for a 1,100 mm wide stair (850 mm door)
- No supplemental alternative solutions are proposed / incorporated within the design (i.e. dead-end corridors not exceeding

A full risk analysis as outlined in the LMDG Technical Report should be considered where the building becomes more complex and / or a greater level of reliability is required for the single stair (i.e. occupant load, environmental impact etc.). Such a requirement remains at the discretion of the AHJ.