Consultation on single egress in residential buildings

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Executive summary

This report provides a summary of a targeted consultation organized by the National Research Council (NRC) on the topic of single egress construction in residential occupancies. The consultation was conducted with a consultation group (CG) formed from stakeholders, representing the fire safety value-chain, through a series of meetings. The CG was divided into two subgroups with provincial and territorial (P/T) representatives in one subgroup and design professionals, industry and the fire services in the other. In addition, observers were permitted to attend the meetings and to also provide input.

The CG shared their knowledge and experience on the topic of single egress in residential occupancies, provided feedback, guidance and validation on the following issues:

1. Scope for a subsequent research work and case studies (P/Ts subgroup members only);
2. Potential building designs ("archetypes") for the research work;
3. Approach and methods to guide the research;
4. Strategies to evaluate hazards and associated risks for single egress in residential occupancies.

A total of five meetings were facilitated for the consultation. Two meetings were organized for each subgroup separately, followed by a concluding meeting with the two subgroups combined. Each meeting had a similar structure, starting with a short presentation given by the NRC, followed by a facilitated discussion in which CG members were asked to provide their input.

Throughout the consultation, the CG members touched on these commonly raised topics: accessibility, firefighting operations, training and education of emergency responders[1] and occupants, human factors, safety of occupants and emergency responders, economic viability, risk assessment, as well as challenges associated with emerging technologies.

This report describes the consultation approach and a summary of what the NRC heard during the meetings. As such, the report presents the collected information and comprises primarily a summary of comments received during the meetings without further detailed analysis. Further, this report captures additional comments and materials received after the meetings, so that other future efforts may also benefit from the comments shared by attendees.

The insights shared by the CG and reported here will serve to inform the development of the scope and methodology for follow-up foundational research work. That work will examine the equivalence of single-egress solutions to existing fire safety requirements in current codes and provide information for the consideration of potential code changes in the National Model Codes through the Harmonized Code Development System.

[1] The emergency responders consulted were primarily associated with fire services; however, in certain instances, attendees made comments that included emergency responders beyond fire services. To indicate these, the term "emergency responder" is used.

Purpose of the report

The purpose of this report is to provide a summary of a targeted consultation by the NRC with provincial and territorial representatives, design professionals, industry and the fire services, on the topic of single egress construction in residential occupancies to inform the scope of the research work following the consultation. The report describes the consultation approach and a summary of what was heard during the consultation. It presents the collected information and comprises primarily a summary of comments received without further detailed analysis. The summarized comments are not reflective of the opinions of the authors or the NRC. Within this report, additional inputs are shared in the appendices, so that other future efforts may also benefit from the material shared by attendees.

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1 Introduction

Housing availability and affordability are an increasing concern across Canada, with access to affordable housing becoming a challenge for many Canadians. To increase the viability of building multi-family residential developments on smaller lots, the idea of designing new buildings with a single means of egress has emerged for residential occupancies.[2] Proponents of this concept argue that there could be measurable benefits of a single egress design, where at least two means of egress would be currently required by the National Building Code (NBC) acceptable solutions, in terms of increased floor area efficiency and reduced construction costs. For example, the premises of single egress construction (SEC) imply less space to be used for internal corridors and staircases, thereby optimizing the use of building living space and, in turn, making such buildings more feasible on smaller properties.[3]

The potential for developing code provisions for residential occupancy with single-egress construction necessitates, however, a thorough evaluation of the proposed concept and potential mitigation strategies with respect to the NBC, where the proposed design is required to achieve at least the minimum level of performance required by the acceptable solutions. Therefore, a careful evidence-based examination of the performance of the proposed design concept and mitigation strategies as well as a cost-benefit evaluation of resulting designs are warranted.

The Canadian Board for Harmonized Construction Codes (CBHCC) has identified the consideration of potential code changes related to single egress construction in residential occupancies as part of their work plan for the 2030 National Model Codes.[4]

1.1 Overview of the project

In support of the code development system consideration, the NRC initiated a foundational research project to examine the equivalence of single-egress solutions to existing fire safety requirements in current codes and inform consideration of potential code changes in the National Model Codes technical requirements through the Harmonized Code Development System.

The NRC coordinated a targeted consultation with provincial and territorial (P/T) representatives, design professionals, industry and the fire services on SEC in residential occupancies, as an initial step, to inform the scope of the research work.

The research project also involves the following activities (not part of this report):

- Scan of available single egress code provisions, standards, and best practices;
- Scoping of buildings to be evaluated (e.g., number of storeys, area limitations);
- Identification of potential building designs (“archetypes”[5]) for the analysis;
- Development of a strategy to evaluate hazards and risks associated with single egress in residential occupancies (NBC, National Fire Code (NFC) 2020 compliant);
- Examination equivalency of SEC alternative solutions to existing fire safety requirements in current building codes.

In potential follow-up work (not part of this report), the NRC will be consulting with stakeholders on potential fire safety solutions.

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[2] Residential buildings for this project are considered to be a building of only residential occupancy above grade and may include below grade parking serving only the residential building above.
[3] See, for example: https://www.publicarchitecture.ca/wp-content/uploads/2024/02/240213-PUBLIC-Single-Stair-Report.pdf
[4] https://cbhcc-cchcc.ca/en/code-priorities/
[5] Building archetypes in this context refers to representations of “typical” buildings of a certain design.

1.2 Report scope

This report provides an overview of the targeted consultation with P/T representatives, design professionals, industry and the fire services, on SEC in residential occupancies to inform the scope of the research work following the consultation. The report describes the consultation approach, and a summary of what was heard during the consultation.

This report presents the collected feedback through the targeted consultation and comprises primarily a summary of comments received without further detailed analysis. Within this report, supplementary inputs shared with the NRC by the attendees are added in the appendices, so that other future efforts may also benefit from them.

The comments summarized here are not reflective of the opinions of the authors or the NRC; they are a summary of comments received from consultation attendees.

2 Description of the consultation

This section describes the consultation approach and methodology.

2.1 Composition of the consultation group (CG)

The consultation group (CG) comprised representatives from the following categories:

(a) **P/T**: This category formed the first subgroup and included provincial and territorial officials who are involved in regulating construction, in the context of the development of Canada's National Model Codes.
(b) **Industry and associations (I)**: This category included those who are involved in production, promotion, retailing or distribution of the subject product(s), material(s), or service(s).
(c) **General interest (GI)**: This category included those who predominantly represent consumer interests or end users of the subject information. This category also included representatives of academic and scientific interests.

The list of the CG members was developed to be representative of the interested and affected stakeholders. To keep the number of required meetings at a manageable level, I and GI representatives were congregated together into one subgroup.

Further, observers (O) were permitted to attend the I/GI subgroup meetings and CG members put forward additional representatives and/or observers that could be involved in the consultation. Observers were also invited to share written input or materials (e.g., published reports) that they deemed relevant. The summary of input provided by CG members and observers are provided in separate sections. See Appendix A for a full list of organizations that attended the consultation.

2.2 Tasks of the CG

The overall task of the CG was to provide support to the NRC research team working on the evaluation of safety related challenges for single means of egress in residential buildings.

The CG carried out the following tasks:

1. Attended CG meetings (where the NRC researchers presented information related to the proposed research).
2. Reviewed relevant documents (e.g., existing and ongoing work in the subject area, Code Change Requests).
3. Shared knowledge and experience on the topic, for example by responding to research questions (see below).
4. Provided feedback and guidance on the approach and method to be used to address the research.
5. P/T representatives only: Provided suggestions, input, guidance and validation of scope for case studies.
6. Provided suggestions, input, guidance and validation of the identification of potential building designs ("archetypes") for the analysis.

7. Provided suggestions, input, guidance and validation of a strategy to evaluate hazards and risks for single egress in residential occupancies.
8. Reviewed the report produced from the consultation to validate the consultation outcomes relevant to the subject matter of the project.

2.3 Consultation process

The consultation procedure was to facilitate a total of five (5) meetings. Two meetings were organized for each subgroup separately, followed by a concluding meeting with the two subgroups combined. Each meeting followed a similar structure, starting with a short presentation given by the NRC, followed by a facilitated discussion (for more details on meeting agendas, see Appendix B). Table 1 provides an overview of the meetings schedule.

Table 1 Meeting Schedule

Meeting	Subgroup	Date
Information session	P/T	August 8, 2024
Information session	I/GI + O	September 13, 2024
Continued information sessions and input confirmation	P/T	September 9, 2024
Continued information sessions and input confirmation	I/GI + O	September 27, 2024
CG wide meeting	All	October 4, 2024

2.3.1 Meeting 1 – information sessions

The first meeting for each subgroup was an **information session**, with the purpose of sharing information and setting the stage for the targeted consultation. At the beginning of each information session, the NRC introduced the research project, the terms of reference as well as the structure of the consultation procedure (CG make-up, schedule, etc.). This was followed by a facilitated discussion.

The following targeted questions were posed to attendees (also see Section 2.2):

- P/T member representatives only: What scoping requirements for NBC 2020 compliant buildings being studied should be considered, e.g., how many storeys, areas, etc.?
- Which building designs (archetypes) should be selected?
- What is an appropriate strategy to evaluate hazards and risks for single egress in residential occupancies?
- Should a cost-benefit analysis be part of the evaluation strategy?

I/GI representatives were invited to share their knowledge and experience on the topic, as well as to provide feedback and guidance on the approach and method to be used to address the research, and to provide suggestions, input, guidance and validation of a strategy to evaluate hazards and risks for single egress in residential occupancies.

After each meeting, attendees were invited to provide additional input in writing. The NRC staff took meeting notes, which were shared for review and approval with the attendees after the meeting.

2.3.2 Meeting 2 – continued information sessions and input confirmation

In the second meeting for each subgroup, the same questions were posed to continue the information session and to confirm the group input. Each meeting began with a presentation of what was heard during the previous information sessions, and attendees were then invited to clarify and expand on the information shared.

2.3.3 Meeting 3 – CG wide meeting

In the **CG wide concluding meeting**, both groups attended the same meeting. Beginning with the P/T member representatives, the NRC shared a high-level summary of what was heard at the CG meetings. Then the P/T member representatives were invited to comment, expand and clarify on the material shared. The same procedure was then followed for I/GI representatives. The meeting concluded with a presentation of the next steps by the NRC.

2.3.4 Documentation

The NRC staff facilitated and documented each meeting and managed the additional information received. The appendices include the meeting agendas as well as the additional information shared.

3 Consultation results

The following sections highlight common themes that emerged during the consultation. Section 3.1 provides an overview of what was heard from the P/T member representatives. This is followed by Section 3.2, in which feedback and guidance received from the I/GI representatives is shared, including information shared by observers.

Note, the following sections summarize the various view points raised by the attendees and does not indicate consensus. Furthermore, it should be noted that statements were not evaluated whether or not they are factually correct. The items were collected to inform the development of a follow-up research project.

3.1 What was heard from P/T member representatives?

The following section provides a summary of what was heard during the information sessions and targeted questions meetings with the P/T member representatives. The summary is based on the notes associated with each meeting, as well as written material shared with the NRC.

3.1.1 Summary of information shared

Since the content of the documents from the meetings overlapped, a single summary was written for all three meetings. The initial feedback and discussion provided general considerations. While there appeared to be general agreement on the overall framework that should be considered, there were differences in specifics (e.g., the building height to be included in the research). The following topics were raised most frequently by several of the P/T member representatives during the meetings: accessibility, firefighting operations, safety (occupant and emergency responder), economic viability and risk assessment.

In addition to the meetings, representatives were invited to provide written feedback on the specific questions asked in the meetings that further clarified the information provided in the meetings and laid out activities by the provinces and territories. The main feedback extracted from the P/T member representatives meeting notes is shown below, followed by a summary of the range of specific responses.

- Necessity to define relevant **building archetypes** to include in the research project and consider factors including:
    - Building height, building size (e.g., number of dwelling units per storey);
    - Exit widths (e.g., in terms of accessibility and fire safety objectives);
    - Water supply;
    - Firefighters' response time and access to buildings;
    - Street facing requirements;
    - Occupant characteristics (i.e., who are the building occupants, number of occupants), as well occupancy type (e.g., mixed-use versus residential occupancies);
    - Sprinklers, ventilation on common areas of floors, fire and smoke control measures;
    - Voice communication system;
    - Travel distance;

    - Construction type (e.g., combustible versus non-combustible) and building material (e.g., wood frame versus mass timber);
    - Basement level or subgrade occupancy;
    - Underground parking;
    - Location of the building (e.g., urban versus rural setting).
- Need to include the **historic rationale** for dual egress in the project scope.
- Consult **previous publications** (e.g., the following reports [6,7]) **and research** (e.g., fire modelling on residential buildings up to six storeys with a single egress stair, studying performance of existing single-stair buildings in Canada).
- Incorporate **disabilities/accessibility** in the analysis.
- Compare with **international jurisdictions** in view of:
    - Acceptable risks;
    - Building materials and construction;
    - Balconies;
    - Fire department requirements;
    - Societal/cultural differences (e.g., cooking differences, furnishing differences);
    - Fire statistics.
- Consider **life safety systems and occupant safety**: additional life safety systems required and their cost (e.g., upgrades to fire alarm systems or increased fire separation ratings), safety system performance and reliability over time, application of the fire code, consequences/implications for building owners who do not maintain life safety systems, acceptable level of safety or lack thereof, equivalent versus acceptable levels of safety, rapid occupant evacuation, and safety of occupants using evacuation means.
- Consider the impact on **firefighting operations**: distinctions between fire departments and their capabilities to make rescues, fire extinguishment, operate complex life safety systems. Factors to consider include:
    - Whether additional personnel and apparatus/equipment are required (rescue response versus suppression response).
    - How fire services will access the building to perform rescue;
    - Training requirements.
    - Access requirements (e.g., access not given or poorly maintained).
- Consider the impact of **changes in building design** in view of:
    - Wind driven fires and the addition of cross ventilation in proposed construction;
    - Areas of refuge;
    - Storage within stairwells.
    - Better airflow (cross ventilation), more access to daylight and views, benefits in terms of occupant wellness, possibilities of innovative building design.
- Consider the **current National Building Code** minimum values: The strategy for evaluating hazards and risks must include all the existing code requirements (life safety, firefighting assumptions and building construction) and be compared with the desired outcome. Compare the archetypical building types to the maximum allowable floor area permitted in the current National Model Codes to ensure equivalence.
- Conduct a **risk analysis/assessment** and **safety analysis**:
    - Analyze the potential performance of compliant buildings (analyze the potential performance of real-world SEC buildings and the potential performance of code compliant building archetypes) and identify which hazards in currently compliant NBC buildings could change when they are designed with a single egress and height/size/occupancy restrictions are considered.

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[6] Jensen Hughes. (2024). *Single Egress Stair Building Designs: Policy and Technical Options Report – British Columbia*. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/reports/report_for_single_egress_stair_designs.pdf

[7] National Fire Protection Association. (2024). *One Stair, Two Perspectives: Single Exit Stair Symposium Report*. https://www.nfpa.org/en/forms/single-exit-stair-symposium-report

    - Analyze the risks (e.g., likelihood and consequence of a risk, assessment of probability of failure or severity, potential new risks if single exit stair is blocked or compromised).
    - Assess mitigation measures and identify compensating measures to address risks.
- Assess the **economic viability** of the building archetype. Perform a **cost-benefit analysis** once the relevant building archetypes to evaluate are defined. A cost-benefit analysis could be performed on additional life safety systems required by the code revisions for the proposed single egress stair construction.

3.1.2 Suggested scoping requirements

The P/T representatives were tasked to provide suggestions, input, guidance and validation of scope for future research work. The following summarizes the range of responses given by P/T representatives as well as areas that should be considered in defining the scope.

- Consider residential occupancies; however, it was also suggested to include mixed occupancies as well.
- Consider building characteristics (e.g., number of storeys, area, construction type, fire resistance requirements, sprinkler protection and travel distance; for more details see Section 3.1.3).
- Review present National Model Code requirements and historical developments.
- Compare or analyse existing adopted single egress building requirements in Canada (e.g., compare those already enforced by the British Columbia Building Code to other P/T) and internationally.
- Compare different sized buildings.
- Consider life safety systems and occupant safety.
- Consider the impact on firefighting operations.
- Consider the impact on occupants with disabilities / accessibility requirements.
- Perform a risk analysis.
- Perform a cost-benefit analysis.

3.1.3 Suggested building designs/archetypes

Building archetypes are representations of “typical” buildings of a certain design. The following summarizes the range of responses given by attendees as well as areas that should be considered when defining building designs/archetypes for future study.

- Consider primarily residential occupancies or mixed-use occupancy with appropriate fire separation.
- The maximum number of storeys suggested to be considered ranged from two to eight storeys. While some suggested considering a maximum of two to three storeys of combustible construction or five or six storeys of non-combustible construction, others suggested considering up to six to eight storeys.
- Consider limiting the maximum number of dwelling units to four to six units per storey.
- Consider both combustible and non-combustible construction types.
- Consider both wood frame and mass timber construction.
- Compare (fully and partially) sprinklered to non-sprinklered construction.
- Consider the impact of SEC on maximum travel distance to exit.
- Assume no basement level or subgrade occupancy.
- Consider underground parking spaces.
- Compare maximum design sized current NBC Part 3 compliant buildings to similar maximum-designed SEC buildings.

3.1.4 Suggested evaluation strategy

Attendees were also asked for suggestions, input, guidance and validation of a strategy to evaluate hazards and risks for single egress in residential occupancies. The following summarizes the range of responses given by

attendees as well as areas that should be considered when evaluating hazards and risks. Suggest to build on existing work (e.g., reports published by P/Ts).

- Consider the likelihood and consequence of a risk.
- Suggest that evaluation strategy includes all current code requirements and compares them with the desired outcome.
- Consider rapid occupant evacuation.
- Consider the safety of occupants during evacuation.
- Consider the safety of firefighters during occupant evacuation.
- Consider fire protection and pressurization of the only means of egress.
- Consider sprinkler protection and rapid smoke detection throughout the building.
- Consider areas of refuge for those unable to evacuate via the only means of egress.
- Consider fire department response characteristics.
- Consider firefighting operations (e.g., alternative means of access for firefighting, distance to fire access routes, fire department service level, water supply).
- Consider the location of the building (i.e., inside or outside of an urban area).
- Consider building orientation (e.g., building faces at least one street).
- Consider limitations to occupancy, such as buildings not occupied by private seniors' residences, student residences, or short-term rental suites.
- Examine wind driven fires and the addition of cross ventilation in proposed construction.
- Consider storage within stairwells.
- Assess long-term issues related to operations and maintenance of SEC buildings (e.g., safety systems, human factors, exit facilities).
- Compare different jurisdictions (e.g., potential performance of real-world SEC buildings and building archetypes).
- Consider societal or cultural differences between countries that have single egress stairs.
- Conduct a risk analysis.
- Evaluate whether the level of safety or level of risk are comparable to other multi-unit residential buildings.
- Conduct a failure analysis of necessary life safety measures and new risks.
- Identify mitigation measures and compensating measures to address risks.

3.1.5 Suggestions regarding cost-benefit analysis

The attendees were also invited to weigh in on whether a cost-benefit should be part of the research work. It was suggested to perform a cost-benefit analysis once the relevant building archetypes to evaluate were defined. Cost-benefit analysis can be performed on additional life safety systems required by the code revisions for the proposed single egress stair construction. The following summarizes the range of additional responses given by attendees as well as areas that should be considered with regard to the cost-benefit analysis.

- Determine building archetype prior to conducting a cost-benefit analysis.
- Conduct a cost-benefit analysis with additional life safety systems required by the code revisions for the proposed single egress stair construction.
- Conduct an impact analysis comparing a design with a single exit and a design with more than one exit.
- Assess the economic viability of the building archetype.
- Conduct a cost-benefit analysis after conducting the safety analysis.

3.2 What was heard from I/GI representatives?

The following section provides a summary of what was heard from the I/GI representatives. The summary is based on the notes associated with each meeting as well as written material shared with the NRC (see appendices for material shared). To be as inclusive as possible, the present summary provides input from CG members as well as observers.

3.2.1 Summary of the information shared

Since the content of the documents from the meetings overlapped, a single summary was written for all meetings. In addition to the contributions in the meetings, the I/GI representative members and observers provided written feedback as well as additional documents that included scientific publications (e.g., journal papers) and reports. Note that these additional documents were not analyzed as part of this report but can be found in the appendices for completeness.

3.2.2 Comments on scoping requirements and building archetypes

Although the I/GI subgroup was not asked to provide information on scoping, several attendees provided additional insights and comments on the suggested scoping requirements. The following summarizes the range of responses given by attendees as well as areas that should be considered in defining the scope.

- Define a **clear scope** for the research project that focuses on:
  - Fire safety (e.g., emergency responders and occupant safety, time to egress, accessible egress and ingress);
  - Evaluation of hazards and risk;
  - Benefits to society.
- Consider the **maintenance and inspection** of building critical life safety systems (e.g., reliability of detection equipment) as well as building conditions (e.g., storage in hallways and exit stairwells, particularly battery powered devices – see also the item on “emerging technologies” below). Consider the impact on safety when these systems are not maintained.
- Consider the **training** required for emergency responders and public education (e.g., include costs, information materials and a plan as to how to deploy across sector and the public for consistent messaging).
- Consider **firefighting operations** including:
  - If the fire services capabilities and resources are sufficient and what constitutes an effective firefighting response, including the following:
    - Comparing communities with professional fire services versus with volunteer fire services;
    - Comparing rural and urban communities;
    - Types and numbers of apparatuses and personnel needed for the first alarm assignment for buildings of this type of design and the numbers, types and timing if additional resources are needed;
    - Understanding limitations to emergency ingress of firefighters;
    - Preplanning to inform equipment and service needs;
    - Municipality limitations;
    - Understanding operational consequences, such as that occupant rescue via ladder or aerial is slower than a rescue via stairs and risk profiles are different;
    - Impact on times for rescue activities and the potential delay of suppression activities;
    - Access to the building from the streets;
    - Possibility of a delayed response if multiple communities are involved in the response component or in smaller communities with a volunteer fire department;
    - Identify the assumptions for the fire services (e.g., regarding arrival time) relevant for any proposed code provisions.
- Consider **accessibility**, i.e., the needs of persons with disabilities (e.g., the equitable opportunity to accessibly egress a building, the potential impact of a single egress on the whole population, including

individuals with physical, cognitive and mobility impairments), and define performance criteria for the following:
    - Accessible egress (e.g., consider compartmentalization, designated areas of relief, areas of refuge)
    - Stair width in relation to having one stair, with ingress and egress, persons with disabilities and the need to carry wheelchairs (e.g., electric wheelchairs can weigh approximately 450 pounds) down one stair;
    - The equipment and resources needed for egress for people with disabilities. While it was suggested to consider other design alternatives such as balconies and designated relief areas/areas of refuge, it was recommended to design for safe means of egress, as a shelter in place solution is not ideal, and design for self-rescue is desirable;
    - It was noted that egress for people with disabilities should not rely on firefighters, and the firefighters should not be responsible for them.
- Consider **ingress** as well as egress: Analyze egress/ingress paths and the impacts on occupants and firefighters. Consider stair/exit widths for two directional flows, accounting for the size of fully equipped firefighters; limitations on the number of personnel able to be deployed; impact of a contaminated/dirty stair being the only stair during operations; and equipment and resources needed for egress for people with disabilities. Consider the impact of the building size, number of storeys, travel distances, occupant load and occupant characteristics.
- Consider **human factors**, including human behaviour (e.g., becoming desensitized to fire alarms; ambulatory issues), occupant characteristics, including vulnerable populations (e.g., aging populations), and the intended type of residential occupancy. Consider how people react in a fire (e.g., sheltering in place versus exiting the building; a shelter in place strategy is based on building design plus administrative controls, including occupant training and consistent public education).
- Consider the **benefits of SEC** to health and wellbeing to occupants (e.g., potential for better airflow, more windows, better views and light, enhanced ventilation/cross ventilation, adaptation to climate change).
- Consider **benefits to building stock** (gap in the market for mid-sized buildings), possibilities of innovative building design.
- Consider the impact of **emerging technologies** and changes in behaviours that impact hazards and risks (e.g., lithium-ion battery powered devices, garbage valet and packages in hallways).
- Explore the **performance of other areas** of the building design (e.g., performance of egress doors, closure time, risk associated with suite door performance).
- Consider **other impacts** of the surroundings on access to the building (e.g., infill housing).
- Consider the **impact on other codes and regulations** beyond the National Model Codes (e.g., elevator code requires two means of egress and access to an alternate floor in the event of smoke).
- Consider the **potential cost** of additional performance measures (e.g., consider if the cost of two-stage alarm systems will cost more).
- Consider **additional emergencies** for access and operations for emergency responders (e.g., medical, law enforcement responses, and 911 operators).

3.2.3 Suggested evaluation strategy

Attendees also provided suggestions, input, guidance and validation of a strategy to evaluate hazards and risks for single egress in residential occupancies. The following summarizes the range of responses given by attendees as well as areas that should be considered when evaluating hazards and risks.

- Follow the usual **consensus-based development process** of the National Model Codes for this and any other topic for potential code changes. Attendees welcomed following a scientific-based approach supporting the code development process that is based upon a thorough technical understanding that supports robust discussions incorporating all factors to inform consensus-based decisions.
- **Continue communication** of the progress of the topic, provide regular updates, with further opportunities to discuss, provide feedback and review the outcomes as the work progresses.
- Consider a range of **research methods**: qualitative (e.g., interviews with firefighters and/or other relevant representatives from the fire services, first-hand experience with single egress), literature reviews (e.g., fire data and statistics including on smoke detector and sprinkler failure; statistics based on construction types;

comparison of different countries/regions incorporating technical and cultural context; comparison of single egress with current minimum egress requirements in terms of life safety and firefighting; establish the level of current risk; consider defining an acceptable level of safety, rather than benchmarking current minimum requirements; coroner reports; existing standards and tools/instruments; National Fire Information Database (NFID) data), case studies (e.g., Grenfell Tower), field/physical testing (e.g., training towers), model scenarios (e.g., using hazard analysis informed by National Fire Information Database (NFID), incorporating the limitations of the database including current state of no building stock of this design in Canada, jurisdictional variations and participation). Research methods should be broad and supported by a literature review. Evaluate the safety performance based on fire data and statistics. A neutral and balanced approach based on technical merit of the proposed solution is important.

- **Evaluate the assumptions stated as motivation** for the proposal to support an evidence-based discussion of the validity and impact, e.g., the assumptions that the proposal would provide an increase in available floor area, reduction in costs, addressing of housing availability and affordability. Note that the mandate referred to addressing housing affordability, not mandating removal of a stairwell, therefore make sure housing affordability is addressed while maintaining safety level for occupants, firefighters and community.
- Analyze **hazards and risks** (e.g., single points of failure, causes of failure, scenarios for failure, probability of various worst-case scenarios occurring), including fire origin, cause, behaviour and time to flashover. Analyze impact of mitigation measures, particularly considering single point of failure of the single means of egress for both ingress- and egress-reliant activities of both firefighters and occupants.
- Consider a **holistic cost-benefit analysis**, including building maintenance and inspection, fire suppression and operational costs for fire services (including potential for increased apparatus needs), fire prevention measures, active and passive fire safety systems. Consider reliability for fire prevention measures and fire safety systems and uncertainty. Consider potential cost differences for increased safety measures as a result of potential additional single egress provisions contributing/commensurate/or greater than the building costs for affordable housing builds. In addition, to inform the transparent discussion beyond hard construction costs, consider home affordability and other influencing factors potentially affecting the costs and benefits to the owners, occupants and community.

3.2.4 Observer input

Observers provided additional valuable input to the consultation:

- Define a **clear scope** for the research project: Research must be well contextualized and broad; need to be aware of issues and biases. Important to use the correct terminology (e.g., housing affordability is different from affordable housing and housing supply).
- Consider different **research methods**: pilot projects, qualitative (e.g., interviews with firefighters), literature review on evacuations, National Fire Information Database (NFID) data particularly on fire-related injuries and deaths, and case studies. Examine loss statistics in other jurisdictions (e.g., Eastern Europe) incorporating the building regulations, practices enforcement and maintenance, and social technical contexts, including cultural, lifestyle and adherence to regulations and maintenance differences. Collaborate and coordinate efforts. Combine qualitative and quantitative methods and a risk analysis. Apply the equivalency method in the alternative solution approach to ensure that the risk to emergency responders is not increased, while managing solutions to the current housing crisis. Consider the NIST study in high-rise and residential occupancies. Consider involving regulators during the information gathering stage (e.g., fire prevention officers) to identify concerns around maintenance and the compliance challenges encountered with some owners and tenants.
- Consider the **safety** of occupants and firefighters (e.g., fire department operations, equivalency method). Housing crisis is a concern, but not to be addressed at the expense of the safety of the occupants, firefighters or community.
- Consider **human factors** (e.g., consequences of human error, cultural differences, low-income housing components and mental health issues). Consider different social technical characteristics, such as lifestyle, culture, language, education, regulations and maintenance. It is essential to understand the policy implications for people who live there.

- Consider **vulnerable populations** and limiting the type of residential occupancy for single egress buildings (e.g., consider Group C occupancies, do not differentiate if private seniors' residence, student residences, or short-term rental suites would be included/excluded) and consider enforcement issues. Consider that people with disabilities live in both market and affordable housing.
- Consider **firefighting operations and safety** (e.g., ingress/egress, impact on operations and training, and following of the longstanding codes process).
- Consider the **maintenance of a single means of egress** and the **management of risks** (e.g., blocked exits and hallways) in jurisdictions with limited ability to enforce code requirements.
- Analyze the impacts of **emerging technology** (e.g., lithium-ion battery powered devices). Consider the potential impact of emerging technology in failure scenarios.
- Consider **fire protection systems and their maintenance** (e.g., automatic sprinklers, emergency power, door closers) and risk of failure. It is more challenging to maintain buildings in rural and regional districts and smaller communities that lack the resources to enforce the fire codes, which results in higher rates of failure and maintenance issues.
- Consider the **impact of smoke on evacuation** of occupants, e.g., when egress areas that are pressurized are compromised by smoke.
- Consider **building construction and materials**, such as embodied carbon, combustible and non-combustible materials, and quantify these through a Life Cycle Assessment (LCA).
- Consider the principle of **exit requirements** as they relate to the area of floor served (e.g., in terms of economy of scale, the measures and acceptable levels of risk for three-, four-, five-storey single egress construction will result in different considerations for each).
- Consider **rooftop amenity spaces** limited to an occupant load of not more than 60 and/or private rooftop patios only accessed from dwelling units on the storey below.
- Consider **other hazards and emergencies beyond fire** (e.g., medical, law enforcement, hazardous response).

4 Summary and limitations

4.1 Summary

The NRC received valuable information through the targeted consultation. Several common themes emerged from the feedback provided by P/T member representatives and I/GI representatives (see Sections 3.1 and 3.2). Both groups emphasized the importance of accessibility, particularly the need to incorporate considerations for persons with disabilities in building designs and evacuation strategies. Firefighting operations and safety were also recurrent topics, with discussions focusing on the capabilities and requirements of fire services as well as training and education requirements of emergency responders and occupants, the impact of building design on firefighting efficiency, and the safety of both occupants and emergency responders. Economic viability and the necessity of conducting thorough cost-benefit analyses were highlighted, stressing the need to balance safety enhancements with financial feasibility, as well as evaluating stated motivations. Risk assessment was another critical theme, with calls for comprehensive evaluations of potential hazards, mitigation measures, and the overall safety performance of proposed building archetypes. Additionally, both subgroups underscored the significance of maintaining and inspecting safety systems to ensure long-term compliance and effectiveness, as well as the impact of emerging technologies and human factors on building safety and evacuation procedures. Finally, while the focus of the consultation was on residential occupancies some suggested to consider expanding the scope to mixed-use occupancies.

This input will be used to develop the scope and methodology for a follow-up foundational research project that examines the equivalence of single-egress solutions to existing fire safety requirements in current codes and inform consideration of potential code changes in the National Model Codes through the Harmonized Code Development System.

Once the scope is defined, the NRC will share this and reach out to invite input on the research to be conducted.

4.2 Limitations

This report summarizes the results of a targeted consultation. This approach, while valuable for gathering input from diverse stakeholders, has several limitations that need to be acknowledged. These include potential biases, as not everyone may participate equally, leading to skewed perspectives. There is also a risk that the consultation may be dominated by more vocal or organized attendees, overshadowing quieter voices. Additionally, the process can be time-consuming and resource-intensive for attendees and those facilitating the consultation, including requiring substantial effort to organize and summarize feedback. Furthermore, translating the gathered input into follow-up foundational research can be challenging, as input could be misinterpreted, and the research may not be able to cover all aspects raised by attendees.

To mitigate these potential limitations, several strategies were employed. Beginning with setting clear expectations (e.g., in the terms of reference for the consultation), including ensuring broad and inclusive participation, facilitating accessible communication through clear, jargon-free language, following a structured format, inviting CG members to provide written input following meetings, and a transparent and consistent method in how feedback was summarized and how the report was developed.

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Appendix A – Organizations represented in the consultation

Table - Appendices 1. Organizations involved in the consultation

Category	Sector	Name of organization
P/T	P/T government organization (Québec)	Régie du bâtiment du Québec
P/T	P/T government organization (Ontario)	Ministry of the Solicitor General (SOLGEN)
P/T	P/T government organization (Nova Scotia)	Office of the Fire Marshal
P/T	P/T government organization (Alberta)	Government of Alberta
P/T	P/T government organization (British Columbia)	Government of British Columbia
P/T	P/T government organization (Saskatchewan)	Government of Saskatchewan
GI	Builders	Canadian Home Builders' Association
GI	Designer/Architect	Robert Dupuis
GI	Professional Firefighters	IAFF
GI	Fire services	Council of Canadian Fire Marshals and Fire Commissioners
GI	Fire services	Canadian Association of Fire Chiefs
I	Materials	Canadian Masonry Design Centre
I	Materials	Canadian Institute of Steel Construction
I	Materials	USG/CGC Inc
I	Materials	Canadian Wood Council
I	Materials	Cement Association Canada
GI	Policy/Regulation	Alliance of Canadian Building Officials' Associations
GI	Policy/Regulation	First Nations National Building Officers Association
GI	Standards	Accessibility Standards Canada
GI	Other	Universal Access Design
I	Other	AC Consulting Solutions Inc
I	Other	WSP
GI	Other	Accessible Built Environment Factors
GI	Other	Council of Canadians with Disabilities
GI	Other	Insurance Board of Canada
I	Other	LMDG
GI	Municipality	City of Toronto
O	Other	SFPE Canada Steering Committee
O	Standards	National Fire Protection Association (NFPA)
O	Other	GHL Consultants
O	Other	LGA Architectural Partners
O	Other	National Indigenous Fire Safety Council
O	Other	Representative of the Consumers Council of Canada on the Advisory Council
O	Other	Caivan Architect

* P/T = Provincial and territorial; I = Industry, GI = General interest, O = Observer

Appendix B – Meeting agendas

Provinces and territories group

- Appendix B - Provinces and Territories Group (August 8, 2024)
- Appendix B - Provinces and Territories Group (September 9, 2024)

General interest group

- Appendix B - General Interest Group (September 13, 2024)
- Appendix B - General Interest Group (September 27, 2024)

Provinces/territories and general interest group

- Appendix B - Provinces / Territories and General Interest Group (October 4, 2024)

Appendix C – Written comments and materials received from I/GI representatives

Tina Saryeddine (CAFC):

Letter to the NRC from CAFC to help inform the consultation on Single Egress Construction:
https://cdn.ymaws.com/cafc.ca/resource/resmgr/single_egress_resources/FeedbackInput2-SESNRC.pdf

William Kuffner:

Considerations sent to NRC:
https://nrc-publications.canada.ca/eng/view/supplement/?id=7a02aec5-db31-4cdc-bf24-5aae16c31be6&dp=6&dsl=en

Appendix D – Written comments received from observers

Rae Dulmage, Representative of the Consumers Council of Canada:

Considerations sent to NRC:
https://nrc-publications.canada.ca/eng/view/supplement/?id=7a02aec5-db31-4cdc-bf24-5aae16c31be6&dp=7&dsl=en

Len Garis:

Considerations sent to NRC:
https://nrc-publications.canada.ca/eng/view/supplement/?id=7a02aec5-db31-4cdc-bf24-5aae16c31be6&dp=8&dsl=en

Additional publications shared with NRC:

- Means of Escape in Residential Buildings, Objective 83: Guidance on evacuation strategies and final report
- APPENDIX A1-1 AND A1-2: REVIEW OF PHYSICAL MEASURES AND INTERNATIONAL GUIDANCE DOCUMENTS
- APPENDIX A1-3: CURRENT TRENDS IN RESIDENTIAL BUILDINGS
- APPENDIX B1: RESIDENT DECISION-MAKING
- APPENDIX A2: PROPOSED EXEMPLAR BUILDING AND MODEL PARAMETER SELECTION
- APPENDIX B2: FINDINGS FROM INTERVIEWS WITH FRS AND RESIDENTS, AND SURVEYS WITH RESIDENTS
- APPENDIX A3: QUANTIFY EFFECTIVENESS OF EVACUATION STRATEGIES
- Strategies for evacuation of occupants from high-rise residential buildings involved in fire - GOV.UK
- Human behaviour in fire: Knowledge foundation and temporal evolution - ScienceDirect
- Study of the occupants' behaviour during the 2 Forest Laneway fire in North York, Ontario January 6, 1995
- https://www150.statcan.gc.ca/n1/daily-quotidien/220616/dq220616b-eng.htm
- https://www150.statcan.gc.ca/n1/daily-quotidien/221011/dq221011a-eng.htm

- https://www.firefightingincanada.com/learning-from-fire-death-data-2/
- https://assets.ctfassets.net/5izjgsoqhaa4/17RcvYpMggzHUl5vZWb9uZ/01988dfd4f0aa45867586abf1897859a/Report_Indigenous_Fire_Deaths_NIFSC.pdf
- https://cjr.ufv.ca/wp-content/uploads/2018/04/Murdoch-University-Fire-and-at-Risk-Populations.pdf
- https://www.cdnfirefighter.com/suicide-accounts-for-more-than-3-in-4-intentional-fire-deaths-statscan/
- Single-Stair-Egress-Report-v-Final_.pdf

Peter Rankin:

- https://www.gov.uk/government/consultations/sprinklers-in-care-homes-removal-of-national-classes-and-staircases-in-residential-buildings/sprinklers-in-care-homes-removal-of-national-classes-and-staircases-in-residential-buildings
- https://assets.publishing.service.gov.uk/media/6605c8cd91a320b20282b085/Annex_C_-_Impact_Assessment.pdf

Conrad Speckert:

Letter sent to NRC:
https://nrc-publications.canada.ca/eng/view/supplement/?id=7a02aec5-db31-4cdc-bf24-5aae16c31be6&dp=9&dsl=en

Additional publications shared with NRC:

- https://www.jchs.harvard.edu/sites/default/files/research/files/harvard_jchs_utile_boston_indicators_single-stair_housing_october_10_2024.pdf
- https://halfclimatedesign.com/research-policy

Pat Gallagher:

Considerations sent to NRC:
https://nrc-publications.canada.ca/eng/view/supplement/?id=7a02aec5-db31-4cdc-bf24-5aae16c31be6&dp=10&dsl=en