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City of St. John's

**Fire Safety Alternatives
For Upper Storeys
Downtown St. John's, NL**

Fire Protection Engineering Analysis

QUALITY REVIEW FORM

RJ Bartlett Engineering Ltd

Document Verification

Page 1 of 1

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1 Executive Summary

1.1 Scope of Analysis

In 2001, the City of St. John's commissioned Ken Richardson Fire Technologies Inc. (Richardson) to undertake a fire protection engineering study to develop practical methods for applying fire and life safety codes to certain heritage property restoration projects within the City limits. The Richardson report, entitled "*Fire Safety Alternatives for Heritage Buildings in St. John's, NL*" and dated December 21, 2001 [1], presented a balanced approach for revitalizing residential heritage buildings for use as either Bed and Breakfasts, or mixed-use occupancies that feature residential suites located above a business or commercial occupancy. The recommendations made within the Richardson report focused on maintaining the historic integrity of heritage properties in their original state, while providing an acceptable degree of fire and life safety through cost effective building upgrades.

RJ Bartlett Engineering Ltd (RJBEL) has been retained by the City of St. John's (Client) to conduct a fire protection engineering analysis which expands the scope of the Richardson report. The analysis has incorporated the use of contemporary fire and egress simulation software and permits a greater degree of flexibility in terms of major occupancy and remedial solutions.

Implementation documents and worked examples have also been developed to assist the City of St. John's in going forward with their evaluation and enforcement processes.

The additional mixed-use occupancy configurations examined as part of this report include:

- Occupancies located above a residential, business or commercial occupancy, and
- Business or commercial occupancies, or combination thereof, located throughout the properties.

In consultation with identified Stakeholders, the approach followed in this analysis has been based on the guidelines set forth in the Society of Fire Protection Engineers (SFPE), "*Engineering Guide to Performance-Based Fire Protection Analysis and Design of Buildings*" [2].

The applied methods of analysis have been selected based on a literature review of applicable similar fire and life safety Codes and Standards, and Fire Protection Engineering analyses via the combined use of computational fluid dynamics and egress simulation software, and technical calculations.

The level of life safety and property protection established in the Richardson report represent a basis for these analyses, which serve as the foundation for this alternative solution and allow for the formation of opinions and subsequent implementation measures.

Users of this report are required to implement the following measures in their entirety. The following individual requirements are intended to apply in whole and not supplemented in part by the acceptable solution requirements of the 2010 National Building Code of Canada (NBC) or other applicable Codes and Standards without the written approval of the Authority Having Jurisdiction (AHJ).

Whereas several measures are mandatory for all instances, the worksheet system does permit a degree of flexibility in an effort to accommodate practical limitations, while maintaining a consistent and acceptable level of fire safety. Notable mandatory measures include (refer to report Section 6.0 for a complete list of measures):

1. The evaluation of existing properties using the *"Fire Safety Evaluation Questionnaire and Worksheet"*.
2. Provision of security/alarm systems monitored by a central monitoring station. Fire detection is required to be provided via manual input devices located at primary exits, and interconnected smoke alarms (wireless or 110V hardwired) located throughout major rooms on all floor levels and exit corridors. Device placement shall be in accordance with the NBC and manufacturers specifications.
3. Combustible wall and ceiling finishes are required to have a flame-spread rating in accordance with the NBC. Materials exceeding these values, such as Tintest, are required to be removed, covered with an acceptable thermal barrier, and/or treated with a listed fire retardant.
4. Properties are required to have a fire safety plan developed in cooperation with the St. John's Regional Fire Department.

The fire safety plans are to include, as a minimum, the following information:

- Committee structure,
- Administration requirements,
- Instructions for occupants of the buildings,
- Posted evacuation drawings,
- Posted instruction for action upon:
 - Discovery of smoke/fire, and
 - Hearing a fire alarm.
- Drawings showing major fire safety components,
- Maintenance requirements for all fire safety components and systems,
- Procedures for fire drills,

- Impairment procedures in the event any life safety system or component of the property is out of service, and
 - A copy of fire safety alternatives documentation.
5. Properties are required to have an annual fire inspection walkthrough and sign-off conducted by the St. John's Regional Fire Department. The fire safety plan is required to be reviewed by the St. John's Regional Fire Department at intervals not exceeding five years.

Information contained within this report is specific to the subject properties in the City of St. John's and, in this regard, all conclusions and subsequent required implementation measures are only applicable to subject properties in this jurisdiction.

1.2 Property Owner Responsibilities

This report utilizes fire and life safety concepts that deviate from the acceptable solution requirements of the NBC. The user or building Owner acknowledges that while the life safety intent of the NBC is met, there is a chance that the property could sustain greater fire damage than if it were constructed to the acceptable solution requirements of the NBC.

Any user of this report or their representative shall be responsible for developing and maintaining all documentation associated with this alternative solution, and retaining these documents on the property.

The maintenance of fire and life safety components required by the NBC and this alternative solution are the responsibility of the property Owner, and are required to be implemented in accordance with Section 2.8. of the 2010 National Fire Code of Canada (NFC).

Any changes to the property in terms of function, occupancy use, or its fire and life safety systems will require re-evaluation in terms of their impact on this alternative solution.

1.3 General Property Description

The buildings in question are typically two to three storeys in building height and less than 150 m² in building area (footprint). Some buildings have full height basement levels or crawl spaces. The buildings are of wood frame construction, and located so that at least one exterior wall faces a public street in terms of fire department access. In some cases buildings may have a second building face accessible by a public right-of-way.

The main levels are typically served by at least one direct exit to the exterior, and have access to an exit stair that serves above grade floors. The exit stair serving above grade floors in some cases may be separated from the first floor, and provided with its own exterior exit door.

1.4 Occupant Characteristics

Occupants are representative of the general population in terms of gender, age, cognitive capacity, and ambulatory capabilities.

All occupants are expected to be capable of recognizing and responding to fire emergency conditions (i.e. capable of self-preservation).

1.5 Local Fire Department Capabilities

Public fire protection is provided by the St. John's Regional Fire Department. Based on discussions with the fire department, it was reported that the fire department is capable of responding to most, if not all locations within 5 min.

It was also reported that fire hydrants located throughout the city are presently served by sufficient water supply and flow pressure for firefighting operations.

2 Applicable Codes and Standards

The Codes and Standards referenced for this fire protection engineering analysis include, but are not limited to, the following:

- 2010 National Building Code of Canada (NBC) – Part 3 and 9,
- 2010 National Fire Code of Canada (NFC),
- National Fire Protection Association, *“Standard for the Installation of Sprinkler Systems”*, (NFPA 13), 2013 Edition.
- National Fire Protection Association, *“Standard for the Installation of Sprinkler Systems in One and Two Family Dwellings and Manufactured Homes”*, (NFPA 13D), 2013 Edition,
- National Fire Protection Association, *“Code for Fire Protection of Historical Structures”*, (NFPA 914), 2010 Edition,
- City of Charlottetown Building Code Bylaw,
- 2011 Nova Scotia Building Code (NSBC),
- 2006 British Columbia Building Code (BCBC),
- 2011 Manitoba Building Code (MBC),
- 2012 International Residential Code (IRC),

- National Fire Protection Association, *"Life Safety Code"* (NFPA 101), 2012 Edition, and
- National Fire Protection Association, *"Building Construction and Fire Safety Code"* (NFPA 5000), 2012 Edition.

2.1 Alternative Compliance

Division A, Section 1.2. of the NBC states that:

"Compliance with the NBC shall be achieved by either:

- *Compliance with the NBC acceptable solutions as presented 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 acceptable solution requirements of the NBC are intended to benchmark tolerable levels of risk associated with life safety.

Given the existing construction conditions typically associated with heritage properties, the alternative solutions developed as part of this report are intended to provide an acceptable level of fire and life safety through cost effective upgrades.

3 Research and Related Theory

3.1 Comparison to International Code Requirements

Several Codes and Standards enforced within other North American jurisdictions directly address the restoration, rehabilitation and reuse of heritage type buildings.

Advancements in fire science and methodologies have facilitated this shift which is aligned with performance or objective-based acceptance criteria.

A comparative literature review of referenced Codes and Standards is summarized in Appendix A.

3.2 Computational Fluid Dynamics Simulation

Fire Dynamics Simulator (FDS) is a computational fluid dynamics (CFD) software model of fire driven fluid flow developed by the National Institute of Standards and Technology (NIST). This software solves numerically, a form of the Navier-Stokes equation with an emphasis on heat and smoke transport from fires.

Design fire models developed using FDS take into consideration parameters such as:

- Fuel loading and combustion characteristics,
- Fire detection and suppression hardware,
- Compartment geometries,
- Ventilation, and
- Compartment material properties.

The design fire scenarios used in this analysis have been developed using this technology. The software has been programmed to report on various data including:

- Heat release rates,
- Fire detection and suppression device activation, and
- Temperature and visibility through smoke.

3.3 Timed Egress Models

An egress time model considers the impact of occupant congestion and speed of travel to estimate the evacuation time for an area. In an egress time model, safe evacuation in a fire condition can be estimated to occur when the required safe egress time (RSET) is calculated or determined to be shorter than the available safe egress time (ASET) [3] [4].

RJBEL has applied various egress models to quantify the RSET for the purpose of this analysis. These models utilize a series of calculations to estimate human movement in an emergency situation, and have been developed through testing and observation as outlined in the SFPE Handbook [3] [4].

The RSET is considered to be the sum of the individual times required for each of the following events to take place:

- Detection of the fire by the building's fire alarm system,
- Pre-movement time by building occupants to recognize and respond,
- Travel time to exit locations, and
- Queuing at transition locations and exits serving floor areas with high occupant loads.

Refer to Figure 1 for an outline of the egress time model.

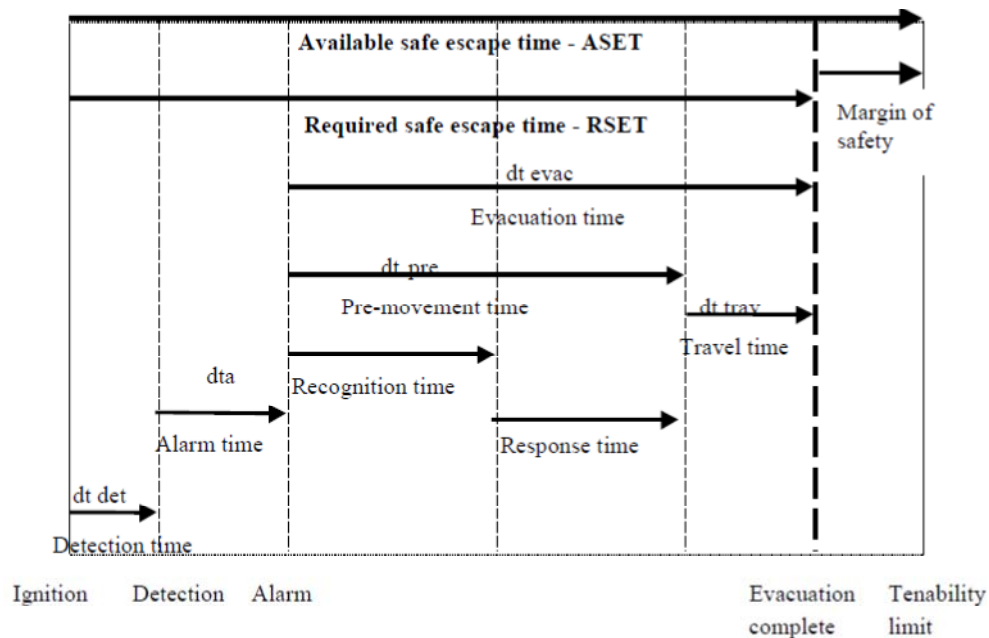


Figure 1: Egress Time Model

Pre-movement time begins at the onset of an alarm, and ends when occupants begin traveling to exits. Movement time begins when travel to exits begins, and ends when occupants reach an exit enclosure or leave the building. For buildings containing a low occupant load density, such as the buildings subject to this report, queuing is not expected to occur at exits. The time to clear a floor area is then dependant on the flow capacity of exit facilities, such that delayed occupant response to exit travel or occupants located further from exit facilities will have a greater impact on the overall estimated RSET [3].

For the purpose of this analysis, a range of premovement times has been considered, given the breadth associated with residential occupancies. [9]

The remaining travel time to exits and queuing time components have been determined using human movement calculations that model occupant flow.

3.4 Tenability Conditions

3.4.1 Temperature and Heat Exposure

Human exposure to fire may lead to hyperthermia, blistering, skin burns, and respiratory tract burns [5]. The SFPE Handbook suggests a thermal endpoint criterion (tenability limit) of 60°C for a smoke layer less than 1.5 m above the floor level [6].

For this analysis, a tenability limit of 60°C at 1.5 m above floor level for temperature exposure has been considered, measured by thermocouples located within the FDS modeling software.

3.4.2 Visibility Threshold

The reduction of visibility in a fire due to smoke obscuration is an important consideration in tenability analyses. The degree of familiarity with the inside of the building affects an individual's ability to move through fire smoke. The SFPE Handbook specifies that those who are familiar with the geometry of the building need a visibility distance of 4 m for safe evacuation, whereas those who are unfamiliar need a visibility distance of 13 m [5].

For this analysis, a tenability limit of 13 m at 1.5 m above floor level for visibility reduction due to smoke has been considered, measured by thermocouples located within the FDS modeling software. This threshold value has been considered based on the probability that building occupants may be unfamiliar with the building and its exit locations.

4 Performance-Based Solution

4.1 Fire Protection Engineering Qualifications

RJBEL has been providing fire protection engineering solutions since 1987 with services provided locally, regionally, nationally, and internationally. The firm has an in-house technical staff which includes nine licensed Professional Engineers, four of which are registered as Professional members with the Society of Fire Protection Engineers.

RJBEL has successfully provided fire-protection engineering consulting services on a variety of projects in Newfoundland and other Canadian jurisdictions for alternative solutions.

4.2 Stakeholders, Authority Having Jurisdiction, and Design Objectives

The stakeholders that have participated in this analysis and consultation include:

- Property Owners.
- St. John's Heritage Advisory Committee.
- City of St. John's Department of Building and Property Management (AHJ).
- City of St. John's Regional Fire Department (Emergency Responder).
- RJ Bartlett Engineering Ltd (Fire Protection Engineering Consultant).

The primary fire protection goal common to all stakeholders for this project is the preservation of heritage building characteristics, while providing an acceptable level of life safety such that fire related injuries and loss of life to building occupants and emergency responders are minimized.

4.3 Defined Performance Criteria

The performance criteria developed by the Richardson report established the acceptable limit of occupant safety based on the NBC functional statements, summarized in Appendix B, for the following aspects:

- Building to building fire spread,
- Interior fire separations,
- Fire detection and alarm systems,
- Fire suppression,
- Occupant egress, and
- Ignition prevention.

The primary performance criteria developed for this analysis is consistent with that mandated by the Richardson report, and will be defined as:

“Demonstration that the estimated required safe egress time (RSET) under the proposed conditions, must not exceed the estimated available safe egress time (ASET), benchmarked as the time at which untenable conditions are reached along egress routes”.

4.4 Approach and Method of Analysis

For the purposes of this report, a case study of a building on Queens Road in St. John's, NL has been presented to demonstrate a fire safety evaluation to be applied to a restoration project within the city.

A deterministic approach has been applied to the case study analysis which employs both quantitative tools and qualitative arguments to demonstrate that the level of life safety and property protection required by the performance criteria are maintained, or exceeded.

Throughout the analysis, NBC compliant configurations have also been developed and evaluated as a comparison tool against the heritage scenarios.

4.5 Downtown Property Description

The downtown property selected for this analysis is a three storey building with a basement level, approximately 44 m² in building area (footprint).

It has been proposed by the building Owner to convert the lowest three floor levels of the former single-family residence into a day spa. The upper storey of the building has been identified as office space with a potential sleeping area for the Owner.

The building is currently not sprinklered. Several spot-type smoke alarms are provided for fire detection throughout the building.

Image 1 and Figures 2 to 4 show an exterior image and proposed floor plan drawing for the building.

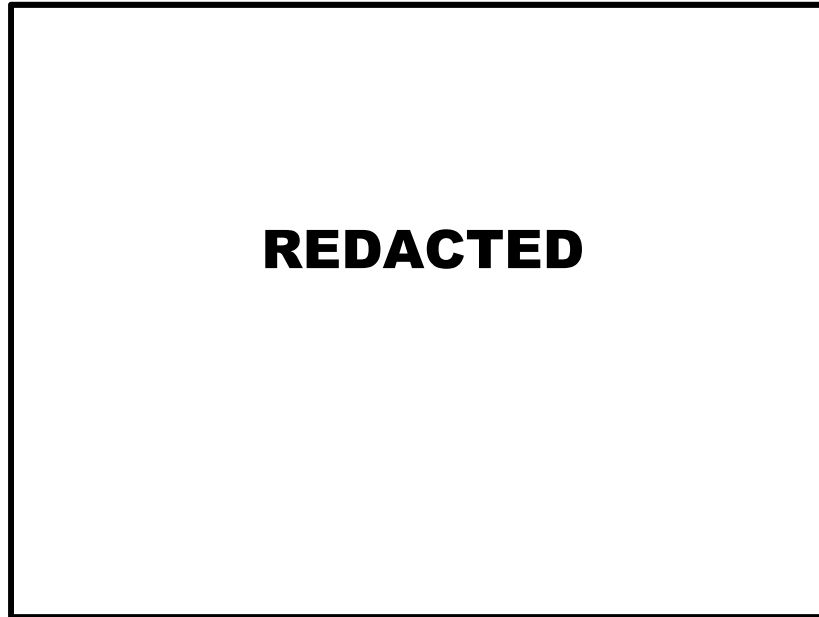


Image 1: Sample Google Street View Property Image

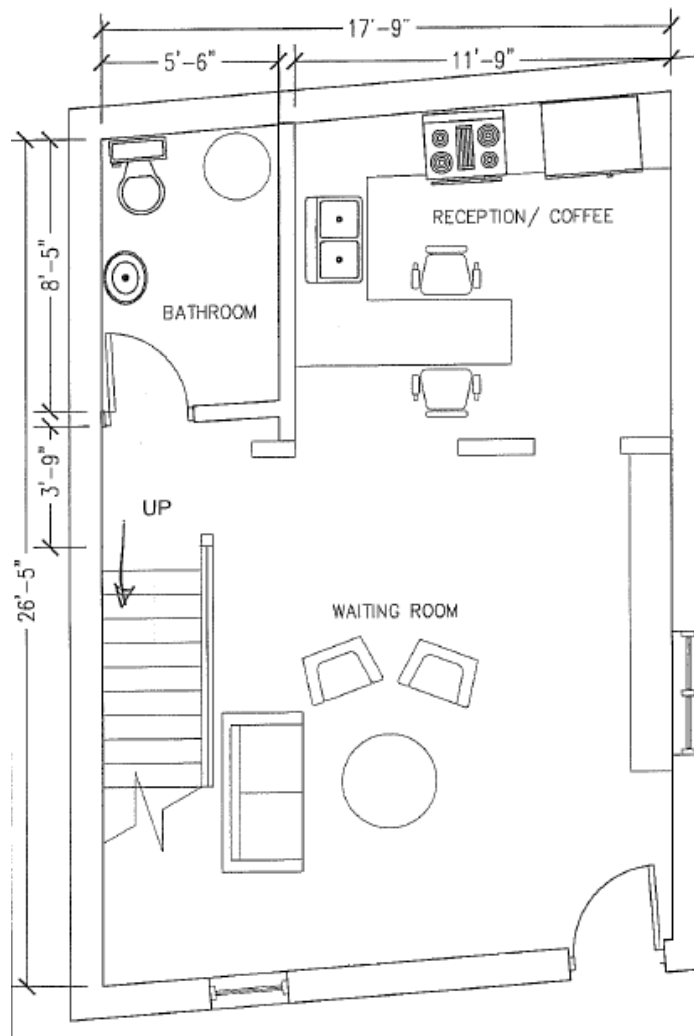


Figure 2: Basement Level Proposed Layout

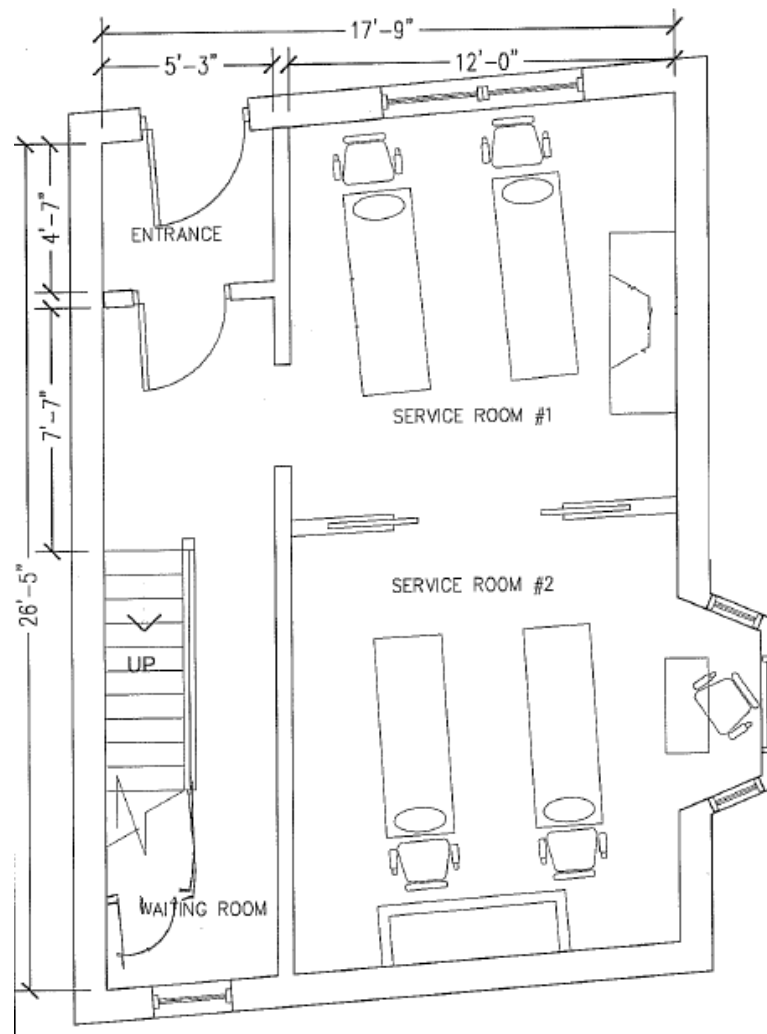


Figure 3: First Floor Proposed Layout

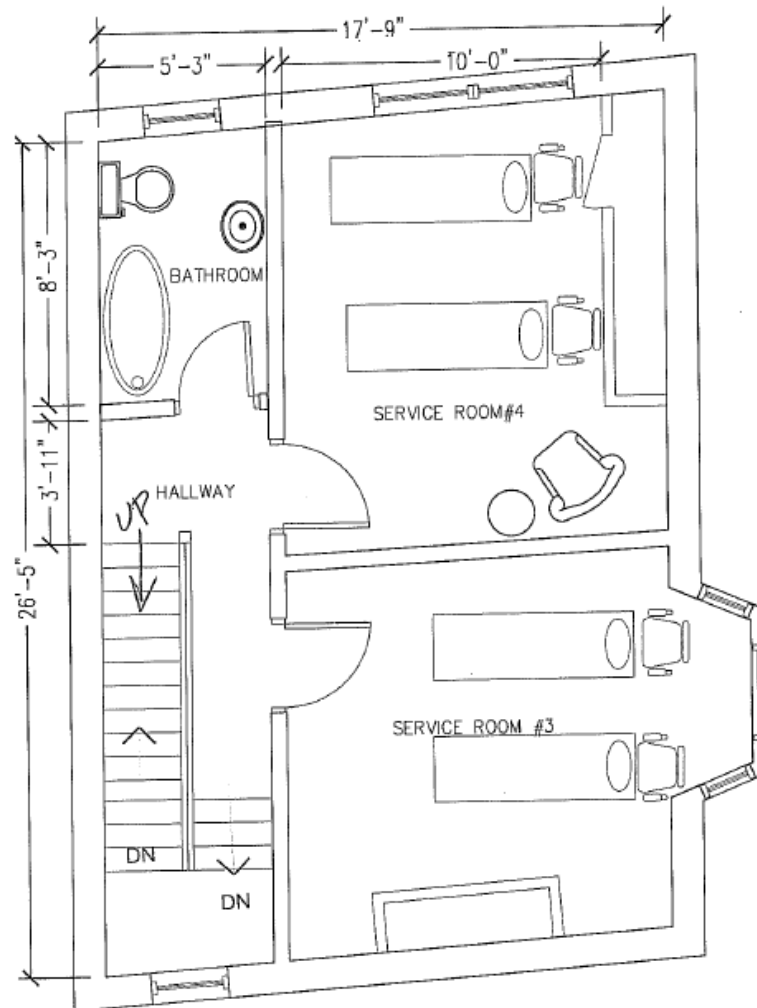


Figure 4: Second Floor Proposed Layout

Refer to Appendix C for complete information collected for the evaluation. RJBEL, in consultation with the Stakeholders has completed several additional case studies over the course of the project to validate usability and consistency.

4.6 Design Fire Development

The “*worst-credible case*” design fire scenarios used in this analysis and discussed in this Section reflect guidance presented in Standards such as NFPA 5000 [7].

“*Worst-credible case*” design fires with a peak heat release rate of 1,500 kW have been assumed based on the results of full scale heat release testing of Christmas trees reported by Babrauskas [8]. Design fires were considered for various locations on each storey, such as open floor areas, office areas, and storage rooms.

The simulated domain geometry and layout has been based on floor plan drawings provided by the AHJ for the downtown case study. Material finishes were considered and observed during site observations reported by the AHJ, and consisted of a combination of carpet and hardwood flooring, and gypsum and plaster walls and ceilings.

Unsprinklered and sprinklered fire conditions were considered for the purposes of this analysis using subroutines within the modeling software. For the sprinklered fire scenarios, sprinklers located within the modeled domain were assumed to activate at a temperature of 68°C, with a Response Time Index (RTI) of 55 (m•s)^{-1/2}.

The activation of smoke alarms located on each storey throughout the building was estimated for each design fire using subroutines within modeling software. For the purposes of this analysis, smoke alarms were assumed to activate at 4% smoke obscuration/m.

The use of various t^2 fire growth periods were considered during the initial stages of fire development using subroutines within the modeling software to represent different fire hazards and sources of ignition. t^2 fires exhibit growth rates that are time dependent and represented by the equation $Q = \alpha t^2$, where ' α ' is the coefficient that corresponds to a time ' t ', when the heat release rate, ' Q ', reaches 1,055 kW for a range of growth rates (i.e. 600 seconds for slow, 300 seconds for medium, 150 seconds for fast, and 75 seconds for ultra fast). These growth rates have a direct impact on the rate of spread, as well as the activation of any fire protection or detection devices.

4.7 Evaluation of Design Fires

4.7.1 Evaluation of Tenability Conditions

It was determined that a design fire occurring on the basement level resulted in the "*worst-credible case*" tenability conditions on all levels for occupants exiting the building under both sprinklered and unsprinklered fire conditions. Figures 5 to 8 and Tables 1 and 2 summarize the tenability conditions at all levels for both the sprinklered and unsprinklered design fire scenarios occurring on the basement level of the building.

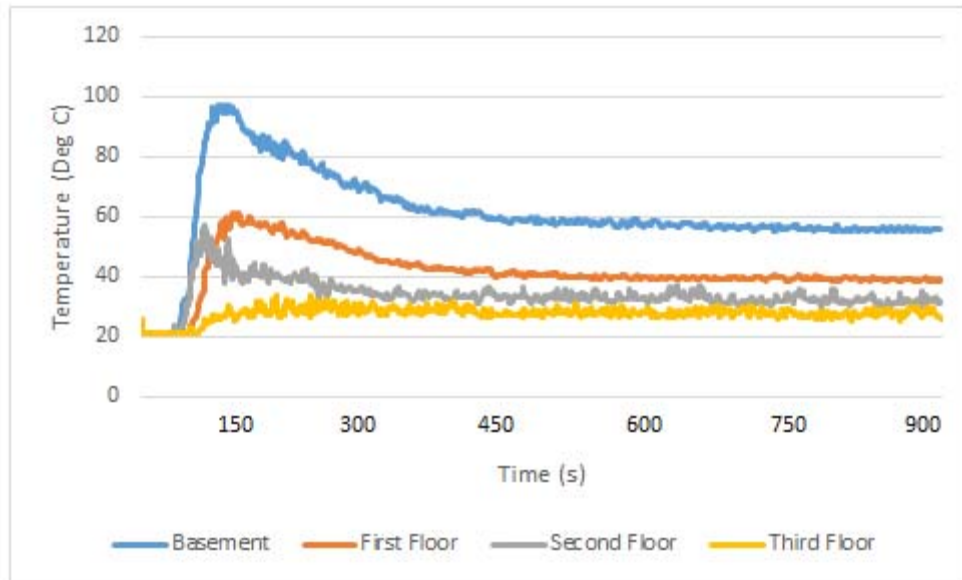


Figure 5: Summary of Sprinklered Temperature Conditions

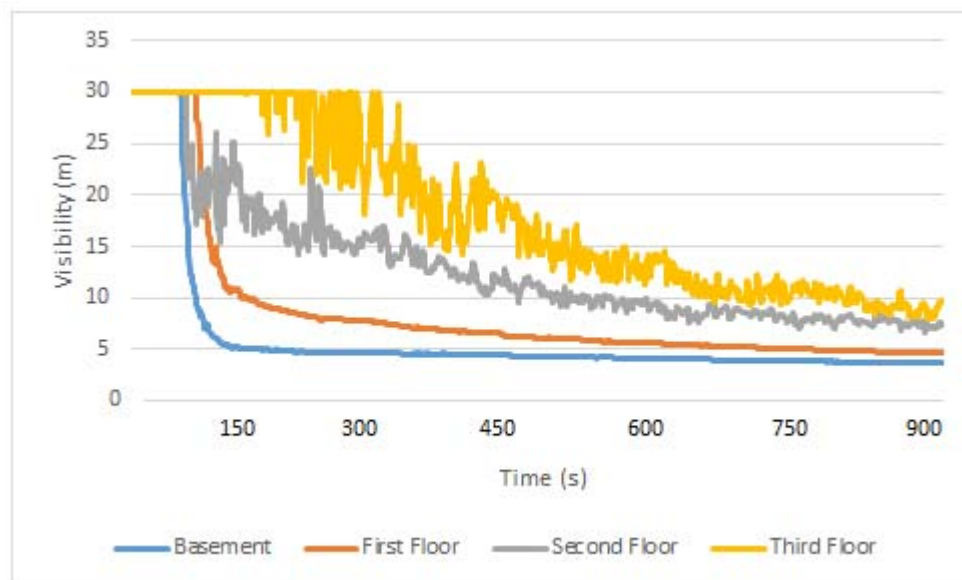


Figure 6: Summary of Sprinklered Visibility Conditions

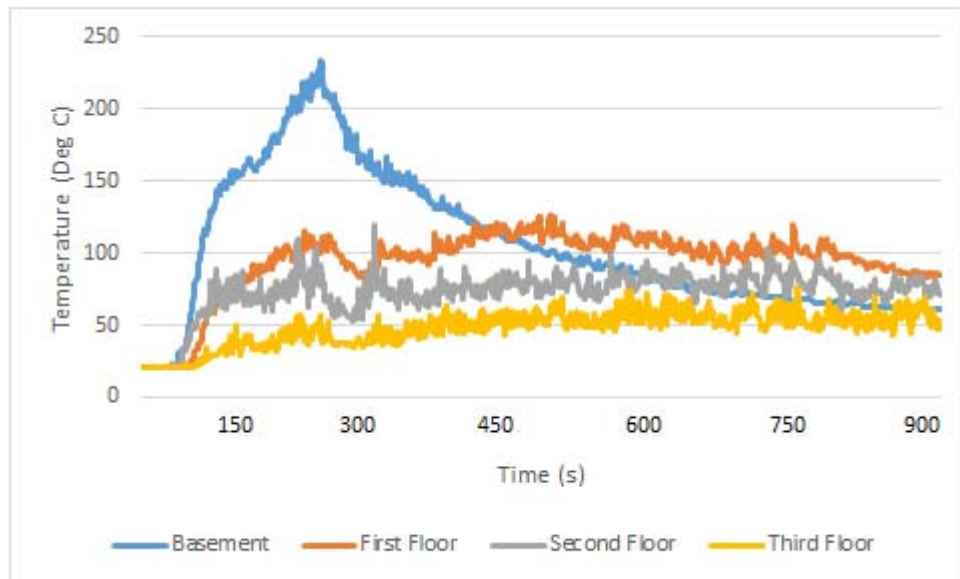


Figure 7: Summary of Unsprinklered Temperature Conditions

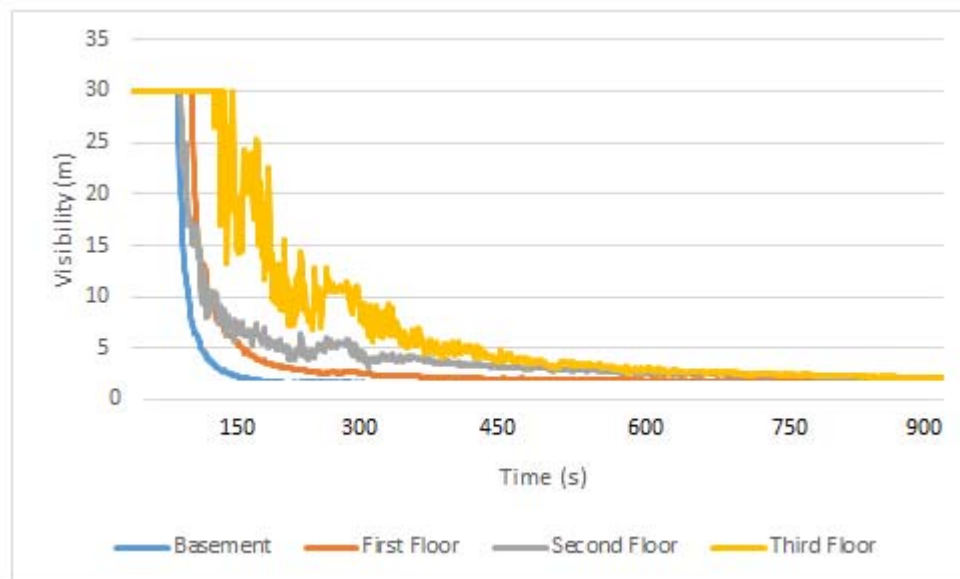


Figure 8: Summary of Unsprinklered Visibility Conditions

Floor Level	Tenability Criteria	
	Time at Which Temperatures Exceed 60°C	Time at Which Visibility Less Than 13 m
Basement	60 s	72 s
First Floor	101 s	140 s
Second Floor	— ¹	476 s
Third Floor	— ¹	685 s

1) Temperatures did not exceed 60°C.

Table 1: Summary of Tenability Results – Sprinklered Fire

Floor Level	Tenability Criteria	
	Time at Which Temperatures Exceed 60°C	Time at Which Visibility Less Than 13 m
Basement	56 s	64 s
First Floor	75 s	86 s
Second Floor	77 s	95 s
Third Floor	384 s	161 s

Table 2: Summary of Tenability Results – Unsprinklered Fire

Images 2 to 4 illustrate examples of the tenability conditions rendered by the fire modeling software for the “worst-credible case” design fire scenarios.

It has been estimated by researchers that the estimated ASET for a two storey single family home is between 120 s (worst case) and 240 s (best case). [9]

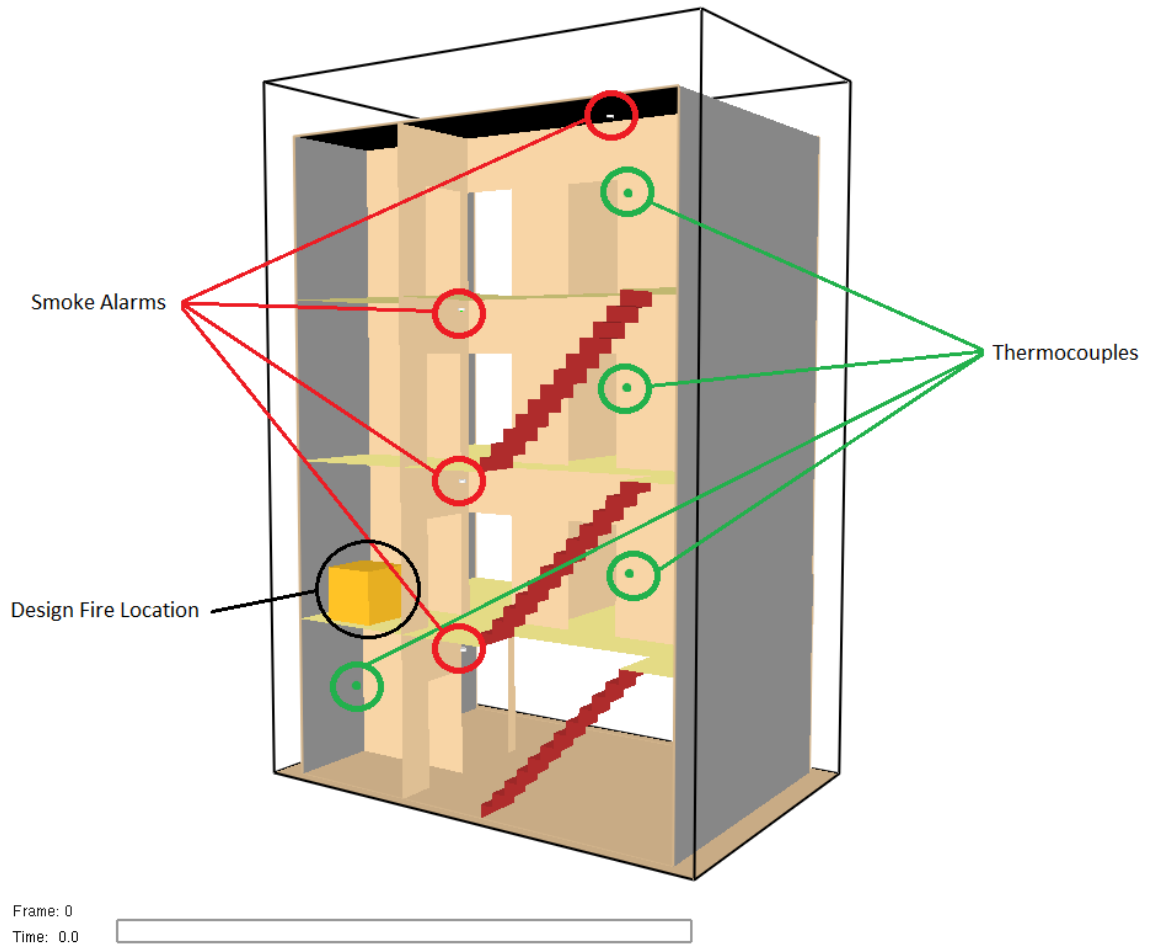


Image 2: Example of Design Fire and Device Locations



Frame: 224
Time: 201.6



Image 3: Design Fire 1 – Tenability Conditions at t=200 s

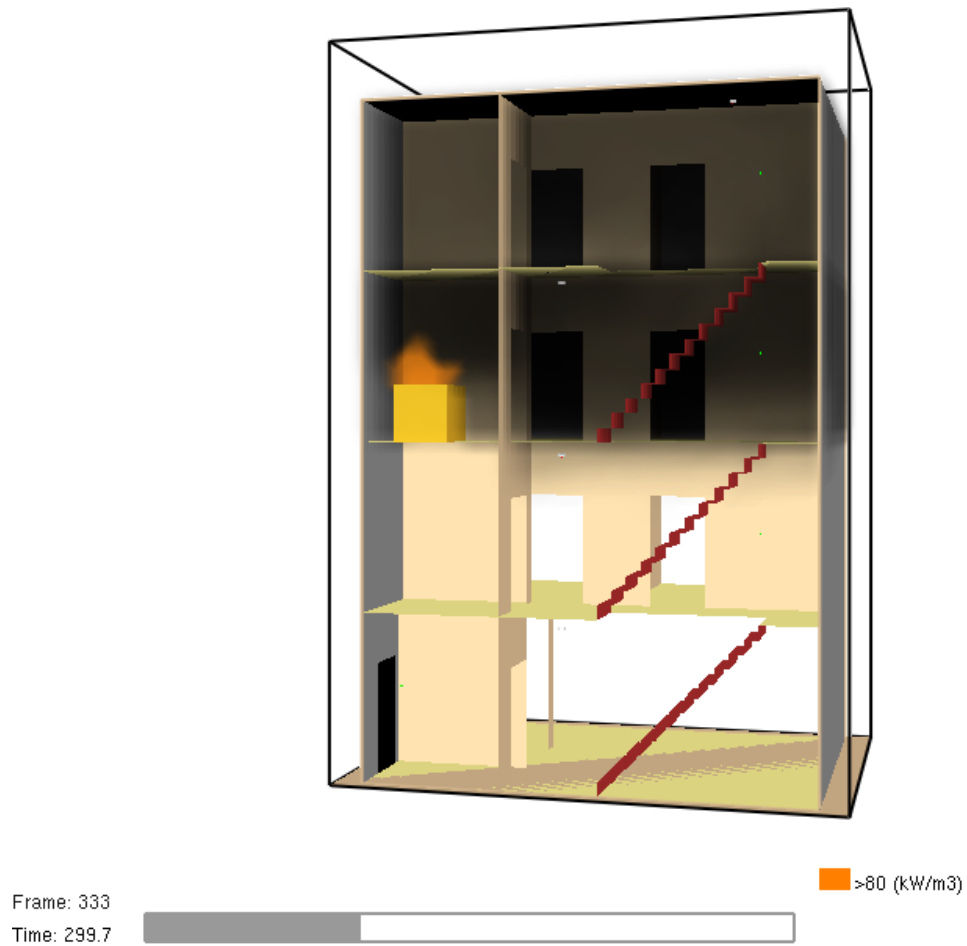


Image 4: Design Fire 3 – Tenability Condition at t=300 s

4.7.2 Evaluation of Fire Notification

Table 3 summarizes the results of smoke alarm activation times based on floor level location for both the sprinklered and unsprinklered design fire scenarios.

Design Fire Location	Fire Condition	
	Sprinklered (s)	Unsprinklered (s)
Basement	14	14
First	40	40
Second	57	53
Third	64	59

Table 3: Summary of Smoke Alarm Activation Times

Significant delays in smoke alarm activation times and failure to detect fire conditions were observed for floor levels located below the design fire location.

For a fire occurring on the basement level, a notification delay time of up to 64 s may occur for occupants located on the top storey.

4.7.3 Evaluation of Occupant Evacuation

The results of the fire simulations have been used as a benchmark in estimating ASET for the egress models based on tenable criteria. The RSET for the building has been estimated through calculation methods as described earlier in Section 3.3 of this report.

For the purposes of this analysis, two egress scenarios were considered. The first scenario considered occupants exiting the building using the existing exiting facilities – one exit stair serving all storeys, with exterior exits located on the basement and first floor. The second scenario involved the addition of secondary egress serving the second and third floors of the building in the form of a new fire escape.

Tables 4 and 5 summarize the results of the timed exit analyses, with the 'Travel Time' equal to the length of time for occupants located on the corresponding floor level to exit the building.

Floor Level	Detection Time (s)	Delay Time (s)	Travel Time (s)	RSET (s)	ASET Sprinklered (s)	ASET Unsprinklered (s)
Basement	14	60 ³	8	82	60 ¹	56 ¹
First Floor			12	86	101 ¹	75 ¹
Second Floor			23	97	476 ²	77 ¹
Third Floor			30	104	685 ²	161 ²

- 1) Based on temperatures exceeding 60° C.
 2) Based on visibility reduced to less than 13 m.
 3) Assuming business occupancy without sleeping.

Table 4: Timed Exit Analyses Summary for Existing Exits

Floor Level	Detection Time (s)	Delay Time (s)	Travel Time (s)	RSET (s)	ASET Sprinklered (s)	ASET Unsprinklered (s)
Basement	14	60 ³	8	82	60 ¹	56 ¹
First Floor			12	86	101 ¹	75 ¹
Second Floor			15	89	476 ²	77 ¹
Third Floor			12	86	685 ²	161 ²

- 1) Based on temperatures exceeding 60° C.
 2) Based on visibility reduced to less than 13 m.
 3) Assuming business occupancy without sleeping.

Table 5: Timed Exit Analyses Summary with Fire Escape

Due to the significant delay time assumed for occupants to begin evacuation, the RSET was determined to exceed the ASET for occupants located on the basement level and first floor for both sprinklered and unsprinklered design fire scenarios. In this scenario the basement level occupants are within the compartment of fire origin and expected to react quicker. Our life safety objective is also directed towards those not intimate with fire origin.

With the introduction of sleeping occupants, the resulting ASET conditions are similar to those found in typical residential Canadian homes, but benefit from enhanced compartmentation features.

Note that when subject to enhanced compartmentation, all upper storeys achieve acceptable ASET values.

Images 5 to 7 show images from Pathfinder exit simulations for the downtown example.

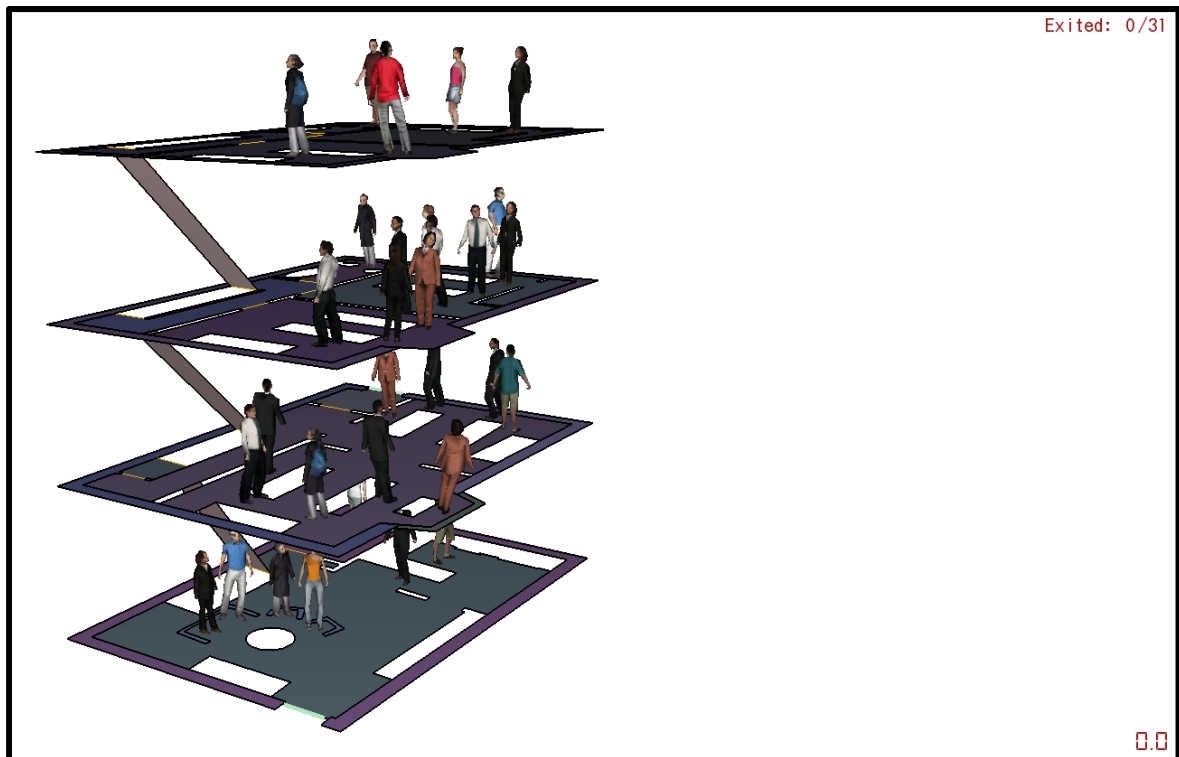


Image 5: Exit Simulation at $t = 0$ s



Image 6: Exit Simulation at $t = 7.5$ s

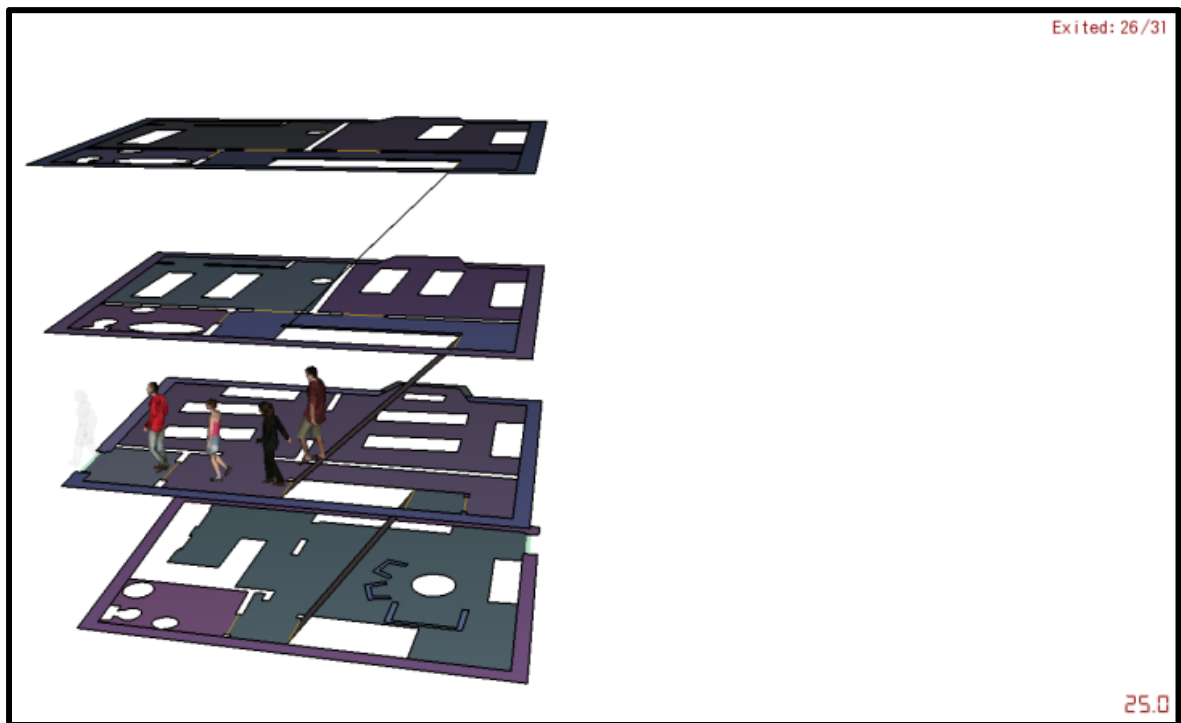


Image 7: Exit Simulation at $t = 25$ s

5 Discussion

A fire protection engineering analysis was conducted to expand the scope of the Richardson report by addressing the potential for heritage building restoration projects that propose the following additional mixed-use occupancy:

- Occupancies located above a residential, business, or commercial occupancy, and
- Business or commercial occupancy, or combination thereof, located on all floors.

The defined performance criteria for this alternative solution requires that tenable conditions be maintained within egress paths until all occupants have evacuated the building or reached a protected enclosure. For the purpose of this analysis, tenable condition levels have been demonstrated for the proposed building design as part of the downtown case study, subject to implementation of the measures dictated by the worksheet.

As part of the analysis, egress time models were considered using methods outlined in the SFPE Handbook. These models feature assumed typical floor plan layouts based on observed existing building conditions, calculated occupant loads, and the estimated benefit that may be realized by the installation of a fire escape. Factors such as pre-movement times and reduced walking speeds have been incorporated into the analysis.

It was determined that the estimated RSET based on a single exit stair serving a building was approximately 104 s – for buildings provided with a secondary means of protected escape, the estimated RSET was approximately 89 s. The factor having the most significant impact on the overall RSET is delay time for occupants to begin evacuation, notably those that may be sleeping; concern that is present within all Canadian residential homes.

The detection time of smoke alarms ranged from 14 s for devices located on the floor level of fire origin, however for a fire occurring on the basement level, an activation delay time of up to 64 s for devices located on the third floor can be expected. This result supports the requirement for interconnected smoke alarms throughout the building to mitigate the possibility of an undetected fire occurring and developing on an unoccupied floor level.

To reduce pre-movement times for occupants, enforcement of proper fire safety planning is required by the building Owners and St. John's Regional Fire Department.

Tenability conditions were estimated using design fires that considered multiple fire growth scenarios occurring on each floor of the building. It was determined that the temperature threshold of 60°C is expected to be exceeded at 60 s for sprinklered fire conditions, compared to 56 s for unsprinklered fire conditions – this illustrates a relatively marginal benefit with the installation of automatic sprinklers.

The results of these analyses demonstrate that in certain scenarios, the RSET may exceed the ASET. This reinforces the conclusions drawn in the Richardson report requiring a degree of fire separation and compartmentation which will provide an acceptable ASET for locations outside the compartment of origin.

6 Conclusions

An acceptable level of life safety, as established by the Richardson report, can be achieved for the mixed-occupancy properties in question, subject to the implementation of the measures as determined by the Worksheet exercise. Additional specifications and guidance have been included in the Commentary document found in Appendix D. Notable measures include:

1. In addition to the building's fire separated primary exit stair, a second means of protected escape must be provided for all storeys. This can include:
 - An NBC compliant exit facility, such as an exterior fire escape or exterior passageway, or
 - Egress windows that provide an unobstructed opening of not less than 0.35 m² with no dimension less than 380 mm. Such windows shall be located within a fire separated compartment.

The provision of an automatic sprinkler system in lieu of a secondary means of escape is also acceptable. The sprinkler systems are permitted to be designed in conformance with NFPA 13D, *"Standard for the Installation of Sprinkler Systems in One and Two Family Dwellings and Manufactured Homes"* where applicable.

Exceptions for a single exit may arise in certain circumstances involving basement or first storey suites that contain limited occupant loading and low travel distances. These conditions are to be reviewed in consultation with the AHJ on a case by case basis.

2. Provision of security/alarm systems monitored by a central monitoring station. Fire detection is required to be provided via manual input devices located at primary exits, and interconnected smoke alarms (wireless or 110V hardwired) located throughout major rooms on all floor levels and exit corridors. Device placement shall be in accordance with the NBC and manufacturers specifications.
3. Party walls adjoining any adjacent building are required to be fire separations having a minimum 30 min fire-resistance rating.
4. Above grade floors, and floors located above a basement are required to provide a fire-resistance rating not less than 30 min or comply with the NBC. Reductions may be permitted in sprinklered properties.
5. All doors located in fire separations are required to have a 20 min fire-protection rating, and are to be equipped with self-closing and positive latching

hardware. Existing solid core wood doors may be acceptable with certain thicknesses.

6. Combustible wall and ceiling finishes are required to have a flame-spread rating in accordance with the NBC. Materials exceeding these values, such as Tintest, are required to be removed, covered with an acceptable thermal barrier, and/or treated with a listed fire retardant coating.
7. Properties are required to have a fire safety plan developed in cooperation with the St. John's Regional Fire Department.
8. Properties are required to have an annual fire inspection walkthrough and sign-off conducted by the St. John's Regional Fire Department. The fire safety plan is required to be reviewed by the St. John's Regional Fire Department at intervals not exceeding 5 years.

The fire safety plans are to include, as a minimum, the following information:

- Committee structure,
 - Administration requirements,
 - Instructions for occupants of the buildings,
 - Posted evacuation drawings,
 - Posted instruction for action upon:
 - Discovery of smoke/fire, and
 - Hearing a fire alarm.
 - Drawings showing major fire safety components,
 - Maintenance requirements for all fire safety components and systems,
 - Procedures for fire drills,
 - Impairment procedures in the event any life safety system or component of the property is out of service, and
 - A copy of fire safety alternatives documentation.
9. Properties are required to have an annual fire inspection walkthrough by the St. John's Regional Fire Department.
 10. Electrical systems within each building shall be in compliance with the City of St. John's electrical bylaws.

These measures are found in the *"Fire Safety Evaluation Questionnaire, Worksheet and Commentary for City of St. John's Mixed Occupancy Properties"*, included in Appendix C of this report.

The *"Fire Safety Evaluation Questionnaire"* is intended to for building Owners and/or Developers to describe the current and proposed conditions of a property or building in terms of physical size, construction, intended use, active fire safety systems, fire separations, exits, etc. Upon completion of the *"Questionnaire"*, City of St. John's Building Officials can determine the required degree of fire safety upgrades for the property using the *"Fire Safety Evaluation Worksheet"*, and provide direction to the building Owners and/or Developers in terms of alternative cost effective upgrade options included in the *"Commentary"*.

An assessment of a downtown case study was completed using the *"Fire Safety Evaluation Questionnaire and Worksheet"*, including a cost comparison analysis of requirements derived from the *"Fire Safety Evaluation Worksheet"* versus the applicable requirements otherwise required by the NBC. The completed *"Questionnaire"*, *"Worksheet"* and cost comparison analysis is included in Appendix D of this report.

References

1. Ken Richardson, *"Fire Safety Alternatives for Heritage Buildings in St. John's"*, Ken Richardson Fire Technologies Inc.
2. Society of Fire Protection Engineers, *"SFPE Engineering Guide to Performance-Based Fire Protection Analysis and Design of Buildings"*, Second Edition, 2007.
3. Proulx, G., *"Evacuation Time"*, The SFPE Handbook of Fire Protection Engineering, 4th Edition, 2008.
4. Gwynne, S.M.V, Rosenbaum, E.R., *"Employing the Hydraulic Model in Assessing Emergency Movement"*, The SFPE Handbook of Fire Protection Engineering, 4th Edition, 2008.
5. Jin, Tadahisa, *"Visibility and Human Behavior in Fire Smoke"*, The SFPE Handbook of Fire Protection Engineering, 4th Edition, 2008.
6. Purser, David, *"Assessment of Hazards to Occupants from Smoke, Toxic Gases, and Heat"*, The SFPE Handbook of Fire Protection Engineering, 4th Edition, 2008.
7. National Fire Protection Association, *"Building Safety and Construction Code"*, NFPA 5000, 2009 Edition.
8. Babrauskas, Vylenis, *"Head Release Rates"*, the SFPE Handbook of Fire Protection Engineering, 4th Edition, 2008.
9. Proulx, G., *"Evacuation from a Single Family House"*, NRCC-51385, July 13, 2009.

Appendix A

Comparative Analysis of Relevant National and International Codes and Standards for Heritage Buildings

12070 Fire Safety Alternative for Heritage Buildings - Literature Review Summary

	Fire Safety Alternatives for Heritage Buildings in Downtown St. John's, NF	Part 9 of NBC	NFPA 914 "Code for Fire Protection of Historical Structures "	Charlottown Building Code Bylaw / Nova Scotia Building Code	British Columbia Building Code / Vancouver Building By-Laws	Manitoba Building Code (aa)	International Residential Code
Analysis Type	Alternative	Prescriptive	Prescriptive	Alternative Method	Alternative Method	(a)	Alternative Method
Fire Resistance Ratings							
Floor assemblies rating	20 min (b)	45 min	1 h (c)	45 min	45 min	45 min	0 h (d)
Roof rating	20 min (c)	45 min (e)	-	45 min (e)	45 min (e)	45 min (e)	0 h (d)
Supporting Structures rating	20 min (b)	45 min	1 h (c)	45 min	45 min	45 min	0 h (d)
Suite to Suite rating	20 min (b)	45 min (f)	1 h (c)	30 min	30 min	45 min	0 h (d)
Suite and corridor rating	20 min (b)	45 min	1 h (c)	45 min (g)	45 min (g)	45 min	0 h (d)
Exit enclosure	30 min (b)	45 min	Non-rated smoke tight	30 min (h)	Non-rated (i)	45 min	Non-rated smoke tight
Protection of vertical openings through horizontal fire separations	30 min (b)(j)	45 min (k)	1 h (c)	45 min	45 min	45 min and sprinklered	As per IRC
Fire Dampers	Not Required (l)	45 min (m)	1 h (n)	45 min (m)	45 min (m)	Not Required (l)	As per IRC
Closures in a 45 min Fire Separations	20 min (o)	20 min	45 min (n)	20 min	20 min	(a)	Non-nated smoke tight and area is protected by sprinklers
Special conditions for unprotected openings in an exterior wall required to have a fire-resistance rating	Yes (p)	-	Yes (n)	Yes (q)	Yes (r)	Yes (p)	No
Major Occupancy Separation							
C from D or F3	30 min (j)	1 h	2 h	30 mins	30 mins	45 min	2 h
C from E or F2	30 min (j)	2 h	2 h	1 h	1 h	45 min	2 h
Fire Detection and Alarm							
System required	Yes	If sprinklered or more than 10 sleeping accomodations are provided (s)	Yes	If sprinklered or more than 10 sleeping accomodations are provided (s)	If sprinklered or more than 10 sleeping accomodations are provided (s).	Yes	As per IRC
Notification	Inteconnected smoke alarms	Heat/smoke detectors (t) and smoke alarms	Smoke detectors (t)	Heat/smoke detectors (t) and smoke alarms (u)	Heat/smoke detectors (m) and smoke alarms.	Voice communication	As per IRC
Manual Pull Station	One per floor	Not Required	Not Required	Not Required	Not Required	Not Required	As per IRC
Fire Department Notification	Yes	No	Via Fire Safety Plan	No	No	Yes	As per IRC
Fire Suppression							
System required	Yes if used for Bed and Breakfast or mixed-use occupancy (v)	No	If deemed as a fire safety hazard by the AHJ	No	No	As per MBC.	No (w)
Occupant Egress							
Window Egress from Sleeping Room Criteria	Fire department accessible, openable from inside, and of sufficient size (in consultation with SJRFD).	Openable to the outside with an area no less than 0.35 m ² and no dimension less than 0.38 m. Window well clearance not less than 0.76 m.	Openable to the outside with an area no less than 0.53 m ² , a width no less than 0.51 m, and a height no less than 0.61 dimension less than 0.38 m. Access conditions apply.	Openable to the outside. Existing windows are not required to comply with the min dimensions.	Openable to the outside with an area no less than 0.35 m ² and no dimension less than 0.38 m. Window well clearance not less than 0.76 m.	Fire department accessible, openable from inside, and of sufficient size (in consultation with AHJ).	As per IRC
Corridor Width	1,100 mm	1,100 mm	1,120 mm	800 mm (x)	800 mm (x)	(a)	Existing is acceptable if approved by AHJ.
Special conditions for existing stairs, ramps, handrails and guards.	Stairs may not be significantly changed.	-	Existing conditions are acceptable if not structually dangerous.	Existing conditions are acceptable if approved by AHJ.	Existing conditions are acceptable if approved by AHJ.	(a)	Existing conditions are acceptable if not structually dangerous.
Dead end corridors	6 m	6 m	6.1 m	10 or 15 m (y)	10 or 15 m (y)	6 m	Prescriptive IRC
Exit signs	In corridors and at exit doors. Connected to emergency power or photoluminescent type	At exit doors. Connected to emergency power or photoluminescent type	Alternative exit sign locations permitted as accepted by the AHJ.	At exit doors.Light only on emergency condition via fire alarm system or power failure.	At exit doors.Light only on emergency condition via fire alarm system or power failure.	(a)	Alternative exit sign locations permitted as accepted by the AHJ.
Emergency Power	30 min in main path of egress	30 min in corridors, at exits, and principal access routes.	1.5 h in means of egress.	30 min in corridors, at exits, and principal access routes.	30 min in corridors, at exits, and principal access routes.	(a)	Prescriptive IRC
Fire Safety Plan							
Required	Yes. For each building. Posted in suites with sleeping accomodations.	If building is equipped with a fire alarm system.	Yes. Refer to Chapter 10 of NFPA 914.	If building is equipped with a fire alarm system.	If building is equipped with a fire alarm system.	Yes	As per IRC

- (a) Based on a fire risk index and a point score comparison system in addition to the fire safety alternative method
- (b) Existing construction of plaster on wood lath membrane on wood studs meets intent
- (c) Fire-resistance rating permitted to be waived if existing construction is of wood lath and plaster and plaster is in good condition
- (d) Provided a 1 h fire-resistance rating is required in accordance with the Interantional Residential Code (IRC) and existing wall and ceiling finish is wood or metal lath and plaster
- (e) Existing assemblies of plaster on wood lath ceiling membrane on wood joists, rafters or trusses meets intent
- (e) If of mixed-use occupancy and 3 storeys in building height. Otherwise, no fire-resistance rating is required. Permitted to be waived if building is sprinklered (some conditions apply
- (f) Permitted to be waived if building is sprinklered.
- (g) May be reduced to 30 min if sprinklered throughout with fast-response sprinklers
- (h) Provided the building is 3 storeys in building height or less and sprinklered throughout with fast response sprinklers.
- (i) Provided the building is 3 storeys in building height or less and sprinklered throughout with fast response sprinklers. Electrical supervision of sprinkler system is requirec
- (j) Single layer of 12.7 mm Type X gypsum wallboard attached to steel or wood studs is acceptable
- (k) Except as permitted by mezzanines not considered a storey and special protection exemptions for interconnected floor space
- (l) Provided ducts of noncombustible construction with a melting point above 760 C penetrate fire separation
- (m) Fire damper not required provided certain conditions apply (i.e. melting point above 760 C, size and type of supply/exhaust ducts, etc.)
- (n) Applies only to new openings.
- (o) Existing wood panel doors and frames may be protected by two layers of fire-retardant intumescent paint
- (p) If exterior wall faces street, no protection required. If exterior wall does not face a street, to be protected by closure (existing frame may remain), or sprinkler protection
- (q) Unlimited unprotected openings provided the limiting distance is not less than 1 m, building is sprinklered throughout, and sprinkler system is connected to fire department
- (r) Unlimited unprotected openings provided the exterior wall has a interior thermo barrier of 12.7 mm thick gypsum board of lath and plaster (in good condition), limiting distance is not less than 1 m, building is sprinklered throughout, and sprinkler system is connected to fire departmer
- (s) Fire alarm system not required if each suite has direct access to an exterior exit leading to ground level or a public corridor serves not more than 4 suites
- (t) Provided a fire alarm system is required and building is not sprinklered
- (u) Smoke alarms may be battery operated in single family homes only.
- (v) Special provisions for design standards and requirements apply (i.e. NFPA 13D, NFPA 13, and sprinkler flow rates and spacing)
- (w) Compliance of any deficiancy may be achieved by the installation of an approved automatic-fire extinguishing system
- (x) Provided the occupant load of the building is not more than 20 persons and the building is three storeys in building height or less
- (y) Provided the building is sprinklered throughout with fast response sprinklers and smoke detectors installed in the corridor system. 10 m for Group C and 15 m for all other occupancies:

Appendix B

Functional Statements of Richardson Report

Requirement	Functional Statement
Building to Building Fire Spread	<i>"Fire spread from building to building shall be prevented for sufficient time for the fire department to control a fire in the building of origin."</i>
Interior Fire Separations	<i>"Vertical and horizontal interior fire separations shall prevent fire spread collapse for sufficient time for the fire department to control a fire in the building."</i>
Fire Detection and Alarm Systems	<i>"Fires shall be detected and occupants notified in sufficient time to enable them to exit the building without exposure to untenable conditions."</i>
Fire Suppression	<i>"Fires shall be controlled automatically in the compartment of fire origin for sufficient time for fire department arrival and commencement of manual fire suppression."</i>
Occupant Egress	<i>"Occupants of heritage buildings shall be provided with means of escape that will enable those, not intimate with initial fire development, to evacuate without being overcome by the effects of fire or fire effluents."</i>
Ignition Prevention	<i>"Ignition sources and fuel hazards and the interaction of the two shall be controlled such that unwanted ignition is limited."</i>

Table B1: Summary of Richardson Report Functional Statements [1]

Appendix C

Fire Safety Evaluation Worksheet, Commentary, and Questionnaire for City of St. John's Fire Safety Alternatives for Upper Storeys

**FIRE SAFETY EVALUATION WORKSHEET FOR
CITY OF ST. JOHN'S HERITAGE PROPERTIES**

0.0	Date _____ Evaluator(s) _____ Civic Address _____ Property Owner _____ Description of Renovation Proposed _____ 																																																																																																		
1.0	PROPERTY DESCRIPTION Number of Storeys _____ Basement _____ Footprint Area / Approx Dimensions _____ Number of Streets Faced _____ Landlocked at Rear _____ Distance to Hydrant _____ Occupancy Description / Locations _____ <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Group A, Division 2 (Assembly)</td> <td style="width: 10%;">Bsmt</td> <td style="width: 10%;">First</td> <td style="width: 10%;">Second</td> <td style="width: 10%;">Third</td> <td rowspan="5" style="width: 30%; border: 1px solid black; vertical-align: top;">Description c/w Occupant Load</td> </tr> <tr> <td>Group C (Residential)</td> <td>Bsmt</td> <td>First</td> <td>Second</td> <td>Third</td> </tr> <tr> <td>Group D (Business or Personal Services)</td> <td>Bsmt</td> <td>First</td> <td>Second</td> <td>Third</td> </tr> <tr> <td>Group E (Mercantile)</td> <td>Bsmt</td> <td>First</td> <td>Second</td> <td>Third</td> </tr> <tr> <td colspan="5"> </td> </tr> </table> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Assembly w/ greater than 100 persons in building</td> <td style="width: 10%;">Yes</td> <td style="width: 10%;">No</td> <td colspan="4"></td> </tr> </table> Comments _____ 										Group A, Division 2 (Assembly)	Bsmt	First	Second	Third	Description c/w Occupant Load	Group C (Residential)	Bsmt	First	Second	Third	Group D (Business or Personal Services)	Bsmt	First	Second	Third	Group E (Mercantile)	Bsmt	First	Second	Third						Assembly w/ greater than 100 persons in building	Yes	No																																																												
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3.0	CONSTRUCTION TYPE FRR of Structural Assemblies / Members <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%;"></th> <th style="width: 30%;">Description / FRR</th> <th style="width: 10%;">45 / 60</th> <th style="width: 10%;">Required FRR 30 min</th> <th style="width: 10%;">0 h</th> <th style="width: 30%;">Upgrades Required</th> </tr> <tr> <td>Basement</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>First</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Second</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Third</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> Comments _____ 											Description / FRR	45 / 60	Required FRR 30 min	0 h	Upgrades Required	Basement						First						Second						Third																																																																
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Commentary for Fire Safety Evaluation Worksheets
City of St. John's Mixed Occupancies and Upper Storey Development

Refer to RJBEL report dated March 21, 2014 for additional information regarding fire engineering analysis and general assumptions.

1.0 Property Description

Numbers of Storeys – Properties typically function as being three storeys in building height with a basement level. In no instance is a building to exceed three storeys as measured from the street of primary fire department response.

Footprint Area – Properties typically have a footprint on the order of 150 m² with a depth to width aspect ratio of 2:1. In no instance is a property to exceed 600 m².

Numbers of Streets Faced – Properties are required to face one street which will provide primary fire department response and access to the primary/secondary egress routes. Some properties may allow pedestrian access to additional building faces but are typically adjacent to neighbouring properties and landlocked at rear face.

Distance to Hydrants – Access to hydrants shall be in compliance with the acceptable solution requirements of the NBC.

Occupancy Types and Locations – Properties are permitted to contain any of the following major occupancies in combination:

- Group C (Residential),
- Group D (Business or Personal Service), and
- Group E (Mercantile).

Note that in no instance shall occupant loading exceed 50 persons on any storey unless evaluated and approved by the AHJ. In the event that greater occupant loading is desired, the Stakeholders should consult with the prescriptive measures of NFPA and the NBC.

Additional Notes – Sketches of floor layouts, site plan, and locations of fire protection components are to be attached to the Worksheet submission.

2.0 Sprinkler Protection

Extent of Coverage – Provide description of sprinkler coverage. Examples of partial protection may include limited floor areas or specific hazardous areas. See additional notes below regarding noncompliant installations.

Design Standard – Note design standard and if it exceeds NBC requirements. For example, an NFPA 13 System installed in a location where NFPA 13R would be acceptable.

Additional Notes – All sprinkler systems are to be zoned and supervised as required by the NBC. In some instances, sprinkler systems may not comply with the full requirements of the applicable design standard. For example, achieving the minimum required discharge pressure at the hydraulically most remote location. Such noncompliance shall be discounted through consideration as a Partial System in terms of its Extent of Coverage. Hydraulic calculations and shop drawings are to be attached to the Worksheet submission.

3.0 Construction Type

Description and Existing FRR – Provide description and associated fire resistance rating (FRR) of existing structural assemblies and members by each floor. Floors containing multiple conditions are to be noted and upgraded accordingly.

Destructive testing may be required to confirm site specific conditions; however properties are typically of combustible construction with both horizontal and vertical assemblies protected by a continuous thermal barrier recognized by the NBC. Guidance in terms of FRR may be derived from full-scale fire testing and references such as “*Guideline on Fire Ratings of Archaic Materials and Assemblies*” [1] or NFPA 914 “*Code for Fire Protection of Historic Structures*”.

Assemblies that comply with the NBC requirements for Heavy Timber do not require any upgrading, unless required by other Worksheet sections. Noncombustible construction shall be treated the same as combustible construction.

Required FRR – Fire-resistance ratings shall be based on the applicable construction requirements of the NBC.

Upgrades Required – Provide description of any associated passive upgrades. Where traditional construction methods are impractical, consider utilization of emerging technologies, such as intumescent fire retardant coatings. Preference for ULC listed coatings that have been tested to CAN/ULC S101 shall be given whenever possible [2].

Sprinkler protection in compliance with the applicable design standard may be provided in lieu of required FRR upgrades.

Additional Notes – Note that other sections of this Worksheet may require assemblies to be constructed as fire separations.

4.0 Fire Alarm System

Detection and Notification throughout Building – As a minimum, interconnected smoke detection and audible notification is required throughout all floor areas, including individual suites and locations that are sprinklered. Device placement is to be consistent with the smoke detector, smoke alarm, and notification requirements of the NBC and CAN/ULC S524, “*Standard for the Installation of Fire Alarm Systems*”.

Manual initiating devices are required at all building exits along primary egress routes.

Central Station Monitoring – All fire alarm systems are to be electrically supervised with central station monitoring.

Additional Notes – Consideration for emerging technologies, such as wireless detection and notification devices may be permitted at the discretion of the AHJ. [3]

5.0 Interior Finishes

Exposed Surfaces in Primary Egress Routes – Flame spread ratings (FSR) within Primary Egress Routes are to comply with the requirements of the NBC for exits. Exposed Heavy Timber members may be exempt.

Upgrades Required – Provide description of any associated upgrades. Where traditional construction methods are impractical, consider utilization of emerging technologies, such as fire retardant coatings. Preference for Class “A”, ULC listed coatings that have been tested to CAN/ULC S102 shall be given whenever possible [4].

6.0 Critical Areas

Description and Existing FRR – Provide description and associated existing fire-resistance rating (FRR) of identified Critical Areas by each floor. Such areas may include, but are not limited to the following:

- Suites such as dwelling units and separate leaseholds,
- Janitorial, refuse and recycling rooms,
- General storage areas not contained within an individual suite,
- Areas containing fuel-fired appliances,
- Vertical service spaces
- Electrical and data closets,

- Primary egress routes, and
- Rooms providing secondary egress located at/above second storey (i.e. Temporary Refuge).

In the instance of a primary egress stair, the bounding area and routing of the fire separation is permitted to contain circulation corridors, such that some degree of floor level interconnection is achieved. This is limited to interconnection of no more than three consecutive floor levels. Refer to 5.0 and 8.0 for further information on limitations with respect to FSR and quantity of permitted combustibles.

Destructive testing may be required to confirm site specific conditions; however properties are typically of combustible construction with both horizontal and vertical assemblies protected by a continuous thermal barrier recognized by the NBC. Guidance in terms of FRR may be derived from full-scale fire testing and references such as *“Guideline on Fire Ratings of Archaic Materials and Assemblies”* [1] or NFPA 914 *“Code for Fire Protection of Historic Structures”*.

Required FRR – Fire-resistance ratings shall be based on the applicable requirements of the NBC for all unsprinklered or partially sprinklered locations where possible, but in no instance less than 30 min. Sprinkler protection in compliance with the applicable design standard will permit a reduction to 30 min for primary and secondary egress routes, and 0 h for all other locations, in lieu of the required FRR upgrades.

Upgrades Required – Provide description of any associated passive upgrades. Where traditional construction methods are impractical, consider utilization of emerging technologies, such as intumescent fire retardant coatings. Preference for ULC listed coatings that have been tested to CAN/ULC S101 shall be given whenever possible [2].

Closures and Hardware – Closures and any associated self-closing and latching hardware shall be provided based on the applicable requirements of the NBC. Where traditional methods are impractical or it is desired to preserve certain aesthetic aspects, consider utilization of emerging technologies such as listed retrofit kits. These kits may facilitate upgrading of existing doors to achieve a 20 min FRR [5]

Depending on the degree of clearance at existing door openings, the installation of listed gaskets may be warranted and is at the discretion of the AHJ. Refer to NFPA 80, *“Standard for Fire Doors and Other Opening Protectives”* for additional guidance.

Fire Dampers and Grilles – Fire dampers shall be provided based on the applicable requirements of the NBC and may be waived in certain sprinklered instances. Existing transfer grilles are to be sealed with a continuous thermal barrier recognized by the NBC.

Fire Stopping – Fire stopping of building services and openings shall be provided based on the applicable requirements of the NBC. The specification of listed fire stop systems that provide an L Rating not greater than 5 CFM/ft² at 400°C may be warranted and is at the discretion of the AHJ.

Protection of electrical junction boxes, receptacles, etc. may require the provision of listed fire stopping products such as “putty pads” [6]

Additional Notes – Party walls at adjoining buildings are required to provide a minimum 30 min FRR. Glazing located within fire separations is to be in compliance with the dimensional criteria of the NBC or a recognized design, such as ULC/ORD C263.1, “*Sprinkler-Protected Window Systems*” [7].

7.0 Egress and Exiting

Primary Stair Description – Provide description of the primary stair enclosure. Note that for instances in which the stair is not enclosed as per NBC requirements, the bounding area and routing of the associated fire separation is permitted to contain circulation corridors, such that some degree of floor level interconnection is achieved. This is limited to interconnection of no more than three consecutive floor levels. Refer to 5.0 and 8.0 for further information on limitations with respect to FSR and quantity of permitted combustibles.

Level of Primary Stair Discharge – Indicate location(s) of the primary stair discharge. Note any instances where discharge does not occur at the face providing primary fire department response.

Direct Exiting to Grade – Indicate storey(s) that provide direct exiting to grade. Note any instances where discharge does not occur at the face providing primary fire department response.

Secondary Egress Route – All storeys, except in buildings that are protected throughout with an NFPA compliant sprinkler system, are to be provided with a secondary egress route that is accessible at all times to occupants. Examples of acceptable secondary egress route components include:

- Exits in compliance with the requirements of the NBC/NFPA 101.
- Egress windows providing an unobstructed opening of not less than 0.35 m² in area, with no dimension less than 380 mm. Such windows are to be operable from the interior without the use of keys, tools, or special knowledge, and without requiring the removal of sashes or hardware. Should the window open into a well, the well must allow no less than 550 mm from the window face.
- Fire escapes in compliance with the requirements of the NBC, except that existing combustible fire escapes are considered acceptable. Openings in exterior walls adjacent to the fire escape are required to be protected by listed closures (i.e. fire damper) except for partially sprinklered buildings, when a sprinkler head is located within 1.5 m of the opening.

Any room housing a window required for secondary egress that is located at/above second storey (i.e. Temporary Refuge) is to be provided with no less than a 30 min fire separation from adjacent floor areas, even when protected by sprinklers.

Emergency Lighting and Exit Signage – Emergency lighting and exit signage is required throughout egress routes in conformance with the NBC.

Additional Notes – Guards, handrails, stairs, ramps, and other aspects of any egress component that does not comply with the requirements of the NBC shall be permitted, provided they do not create a hazardous condition and are acceptable to the AHJ.

8.0 Fire Safety Planning

Review of Fire Safety Plan – The Building Owner is required to review and update fire safety plan documentation on a regular basis. Written record is to be submitted to the Fire Prevention division of the St. John's Regional Fire Department.

Annual Fire Drill – An annual fire drill is required and is to be coordinated with the Fire Prevention division of the St. John's Regional Fire Department.

Fire Department Walkthrough – The property shall be made available for a walkthrough on an annual basis to observe general fire safety compliance. Such initiative shall be at the discretion of the AHJ and St. John's Regional Fire Department.

List of References and Supplementary Information

[1] *"Guideline on Fire Ratings of Archaic Materials and Assemblies"*,
<http://www.huduser.org/Publications/PDF/fire.pdf>

[2] SafeCoat Latex Intumescent Coating
<http://www.quantumchemical.com/images/stories/PDFs/SC%20Latex%20June%202011.pdf>

[3] Wireless Photoelectric Smoke Detector
http://www.grandalarms.com/home_alarms_wireless_home_alarms_WS4916.html

[4] SafeCoat Fire Retardant Coating
<http://www.quantumchemical.com/images/stories/PDFs/SC%20Clear%20October%202012.pdf>

[5] Fireskin Retrofit Fire Door Kit
<http://fireskin.com/>

[6] 3M Fire Barrier Moldable Putty Pads (MPP)
http://solutions.3m.com/wps/portal/3M/en_US/Building-Life/Cycle/Products/Catalog/?PC_7_RJH9U52300PM102FLRECAB2K44000000_nid=77WRFFR483beQH6W2S54F8gl

[7] ULC/ORD C263.1, *"Sprinkler-Protected Window Systems"* and Tyco WS-1 Sprinkler Head
<http://www.scc.ca/en/standardsdb/standards/7224>
http://www.tyco-fire.com/TD_TFP/TFP/TFP620_12_2011.pdf

FIRE SAFETY EVALUATION WORKSHEET QUESTIONNAIRE

Date:

Civic address:

Property owner:

Description of renovation proposed:

Number of storeys:

Basement level:

Concealed spaces and location(s):

Footprint area and approximate dimensions:

Number of streets faced:

Landlocked at rear:

Distance from entrance to hydrant:

General description of use by floor level:

Is the building equipped with sprinkler protection:

If so, provide general description:

Size and location of water entrance:

Observed water pressure at water entrance:

How is a typical floor assembly constructed:

How is a typical wall assembly constructed:

How are party walls constructed:

Note any assemblies that deviate from typical conditions and their location(s):

Is the building equipped with a fire alarm system:

If so, provide a general description:

Where present, provide location(s) of any of the following area uses:

- Multiple tenants, leaseholders, etc.
- Janitorial/refuse/recycling:
- General storage:
- Fuel fired appliances:
- Electrical/data:
- Usable space below stairs:
- Concealed spaces:

For the above locations, identify any areas where ducts, grilles, transoms etc are present:

For the above locations, identify if self-closing and latching hardware is provided on doors:

For the above locations, identify if there are any unsealed penetrations:

Provide a general description of egress stair(s):

Which levels have direct access to the exterior:

Note any levels served by fire escapes or balconies and their location(s):

Note any levels served by egress windows and their location(s):

Note any areas equipped with emergency lighting:

Does the building have a fire safety plan:

Does the building have any Orders to Comply in place: