Knowles, Jessica D OHCS:EX

From:	Kuan, Steven Y OHCS:EX
Sent:	Friday, August 3, 2012 2:40 PM
To:	Rotgans, Trudy OHCS:EX; Nutting, Alison OHCS:EX; Hutchinson, Jarrett OHCS:EX
Subject:	WoodWorks!BC seminars Mid-Rise and Wood First
Follow Up Flag:	Follow up
Flag Status:	Flagged

I didn't see this earlier. Note the interesting presentations by Sukh and Werner which may have good info for us. I hope that they will repeat both together in Vancouver and/or Victoria later or repeat at the Wood Solutions Fair in October.

Steven



SummerClusterSe minarsAgendalas...





Summer Wood Cluster Seminars by Wood WORKS! BC

Okanagan Tour

- 1 August 13th 2012 **Penticton** at the Penticton Lakeside Resort Zinfandel Room
- 2 August 14th 2012 Kelowna at the Prestige Inn Regatta Room
- **3** August 15th 2012 **Vernon** at the Prestige Hotel & Conference Centre Okanagan Salon
- 4 August 16th 2012 Kamloops at the Four Points by Sheraton Sundial Room

Presenters PLYWOOD 101 by Paul Jaehrlich from Certiwood

Overview of the Canadian plywood industry. Learn how to specify the right panel grades and species for the job. Best practices painting in exterior applications. Important facts about imported plywoods. Eligible LEED points, indoor air quality and which plywood glues to avoid. Plywood's manufacturing process and its quality control. An in-depth look at plywood's unique engineering properties.

Mid-Rise Three years later by Sukh Johal from Wood *WORKS!* BC

Overview of where we are at since the changing of the BC Building Code in 2009 to allow for six story residential buildings of wood construction. Learn how the development community has taken hold of this new opportunity to build more cost effective multi-family housing in your community.

Time	Item	Ву
10:30-10:45	Welcome, coffee and registration	Bill Billups
10:45-11:45	Mid-Rise – Three years Later	Sukh Johal
11:45-12:10	Complementary Linch	All
12:10-1:10	PLYWOOD 101	Paul Jaehrlich
1:10-1:30	Close	Bill Billups

Register now! For your free lunch seminar!

Email **Linda Shauer** at <u>lshauer@wood-works.ca</u> NOW and be sure to indicate which of these great venues you will be attending

From the desk of: Bill Billups, AScT. Technical Advisor #110 – 1692 Atkinson Street, Penticton BC V2A 6B5 Phone: 1-877-929-9663 Ext. 2 Cell: 1-250-462-1994 Email: <u>wbillups@wood-works.ca</u>





Summer Wood Cluster Seminars by Wood WORKS! BC

Kootenay Tour

- 5 August 27th 2012 **Revelstoke** at the Hillcrest Hotel Mt. Revelstoke Room
- 6 August 28th 2012 Golden at the Prestige Inn Percel Room
- 7 August 29th 2012 Cranbrook at the Prestige Rocky Mt. Resort Hotel Fernie Salon
- 8 August 30th 2012 **Nelson** at the Prestige Lakeside Resort Monashee Salon

Presenters PLYWOOD 101 by Paul Jaehrlich from Certiwood

Overview of the Canadian plywood industry. Learn how to specify the right panel grades and species for the job. Best practices painting in exterior applications. Important facts about imported plywoods. Eligible LEED points, indoor air quality and which plywood glues to avoid. Plywood's manufacturing process and its quality control. An in-depth look at plywood's unique engineering properties.

Wood First and the Demo Projects by Werner Hofstätter from Wood *WORKS*! BC

Overview of where we are at since the passing of the Wood First Act in BC and what its impact has been on the design community. Werner will run through the Wood Use Matrix and show you six BC Demonstration Projects recently completed across BC that show wood innovation at its best.

Time	Item	Ву
10:30-10:45	Welcome, coffee and registration	Bill Billups
10:45-11:45	Wood First and the Demo Projects	Werner Hofstätter
11:45-12:10	Complementary Lunch	All
12:10-1:10	PLYWOOD 101	Paul Jaehrlich
1:10-1:30	Close	Bill Billups

Register now! For your free lunch seminar!

Email **Lorna Malone** at <u>Imalone@wood-works.ca</u> NOW and be sure to indicate which of these great venues you will be attending

From the desk of: Bill Billups, AScT. Technical Advisor #110 – 1692 Atkinson Street, Penticton BC V2A 6B5 Phone: 1-877-929-9663 Ext. 2 Cell: 1-250-462-1994 Email: wbillups@wood-works.ca



REGISTRATION

Okanagan Tour

- August 13th 2012 **Penticton** at the Penticton Lakeside Resort Zinfandel Room 1
- 2
- August 13th 2012 **Kelowna** at the Prestige Inn Regatta Room August 15th 2012 **Vernon** at the Prestige Hotel & Conference Centre Okanagan Salon August 16th 2012 **Kamloops** at the Four Points by Sheraton Sundial Room 3
- 4

Kootenay Tour

- August 27th 2012 **Revelstoke** at the Hillcrest Hotel Mt. Revelstoke Room 5
- August 28th 2012 **Golden** at the Prestige Inn Percel Room 6
- August 29th 2012 Cranbrook at the Prestige Rocky Mt. Resort Hotel Fernie Salon 7
- 8 August 30th 2012 – **Nelson** at the Prestige Lakeside Resort – Monashee Salon

Name	
Company	
Address	
Phone	Email

Be sure to circle which venue you will be attending!

You must register before August 3rd !!!!!!!! for the Okanagan Tour

And before August 15th !!!!!!!!!! for the Kootenay Tour

Knowles, Jessica D OHCS:EX

From:	Rotgans, Trudy OHCS:EX
Sent:	Friday, June 15, 2012 8:58 AM
То:	Jensen, Jun'ichi OHCS:EX; May, Zachary OHCS:EX; Kuhnert, Lyle OHCS:EX
Cc:	Green, Tracy OHCS:EX; Nutting, Alison OHCS:EX; Hutchinson, Jarrett OHCS:EX
Subject:	FW: Construction Fire Safety final
Attachments:	image001.jpg; C635703_R01FINAL.PDF; C635703_R01FINALAppendixAtoF.PDF
Follow Up Flag:	Follow up
Flag Status:	Flagged

Fyi - it would be worth reading this report and familiarizing yourselves with it.

Thank you,

Trudy

-----Original Message-----From: Ben Henzler [mailto:Ben.Henzler@bcfii.ca] Sent: Friday, June 15, 2012 8:34 AM To: Rotgans, Trudy OHCS:EX Cc: Nicol, John OHCS:EX; Thompson, Bob R OHCS:EX Subject: FW: Construction Fire Safety final

Trudy — attached for your records is an e-version of the final report from CFT on Construction Fire Safety. I will also forward a couple of hard copies to you when I receive them from Brad. Thanks to you and your staff for supporting the project and helping shape it.

The broad engagement by interested parties in creating the report has generated some interest. As has been the case with other reports, I believe you would agree to sharing it with the people/associations Brad is requesting below, in addition the normal FII practice of posting funded studies on our website. Unless I hear otherwise, I will proceed on that basis.

Thanks and Regards, Ben Henzler Director, Wood First

Forestry Innovation Investment
604.601.5322
www.naturallywood.com<http://www.naturallywood.com/>





#800-1901 Rosser Avenue Burnaby, B.C. V5C 6R6 Office: (604) 684-2384 (CFTI) Fax: (604) 684-2402 cft@cftengineering.com

SUMMARY OF REQUIREMENTS FOR CONSTRUCTION FIRE SAFETY IN BRITISH COLUMBIA,

ANALYSIS AND RESEARCH OF CONSTRUCTION FIRE RISKS,

AND IDENTIFICATION OF AREAS OF POTENTIAL IMPROVEMENT THROUGH LEGISLATIVE CHANGE IN BRITISH COLUMBIA

Prepared For:

Forestry Innovation Investment Ltd. 1200 - 1130 West Pender Street Vancouver, BC V6E 4A4

June 12, 2012

C6357.03

Building Code Consultants • Certified Professionals • Fire Protection Englishers

EXECUTIVE SUMMARY

The purpose of this report is to put forward recommendations for potential changes and means of enforcement to current legislative requirements addressing fire safety at construction sites. The report summarizes key fire and life safety risks at construction sites as identified by research conducted through literature review, and also through the analysis of data regarding fires at construction sites in British Columbia over a five year period, in order to compare these risks with fire and life safety risk mitigation strategies required under current legislation. The report also examines the mechanisms for enforcement of these legislated requirements. In addition, the report reviews construction site safety requirements and practices from other jurisdictions, such as the Province of Alberta and the United States.

The recommendations are based on the findings from the research of actual fires as well as other literature sources, and are put forward for discussion for the purposes of improving fire safety at construction sites through potential changes to legislative requirements and enforcement practices in British Columbia.

The report identifies fire and life safety risks that are unique to construction sites as opposed to occupied buildings. These risks include the following:

- Lack of completed fire separations (passive protection),
- Lack of functional/commissioned fire suppression and alarm systems (active protection),
- Inadequate water supply for manual firefighting,
- Fire Department response inefficiencies,
- Increased risk of incendiary fires due to periods where the site is unoccupied, and the incompleteness of security devices,
- Hazardous operations that take place at construction sites (e.g. hot works).

Recommendations for potential changes include the following:

- Provision of a link to the BC Fire Code construction fire safety requirements from Division B, Part 3 and Division B, Part 9 of the BC Building Code.
- Assignment of a Fire Safety Coordinator for construction sites.
- Provision of a fire warning system during inactive periods (e.g. after hours.).
- Additional guidance with respect to construction fire safety responsibilities.
- Specific requirements with respect to water supplies to construction sites.
- Requirement to conduct a fire risk assessment prior to construction commencing.
- Requirement for a pre-construction meeting with the Fire Department and Authority Having Jurisdiction.
- Provision of detailed guidelines with respect to the development and implementation of the construction fire safety plan.
- Development of fire protection industry practices.
- Provision and maintenance of Fire Department access.
- Procedures for the management of ignition sources and combustible content.
- Procedures for monitoring compliance with fire prevention requirements.

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1.0 INTRODUCTION

1.1 Background - CFT Engineering Inc. was contracted by Forestry Innovation Investment Ltd. (FII) to prepare this report assessing fire risks during the course of construction for all types of projects (i.e. both combustible and noncombustible construction, and all building heights). Previously, CFT Engineering Inc. was contracted by Forestry Innovation Investment Ltd. (FII) to prepare reports on the potential risks in increasing wood frame height limitations in the National Building Code 2010 from three storeys to four storeys for Group B, Division 3 occupancies, and on Building Code requirements for construction with heavy timber. Please refer to CFT Engineering Inc. reports "Research to Increase Wood Frame Height Limitations in the NBC 2010 from Three to Four Storeys", dated March 31, 2011, last revised August 4, 2011, and "Review of Heavy Timber Requirements in the NBC 2010, and Potential Additional Heavy Timber Requirements", dated November 29, 2011.

A meeting was held on December 8, 2011, between members of the Building Safety Standards Branch, WorkSafe BC, the Wood Enterprise Coalition, and CFT Engineering Inc, in order to discuss construction fire risk and explore the potential for collaboration with respect to protection measures and enforcement relating to construction fire safety. The meeting minutes are attached in Appendix A.

A stakeholders meeting was held on May 30, 2012 at the offices of CFT Engineering Inc. to review Draft 3 of this report (see minutes in Appendix B). At the meeting there was general concurrence with the report. The AIBC (Architectural Institute of British Columbia) and APEGBC (Association of Professional Engineers and Geoscientists of British Columbia) raised concerns about the recommendations that the role of the CRP (Coordinating Registered Professional) be expanded to include coordination of the fire risk assessment and construction fire safety plan. The concerns related to training members that provide CRP services and the limitations of professional liability insurance that excluded construction safety or fire safety on construction sites. The recommendations in Part 10 of the report were revised to reflect those concerns. Minor revisions were also incorporated in the recommendations to address the issues raised by the stakeholders.

1.2 Purpose of Report - The purpose of the report is to review current legislation regulating fire safety and current industry practice in order to identify potential areas of improvement, and provide recommendations for potential changes to legislation and enforcement practices governing construction fire safety in British Columbia. Recommendations are based on findings from research of actual construction site fires, a review of existing literature on construction site fire safety as well as construction fire safety requirements in other jurisdictions.

1.3 Sources of Information - The following documents and publications have been reviewed as part of this study:

- National Building Code (NBC) 2010,
- National Fire Code (NFC) 2010,
- British Columbia Building Code (BCBC) 2006,

- British Columbia Fire Code (BCFC) 2006,
- Vancouver Building By-Law (VBBL) 2007,
- Vancouver Fire By-Law (VFBL) 2000,
- International Building Code (IBC) 2012,
- Workers Compensation Act (WCA),
- NFPA Fire Protection Handbook, 20th Edition (2008),
- NFPA 10 "Potable Fire Extinguishers",
- NFPA 13 "Standard for the Installation of Sprinkler Systems",
- NFPA 14 "Standard for the Installation of Standpipe and Hose Systems",
- NFPA 51B "Fire Prevention During Welding, Cutting and Other Hot Work",
- NFPA 82 "Incinerators and Waste and Linen Handling Systems and Equipment",
- NFPA 241 "Safeguarding Construction and Demolition Sites",
- NFPA 730 "Guide for Premises Safety",
- NFPA 731 "Standard for the Installation of Electronic Premises Security Systems",
- NFPA 1231 "Standard for Water Supply for Suburban and Rural Firefighting",
- The American Water Works Association "Distribution Requirements for Fire Protection",
- Construction Confederation the Fire Protection Association "Fire Prevention on Construction Sites" 2000,
- Alberta High Intensity Residential Fires Working Group "Final Report" 2007,
- Health and Safety Executive "Fire Safety in Construction",
- The Association of Professional Engineers and Geoscientists of BC (APEGBC) "Structural, Fire Protection and Building Envelope Professional Engineering Services for Five and Six Storey (Mid-Rise Buildings) Wood Frame Residential Building Projects",
- Canadian Wood Council (CWC) "A Technical Note on Fire Safety and Security on Construction Sites in British Columbia",
- The Building and Safety Standards Branch (BSSB) Technical Advisory Group (TAG) "Response to Stakeholder Issues Connected to Mid-Rise Wood Frame Residential Construction" 2008.

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2.0 CURRENT LEGISLATIVE REQUIREMENTS FOR CONSTRUCTION FIRE AND LIFE SAFETY IN BRITISH COLUMBIA

2.1 Objectives of Legislative Requirements - The objective of the legislative requirements regulating construction sites is to provide a framework for reducing or eliminating identifiable risks to fire and life safety. The introduction of the BC Fire Code summarizes its three broad objectives as safety, health, and fire protection of buildings and facilities. The introduction to the BC Building Code states the same broad objectives, with the addition of accessibility for persons with disabilities.

2.2 Code and other Legislative Requirements - The regulations that govern construction sites with respect to fire and life safety are primarily contained in the BC Fire Code, the BC Building Code, and Occupational Health and Safety Standards. The administration and enforcement of Occupational Health and Safety Standards are responsibilities of WorkSafe BC per the mandate under Section 111 of the BC Workers Compensation Act. The enforcement of Building and Fire Codes is the responsibility of the Authority Having Jurisdiction in each municipality. The administration of Building and Fire Codes is a responsibility of the Minister of Forests and Range and the Minister Responsible for Housing, while the development of Codes is undertaken by the Ministry of Energy and Mines' Office of Housing and Construction Standards' Building and Safety Standards Branch.

A summary of the key requirements from the BC Fire Code, the BC Building Code and the BC Occupational Health and Safety Standard are as follows:

- 2006 BC Fire Code:
 - Fire Safety Plan (Subsection 2.8.2, Articles 3.3.2.9, 5.2.3.7 and 5.6.1.2),
 - Designation of personnel with fire safety duties (Clause 5.6.1.2.(2)(a)),
 - Means for sounding a fire alarm (Subclause 5.6.1.2.(2)(b)(i) and Article 5.6.1.9),
 - Means for notifying the Fire Department (Subclause 5.6.1.2.(2)(b)(ii)),
 - Training of alarm procedures for all personnel (Subclause 5.6.1.2.(2)(b)(iii)),
 - Predetermined response procedures for personnel assigned with duties in the case of a fire (Subclause 5.6.1.2.(2)(b)(iv) and Article 5.6.1.19),
 - Housekeeping (Clause 5.6.1.2.(2)(c)),
 - Firefighting facilities maintenance (Clause 5.6.1.2.(2)(d)),
 - Access to firefighting equipment (Sentence 5.6.1.4.(1)),
 - Fire Department vehicle access (Sentence 5.6.1.4.(2) and Sentence 3.3.2.5.(1)),
 - Fire Department use of available elevators, hoists and lifts (Appendix Note A-5.6.1.4.(2)),
 - Portable extinguishers (Article 5.6.1.5),

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- Progressive standpipe installation (Sentence 5.6.1.6.(1)),
- Provision of one usable exit (Article 5.6.1.8),
- Service line shut-offs (Article 5.6.1.10),
- Clearances for internal combustion engines (Sentence 5.6.1.11.(1) and Sentence 5.6.1.11.(2)),
- Clearances for certified heating equipment (Sentence 5.6.1.11.(3)),
- 1 h fire separations in partially occupied buildings (Article 5.6.1.14),
- Provisions of alarms or watch tours at 1 h intervals in partially occupied sites (Article 5.6.1.14),
- Use of bitumen heating equipment (Article 5.6.1.17),
- Fastening of temporary enclosures (Article 5.6.1.18),
- Maintenance, inspection and storage of hot work equipment (Subsection 5.2.2),
- Protection of hot works areas (Sentence 5.2.3.1.(1), Clause 5.2.3.1.(2)(a)), Sentence 5.2.3.1.(3), Article 5.2.3.2, Article 5.2.3.4 and Article 5.2.3.5),
- Fire watch for hot works (Clause 5.2.3.1.(2)(b), Clause 5.2.3.1.(2)(c), Article 5.2.3.6 and Article 5.2.3.3),
- Outdoor Storage of materials (Section 3.3),
- Storage of flammable and combustible liquids (Part 4), and
- Requirements when smoking is permitted (Subsection 2.4.2).
- 2006 BC Building Code:

-

- Requirement to conform with Section 5.6 of the British Columbia Fire Code (Sentence 8.1.1.1.(3))
- Barricade requirements (Article 8.2.1.3),
- Suspended construction activities (Article 8.2.1.5), and
- Housekeeping (Article 8.2.5.2).
- BC Occupational Health and Safety Standard:
 - Training required for workplace response to fire or emergency (Sentence 4.16.(2)),
 - Physical capabilities of workers assigned with firefighting duties (Sentence 4.16.(4)),
 - Illumination levels and inspection and testing requirements of emergency lighting (Section 4.69), and
 - Procedures for checking on workers well being when working alone (Section 4.20).
- Other Applicable Standards Adopted through Articles of the 2006 BC Fire and Building Codes:
 - CAN/CSA-W117.2 "Safety in Welding, Cutting and Allied Processes" (BC Fire Code Sentence 5.2.1.1.(2)),

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-	NFPA 51 "Design and Installation of Oxygen-Fuel Gas Systems for
	Welding, Cutting and Allied Processes" (BC Fire Code Sentence
	5.2.2.4.(1)),
-	CAN/CSA-B139-M "Installation Code for Oil Burning Equipment" (BC
	Building Code Clause 6.2.1.4.(1)(a)),
-	Gas Safety Regulation (BC Building Code Clause 6.2.1.4.(1)(b)),

- Electrical Safety Regulation (BC Building Code Clause 6.2.1.4.(1)(c)),
- Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation (BC Building Code Clause 6.2.1.4.(1)(d)),
- CAN/CSA B365-M "Installation Code for Solid-Fuel Burning Appliances and Equipment" (BC Building Code Clause 6.2.1.4.(1)(e)), and
- NFPA 82 "Incinerators and Waste and Linen Handling Systems and Equipment" (BC Building Code Article 6.2.6.1).

As shown above, the majority of legislative requirements which specifically address construction fire safety are contained in the BC Fire Code. The BC Building Code addresses fire and life safety at construction and demolition sites through the requirement in Part 8 of the BC Building Code to conform with the BC Fire Code. There are also supplementary requirements from the BC Occupational Health and Safety Standard. A more detailed description of some of the key requirements follows.

2.3 The Fire Safety Plan - As required by the BC Fire Code, the measures for safeguarding a construction site are compiled into a fire safety plan which is intended to be unique to each site in order to address site specific hazards. The BC Fire Code requires that fire safety plans contain the following information:

- A list of site personnel responsible for duties related to fire and life safety,
- The procedure for controlling fire and life safety risks and hazards in and around the structures on site,
- The procedure for notifying the Fire Department in the event of a fire, and
- The maintenance procedure for the site's firefighting facilities.

The fire safety plan also provides the Fire Department with site specific information which is used to improve the effectiveness of the Fire Department response in the event of a fire.

To clarify the requirements of construction fire safety plans, on August 17, 2009 the Ministry of Public Safety and Solicitor General's Office of the Fire Commissioner released a bulletin for fire safety planning on construction and demolition sites. The bulletin is a checklist intended to assist industry in meeting the fire safety requirements in BC. A copy of the bulletin is provided in Appendix C.

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2.4 Code Requirements for Active Systems for Fire Protection on Construction Sites -

Active systems include fire detection and notification systems, and fire suppression systems. For construction sites, the BC Fire Code requires that a system is provided to alert site personnel of a fire. The majority of buildings regulated under Division B, Part 3 of the BC Building Code or the Vancouver Building By-Law are required to have a fire alarm system that will notify occupants of a fire upon fire or smoke detection, a sprinkler water flow or from activation of a manual pull station. The fire alarm in a completed building will not only notify all occupants, but will automatically relay the alarm to the Fire Department. In buildings under construction, fire alarm systems are not installed until the later stages of construction, and even when they are installed, they are often deactivated for periods until the building is complete.

To meet the requirements for alerting site personnel, manual air horns are typically provided throughout sites for workers to manually notify others of a fire emergency. The site notification requirement provides a means for manual notification of a fire incident but does not require any automatic detection system to alert occupants of the construction site.

2.5 Requirements for Passive Systems for Fire Protection on Construction Sites - Passive fire and life safety protection features include the construction of fire separations for safe egress and exiting, fire separations to limit the spread of fire, and fire separations designed to protect adjacent properties or occupied portions of the site.

The BC Fire Code requires that at least one usable exit be maintained at all times. In addition, the BC Fire Code requires a 1 h fire separation to be constructed between occupied areas and areas under construction for sites where there is phased occupancy.

2.6 Requirements for Manual Suppression Systems on Construction Sites - The BC Fire Code requires that extinguishers be provided in areas where flammable liquids, gases or other combustible materials are stored, adjacent to cutting or welding, on or near internal combustion engines and adjacent to oil-fired equipment, gas-fired equipment and bitumen heating equipment. It is a requirement of the BC Fire Code to inspect, test and maintain portable extinguishers in accordance with NFPA 10 "Portable Fire Extinguishers". Providing sufficient size and distribution of portable extinguishers is essential in order to provide a means to suppress a fire in its early stages.

The BC Fire Code requires that where standpipe systems are required as per Division B, Part 3 of the BC Building Code, they be installed progressively during construction. The standpipe system is required to be connected to a water supply, which may also require a fire pump to achieve the required flow-rate at the topmost hose connection. For completed buildings, the BC Building Code requires a water supply that conforms with NFPA 14 and/or NFPA 13 where a standpipe system and/or automatic sprinklers are installed. However, it is not always part of construction practice to provide an adequate water supply to a partially completed standpipe system, as fire pumps may not commissioned until the later stages of construction, or the connection to the City water supply is delayed.

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2.7 Requirements for Limiting Combustible Materials - The BC Building Code and BC Fire Code require that combustible refuse in sufficient quantities to constitute a fire hazard be moved to a safe location, and that proper containers or enclosures be used for waste materials. Storage of combustible materials, including combustible or flammable liquids, is required to conform with Parts 3 or 4 of the BC Fire Code, which specifies the requirements for fire separations, maximum permitted quantities, and required fire protection measures.

2.8 Requirements for Barricades on Construction Sites - The BC Building Code requires that barricades of at least 1.8 m in height provide a complete perimeter around structures when openings are left unprotected, which may allow access into the structures. There is also a barricade requirement in the BC Fire Code requirement for outdoor storage of goods.

2.9 Requirements for Hot Works on Construction Sites - The use of hot works is covered by the BC Fire Code in Subsection 5.2 "Hot Works". Hot works operations include cutting, grinding, welding, brazing, soldering, thermal spraying, thawing of piping, and torch applied roofing.

To mitigate the fire risk presented by the use of hot works, the BC Fire Code requires that hot works are monitored with a fire watch both during hot work and after the completion of hot works. For a fire watch, personnel equipped with fire extinguishing equipment monitor areas endangered by hot works. The Fire Code requires that a fire watch continue for a period of 1 hour after completion. A final inspection 4 hours after completion is also required to confirm that the area where hot works was performed does not still present a risk of a fire occurring.

2.10 Requirements for Smoking on Construction Sites - Smoking is allowed on construction sites, but only in permitted areas in accordance with the BC Fire Code, Subsection 2.4.2. Permitted smoking areas are required to be separated from conditions where smoking may create a fire or explosion hazard. Some sites may implement a no smoking policy, but when smoking is permitted, adequate signage and ashtrays must be provided in smoking areas in accordance with Article 5.6.1.16 of the BC Fire Code.

2.11 Requirements for Heating Equipment on Construction Sites - Temporary heating equipment is used on construction sites to control temperature, as well as moisture. For example, temporary heating may be used to prevent freezing and to maintain a warm working environment. Temporary heating may also be used to reduce moisture in order to expedite drying processes for construction materials like drywall or wood, and for the curing of concrete.

The BC Fire Code requires that the clearance between combustible materials and temporary heating equipment conform with Part 6 of the BC Building Code, or in conformance with minimum clearances shown on certified heating equipment.

In addition, there is a requirement that where temporary enclosures such as fabrics and films are used, these must be securely fastened to prevent the enclosure material from being blown against the heaters or other ignition sources.

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3.0 ENFORCEMENT OF LEGISLATED REQUIREMENTS

3.1 Authority Having Jurisdiction - The Authority Having Jurisdiction has the responsibility for auditing that legislated fire and life safety requirements are conformed with at construction sites. The ultimate responsibility of fire and life safety on construction sites lies with the owner, who typically delegates the implementation of fire and life safety practices to the general contractor. This can lead to inconsistencies with respect to fire safety at construction sites, since the enforcement of Code requirements varies between municipalities. Some municipalities require the submission of a construction fire safety plan for review and acceptance prior to work commencing at the site. The submission process of construction fire safety plans is intended to reinforce the requirement for the contractor to identify the risks and implement a mitigation strategy to meet the Code requirements, which addresses hazards unique to the site. For example, the City of Vancouver Building By-Law requires that complex projects employ a full-time construction safety officer, which is not a requirement in all jurisdictions. This greater level of enforcement gives the Vancouver Building Department more control of construction fire safety since the work of the construction safety officer is subject to review, and the Vancouver Building Department has the authority to require changes to construction fire safety plans.

3.2 Enforcement Considerations Coinciding with the Allowance of Mid-Rise Wood Frame Residential Construction - In January of 2009, through a local government act, the Province of British Columbia amended the BC Building Code to allow the construction of five and six storey wood frame residential buildings which became effective in April of 2009. Prior to the implementation of these changes, the Building and Safety Standards Branch held several Technical Advisory Group (TAG) meetings to address safety issues pertaining to the proposed changes. Each suggestion put forward by the TAG was reviewed and assessed against two criteria: whether it addressed the incremental risk of raising the allowable height of wood-frame residential buildings from four to six storeys, and whether they were specific to five and six storey residential wood-frame construction. Some of the key recommendations put forward by the TAG were as follows:

- Improve site security,
- Ban drywall heaters,
- Incremental protection such as install standpipes, sprinklers, temporary wireless alarms, fire separations and fire doors as construction progresses, and
- Consistent requirement and enforcement of the fire safety plans per the BC Fire Code.

We understand that the action taken to address the concerns raised by the TAG was to implement a requirement for a designated site fire safety supervisor, and the issuance of the Office of the Fire Commissioner's Construction Fire Safety Plan Bulletin, the purpose of which is to provide consistent requirements regarding the information necessary to submit a complete construction fire safety plan. This bulletin is included in Appendix C.

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4.0 CODES, ENFORCEMENT AND REFORM OF CONSTRUCTION FIRE SAFETY IN OTHER JURISDICTIONS

4.1 Construction Fire Safety Practices and Reform in Alberta - The 2006 Alberta Fire Code has additional or more detailed "unique to Alberta" requirements for construction and demolition sites, addressed in Section 5.6. Key requirements that differ from the BC Fire Code are as follows:

- There is a requirement for protection of adjacent buildings or facilities from fires originating from buildings, parts of buildings, facilities and associated areas undergoing construction, alteration or demolition operations.
- There are additional requirements for access for firefighting, including the requirement for a means for firefighters to carry out firefighting on all levels of the building, and the provision for the use of existing elevators, hoists or lifts to assist emergency personnel in reaching all levels of the building. This is also a requirement of the BC Building Code, but the wording in the Alberta Fire Code is more specific.
- There are extensive additional requirements for the progressive installation of standpipe systems, such as the provision of readily accessible Fire Department connections on the outside of the building at the street level, and the provision of at least one hose outlet at each floor, and that the standpipes shall be not more than one floor below the highest forms, staging, and similar combustibles at all times.

Since the issuance of the 2006 Alberta Fire Code, the Government of Alberta established a committee to study large-loss building fires in Alberta, following a number of high intensity residential fires, including a large loss fire at a condominium complex construction site. The aim of the study was to recommend changes to the Alberta Fire Code to mitigate key risk factors as identified by the study.

The key recommendations relating to construction site fire safety arising from the study were to consider new or improved fire and life safety requirements to address:

- Protection of existing buildings adjacent to construction, alteration, or demolition work,
- Improved access for emergency personnel to and within buildings under construction or demolition,
- New requirements for hot application roofing materials such as bitumen and torch applied membranes,
- The need to develop and implement a model fire safety plan for construction companies and permit issuing authorities to use as a reference in establishing plans that will also take site security and arson prevention into consideration,

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- The need to develop and implement a system requiring construction companies to appoint a trained "Work Site Fire Safety Officer" responsible for the Fire Safety Plan,
- The need to develop and implement a communication strategy to provide the construction industry with more information on how to recognize and respond to fire safety hazards.

Following the study, several Standatas (Alberta Fire Code interpretations) were issued by the Safety Codes Council of Alberta, which particularly address construction and demolitions sites. These include clarifications to the requirement for water supplies and access for firefighting requirements, clarification regarding the protection of adjacent buildings, and clarifications regarding the development and content of the fire safety plan.

Examples of methods to protect adjacent property listed in the Alberta Fire Code and related Standata are as follows:

- Use of water curtains,
- Provision of spatial separation,
- Use of fire resistive construction methods, and
- Erection of temporary fire barriers such as a fire tarpaulin.

The Standata addressing the fire safety plan includes the requirements for the fire safety plan to specifically include:

- Assignment and responsibility for fire safety duties to workers,
- Emergency procedures to: provide fire warning, notify the Fire Department, evacuate the site and conduct first aid training,
- Control of fire hazards on the site, and
- Procedures to ensure maintenance of firefighting measures.

In addition, this Standata includes specific conditions where no fire safety plan is required (projects with a value under \$5,000.00), where a "small buildings" generic fire safety plan may be adopted, and when a customized fire safety plan is required to be submitted to the Fire Department for approval.

The Standata that addresses water supplies and access for firefighting includes a requirement that the owner, developer or contractor responsible for a construction or demolition site is will:

- Incorporate measures which provide the Fire Department with unobstructed access routes (interior and exterior), and also unobstructed access to hydrants and manual firefighting equipment (e.g. portable extinguishers, standpipes),
- Verify that water supply systems are operational and sufficient for firefighting operations.

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4.2 Construction Fire Safety Practices in the United States - The International Building Code (IBC) is widely adopted as the governing Building Code by jurisdictions in the United States. Chapter 33 of the 2012 IBC is dedicated to safeguards during construction. This chapter specifically addresses the following:

- A minimum of one lighted stairway to be provided where a building is constructed to at least 50 ft. or four storeys,
- Where standpipes are required for the building, at least one standpipe is to be installed when the progress of construction is not more than 40 ft. in height above the lowest level of Fire Department vehicle access. The standpipes are required to be extended as construction progresses to within one floor of the highest point of construction having secured decking or flooring,
- An approved water supply is required for fire protection as soon as combustible material arrives on site.

NFPA 241, "Standard for Safeguarding Construction, Alteration and Demolition Operations" provides a comprehensive guide and standard for construction, alteration, and demolition operations. The NFPA standards provide the framework for fire and life safety practices in the United States. NFPA 241 provides guidance on the construction of temporary offices and storage areas, typical processes and hazards such as temporary heating equipment, flammable and combustible liquids and flammable gas storage and handling, temporary electrical work and lighting, and requirements for fire protection. Some significant items to note from NFPA 241 are as follows:

Chapter 4

- Spatial separation requirements for temporary construction-related buildings and the buildings under construction based on the temporary structure exposing wall length are provided in a table.
- Service areas for equipment shall not be located within structures under construction.

Chapter 7

- In all buildings over one storey in height, at least one stairway shall be provided that is in usable condition at all times. This stairway is required to be extended upward as each floor is installed for new construction, and must be maintained for each floor remaining during demolition, and is required to be lighted.
- In all new buildings in which standpipes are required or where standpipes are existing in a building to be altered or demolished, such standpipes shall be maintained in conformity with the progress of the building construction in such a manner that they are ready for use.
- At least one approved fire extinguisher shall be provided in plain sight on each floor at each usable stairway, as soon as combustible material accumulates.

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Chapter 8

- Portable fire extinguishers or charged hose lines are required during forming/stripping operations using combustible forming material.
- Firewalls and exit stairways where required for the completed building, shall be given construction priority for installation. Fire doors with approved closing devices and hardware shall be installed as soon as practical, and preferably before combustible material is introduced. Fire doors shall not be obstructed from closing.
- A water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material accumulates on the site, and there shall be no delay in the installation of fire protection equipment.
- Where underground water mains and hydrants are to be provided, they shall be installed, completed, and in service prior to construction work.
- If automatic sprinkler protection is to be provided, the installation shall be placed in service as soon as practicable.
- There are more extensive standpipe requirements, such as the provision of readily accessible Fire Department connections on the outside of the building at the street level, and the provision of at least one hose outlet at each floor, and that the standpipes shall be not more than one floor below the highest forms, staging, and similar combustibles at all times.

4.3 Construction Safety Plan Bulletin, Surrey Fire Service, BC - The Surrey Fire Service issued a bulletin in 2011, which is intended to aide owners and contractors in developing a construction fire safety plan (CFSP) that addresses fire and life safety issues unique to a particular construction site. The bulletin was the result of research conducted to identify key risk factors during construction, and to summarize the appropriate risk mitigating features that should be in place at various stages of construction, with an emphasis on implementation of existing BC Building Code and BC Fire Code requirements.

The bulletin gives guidance on how to prepare a CFSP, and emphasizes the need to develop the plan in conjunction with the Surrey Fire Services. Another key requirement of the bulletin is to update the CFSP as the construction progresses, as fire and life safety risks will differ depending on the construction operations taking place on site, and the degree to which active and passive fire protection is available. It also emphasizes the need to develop a site specific plan, since a generic plan is not practical when considering the varying complexity of construction sites. The bulletin provides a checklist which the Surrey Fire Service will use to assess the adequacy of the CFSP (included in Appendix C of this report). This bulletin includes general items to be included, and also specific issues to be addressed for the differing phases of construction.

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5.0 ANALYSIS OF DATA FROM REPORTED CONSTRUCTION FIRES

5.1 Occurrence of Construction Fires in British Columbia - Over the five year period from 2005 through 2009, a total of 275 fires were reported as occurring on construction sites in BC. These fires were reported through the fire reporting system maintained by Emergency Management BC's Office of the Fire Commissioner. Losses as a result of these fires included 10 injuries, one fatality and equipment and property loss valued at over \$53 million. The losses from these fires have created concern over the current state of construction fire safety practices in BC.

The data from the construction site fires during this five year period was analyzed to determine the most frequent causes of fires on construction sites, as well as the potential impact of the type of construction and the location of the initial fire (ground floor or second storey and above). This information can be used to identify effective mitigation strategies that are or could be employed during the construction phase of a project to protect against the most frequent fire scenarios. Analysis of the fires reported to the Office of the Fire Commissioner can be found in Appendix F "Analysis of Reported Fires in British Columbia 2005 through 2009".

The data from the reported fires in BC indicates that the number of fires attributed to having incendiary or suspicious sources are significantly greater than fires from any other sources. Of the 275 fires reported, 62.9% of the fires were reported as incendiary. A further 21.5% of fires were reported with reasons that could not be determined. As a result of the 173 incendiary fires reported, seven persons were injured and over \$26 million of property was lost. It can therefore be concluded that the predominant risk of construction fires is incendiary risk. The greatest portion of incendiary fires occur between the hours of 5:00 pm and 4:00 am, as seen in Figure 1 "Number of Incendiary Fires Occurring on Construction Sites vs. Time of Day". This indicates that the after hour security measures provided did not deter incendiary acts to the same extent as the presence of workers on site.



Figure 1: Number of Incendiary Fires Occurring on Construction Sites vs. Time of Day

Location of the source of the fire was also significant factor, with more than half the construction fires starting on the ground floor.

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6.0 ANALYSIS OF LITERATURE REVIEW REGARDING CONSTRUCTION FIRE SAFETY

6.1 Wood Works BC - The Wood Enterprise Coalition has issued a draft document that addresses prevention of risks during the course of construction. This document emphasizes the inherent greater risk potential of a construction site versus a completed building. A completed building is designed to incorporate passive and active fire protection systems that work together to mitigate the risk of fire and life safety through the following features:

- Compartmentation,
- Means of escape,
- Fire alarm and detection systems,
- Fire suppression systems,
- Access for facilities for firefighting.

On a construction site, many of these built-in fire and life safety features are not fully functional. Therefore, alternative mitigating features are required while these active and passive systems are being installed, and priority should be given to implementing these systems as soon as practicable, to minimize the period of time when such systems are not fully functional.

The document identifies typical combustibles and ignition sources that are present at construction sites, and focuses on removing one of the elements of the fire triangle (fuel, oxygen or ignition source) as an effective strategy when considering the mitigation of fire risks.

6.2 Health and Safety Executive (UK) - The Health and Safety Executive document, "Fire Safety in Construction", contains guidance with respect to implementing appropriate fire safety standards during construction. Some of the key elements contained in this document are as follows:

- Conducting a fire risk assessment, including identifying sources of ignition, fuel and oxygen.
- Identification of persons most at risk as a result of the construction operations.
- Strategies for reducing the risk, such as removal or reduction of sources of ignition, removal or reduction of fuel sources, and removal or reduction of oxygen (e.g. providing closures for reducing the amount of oxidizers on site).
- Recording, planning, informing and instructing, such as drawings, emergency plans, training procedures, and identified risks.
- Provision of firefighting equipment.
- Provision of emergency lighting.
- Liaison with the Fire Department.
- Enforcement of fire safety legislation at construction sites.

The document contains detailed information on typical sources of ignition, and types of combustibles typically found on construction sites, and suggests potential mitigating strategies that can be adopted to protect against the hazards identified in the fire risk assessment.

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7.0 INFORMATION/ANALYSIS OBTAINED FROM SITE VISITS

Site visits were also performed by CFT Engineering to highlight the predominant risks for different sites, and also to assess the methods used on site to implement legislative requirements for construction site safety. One lowrise, one midrise and one highrise project under construction were visited. Field review reports that include analysis of the site visit case studies are included in Appendix E.

At all three sites, the legislative requirements for fire and life safety at construction sites was largely adhered to. Procedures were in place for notifying the Fire Department in the event of an incident, and also horns were installed for the notification of site personnel. At least one exit was available from each floor area. Other safety procedures that were noted at all three sites were formal hot works policies including fire watch, correct placement of temporary heating equipment, and site smoking policies.

Hazards that are specific to construction activities that were noted at one or more of the sites visited were as follows:

- Accumulation of combustibles, including styrofoam, flammable and combustible liquids, wood and cardboard.
- Insufficient or delayed communication with the Fire Department with respect to availability of active fire protection systems, such as standpipes.
- Delay in charging installed fire protection systems, such as sprinklers and standpipes.
- Water supply for firefighting not available in highrise building due to the delay in fire pump installation.

Although the above listed deficiencies were noted, the majority of fire safety procedures required under Section 5.6 of the BC Fire Code, which regulates fire safety at construction sites, were followed. However, there were varying levels of proficiency with respect to applying the requirements, which could be attributed to the generic nature of the BC Fire Code requirements, which in many cases do not provide specific details with respect to how to implement the requirements.

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8.0 LEVEL OF FIRE RISK DUE TO CONSTRUCTION ACTIVITIES

8.1 Construction Phases - Construction sites present a significantly greater fire risk than the fire risk in completed buildings. This is because of the incompleteness of building elements that provide passive fire protection, and also because active systems are not fully installed/operational or commissioned during construction stages.

The level of risk may be higher during some construction phases than others, based on the hazards attributed to the activities conducted and the level of protection provided by the active and passive fire protection systems that are available during that phase. In order to illustrate the potential for the level of risk to vary, the typical activities conducted during construction have been broken down into five stages. Where the building under construction is built of combustible materials (e.g. wood frame), the inherent risk will be greater than where noncombustible building materials are used. The five stages reviewed are as follows:

- 1. Foundation Operations This includes excavation, footings, foundation walls (or slab), waterproofing, backfill and compaction, and underground plumbing.
- 2. Framing Operations This includes wood or steel framing, exterior wall and roof sheathing, exterior trim and siding (and/or stucco/brick), windows and exterior doors, and roofing.
- 3. Rough Plumbing, Mechanical, Electrical Operations This includes installation of water and waste/vent systems and associated piping, duct work, venting and furnace installation, and wiring and electrical panel installation.
- 4. Insulation and Drywall Operations This includes wall insulation, drywall installation, tape and texture.
- 5. Paint, Trim and Finishes Operations This includes finished flooring, cabinets, counter tops, wall tile, mirrors, shower doors, final electrical (including fixtures), final plumbing (including fixtures), and final mechanical.

These construction phases may be completed in sequence; however, it is common for construction operations to be performed simultaneously. Figure 2 "Fire Risk Curve Over the Course of Construction" includes two arbitrary time lines of the five construction phases, one with the phases being completed in sequence, and one with expected periods of overlap where multiple construction operations are performed simultaneously. The risk-time curves are based on Appendix D "Quantification of Risk Over Construction Phases" which assigns arbitrary values of fire risk for individual construction operations as well as cumulative risk due to multiple risk factors being present simultaneously.



Figure 2: Fire Risk Curve Over the Course of Construction

Typically, the construction sequence is to first complete the supporting structure, floors and building envelope while the completion of framing, drywall, door installation and the sealing of penetrations is undertaken at later stages. This may create a condition where the incomplete structure is susceptible to rapid fire spread due to the lack of fire separations.

A common phasing practice for wood frame construction which also presents an inherent increased fire risk is top-down construction. In top-down construction, the supporting structure is completed, followed by the installation of drywall at the uppermost floor first, with progress downward. This creates a greater potential for the collapse of all floors in the event of a fire than when the framing is protected with drywall on the ground floor first. Based on the statistical analysis of the 275 construction fires discussed in Section 5.0 of the report, the fire source is most frequently at the ground floor level.

From the above analysis, it can be concluded that the greatest level of risk is present when the framing is near completion and the installation of drywall has yet to commence. At this point, the greatest amount of unprotected framing is exposed.

8.2 Phased Occupancy - When a building under construction is partially occupied, there is also a greater inherent fire and life safety risk, due to exposure to the occupied areas to risk from a fire incident in the building portion under construction. The BC Fire Code requires a 1 h fire separation be provided between the occupied portions of the site and areas under construction. The Code also requires that either alarms be provided for the site or watch tours monitor the site at intervals of 1 h or less.

8.3 Water Supply During Construction - The water supply needed to fight fires in buildings under construction can be significantly greater than the flow needed for firefighting in completed buildings. This is because completed buildings are typically protected with automatic sprinkler

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systems which will provide containment, control and/or extinguishment. The required water demand is reduced where sprinklers are installed, since manual hose stream demand is supplementary to automatic suppression. Also, there may be a delayed Fire Department response due to the absence of detection systems and automatic signaling to the Fire Department, allowing more time for a fire to spread before manual firefighting commences.

As addressed by the BC Building Code, the water supply for firefighting for completed buildings that are provided with automatic sprinklers and/or standpipes is required to be designed in accordance with NFPA 13 and NFPA 14 respectively. For unsprinklered buildings, the BC Building Code requires that an adequate water supply be provided. The BC Building Code does not provide specific design criteria, but references the following documents as useful guidelines with respect to calculating adequate water supply requirements: Insurance Services Office (ISO) "Needed Fire Flow Guide", the American Water Works Association "Distribution Requirements for Fire Protection" and NFPA 1231 "Standard for Water Supply for Suburban and Rural Firefighting".

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9.0 FIRE DEPARTMENT RESPONSE TO CONSTRUCTION FIRES

The primary goal of the Fire Department is to assist occupants who may be endangered by a fire and to minimize the impact of the fire to adjacent buildings. For fires occurring on construction sites, the number of occupants are typically limited to workers onsite unless phased occupancy has been granted. In cases where the site is expected to be vacant and adjacent properties are at risk of exposure, protection of the adjacent occupied properties may become the Fire Department's first priority.

The priorities of the Fire Department response can be determined upon arrival to the site, but they can be predetermined to some extent by a Fire Department pre-incident response plan. The effectiveness of pre-incident planning is dependent on the information provided to the Fire Department. The following information is valuable for pre-incident response planning:

- Site personnel muster point,
- Personnel assigned to meet and inform the Fire Department,
- Location of nearest hydrant(s),
- Locations of firefighting systems,
- Status of firefighting systems,
- Completeness of exit stairs and passageways to exit stairs,
- Material hazards present on site,
- Site plans and building diagrams.

To aide pre-incident planning, it is important to provide the Fire Department with an up to date construction fire safety plan. For occupied buildings, the Fire Department typically has a greater familiarity with the building layout and the fire suppression systems. Even if the Fire Department periodically tours a construction site, the changing environment of the site might reduce the effectiveness of the planned response. When the Fire Department responds to a site with no occupants expected to be in the building, the response will typically be less aggressive as to not endanger the lives of those fighting the fire. Unfamiliarity with the level of completion of the building structure and fire separations will reduce the effectiveness of firefighting efforts for a fire on a construction site.

Firefighting access is typically gained through the exit stairs where a connection can be made to the standpipe within the stair. Because of the rated fire separation provided for exit stairs in a completed building, firefighters are provided with a barrier to adjacent spaces for staging the response within the stair. For buildings under construction, the Fire Department may have limited numbers of available exit stairs to access the area where the response is needed. The BC Fire Code requirement for exit stairs in construction sites requires that one usable exit be provided that is accessible and useable at all times.

The BC Fire Code requirement provides a safeguard for occupant egress but does specifically require the completion of the fire separation for the usable exit which would assist the response of the Fire Department within the building.

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10.0 CONCLUSION AND RECOMMENDATIONS

The legislation that regulates fire safety at construction sites in British Columbia is intended as a mechanism to reduce or eliminate identifiable risks from site specific hazards that are unique to the construction industry. Most of the legislative requirements are contained in Subsection 5.6 of the BC Fire Code, which is intended to apply to construction sites as well as demolition sites. Part 8 of the BC Building Code also requires compliance with Subsection 5.6 of the BC Fire Code, for buildings under construction. However, because of the broad spectrum of construction sites, ranging from single dwelling units to large highrise developments, the legislative requirements tend to be generic in nature. The key element of fire safety in construction is the development of a working active fire safety plan after analysis of the site has been completed. The Code requirements are intended to provide fire safety procedures that are applicable to all construction sites, such as emergency notification procedures and assignment of personnel to take responsibility for construction fire safety. The intent of the fire safety plan is also to develop site specific procedures designed to mitigate risks that are unique to a particular construction site. However, current requirements lack sufficient guidance on how to incorporate this into the construction fire safety plan, and in general, construction fire safety plans and risk mitigation have not been a high priority.

Because of the limited detail and awareness with respect to the implementation of site specific mitigating features, there is the potential for an inconsistent approach to the management of risk with respect to fire and life safety within the construction industry. Additional guidance and education is needed with respect to the management and mitigation of risks, including details of mitigating strategies that should become industry practice. In addition, more emphasis should be placed on the need to update the fire safety plan and construction site procedures as construction progresses, to adequately address the changing nature of the hazards based on the construction phase and availability of passive and active fire protection features. Training of construction workers and the involvement of the responding Fire Department and the Authority Having Jurisdiction prior to construction commencing can lead to a more effective fire prevention and risk mitigation strategy for each individual project.

The following recommendations are put forward for consideration with respect to potential modifications to the current legislated requirements governing fire and life safety at construction sites in British Columbia, and are based on the analysis from the research conducted as well as some of the regulations and recommended practices in other jurisdictions.

10.1 Linking of Construction Fire Safety within the BC Building Code and Fire Code -

Currently, Division B, Part 8 of the BC Building Code contains the requirements relative to construction sites, and also contains the requirement for conformance with Section 5.6 of the BC Fire Code. However, the majority of fire and life safety requirements are contained in Division B, Part 3 or Part 9 of the BC Building Code. In order to increase the awareness of the requirements for construction fire safety of professionals and contractors involved in the

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construction industry, it is recommended that there be a reference to the BC Fire Code requirements relating to construction fire safety within Division B, Part 3 and Division B, Part 9, Article 9.10.1.2, of the BC Building Code. Division B, Part 1, Subsection 1.1.4 of the BC Building Code should be revised to include a reference to the construction fire safety plan.

10.2 Assignment of a Fire Safety Coordinator - In order to provide continual monitoring of risks throughout the different construction phases, it is recommended that the assignment of a fire safety coordinator be required, by Section 5.6 of the BC Fire Code. The fire safety coordinator should have the overall responsibility of coordinating fire protection and risk mitigation issues before construction commences through to building occupancy. This coordinator should keep workers up to date with emergency procedures on a regular basis, monitor the site relative to the fire safety plan, provide a single point contact with the fire service and be trained to identify basic hazards.

10.3 Fire Warning and Alarm - It is recommended that BCFC Article 5.6.1.9 be amended to include a fire warning system when the site is not active, such as after hours. A fire warning system may be a fire watch or active detection systems or a combination of fixed detection and manual fire watch, potentially supplemented by lighting and security cameras.

10.4 BC Building Code Part 2, Division C, Article 2.2.7.3 (Appendix), Coordinating Registered Professional - Division C, Appendix A should provide general direction to inform the owner and constructor that as part of the project planning, a CFSP is required by the BC Fire Code, Section 5.6, "Construction and Demolition Sites".

10.5 Adequate Water Supply for Firefighting - BCFC Article 5.6.1.4 should be amended to require the provision of a water supply for firefighting to the site as soon as combustible material arrives onsite. This may require early coordination with the City, Engineering Department, consultants and trades, or a temporary water supply for firefighting could be provided.

10.6 Fire Risk Assessment Management - BC Fire Code Division B, Appendix A 5.6 should add an explanatory note stating that in order to enable the development of practical risk reduction and/or prevention strategies at a construction site, it is essential that a risk assessment of potential fire hazards be carried out. This assessment should identify potential scenarios for ignition and propagation of a fire, and identify mitigation or prevention strategies for each identified scenario. This risk assessment should be a mandatory exercise, and the findings should become the basis of the detailed fire risk management adopted on site. The findings and recommendations would form the approach to risk mitigation in the construction fire safety plan. This task should be undertaken by the onsite fire safety coordinator, potentially assisted by a knowledgeable professional, and coordinated with construction personnel, consultants, the Fire Service and local Police Department.

When risks to adjacent structures, services, adjacent property, urban wildland interface or complex sites are identified, the analysis needs to consider potential fire risks to these adjacent exposures from the site under construction. For complex sites or higher risk sites, a review and analysis should be completed by a knowledgeable professional.

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10.7 Pre-Construction Meeting - It is recommended there be a suggestion within the BC Fire Code, Division B, Appendix A, for a pre-construction meeting upon issuance of building permit (this is a requirement in many local municipalities). This meeting should provide the opportunity to obtain clarification of expectations from the Authority Having Jurisdiction and an opportunity to clarify roles and responsibilities during construction and review the fire risk analysis. The Fire Department and/or local assistant to the fire commissioner should be invited to this meeting.

10.8 Construction Fire Safety Plan (CFSP) - Universal and detailed guidelines should be provided to the industry with respect to the development of a construction fire safety plan and the implementation of construction practices. Currently, the BC Fire Code outlines minimum key components of a fire safety plan, such as designation and organization of site personnel responsible for carrying out fire safety duties, emergency procedures to be followed, measures for controlling fire hazards, and maintenance procedures for firefighting facilities.

These minimum requirements should be expanded to include the requirement for submission and review of the CFSP by the responding Fire Department and/or the Authority Having Jurisdiction prior to construction commencing. The CFSP review process should include an analysis of the fire risk assessment and proposed actions to mitigate the risks, which will include unique hazards associated with the individual construction site. The type and severity of the risk will vary depending on factors such as the project size, complexity and proximity to other buildings.

Because of the changing nature of a construction site, a requirement to update the CFSP at regular intervals and make changes as necessary to address hazards associated with a particular construction phase should be considered. In addition, because arson is the most frequent cause of fire on construction sites, consideration should be given to a requirement for the CFSP to include measures specifically designed to address this risk.

The City of Surrey and the Office of the Fire Commissioner have both produced construction fire safety bulletins which contain detailed guidelines with respect to fire safety planning. These documents are reproduced in Appendix C. The universal guideline should capture the work done by the City of Surrey and the Office of the Fire Commissioner and include the roles and responsibilities to achieve the objectives of fire risk management at all construction sites. The following are some of the issues that should be addressed in the universal guideline:

- Pre-construction meeting with local Fire Department with on site fire safety coordinator.
- Identification of roles and responsibilities, emergency contacts and procedures.
- Review fire safety plan procedure for unique hazards and risk mitigation features.
- Review Fire Department access, onsite firefighting water supplies and available fire protection systems.
- An individual and an alternate should be assigned to implement and maintain key aspects of the CFSP, including:
 - Egress systems during construction,
 - Safety of the public,
 - Available hoists and elevators,

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- Storage of combustible and flammable liquids,
- Forming and stripping and waste material, (combustible load),
- Available onsite water supply for systems and hose stations,
- Available onsite water supply for firefighting for responding fire service,
- Written procedure and fire watch for hot works and record keeping,
- Written program for after hours security measures on site and contact information,
- Use and supervision of temporary heating equipment,
- Development of a policy for progressive installation of active and passive fire protection systems,
- Written policy for security measures on site,
- Identification and mitigation of fire risks to adjacent properties,
- Phased construction in an occupied building.

-

10.9 Development of Fire Protection Practice to Mitigate Risk during Construction - It is recommended that guidelines be established and reviewed with WorkSafe BC with respect to existing requirements for provision of passive and active fire protection at construction sites, as well as new concepts that should become industry practice. Industry practice cannot be legislated, but through a combination of legislation, comprehensive guidelines and education, these practices should become the standard practice for all sites. Key fire safety features/practices are summarized below:

- The provision of an unobstructed stair to each floor level, that discharges to ground level.
- Construction sequencing such that fire compartments, firewalls and the installation of closures through fire separations be given priority.
- Construction sequencing for "bottom-up" construction, to allow for fire protection systems to be progressively installed and to minimize the volume of unprotected combustible construction.
- Provision of fire separations between occupied areas and construction areas.
- The installation of security measures, such as provision of exterior lighting, fencing, potential use of security cameras, signage and protection of outdoor storage areas.
- Exposure protection for adjacent buildings, where required.
- Standpipe installation progressive with building construction.
- Charged sprinkler system when available and practical (active during the night, possibly off during the day if work is undertaken in that area). The sprinkler system should be provided with temporary water flow alarm/device deactivation.
- Onsite portable fire protection stations (use of garden hose in conjunction with, portable fire extinguishers and/or hose stations).
- Early installation of fire pumps where required for standpipes, hydrants and hose stations (important for highrise buildings).
- Requirement for watchman rounds on an hourly basis, and a means to verify that the security round has taken place and covered all areas.

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10.10 Provision and Maintenance of Fire Department Access - A Code conforming Fire Department access route to the construction site should be available as soon as work commences at the site. A drawing showing the layout of the site and the fire protection features such as location of standpipes, muster points, and fire stations should be available at the main Fire Department response point.

10.11 Management of Ignition Sources and Combustible Content - It is recommended that procedures be developed and implemented to control sources of ignition and also to prevent accumulation of combustible materials. These include:

Control of Ignition Sources

- Management of hot works through a formal program involving a permit process that documents and coordinates the use of hot works between management, the fire watch and the workers performing hot works.
- Management of roofing operations involving heat sources and hot processes.
- Management of temporary heating equipment.
- Management of fuel fired equipment.
- Designation and enforcement of permitted smoking areas on site.

Control of Combustible Content

- Implementation of a procedure for prompt waste material removal.
- Procedures for the storage and prevention of excessive accumulation of combustible building materials.
- Separation of combustibles from ignition sources by at least 3 m.
- Location and quantities of dangerous goods, including flammable or combustible liquids, and information relating to their specific hazards (Material Safety Data Sheets).
- The use of less hazardous materials where practical.

10.12 Responsibility and Enforcement - The current legislative requirements do not include specific procedures for monitoring compliance with fire safety requirements at construction sites. It is recommended that a method be established such that regular auditing of fire safety at construction sites is carried out. Ownership and responsibility for construction fire safety should be clearly established. This could be achieved through the requirement of regular field reviews undertaken by either the authority having jurisdiction or knowledgeable professional. Schedules similar to those that currently exist for auditing design compliance with Division B, Part 3 of the BC Building Code could be adopted for this purpose.

CFT Engineering Inc.

Construction Fire Safety

Prepared by,
CFT Engineering Increase
CAN 19 LANA BURGESS 35659 LAUSE 2012
Katarina Burgess, P.Eng., CP.
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Prepared by, CFT Engineering Inc.

for John Bolduc, BASc, EIT

JB/mc

Prepared by, CFT Engineering Inc. Brad Walton, AScT

C6357.03_R01Final

APPENDIX A

Minutes of Meeting

Meeting Date: Thursday December 8, 2011 (11:00 am to 1:00 pm)

Location: WorkSafe BC 6951 Westminster Highway, Richmond

Attendees:

	John Ivison	-	Wood Enterprise Coalition
	Steven Kuan	-	Building Safety Standards Branch
	John Nicol	-	Building Safety Standards Branch (via phone)
	Michael Carter	-	Manager, WorkSafe BC
	Alan Brose	-	WorkSafe BC
	Dave Stewart	-	WorkSafe BC
	Don Schouten	-	WorkSafe BC
	Dean Albrecht	-	WorkSafe BC
	Brad Walton	-	CFT Engineering Inc.
	Samir Eidnani	-	CFT Engineering Inc.
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Subject: Course of Construction Fire Safety

Prepared by: Samir Eidnani

The purpose of this meeting was to discuss the fire risk in projects and the potential for collaboration and enforcement strategy of fire protection measures related to safety and fire risk mitigation.

- 1. <u>Background</u> John Ivison provided information on the background of project. John noted that the existing guidance may require revisiting to address the practicality of onsite safety and the relationship to professional requirements. There is potential to improve response and provide intervention at an earlier stage of a fire occurring on a construction site. Some potential jurisdictional barriers exist, a change in process is anticipated via the current reference to Part 8 of BC Building Code. The intent is to have construction sites develop a practical plan rather than the token plans that are often provided currently. British Columbia is a leader in construction and the intent is to improve safety on construction sites.
- 2. Brad Walton noted that the requirements for Course of Construction Fire Safety planning currently applies to all construction sites regardless of the type of construction. The City of Surrey had hired CFT to assist in the development of a Bulletin on this issue and has implemented measures to improve Course of Construction Fire Safety in Surrey, a Course of Construction Fire Safety plan must be submitted concurrently with a Building Permit application and be accepted by the Fire Department. Clarification is required relative to enforcement of Course of Construction Fire Safety. The current requirements addressing
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|------------------------------------|------------------|
| Course of Construction Fire Safety | December 8, 2011 |

Course of Construction Fire Safety have been around for a long time, but may not always be practiced in the field. There is a sense that real construction practice does not incorporate many of the basic requirements of existing Course of Construction Fire Safety. Brad stated that, it is widely felt by industry stakeholders that this issue may potentially be coordinated with existing occupational health and safety requirements. In the past, enforcement has been the limiting factor and the result is that the intent of the various guidance is not being met. The Fire Chiefs' Association of British Columbia may be interested in supporting new initiatives.

- 3. John Ivison identified that there is a multiplicity of guidance on construction fire safety including the latest draft CWC technical Note and the existing fire Commissioner's bulletin. This however is not being translated into practical measures on site. Some sites have competing jurisdictions with Building Inspectors having jurisdiction on some sites and the Fire Service on others. Some Building Officials have limited knowledge of fire risks control and mitigation.
- 4. Brad Walton asked if there was potential for the WorkSafe Prevention Officer or the Onsite Safety Officer (qualified coordinator) to be engaged in the compliance role. Typically, the Fire Department will visit a small percentage of randomly chosen construction sites to review items for enforcement relative to construction safety. Not all construction sites through out the province are reviewed by the fire service.
- 5. John Ivison stated that there are resources available via the existing fire protection consultants, to produce reasonable Fire Safety Plans for sites specific designs. There are sufficient resources available for plan development; however, how can we implement responsibility for the site and ensure sufficient training to back up the existing requirements, it is suggested that support is required from WorkSafe BC. Any fire safety plan requires sufficient skill in fire risk analysis. Some plans have reached the lowest common denominator and may only be a sign with the site instructions on them. While there are sufficient resources to enable full and complete fire safety plans to be prepared, at some stage continuity has to be maintained on the site through the site safety manager or others. For instance fire protection consultants may not typically inspect the site and some continuity between the professionals and the site personnel may be necessary until all parties are fully up to speed.
- 6. Alan Brose of WorkSafe BC noted that under the Fire Service Act, the Local Assistant to the Fire Commissioner (LAFC) has a broad scope of responsibility to address these concerns and this is an item that they would suggest that Fire Inspectors would review. Additionally, Municipalities have Building Inspectors available as part of the Building Department who may be able to assist with enforcement.
- 7. Brad Walton noted the Fire Service presently does not have sufficient training programs or staff to review construction sites through out the province. This issue will be reviewed concurrently with the BC Fire Chief's Association for their comment.
- 8. John Ivison stated that typical Fire Service Training is presently concentrated on occupied buildings based on expected occupant loads and occupancy classifications, rather than construction sites. There is a risk to firefighters, and some fire services will not enter

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buildings that have fires during construction. The risk to working firefighters responding to this type of fire should be considered as increased risk associated with constructing these buildings.

- 9. Brad Walton stated that the BC Building Code and BC Fire Code cover the scope of the entire province and smaller municipalities are not provided with sufficient resources. Note that some Fire Services and local LAFC role are staffed with volunteers.
- 10. Brad Walton noted that the analysis of Fire Risk for some construction sites may require a professional fire risk analysis. During stages of construction, compliance with the BC Building Code requirements are not feasible due to the fact that the building fire safety measures are typically incomplete until the time of occupancy. For example, spatial separation requirements between buildings and property lines is reduced for a sprinkler protected building, or may be based on noncombustible cladding, or fire rated assemblies. During construction sprinklers are not charged or functioning until later stages such that the location of the building relative to neighboring buildings exceeds what would be permitted by the Building Code. Special risk such as hot work/spray painting and other issues require special attention.
- 11. Brad Walton noted the National Fire Protection Association has developed a detailed standard on Construction Fire Safety Requirements (NFPA 241) which has specific requirements for construction site egress and exiting, construction of fire compartments, installation of closures in fire separations and the requirement for water supply for construction site. Water supply to a construction site involves coordination with the Municipal Engineering Department and in many cases water supply is not available until well into the construction process. Separate permit is a possible solution to enable the water supply for the standpipe to be provided as intended by the fire code, at an early stage of the project.
- 12. Brad Walton noted that insurance companies are no longer a predominant player relative to fire protection; however, in the past they had provided detailed site specific requirements. Insurance requirements seem to be inconsistent because of the market forces with limited loss control or engineering offered.
- 13. John Ivison noted that there is significant litigation underway for the Remy Project, the fire which occurred in Richmond, BC recently. John Ivison noted that the specific cause of the fire has not been determined although it appears that hot work may have been identified as the cause. Although the fire code requires wet down of combustibles when they cannot be effectively shielded or covered, this is typically not being followed on site. The use of pressure washers to wet down will enable sparks to be extinguished without excessive wetting. As sites are open to the weather this minor wetting should not be a significant issue.
- 14. Brad Walton provided a summary of existing standards as required throughout BC including Part 8 of the 2006 BC Building Code, Sections 2.8, 5.2 and 5.6 of the 2006 BC Fire Code, and the BC Office of the Fire Commissioner's Bulletin for Fire Safety Planning for construction and demolition sites.
- 15. Alan Brose requested clarification for the term "partially occupied building". Brad Walton

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confirmed this is a state where phased occupancy for a building under construction may be provided. For example, one stage of the building is occupied by owners and the public while the adjacent stage of the same project is under construction. This can place new occupants at risk if special measures are not taken. John Ivison stated good engineering is vital to reduce risk for these unique situations.

- 16. Steven Kuan noted that the relationship between the onsite contractor and the onsite team and project consultants differs greatly between the type of project being built. A private public partnership project versus a design build project verses a standard construction project. All may require different relationships between contractor and consultants.
- 18. Brad Walton requested clarification for WorkSafe BC's intended involvement in this type of program. It was noted that there may be a potential for more specific fire prevention training as an opportunity for WorkSafe BC personnel
- 19. John Ivison noted that there is an opportunity to do more onsite to enhance worker safety, as major fatalities have occurred in other jurisdictions including noncombustible construction.
- 20. Alan Brose noted that unless specifically triggered, Fire Safety is not a primary focus of WorkSafe BC enforcement.
- 21. Don Schouten noted that WorkSafe BC tends to have specific requirements for workers safety on construction sites, such as where fall protection is required and work safe regulation does require access throughout a site, to ensure that an injured worker is acceptability evacuated from a site, and the regulations concerning may different aspects of safety.
- 22. John Ivison stated that risk in construction is increased, as we are now building higher buildings. This has raised concerns, primarily with the fire service. John noted that while there has always been an opportunity to work with WorkSafeBC this has not happened in the past. There is therefore an opportunity for coordination between many of the authorities on this subject.
- 23. Don Schouten noted that although fire prevention is not a prime focus of site inspections it may become important if obvious violations are noted. This will then bring it into focus as an important issue. Michael Carter suggested that there could be an opportunity for coordination for training with fire service personnel on this issue. Don Schouten noted that the owner of the construction site and the employer of trades needs to be motivated to address an increased level of fire prevention on-site and this would require a multi prong approach involving many parties. Don noted that there are significant secondary benefits to reducing risk on sites including more efficient work parties.
- 24. Brad Walton stated that there are opportunities for all stakeholders to work together on this issue in the future. WorkSafeBC therefore agreed to participate in the stakeholder consulting process.

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- 25. Alan Brose noted that there may be a potential for collaboration on industry training programs.
- 26. Brad Walton noted the majority of developers and construction groups are good operators; however, there is a bottom 10% who may have the same commitment or culture on site to address these issues.
- 27. Don Schouten noted that it is a responsibility of the General Contractor on the site to inform all the subtrades below them of these concerns. Brad Walton noted that the Building Code and Fire Code contains some measures related to Course of Construction Fire Protection; however, it would be beneficial to foster this relationship between WorkSafe BC and the British Columbia Fire Service relative to training opportunities to meet training needs of both fire service and site managers/ others.
- 28. John Ivison noted that it may be possible to produce new guidance, or to share new Bulletins with WSBC in order that they can distribute them through their own network.
- 29. Alan Brose noted that it may be possible WorkSafe BC to link to external resources to highlight the issues and to make it available to WorkSafe BC officers. Alan agreed, but noted that this issue must be carefully reviewed within the bounds of the WorkSafe BC mandate and they must be careful not to cross the bounds they are required to work within. John Ivison noted it is not suggested that WorkSafe BC would provide a comprehensive guide on the topic.
- 30. Don Schouten noted that, Course of Construction Fire Safety is a culture that must be encouraged onsite, in the same manor that site safety concerns have become widely embraced by the construction industry. Many small operators grow to build larger and larger buildings, but typically the smaller construction operators may not be up to speed with the type of culture to provide a safe construction site. Due diligence from all players, including WorkSafe BC, is required to achieve a culture that embraces construction safety. Dave Stewart summarized by saying that to the extent that it is within their jurisdiction, as requested. This issue will be reviewed and confirmed. He expressed that this is a take away issue for WorkSafeBC. Alan also requested a summary of the scope of this project. John Ivison will request this of FII.
- 31. John Ivison noted that the scope is very broad covering all construction including noncombustible construction, other than one and two family dwellings.
- 32. Don Schouten noted that WorkSafe BC has a Construction Safety Association which is funded by an industry levy where communication with industry personnel is possible. He suggested that a document that is brief and easy to understand and comprehend would be useful for addressing this issue through multiple channels, and additionally noted that WorkSafe BC has had a lot of success with communication using posters, in order to simplify the message, such that it may become the apart of the site culture.
- 33. John Ivison noted that the WSBC Safety Conference may be a good platform to launch any

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new initiatives on fire safety. Additionally an agenda of the wood industry is to reduce construction site fires as wood is considered to be a carbon captured material with benefits related to environmental concerns. The burning of the construction material releases huge emissions that was previously considered to be captured. The scope, extent and application of various guidance need to be assessed and clarified. Certain organizations would have an interest in seminars and information including the Construction Safety Association, which is supported by WSBC. It was also noted that sustainability is now an important part of the WSBC mandate.

- 34. Brad Walton noted that over the past two decades he has witnessed a very positive change relative to general safety procedures. There has effectively been a culture change on construction sites, and that it would be beneficial as a long term goal to have fire safety issues and fire protection have the same positive attitude shift.
- 35. John Ivison to Alan Brose, "Is there a requirement for the site personnel to review these items on the construction site?" Alan Brose states, "No. The Principal Contractor has responsibilities and the employee must comply with the Health and Safety Regulations Act. This is the responsibility for all employers including the General Contractor and all Sub-Contractors. Item 1.15.2.E. covers this responsibility for all employers." Brad Walton noted that the qualified Coordinator, as noted in Item 20.3(2), of the Occupational Health and Safety Regulation could address these items in the future if training was available.

The meeting closed with a consensus that the development community and WSBC share the same goals and there is the potential for closer cooperation in the future. The development of a PowerPoint presentation on construction fire risk to be presented at the annual safety conference is a possibility. There is recognition that risk is higher in the course of construction and this has been an accepted risk based on the previous incidence of fires in construction. Recent trends in arson and other risks suggest that more vigilance, preplanning and mitigation measures are necessary. The focus of WorkSafeBC is worker safety. Most of the fires have not resulted in injury or deaths. However, fires elsewhere in non-combustible construction suggest fatalities can occur. The risk is increasing due to demographic and other problems.

This meeting confirmed that there may be some overlap of authority between WorkSafe BC, Occupational Health and Safety regulation, the British Columbia Building Code and Fire Code requirements relating to construction fire safety. It was agreed that the primary responsibility lies with the owner of the construction site, as well as the general contractor. There is enforcement via the local Fire Department and municipal Building Department. Further analysis and development would be required to have a "qualified coordinator" whose duties are specified by OHS regulations addressing construction fire risk mitigation. This is not the current mechanism in the regulations although it is required in Vancouver.

Additional investigation and research would be necessary to determine further if there is a potential for WorkSafe BC/Fire Service joint educational programs, including industry stakeholders. Communication and information sharing through online links is a good start. The consensus was that it is a good idea to reinforce the requirements and the implications on site. Certain support may be available from Homebuilders, WEC, CWC, FII and other agencies to enable seminars to be

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designed and delivered in conjunction with the various stakeholders.

These minutes are intended to summarize the main points of the discussions at this meeting. If you believe that the minutes are incomplete or incorrect, please notify the undersigned immediately.

Prepared by, CFT Engineering Inc Samir Eidnani, P.Eng., CP

cc: All present

SE/kd

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APPENDIX B



Minutes of Meeting

Meeting Date: Wednesday May 30, 2012

Location:	CFT Engineering Inc. Offices, 1901 Rosser Avenue, Bu	ırnaby, BC
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Attendees:	John Caviglia	-	City of Surrey Fire Department (FCABC)
	Dave Burgess		City of North Vancouver Fire Department (FCABC)
	Gordon Richards	-	Gage-Babcock & Associates (AIBC)
	Frank Durante	-	City of New Westminster (BOABC)
	Tom De Wolf	-	Axiom Builders Inc. (BCCA)
	Bill May	-	Protection Engineering (APEGBC)
	Doug Wilson	-	Peak Construction Group (BCCA)
	Brad Walton	-	CFT Engineering Inc.
	Tina Burgess	-	CFT Engineering Inc.
	John Bolduc	-	CFT Engineering Inc.
Subject:	Construction Fire S	afety Res	search and Industry Evaluation

Prepared by: John Bolduc/Tina Burgess

The purpose of this meeting was to review the draft construction fire safety research report in order to obtain comments, specifically with respect to the recommendations proposed in the report.

1. <u>Background</u> - Copies of the technical research report were circulated and approximately 45 minutes was provided for a brief review. Brad Walton lead a general discussion and overview, providing a summary of the research and literature review culminating to the recommendations which were the objective of the research project. The 12 specific recommendations were presented and discussed. The discussions for each recommendation are summarized below:

Section 10.1, Linking of Construction Fire Safety within the BC Building Code and Fire Code

2. There was general agreement that there is a need to raise the awareness of BC Fire Code requirements for construction fire safety within the BC Building Code. The link between the BC Fire Code and the BC Building Code with respect to construction fire safety is currently located in Part 8, whereas most professionals who work within the fire and life safety field are generally more familiar with Part 3. There was also some discussion on the issue of water supply sizing. Water supplies are addressed as a separate recommendation.

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- 3. Brad suggested that the section on CRP responsibilities might also be a means of linking the BC Building Code and BC Fire Code requirements. Gordon agreed with the recommendation in that the Code should bring forward attention to construction fire safety. However, he expressed concerns relating to liability for the CRP, and the need for a discussion regarding liability later on.
- 4. Brad clarified that this recommendation is specific to the appropriate location of the reference in the BC Building Code to the BC Fire Code with respect to construction fire safety, and on this point it was generally agreed that this was a good idea.

Section 10.2, Assignment of a Fire Safety Coordinator

- 5. The question was asked whether there is currently a training program or certification program available for a fire safety coordinator. The BCIT course has been shut down and the JI program is being redeveloped. It was noted that the requirement for adequate training may be specified by WorkSafe BC.
- 6. Brad discussed how the responsibilities of a fire safety coordinator are typically fulfilled by a person who also has other roles onsite. Doug stated that there is an assigned CSO on every site that his company is involved with.
- 7. There was general agreement with respect to the benefits of having an assigned fire safety coordinator. Brad stressed the need for a single point of contact with the AHJ and Fire Department. He also identified that the fire safety coordinator must be a knowledgeable person for larger projects or those with specific risks. Frank outlined the necessity for auditing by the AHJ to evaluate the quality/performance of a fire safety coordinator.

Section 10.3, Fire Warning and Alarm

- 8. Brad noted that a considerable amount of fires on construction sites are incendiary. It was commented that the requirement for an out-of-hours fire watch is generally a condition of the insurance policy, but that the requirement should be clearer in the Fire Code.
- 9. Dave suggested that specifics be added to this requirement. Brad responded that the best means of implementation of this recommendation is site specific, but that suggested methods (and specific) should be provided in a guideline, produced by the Office of the Fire Commissioner or BC Fire Chief's Association.

Section 10.4, BC Building Code Part 2, Division C, Article 2.2.7.3 (Appendix), Coordinating Registered Professional Responsibilities

10. This proposed recommendation generated a discussion regarding how the legislated requirements for construction fire safety should be most appropriately implemented and audited. Although there was agreement that the mechanisms for implementing and auditing construction fire safety practices are not consistently applied in BC, and there is a need to develop procedural methods to address the adequacy of construction site fire safety, there was no consensus on how this could best be achieved.

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- 11. Gordon stated that this role is typically the responsibility of the AHJ, and that the CRP for a project may not have the required expertise to develop or audit construction fire safety plans and procedures. Dave mentioned that the Fire Department/AHJ identifies construction fire safety as the responsibility of the owner. Tom De Wolf provided his opinion that the contractor should be responsible for construction fire safety planning.
- 12. Brad noted that an important function of the preliminary assessment is to address potential exposure to adjacent sites. John C suggested that the wording of the recommendation to be changed to <u>exposure</u> as opposed to <u>adjacent structure</u> to make it clear that exposures may not be limited to adjacent structures.
- 13. Brad clarified that the recommendation addresses two issues: exposure to adjacent properties and construction fire safety at the site, and suggested, based on this discussion, they should be separated.
- 14. Gordon explained that the schedule requirements are currently applicable only after occupancy, and voiced his concerns of requiring the architect/CRP to take responsibility during the construction phase. Bill echoed this concern.
- 15. Tina stated that it is important that the responsibility for construction fire safety is clearly defined to reduce the risk that requirements for construction fire safety are not clearly identified or implemented.

It was agreed that Brad, Gord and Bill would try to refine this recommendation to address the concerns raised.

Section 10.5, Adequate Water Supply for Firefighting

- 16. There was consensus that an adequate water supply should be available early on in the construction process. Brad described how water supplies are given a high priority for construction sites in the United States, and are generally available as soon as combustibles start accumulating.
- 17. Brad also noted that one of the issues in BC is that there is often a time lag between the commencement of construction and obtaining the clearance from engineering departments to allow connections to be made to water supplies. Doug agreed that the hold up with municipal engineering departments is a large concern because the "garden hose" water supply is often the only supply available, even when the site is approaching occupancy. Doug also mentioned that the requirement may be unenforceable because of the imposed slowdown to the construction schedule.
- 18. Brad suggested that there is more than one way to provide a water supply, for example a forestry hose.

19. Frank suggested that a change in the Code requirement would result in a change to the process for local engineering departments.

Section 10.6, Fire Risk Assessment Management

20. Gord expressed his concern with the reference to a CRP with respect to the fire risk assessment. However, it was generally acknowledged that there is a need for a formal requirement to conduct a risk assessment prior to construction commencing.

Section 10.7, Pre-Construction Meeting

21. This was generally accepted as a valuable recommendation. Brad pointed out that early involvement of the police department may provide an incentive for more active police surveillance at the site.

Section 10.8, Construction Fire Safety Plan (FSP)

- 22. Brad stated that a new guideline similar to the one developed by the City of Surrey could be administered by the Fire Commissioner's office. Dave mentioned that alternatively the administration could be through the Building Policy Branch.
- 23. It was acknowledged that adequate training on how to develop a construction fire safety plan is crucial. Doug Wilson noted that training is normally provided on site. Frank mentioned that training is not usually an issue with experienced construction companies, but legislated requirements should address the lowest common denominator.
- 24. Brad suggested the importance that openings in firewalls be closed at night. Gord mentioned that in practice the doors are typically installed last. Brad suggested that even string closures for doors could provide the necessary protection for doors in firewalls. Doug suggested that this requirement may be impractical because of the extension cords and air hoses that typically pass through these doors.
- 25. Brad suggested that this may be one of the requirements which might benefit the wording <u>where practical</u>, and that goal should be to change industry practice. Doug stressed the need for careful wording, because what might be observed as a "where practical" Code article might be applied more rigidly in the future. Frank suggested with some confidence that the industry will evolve to work with new obligations.
- 26. The necessity for industry practice changes with respect to the development of the construction fire safety plan was generally acknowledged.

Section 10.9, Development of Fire Protection Practice to Mitigate Risk During Construction

27. Gordon mentioned that the use of combustible firewalls may have contributed to the severity of some of fires at construction sites.

- 28. Frank stressed the importance of a qualified fire watch. Brad suggested that it should be required to have security patrols that use punches or other record devices in order to potentially audit a fire watch.
- 29. Dave explained the advantages of cross-municipality consensus and application. He also noted the importance of coordination of the AHJ and Fire Department.
- 30. Brad explained how the Fire Code used to have a more intricate scheme for fire watch. He also explained how hot work permit programs were a part of what was required by the Fire Code, but also by insurance providers (and records kept of hot work permits on site).

Section 10.10, Provision and Maintenance of Fire Department Access

- 31. The group agreed on the importance of the requirement for maintaining Code conforming access to the site. Brad mentioned that Fire Department access should be shown in preliminary planning.
- 32. Dave explained that Fire Department access goes further than fire protection on construction sites. Access routes need to be maintained even at the excavation stage, since emergency response also include rescue and medical emergencies.

Section 10.11, Management of Ignition Sources and Combustible Content

33. This was generally acknowledged as "common sense". It was agreed that formal procedures should be common industry practice.

Section 10.12, Responsibility and Enforcement

34. Dave spoke to the resource implications that would be a part of required auditing. Brad responded that it would be up to the AHJ how auditing would be managed. Frank suggested that auditing could be limited to receiving reports via fax or email. Dave suggested that the wording specifically say <u>may be audited</u>. John C mentioned that small municipalities could benefit from some auditing from the CRP. More discussion/suggestions with respect to how to allocate responsibilities with respect to auditing and implementation of construction fire safety requirements is needed.

General Discussion/Conclusion

35. Doug Wilson expressed that it would be advantageous if the implementation of this concept did not require another new consultant on site. The meeting was adjourned and it was requested that any additional comments be submitted to CFT within one week.

These minutes are intended to summarize the main points of the discussions at this meeting. If you believe that the minutes are incomplete or incorrect, please notify the undersigned immediately.

Prepared by, CFT Engineering Inc.

Brad Walton, AScT

cc: All present

JB/mc

C6357.03_MOM03

APPENDIX C



OFC BULLETIN

April 17, 2009

Fire Safety Planning for Construction and Demolition Sites

The purpose of this Information Bulletin is to provide the construction and demolition industry with an easy to follow checklist to assist them in meeting the fire safety requirements of British Columbia's Building and Fire Codes. The goal is to prevent fires in and around construction/demolition sites and reduce the fire risk to life and property.

This bulletin only covers provincial building and fire code requirements. Specifically:

- British Columbia Building Code 2006, Division B, Section 8.1 makes reference to the British Columbia Fire Code (BCFC) 2006, Division B, Section 5.6 which applies to buildings, parts of buildings, and associated areas undergoing construction or demolition operations, including renovations.
- BCFC, Division B, Section 5.6.1.2 (1) states: "Prior to the commencement of construction/demolition operations, a fire safety plan shall be prepared for the site."

The owner or owner's authorized agent is responsible for carrying out the provisions of the BCFC, which includes establishing a work site fire safety plan to ensure that:

- Fire hazards will be controlled.
- Emergency responders will be notified of a fire emergency.
- Emergency responders will not be delayed in carrying out their duties.
- Firefighting operations will be managed effectively, without unnecessary delays.
- Designated supervisory staff will be appointed and organized to respond to fire emergencies.
- Instructions including schematic diagrams describing the type, location and operation of building fire emergency systems will be established.
- Building facilities, systems, equipment and devices will be properly inspected and maintained.

The fire safety plan not only reflects the unique characteristics of building, operation and construction techniques (including the construction/demolition trades), but also considers the available firefighting infrastructure. For this reason, the fire safety plan must be prepared by the owner or owner's authorized agent in cooperation with the <u>local fire department</u> and other applicable regulatory authorities.

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Prior to commencing any work at a site, it's important for the owner or authorized agent of the owner to:

- ensure they are also in compliance with the laws, regulations and requirements of the BCBC, the BCFC, local government and other regulatory authorities; and
- contact the local fire department and other regulatory authorities such as the <u>British</u> <u>Columbia Safety Authority</u> and <u>WorkSafeBC</u>.

Fire safety planning and risk management assessments of the site done prior to, during and after building construction/demolition is completed, are essential to prepare for and manage fire hazards. Planning and assessment will identify and lead to methods and processes that will minimize or contain potential fire hazards. All site safety activities should be coordinated through the planning and assessment process.

BCFC provisions are included in the fire safety plan and are applied depending on the project's scope and conditions of the site, e.g. the size and type of the building and its proximity to adjacent buildings.

At a minimum, a fire safety plan should include the following information:

1. Emergency procedures and information needed to plan for an emergency:

- □ Who is the designate and backup person responsible to sound the fire alarm (horn)?
- □ Who is the designate and backup person responsible to notify the fire department (9-1-1)?
- □ Is instruction given to site personnel on the procedure to follow when an alarm is sounded?
- □ Are exit routes clearly visible within the site and on all floors?
- □ Is the muster point (or meeting place) known by all site personnel?
- □ Is there a list of on-site personnel, and is it updated and current? (Can everybody on-site be accounted for?)
- □ Are there assigned personnel to meet the fire department upon arrival and give information, such as the location of the fire or injury?
- □ Are there persons assigned as site fire wardens (ensuring various trades are represented)?
- □ Are there personnel directed and trained to confine or control the fire?

2. Training of site personnel on evacuation procedures:

- □ Is site orientation provided?
- □ Are regular site fire safety meetings a part of regular safety meetings?
- □ Are simulated fire drills conducted when applicable and warranted?

3. Assigned site personnel must be responsible to install and maintain fire safety duties such as:

- □ Controlling combustibles on the site and around the buildings.
- General site housekeeping.
- Removing excess pallets, garbage/waste material and other combustibles on a regular basis.

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- □ Maintaining separation of combustibles from open flame devices.
- Maintaining clear unobstructed access route(s) for fire department apparatus and to fire hydrants.
- Designating and maintaining at least one exit from every floor.
- □ Separating access routes from materials stored on-site, combustibles, etc.
- Parking of vehicles or delivery trucks should not obstruct fire department access to the site, and
- □ adjacent buildings (off-site parking and storage may be considered).

4. Firefighting Services – Hydrant, Siamese Connection, Sprinkler, Access Route:

- □ Are they installed, tested and activated at the start of construction?
- □ Are firefighter access route(s) to the building provided?
- Are firefighting services (standpipes, hydrants) maintained and accessible?
- □ Do drawings provided to the fire department show the location of firefighting systems as they become operational?
- □ Is the site address sign visible and legible to emergency crews form the street? (if they must be provided according to bylaw)

5. Fire Extinguishers:

- □ Is there sufficient quantity and type on-site? Such as:
 - 2-A:10-B:C on movable equipment?
 - 4-A:40-B:C in all other locations?
- \Box Is the servicing up-to-date (within the last year)?
- □ Are they provided at or near fuel operated equipment?
- □ Are they mounted with proper signage at exit locations within the required travel distance?
- Are they adjacent to any hot works operations (e.g. cutting torch, welding, torching, etc)?

6. Hot Works Operations:

- □ Is the area clear of flammable and combustible materials?
- □ Is a fire watch assigned during a hot works operation and for 60 minutes after its completion?
- □ Is there a final inspection of the hot works area 4 hours after completion?
- □ Are the hot works in the proximity of combustible or flammable materials?
- □ Have provisions been made for protection of such materials by non-combustible materials, thermal barrier or other means?
- □ Is the work being performed by trained or certified personnel?
- □ Is a fire extinguisher present at all times? Such as:
 - 2-A:10-B:C on movable equipment?
 - 4-A:40-B:C in all other locations?
- □ Is proper ventilation provided as required?
- □ Are the hot tar pots on-site complete with fire extinguishers, trained personnel, and located away from combustible materials?

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7. Flammable and Combustible Storage:

- □ Are flammable and combustible liquids properly stored, handled and used in and around the building?
- Are non-petroleum based compressed gases properly stored, handled and used in and around the building?
- □ Is the storage area separated from combustible material by 3 metres?
- □ Is the storage area locked and vented?
- □ Is the storage area protected from vehicular/ industrial motorized traffic?
- Do containers and/or storage areas have proper signage/placards in place?
- Is there a current or updated list of dangerous goods on-site such as material safety data sheets (MSDS), as per the <u>Workplace Hazardous Materials Information System</u> (WHMIS)?
- Are portable extinguishers provided in close proximity to storage and work areas such as:
 - 2-A:10-B:C on movable equipment?
 - 4-A:40-B:C in all other locations?
- □ Is the storage area away from egress and access routes to the site?

8. Electrical Installations and Petroleum Gases:

□ Do the electrical installations, storage and use of petroleum gases comply with the requirements of the Safety Standards Act and pursuant regulation? (contact the British Columbia Safety Authority 1-866-566-7233)

9. Security:

- □ What type of on-site security is provided: e.g. locked gate, monitored alarm and/or CCTV, 24 hour or nightly walk around?
- Do security personnel have knowledge of and understand their role in the site's fire safety plan?
- □ Can the fire department effectively communicate with the security personnel during an emergency?
- Do security personnel have access (keys) to locked areas?

10. Contact Personnel:

- □ Is there a list of names and telephone numbers of persons to be contacted during and after normal operating hours or in the event of an emergency?
- Are the contact personnel able to respond in a timely fashion?
- □ What is their estimated response time?

11. Building Diagrams:

- □ Are diagrams available on-site? These diagrams should indicate:
 - Plans of each floor area;
 - Muster point(s);
 - Location of nearest hydrant(s);
 - Location of fire protection equipment;
 - Exit paths; and,
 - Service rooms.

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The fire safety plan must be reviewed and updated as construction/demolition progresses and then periodically afterwards to provide the greatest value. The plan that is developed for a building construction site should evolve into the plan that will be used to maintain and protect the building and its occupants after completion. It's very important that all supervisory staff remain familiar with the plan throughout the process so they are familiar with how it pertains to their responsibilities.

It may be beneficial to owners to obtain the services of a consultant who specializes in fire safety planning. This consultant would oversee the fire safety plan's development and implementation. This is especially useful to owners who have neither the time nor the expertise to develop their own plan as well as when a fire department isn't available to them.

Contact: Stephen Watt Codes and Standards Coordinator 1-888-988-9488

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The contents of this OFC Bulletin are not intended to be provided as legal advice and should not be relied upon as legal advice.

SURREY FIRE SERVICE

Construction Fire Safety Plan Bulletin



The B.C. Fire Code requires building owners/contractors to comply with the requirements of the BC Fire Code 5.6 Construction and Demolition Sites



CITY OF SURREY FIRE SERVICE

8767 132 Street Surrey B.C., V3W 4P1 Fire Prevention: 604-543-6780 Fax: 604-594-1237 www.surrey.ca



This bulletin is provided by the Surrey Fire Service to assist owners, contractors, and workers on the requirements of a Construction Fire Safety Plan (CFSP). The document is intended to provide a brief overview of existing information that has previously been developed. Each site and construction project will have site specific issues that will need to be addressed in the CFSP.

During the construction phase, a building is at its most vulnerable state. A CFSP is a part of a system that is intended to protect the building during this vulnerable stage. Once a building is completed, there are a number of life safety systems in place to protect the building and its occupants. These include fire alarm systems, sprinklers, and fire compartmentalization. During construction these fire safety measures may or may not be installed or fully operational. Therefore, the CFSP must address hazards that could be present during construction.

The leading causes of fire in buildings under construction or demolition are:

- Incendiary/suspicious events.
- Smoking on site.
- Open flames/embers.
- Heating equipment.

While minimizing the fire hazards at a construction site, the CFSP must also take into account the impact a fire would have on the neighboring building(s).

It is the owner's responsibility to develop a Construction Fire Safety Plan that meets the requirements of the BC Building and

Revised July 29, 2011

Fire Codes and the referenced standards and publications listed within this bulletin. It may be beneficial for owners or contractors to obtain the services of a Fire Safety Planning specialist to assist in ensuring an adequate plan is developed for their site.

In order to reduce hazards and the spread of fire, the following minimum requirements need to be reviewed and incorporated in your construction fire safety plan.

Fire Safety Plan Minimum Requirements

Section 5.6, Division B of the BC Fire Code requires that for any building or parts of buildings undergoing construction, renovation, or demolition operation, a fire safety plan be prepared for the site prior to any work commencing. Part 8, Division B of the BC Building Code provides requirements for safety measures at construction and demolition sites. The fire safety plan shall be prepared by the owner or owner's authorized agent in cooperation with the Surrey Fire Service and shall be reviewed after any significant changes to the project. The minimum requirements for a fire safety plan shall include the following (BCFC, Div B, 5.6.1.2/2.8.2.1):

- 1) The designation and organization of site personnel to carry out fire safety duties.
- 2) The emergency procedures to be followed in the event of a fire, including:
 - a) sounding the alarm,
 - b) notifying the Fire Department,
 - c) instructing site personnel on the procedures to be followed when the alarm sounds,
 - d) firefighting procedures
- 3) Measures for controlling fire hazards in and around the building.
- 4) A maintenance procedure for firefighting facilities.
- 5) Documents, including diagrams, showing the type, location and operation of the building fire emergency systems.
- 6) List of all emergency response numbers and list of names, addresses, and telephone numbers of persons to be contacted during and after normal operating hours in the event of an emergency.

Summary of Part 8, Division B, BC Building Code - Safety Measures at Construction and Demolition Sites

Part 8, Division B of the BC Building Code provides details for protection of the public and adjacent properties. Prescriptive requirements related to construction sites are addressed in the following Subsections:

- 8.2.1. Fencing and Barricades
- 8.2.2. Excavation
- 8.2.3. Use of Streets or Public Property
- 8.2.4. Direction of Vehicular Traffic
- 8.2.5. Waste Material

Unique Details for Construction Fire Safety Plans

Since projects vary in size and complexity, it is unreasonable to expect that a single template can serve to develop a CFSP for all projects. A more detailed CFSP may be necessary to meet the minimum fire safety requirements. A project specific CFSP will address items such as phases of

2

construction (excavation, structure, etc...) or phased occupancies. The degree to which additional mitigating risk reduction measures are applicable will depend on the project size, scope, proximity to other buildings, and unique site conditions.

Fire Safety Training

The assignment of a WorkSafe BC qualified coordinator as required by the WorkSafe General Conditions Occupational Health & Safety (OHS) regulation should be complete prior to construction. The qualified coordinator should also address construction fire safety concerns and maintain a site copy of the accepted CFSP. Workers should be kept up to date with emergency procedures as per WorkSafe General Conditions OHS Part 4:

4.16 Training

- 1) All workers must be given adequate instruction in the fire prevention and emergency evacuation procedures applicable to their workplace.
- 2) Workers assigned to firefighting duties in their workplace must be given adequate training, by a qualified instructor, in fire suppression methods, fire prevention, emergency procedures, organization and chain of command, firefighting crew safety and communications applicable to their workplace.
- 3) Retraining for firefighting duties must be provided periodically, but not less than once a year.
- 4) A worker not covered by Part 31 (Firefighting), who is assigned to firefighting duties, must be physically capable of performing the assigned duties safely and effectively before being permitted to do them.

Enforcement

Course of construction fire safety falls under numerous jurisdictions. Therefore, violations may result in enforcement from a number of different regulatory bodies or authorities, including insurance providers. Enforcement for violations may include:

- Issuance of order by Surrey Fire Service under the Fire Code,
- Issuance of a Stop Work Order or removal of Building Permit by the Building Division,
- Removal of Business License,
- Action by WorkSafe BC

Features for Coordination

- 1. Passive Protection:
 - 1.1 Provision at each floor level of an unobstructed stair discharging to grade level.
 - 1.2 Coordination during construction of fire compartments and fire walls.
 - 1.3 Management of fuel fired equipment.
 - 1.4 Management of temporary heating equipment. All temporary heating equipment shall be listed and used in accordance with manufacturer's instructions.
 - 1.5 Management of roofing operations involving heat sources and hot processes. These

operations must be conducted by a qualified agency.

- 1.6 Maintaining a high standard of Housekeeping on site.
- 1.7 Providing and maintaining a Fire Department access to site complying with BC Building Code Division B Subsection 3.2.5. (BC Fire Code Division B, Article 5.6.1.4)
- 1.8 Providing 1 h fire separation between occupied areas and areas under construction (BC Fire Code Division B, Article 5.6.1.14).
- 2. Fire Protection:
 - 2.1 Activated (charged) standpipe installed progressively with building construction.
 - 2.2 Activated (charged) sprinkler system upon installation of ceiling membrane. Where practical, the system should be activated when construction is not taking place but may be turned off during operating hours.
 - 2.3 Onsite fire protection stations that may include portable fire extinguishers possibly supplemented by garden hose for ease of use by all personnel.
 - 2.4 Early installation of fire pumps where required for fire protection water supply.
 - 2.5 Coordination such that the municipal water supply is available onsite when grade level construction begins (required by NFPA 1, Article 16.4.3.1.1 upon accumulation of combustible material).
 - 2.6 "Watch" during demolition or construction with partially occupied buildings (BC Fire Code Article 5.6.1.15).
 - 2.7 Fire alert warning system (Article 5.6.1.9).
 - 2.8 Temporary heating equipment to comply with Division B Articles 5.6.1.11 and 12 of the BC Fire Code.
 - 2.9 Fire watch during hot works operations and for a period not less than 60 minutes after, and a final watch 4 hours after completion (BC Fire Code Division B Articles 5.2.3.1 and 5.2.3.3).
- 3. Additional Items:
 - 3.1 Install doors in firewalls, close the doors during non-operating hours, and put doors on fusible links during construction.
 - 3.2 Provide temporary water flow alarms on sprinklers.
 - 3.3 Timing for issuance of sprinkler permit (sprinkler drawings must be reviewed by numerous consultants and accepted by Municipal Authorities prior to issuance of permit and commencement of installation of sprinklers).
 - 3.4 Exposure protection sprinkler systems.
 - 3.5 Completion of a pre-construction meeting with the City of Surrey Fire Department prior to start of construction.

4

3.6 Development of a fire risk assessment for more complex sites. This will identify time frames and processes where risk may be greater and extra measures may be required (in accordance with the Society of Fire Protection Engineers guidelines).

Referenced Standards and additional North American Standards/Guides which relate to course of construction fire protection are listed below:

Existing Referenced Standards/Bulletins

- Section 2.8, 5.2 and 5.6, Division B of the 2006 BC Fire Code
- Part 8, Division B of the 2006 BC Building Code
- Office of the Fire Commissioner (OFC) of BC, OFC Bulletin- April 17, 2009
- Standata Fire Code Interpretation FCI-09-03 (AFC)

Further Resources and Additional Recognized North American Standards

- NFPA 1, Fire Code.
- NFPA 101,Life Safety Code
- NFPA 5000, Building Construction and Safety Code
- NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations
- SFPE Engineering Guide to Fire Risk Assessment

For complex sites where a more robust fire safety plan is required, review of further additional standards is recommended; see relevant items from NFPA 241 below.

Summary of NFPA 241, Standard for Safeguarding Construction, Alteration and Demolition Operations

NFPA 241 provides a comprehensive guide for construction, alteration, and demolition operations. This standard provides guidance on the construction of temporary offices and storage areas, typical processes and hazards such as temporary heating equipment, flammable and combustible liquids and flammable gas storage and handling, temporary electrical work and lighting, and requirements for fire protection. Some significant items to note from NFPA 241, Chapter 7:

- As noted in Article 7.5.6.1, in all buildings over one storey in height, at least one stairway shall be provided that is in usable condition at all times. This stairway is required to be extended upward as each floor is installed for new construction, and must be maintained for each floor remaining during demolition.
- As noted in Article 7.6, in all new buildings in which standpipes are required or where standpipes are existing in a building to be altered or demolished, such standpipes shall be maintained in conformity with the progress of the building construction in such a manner that they are ready for use.
- As noted in Article 7.7.4, at least one approved fire extinguisher shall be provided in plain sight on each floor at each usable stairway, as soon as combustible material accumulates.

Chapter 8 of NFPA 241 provides details on safeguarding construction and alteration operations, and provides comments on scaffolding, shoring and forms, construction material and equipment storage,

building separation walls such as fire cut-offs and temporary separation walls. Some significant items to note from NFPA 241, Chapter 8:

- As noted in Section 8.2.5, portable fire extinguishers or charged hose lines are required during forming/stripping operations using combustible forming material.
- As noted in Section 8.6.1, firewalls and exit stairways where required for the completed building, shall be given construction priority for installation. Fire doors with approved closing devices and hardware shall be installed as soon as practical, and preferably before combustible material is introduced. Fire doors shall not be obstructed from closing.
- As noted in Article 8.7.2.1/.2, a water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material accumulates on the site, and there shall be no delay in the installation of fire protection equipment.
- As noted by Article 8.7.2.3, where underground water mains and hydrants are to be provided, they shall be installed, completed, and in service prior to construction work.
- As noted by Article 8.7.3.1, if automatic sprinkler protection is to be provided, the installation shall be placed in service as soon as practicable.
- Section 8.7.4 discusses the standpipe requirements.

Conclusion

The protection of a construction site from fire is paramount to the owners, contractors, the community and the Surrey Fire Service. The implementation of this bulletin can assist in reducing the inherent risks associated with construction sites.

The CFSP should take into account any potential hazards that may be present during the building's construction period. The CFSP should have the potential to be developed into the final Fire Safety Plan for the building and the occupants of the building upon completion.

It is the owner's responsibility to ensure the construction fire safety plan is developed for each project. When important components of the approved construction fire safety plan need to be altered, the owner or owner's authorized agent must consult with the Surrey Fire Service.

Please review the information within this bulletin as well as the attached checklist when developing a fire safety plan.

Questions regarding Construction Fire Safety Plans can be directly addressed to the Surrey Fire Prevention Office at 604 543 6780.



Surrey Fire Service Fire Prevention Division

Name: Date: Address: Building Permit #:

Item #	Description	Acceptable	NA
0.0	General Requirement:		
0.1	Name and contact of fire safety director (Should be Onsite WCB Qualified Coordinator)		
0.2	Name and contact of owner, all consultants, and contractors		
0.3	Updated List of Site Personnel		
0.4	Site address, posted and visible from street		
0.5	Contact numbers for nearest hospital		
0.6	Contact numbers for emergency services - police/fire/ambulance (911)		
0.7	Site Schematic showing the following:		
	Existing and proposed buildings		
	Site office		
	First aid station and safety station		
	Location of fire extinguishers		
	Location of emergency air horn		
	Hazardous materials storage		
	Emergency vehicle routes in and out of site		
	Emergency exits from site		
	Location of fencing and barricades		
	Fire department connections and hydrants		
	Designated gathering location		
	Parking for vehicles and delivery trucks		
0.8	Emergency procedures in the event of a fire		
0.9	Training of Site Personnel on Excavation Procedures		
0.10	Access for Firefighters (BC Fire Code 5.6.1.4)		
	Clear access to fire hydrants, portable extinguisher,		
	and connections maintained at all times		
0.11	Portable Fire Extinguishers (BC Fire Code 5.6.1.5)		
0.12	Provision for Egress (BC Fire Code 5.6.1.8)		
	At least one usable exit at all times		
0.13	Control and Removal of Waste Materials (BC Building Code 8.2.5)		
0.14	Water Supply (NFPA 241 8.7.2)		
	No delay in installation of fire protection (standpipe or sprinklers)		
0.15	Completion of Site Fire Safety Meetings and Fire Drills (BC Fire Code 2.8.3)		
0.16	Prohibition of Smoking in Areas with Potential for Ignition (BC Fire Code 2.4.2)		



Surrey Fire Service Fire Prevention Division

Item #	Description	Acceptable	NA
1.0	Excavation Phase:		
1.1	Building Services to be Shut - Off (BC Fire Code 5.6.2.1)		
	Existing gas, electrical, water, steam and other services		
	shall be shut off, capped, and labeled		
1.2	Building Services to be Maintained (BC Fire Code 5.6.2.2)		
	For services remaining during excavation		

Item #	Description	Acceptable	NA
2.0	Structure to Grade:		
2.1	Scaffolding, Shoring, and Forms (NFPA 1 16.4.1) Combustible forms shall not accumulate		
22	Forming and Stripping (NFPA 241 8.2.5) Fire extinguishers or charged hose lines are required		

Item #	Description	Acceptable	NA				
3.0	Superstructure:						
3.1	Standpipe System (BC Fire Code 5.6.1.6) In conformance with BC Building Code Subsection 3.2.5, installed progressively						
3.2	Fire Warning System (BC Fire Code 5.6.1.9)						
	Automatic or Manual						
3.3	Exit Stairs (BC Fire Code 5.6.1.8 & NFPA 241 7.5.6.1)						
	At least one stairway usable at all times						
3.4	Sprinkler System (NFPA 241 8.7.3)						
	Installed as soon as practical						
3.5	Fire Cutoffs (NFPA 241 8.6.1)						
	Firewalls and exits stairs given construction priority						
	Fire doors with required closures, closing devices and hardware to be installed as soon						
	as practical and kept closed or placed on fusible link						

Item #	Description	Acceptable	NA
4.0	Additional Requirement for Certain Applications:		
4.1	Phased Occupancy Adjacent to Area Under Construction (NFPA 241 8.6)		
	Adding spatial separation, exit exposure etc. (BCBC)		
4.2	Fire Separation from Occupied Areas (BC Fire Code 5.6.1.14 & NFPA 241 8.6.2)		
	Minimum 1 hour fire separation if building is partially occupied during construction		
4.3	Watch/Site Security (BC Fire Core 5.6.1.15)		
	When a portion of the building is occupied during construction		
4.4	Temporary Heating Equipment (BC Fire Code 5.6.1.11 and .12)		
1	Exhausts 500 mm away from combustible materials,		
	Exhaust piping kept 150 mm away		
4.5	Combustible and flammable liquid storage and handling (BC Fire Code 5.6.1.17)		
	In conformance with BC Fire Code Part 4		
4.6	Fencing and Barricades (BC Building Code 8. 2.1)		
	To protect the public, maintain access		
4.7	Safety of Streets (BC Building Code 8.2.3 and .4)		
	Also traffic directing		
4.8	Torch-Applied Roofing Systems (NFPA 1 16.6)		
L	Permits shall apply with Section 1.12		
4.9	Cutting and Welding Operations (BC Fire Code 5.6.1.7)		
	Shall conform to BC Fire Code section 5.2		
4.10	Hoists and Elevators		
	Available to the fire department whenever necessary		
4.11	Pre-construction meeting		
4.12	Safe Conducting of Hot Works (BC Fire Code 5.2.3)		
	Shall be included in the fire safety plan		

APPENDIX D

· Quantification of Risk Over Construction Phases

Individual Contribution to Risk from Construction Stages (In Sequence)

Foundation Change -1 Risk Framing Change Risk **Plumbing and Electrical** Change -1 Risk Insulation and Drywall Change -1 -1 -1 Risk -2 -3 -1 -3 -3 -3 Paint, Trim and Finishes Change -1 Risk



Individual Contribution to Risk from Construction Stages (With Overlaps)

1							
1	0	0	-1	0	0	0	0
1	1	1	0	0	0	0	0
0	0	0	1	1	1	0	0
0	0	0	1	2	3	3	3
and E	lectrica	al					
0	0	0	0	1	0	0	0
0	0	0	0	1	1	1	1
and D	Drywall						
0	0	0	0	0	0	0	-1
0	0	0	0	0	0	0	-1
and	Finishe	es					
0	0	0	0	0	0	0	1
0	0-	0	0	0	0	0	1
	1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 0 1 1 0 0 and Electrics 0 0 and Drywall 0 0 and Finishe 0 0 0 0 0 0	1 0 0 1 1 1 0 0 0 0 0 0 and Electrical 0 0 0 0 0 0 0 0 and Drywall 0 0 0 0 0 and Finishes 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 0 0 -1 1 1 1 0 0 0 0 1 0 0 0 1 and Electrical 0 0 0 0 0 0 0 0 and Electrical 0 0 0 0 0 0 0 0 and Drywall 0 0 0 0 0 0 0 0 0 and Finishes 0 0 0 0 0 0 0 0 0	1 0 0 -1 0 1 1 1 0 0 0 0 0 1 1 0 0 0 1 2 and Electrical 0 0 0 1 0 0 0 0 1 and Drywall 0 0 0 0 and Finishes 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 0 0 -1 0 0 1 1 1 0 0 0 0 0 0 1 1 1 0 0 0 0 1 1 1 1 0 0 0 1 2 3 and Electrical 0 0 0 1 1 0 0 0 0 1 1 0 and Drywall 0 0 0 0 0 0 and Finishes 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 0 0 -1 0 0 0 1 1 1 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 1 1 1 0 0 0 0 0 1 2 3 3 and Electrical 0 0 0 1 0 0 0 0 0 0 1 1 1 and Drywall 0 0 0 0 0 0 0 0 0 0 0 0 0 0 and Finishes 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
3	3	3	3	3	3	3	3	3
-1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
-1	-1	0	0	0	0	0	0	0
-2	-3	-3	-3	-3	-3	-3	-3	-3
0	0	-1	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0



Arbitrary Timeline of Construction Phase

APPENDIX E



FIELD REVIEW REPORT

Construction Fire Safety Research

Project: Five & Six Storey Wood Frame Residential			Report No.: 1	
Address:	North	Vancouver		Date: October 19, 2011
Owner: Anonymous				Project No.: C6479
Contractor: Anonymous				Weather: Sunny, cool
In Attendance:		John Bolduc Samir Eidnani Brad Walton John Ivison	- - -	CFT Engineering Inc. CFT Engineering Inc. CFT Engineering Inc. Wood Enterprise Coalition

Distribution:

Wood Enterprise Coalition johnivison@wecbc.ca John Ivison

Report by: _

John Bolduc



FIELD REVIEW REPORT

Construction Fire Safety Research

It is understood that the field reviews provided for this project are not intended to identify deficiencies for action by contractors and owners in regard to fire safety for their sites, but to survey typical fire risks present in construction and the efforts taken to mitigate these risks.

INTRODUCTION: The site consists of three residential midrise structures constructed of combustible construction over a common noncombustible parkade structure. The parkade structure is three levels and has a building area of approximately 5,600 m². The project is phased and progress is such that the parkade and one of the three structures are nearing completion. The first building that is nearing completion is the largest of the three structures, having a building area of approximately 2,500 m². The structure is separated by a noncombustible (masonry) firewall and is therefore considered as two buildings. The structure is five storeys above grade on one side of the firewall and six storeys above grade on the other side of the firewall. The other two buildings, considered as Phase 2 of the project, consist of a six storey building with a building area of approximately 1,000 m² and a five storey building with a building area of approximately 900 m². The construction of exterior building faces for the project are constructed with a 1 h fire-resistance rating.

1.1	Fire Department access is provided to the site via existing streets. Water supply is available for the site.
1.2	The method for contacting the Fire Department is dialing 911 on a cellular phone. Air horns are located at every exit stair landing as a method of notifying the rest of the site in the occurrence of a fire or any other emergency incident.
1.3	Portable fire extinguishers are located throughout the site. Extinguishers are located at stair landings and are highly visable.
1.4	Exit routes are east to identify and the muster point is logically located at the main entrance to the site, which was identified in the site orientation.
1.5	Phased occupancy is expected for when the first six storey wood frame building is complete and the second building is still in the construction stage.

Building Code ConsultantsCertified ProfessionalsFire Protection Engineers#800 - 1901 Rosser Avenue, Burnaby, BCV5C 6R6Telephone: (604) 684-2384Fax: (604) 684-2402

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CFT Engineering Inc.

FIELD REVIEW REPORT

Construction Fire Safety Research

1.6	Exit stairs in the structure observed vary in completeness, coinciding with the varied completion of phased compartmentalization throughout the building. Three exit stairs are provided for the structure, all of which are constructed of combustibles. One exit stair is near completion (i.e. doors not installed, sprinkler and standpipe provided, fully framed and minimal penetrations). The other two exit stairs, located in the portion of the building with less complete compartment framing, are at a lesser level of completeness (i.e. standpipe provided, framing incomplete, doors not installed and sprinkler heads not installed).
1.7	Firestopping of service penetrations between parkade slabs and the combustible buildings above are complete.
1.8	Masonry firewall separating the building is complete with one exception that doors in the corridor for the firewall have not been installed. We understand that the doors are on back order.
1.9	For the building that is nearing completion, temporary sprinkler water flow switches are installed in order to sound an audible alarm. Security is instructed to contact the Fire Department upon activation of an audible alarm.
1.10	Watchman services are provided by after hours security, scheduled to arrive on site at 4:00 pm. The head of security is notified of any hot work permits. Security performs fire watches after hot work operations. Fire watch continues for a duration of 4 hours after the completion of hot works.
1.11	The most substantial use of hot works on this site is for construction of suspended slab assemblies. Hot work permits are issued when hot works are performed in suspended slabs. Wetting of surfaces is not performed in conjunction with hot works on suspended slabs.
1.12	Some hot works are performed by plumbing contractors on site. Hot work permits are issued when hot works are performed for plumbing. Hot work for plumbing is restricted to normal site hours.
1.13	Hard wired telephone connection installation (Telus) has not been completed. Efforts to relay alarm activations directly to the Fire Department have been hindered by the completion of the phone line connection.



FIELD REVIEW REPORT

Construction Fire Safety Research

1.14	Smoking is prohibited on site or in the structure. Smoking is only acceptable when off of the slab structure for the buildings (on adjacent grade).
1.15	Temporary heating for drying operations is provided with propane fueled heaters. In addition to drying practices that follow the product specifications for positioning the heater, the heaters are mounted in drywall framed mounts that ensure that the heater is positioned a safe distance away from walls. Heaters are cUL, ULC listed for use.
1.16	Municipal hot water connections have been completed for some areas which has reduced/replaced the need for propane fueled heaters in these areas.
1.17	For balconies, surfacing is applied with a cold liquid method, opposed to to torch applied (hot works) method used for surfacing of roof assemblies.
1.18	Incomplete lighting in the corridors that is wired to provide construction lighting is provided with a simple means of protecting the lighting from contact with the walls. A small piece of sheet metal is threaded directly to the lighting wire to provide a reflective/noncombustible barrier between the active light and the combustible wall.
1.19	Minimal combustible hazards are present in the site office (i.e. oxygen for first aid).
1.20	MSDS Sheets are available in the site office (construction trailer).

JB/mc

C6479_S01



FIELD REVIEW REPORT

Construction Fire Safety Research

Project: Three Town		e Storey Wood Fra houses	ame	Report No.: 2
Address:	North	Vancouver		Date: October 19, 2011
Owner: Anonymous				Project No.: C6479
Contractor:	Anon	ymous		Weather: Sunny, cool
In Attendan	ce:	John Bolduc Samir Eidnani Brad Walton John Ivison	-	CFT Engineering Inc. CFT Engineering Inc. CFT Engineering Inc. Wood Enterprise Coalition

Distribution:

Wood Enterprise Coalition johnivison@wecbc.ca John Ivison

Report by:

John Bolduc



FIELD REVIEW REPORT

Construction Fire Safety Research

It is understood that the field reviews provided for this project are not intended to identify deficiencies for action by contractors and owners in regard to fire safety for their sites, but to survey typical fire risks present in construction and the efforts taken to mitigate these risks.

INTRODUCTION: The site is approximately 2,500 m² with three residential townhouse buildings constructed over a common underground parkade structure. Each townhouse structure has a building area of approximately 500 m². The townhouses are three storeys in height and are protected with automatic sprinklers in accordance with the City of North Vancouver By-Law. Because of the sloping site, one of the three townhouses has a 1 h rated step to maintain its three storey building height.

2.1	Fire Department access is provided by existing streets adjacent to the site. Water supply is available for the site.
2.2	Access to townhouse units provided through temporary staircases.
2.3	Phased occupancy expected for completed townhouses. As a result, there will be a period where spatial separation issues may be present when drywall compartments are incomplete in the adjacent townhouses.
2.4	Parkade sprinkler system activated but not verified for the parkade for protection during construction.
2.5	Housekeeping on site presents potential fire hazard. Combustible material is present between the construction trailer and the nearest townhouse, behind the construction trailer, and underneath the construction trailer, including wood, cardboard, flammable liquids and styrofoam.
2.6	Combustible painting well ventilated. Paint stored off-site after hours.

JB/mc

C6479_S02


CFT Engineering Inc.

FIELD REVIEW REPORT

				Construction Fire Safety Research
Project:	29 Storey Noncombustible Highrise		ble	Report No.: 3
Address:	Burna	aby		Date: October 19, 2011
Owner:	Anon	ymous		Project No.: C6479
Contractor: Anonymous			Weather: Sunny, cool	
In Attendan	ce:	John Bolduc Samir Eidnani Brad Walton John Ivison	- - -	CFT Engineering Inc. CFT Engineering Inc. CFT Engineering Inc. Wood Enterprise Coalition

Distribution:

Wood Enterprise Coalition johnivison@wecbc.ca John lvison

Report by:

John Bolduc



CFT Engineering Inc.

FIELD REVIEW REPORT

Construction Fire Safety Research

It is understood that the field reviews provided for this project are not intended to identify deficiencies for action by contractors and owners in regard to fire safety for their sites, but to survey typical fire risks present in construction and the efforts taken to mitigate these risks.

INTRODUCTION: The site includes a 29 storey noncombustible residential highrise and 2, two storey combustible residential townhouse buildings. The buildings are connected with a below grade parkade structure. Sprinklers are provided for the highrise and the parkade, but not for the townhouse structures. Exposing building faces are positioned such that they permit 100% unprotected openings and there are no construction requirements for the building faces. Construction has progressed in a "bottom up" manner. Occupancy for the site is expected in three months.

3.1	Fire Department access is provided to the site via existing streets. Water supply is available for the site.
3.2	Three methods are provided for workers to alert the site of a fire incident; horns located on each floor, worker's radios and communication with the skip operator.
3.3	Watchman services are provided after hours by one person whose shift is from 5:00 to 5:00 and another whose shift is from 6:00 to 6:00.
3.4	An infrared security camera system was provided for the site for the first three quarters of the project. Incentive was provided by WorkSafe BC for installation of the security system.
3.5	Firestopping of service penetrations between the parkade slab and the combustible townhouses above is complete.
3.6	Phased occupancy of the parkade was recently granted. Phased occupancy is intended to continue with opening the sales centre in townhouse portions of the project adjacent to the highrise.
3.7	Alarm is monitored for the parkade occupancy where security is to contact the Fire Department in the case of an alarm for water or smoke (for the parkade).

Building Code ConsultantsCertified ProfessionalsFire Protection Engineers#800 - 1901 Rosser Avenue, Burnaby, BCV5C 6R6Telephone: (604) 684-2384Fax: (604) 684-2402



CFT Engineering Inc.

FIELD REVIEW REPORT

Construction Fire Safety Research

3.8	Sprinkler system is installed but not charged.
3.9	Hard-wired telephone connection installation has not been completed. Efforts to relay alarm activations directly to the Fire Department are hindered by the completion of the phone line connection.
3.10	Noncombustible exit stairs are complete with standpipes provided and doors installed. The standpipes were installed progressively (six to seven floors behind highest floor). Hoses are not provided for connection to standpipes.
3.11	The fire pump is not installed and will likely remain uninstalled until the end of the project (reason being that early activation in the construction phase would void the warranty).
3.12	Temporary water for construction use was supplied for upper floors via a pump installed for construction use only (pump is no longer required).
3.13	Siamese connection is provided; however, information about location/completeness of the siamese connection is not officially relayed to the local Fire Department. Therefore, a delay might occur due to lack of coordination when the Fire Department arrives to use the installed siamese connection in the event of a fire.
3.14	A mechanical dust collection system is provided for the area where cutting pieces is performed. The traps are emptied and the room is cleaned (reasonably) at the end of each day.
3.15	Temporary heating/drying provided for the site mainly with electric heaters. Some propane heaters are also used. Propane heaters provide specification for placement to ensure spacing of 40 in. on sides, 40 in. for back and 54 in. in front of the heater.

JB/mc

C6479_S03

APPENDIX F

Appendix F - Analysis of Reported Fires on Construction Sites in British Columbia 2005 through 2009

Description		Occurrences Injuries	Deaths	Max Loss Value	Average Loss Value
Combustible Construction		207	7	1 1600000	173290
1 Storey		125	1	1 1400000	29969
	Incendiary/Suspicious	83	1	0 280000	17282
	Cannot Be Determined	27	0	1 1400000	79463
	Flying Embers from Wood Burning Appliance	3	0	0 60000	20000
	Playing with Source of Ignition	2	0	0 500	250
	Inadequate Control of Open Fire	1	0	0 0	0
	Ignorance of Hazard - With Portable Space Heater	1	0	0 60000	60000
	Ignorance of Hazard - With Machinery	1	0	0 0	0
	Human Failing - Open Fire	1	0	0 500	500
	Human Failing - Undetermined	1	0	0 0	0
	Suspected Impairment - With Candle	1	0	0 1500	1500
	Suspected Impairment - With no Explanation	1	0	0 3000	3000
	Illegal Operations - Lighter	1	0	0 0	0
2 Storey		68	1	0 4900000	159659
	Incendiary/Suspicious	50	1	0 4900000	190867
	Cannot Be Determined	12	0	0 400000	84818
	Flying Embers from Wood Burning Appliance	1	0	0 150000	150000
	Torch Too Close	1	0	0 7500	7500
	Smoker's Material	1	0	0 10	10
	Ignorance of Hazard - Smoker's Material	1	0	0 1000	1000
	Ignorance of Hazard - Spontaneous Combustion	1	0	0 60000	60000
	Ignorance of Hazard - Portable Cooking Equipment	1	0	0 37000	37000
3 Storey		10	0	0 146000	26750
	Incendiary/Suspicious	7	0	0 146000	37786
	Human Failing - Construction Wiring	1	0	0 2500	2500
	Torch Too Close	1	0	0 500	500
	Ignorance of Hazard - Explosive	1	0	0 1	1
4 Storey		4	5	0 1600000	5250125
	Incendiary/Suspicious	2	5	0 300000	2500000
	Torch Too Close	1	0	0 1600000	1600000
	Human Failing - Halogen Bulb	1	0	0 500	500
Heavy Timbe	r Construction	7	0	0 150000	51428
1 Storey		3	0	0 45000	15000
	Incendiary/Suspicious	2	0	0 45000	22500
	Cannot Be Determined	1	0	0 0	0
2 Storey		2	0	0 150000	75000
	Incendiary/Suspicious	1	0	0 150000	150000
	Cannot Be Determined	1	0	0 0	0
3 Storey		1	0	0 100000	100000
	Cannot Be Determined	1	0	0 100000	100000
4 Storey		1	0	0 65000	65000
	Incendiary/Suspicious	1	0	0 65000	65000

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Noncombustible Construction 24 3 0 1030000	7873 8075
	8075
i Storey 8 U U 30000	
Cannot Be Determined 3 0 0 0	0
Incendiary/Suspicious 4 0 0 30000	12025
Tampering with Safety Devices - Portable Generator 1 0 0 16500	16500
2 Storey 8 0 0 103000	14038
Incendiary/Suspicious 3 0 0 3000	1000
Cutting or Welding Too Close 2 0 0 5000	2550
Smoker's Material 1 0 0 103000	103000
Cannot Be Determined - Heating Equipment 1 0 0 1000	1000
Cannot Be Determined 200	200
3 Storev 3 3 0 50	50
Suspected Impairment - Lighter and Oxidizing Material 1 0 0 50	50
Illegal Operations - Ignited Insulation 1 0 0 0	0
Cannot Be Determined - Garbage Ignited 1 1 0 0	Ő
6 Storev 1 0 0 0	Ő
Electronic Communications Part Failure 1 0 0 0	0
8 Storev 2 0 0 10000	5900
Electrical Cord Failure Igniting Cardboard 1 0 0 10000	10000
	1800
20 Storey 1 0 0 0	0000
Cannot Be Determined - Cardboard Ignited 1 0 0 0	0
BH Linknown	200
Torch Too Close 1 0 0 200	200
	200
Construction Type Undetermined 37 0 0 1000000	467073
1 Storey 20 0 0 6375000	323560
Incendiary/Suspicious 12 0 0 52000	4917
Undetermined 4 0 0 6375000	1598000
Undetermined - Cooking Equipment 1 0 0 10200	10200
Playing with Source of Ignition 3 0 0 10000	3333
2 Storey 6 0 0 250000	77052
Incendiary/Suspicious 4 0 0 74313	38078
Undetermined 2 0 0 250000	155000
4 Storev 1 0 0 1000000	10000000
Incendiary/Suspicious 1 0 0 1000000	10000000
9 Storev 1 0 0 65681	65681
Ignorance of Hazard - Electricity 1 0 0 65681	65681
BH Unknown 9 0 0 150000	31389
Human Failing - Spark and Shrubs 1 0 0 0	0
Cannot Be Determined 5 0 0 150000	52400
Incendiary/Suspicious 2 0 0 10000	5250
Portable Space Heater Too Close to Combustibles 1 0 0 0 0	0

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Incendiary and Suspicious Fires Reported

Incendiary/Suspicious	173
Other	102
Incendiary/Suspicious Including Illegal Operations and Playing with Sources of Ignition	181
Other	94
Incendiary/Suspicious	173
Illegal Operations and Playing with Sources of Ignition	8
Other	94



Knowles, Jessica D OHCS:EX

From:	Kuan, Steven Y OHCS:EX
Sent:	Friday, August 3, 2012 4:28 PM
To:	Thompson, Bob R OHCS:EX; Hutchinson, Jarrett OHCS:EX; Rotgans, Trudy OHCS:EX
Cc:	Green, Tracy OHCS:EX
Subject:	RE: Follow Up: CWC presentation
Follow Up Flag:	Follow up
Flag Status:	Flagged

This looks good to me too.

It may be worthwhile to add a subheading "Code and Standards" to talk about how they are different and reference each other. Code governs or standard governs. We can use the CLT standard as an example of the latest challenge.

One more comment. Some of the topics may be tricky to separate Part 3 and Part 9 buildings. Of course with wood, we have that large group of Part 9 single-family houses which do not need Letters of Assurance, alternative solutions, etc. They have their own little beast of issues regarding compliance, quality assurance, etc. For eg, does the main engineer sign off on the design by the truss engineer. If we don't want to include this group, we should make it clear at the start of the presentation or in the outline. Topic for another general educational presentation, perhaps?

Steven

From: Thompson, Bob R OHCS:EX
Sent: Fri, August 3, 2012 3:53 PM
To: Hutchinson, Jarrett OHCS:EX; Rotgans, Trudy OHCS:EX; Kuan, Steven Y OHCS:EX
Cc: Green, Tracy OHCS:EX
Subject: RE: Follow Up: CWC presentation

I like it! Especially as I apparently won't be presenting it the first time!

Bob Thompson Senior Codes Administrator

From: Hutchinson, Jarrett OHCS:EX
Sent: Friday, August 3, 2012 3:36 PM
To: Thompson, Bob R OHCS:EX; Rotgans, Trudy OHCS:EX; Kuan, Steven Y OHCS:EX
Cc: Green, Tracy OHCS:EX
Subject: Follow Up: CWC presentation

Hi,

After our meeting together and after reviewing Bob's outline I spoke with Bill at CWC about the possibility of presenting a general educational presentation. (The idea for us is that this presentations could be used again and again.) He agreed and so I've modified Bob's outline.

The synopsis outline we send to CWC would just include the subheadings that are underlined. Comments please.

Jarrett Hutchinson Manager, Building Policy and Codes Development Building and Safety Standards Office of Housing and Construction Standards Ministry of Energy and Mines Province of British Columbia T: 250.356.8163 F. 250.387.8164 Jarrett.Hutchinson@gov.bc.ca www.housing.gov.bc.ca/building

CWC Wood Solutions Fair October 23, 2012, Vancouver Convention Center

- 1.5 hour presentation twice, once in morning, once again in afternoon
- 40-100 attendees, 50% are architects, then engineers, technologists, building officials and students
- CWC to cover travel, meal and accommodation costs for speakers.
- Speaker(s) TBD

Presentation Title:

BC Building Code Development– who wrote this stuff? Outline:

- <u>History of Codes in BC (10 minutes)</u>
 - Confederation, WWII, CMHC, National Code
 - o BC adopts Provincial code.
 - Early codes (<\$10 booklet) Current codes (\$\$, volumes!) [note: Bring props]
- <u>National Code vs. Provincial Code what's the relationship? (25 minutes)</u>
 - National Code Development System
 - PTPACC/CCBFC
 - Ex. 6 storey wood (partners didn't want to participate)
 - Ex. 1st and then 2nd try at Part 9 lateral (partners were very responsive to us)
 - Standing Committees
 - NRC staff support
 - What is the impetus for a National code change?
 - Ex. Cathy Saby's code change.
 - Ex. BC appeal 1621 domicile
 - Ex. B-3
 - o SCC

- Certification to standards vs. conforming to standards
 - What is the impetus for the creation of a standard
 - ANSI CLT standard
- Adopting model codes as Provincial Regulations
 - Appendix is not part of the regulation, what does that mean
 - BC Variations, why and how?
 - Other legalities [note: TBD after our Leg Counsel review]
 - Provincial initiatives what's the impetus
 - Similar development process
 - Different Branches of government equals different mandates, but all working for public good
 - Wood First
 - Energy
- <u>Code and Standards</u>

0

- <u>Code Administration what's the relationship (Provincial role, local government role) (15 minutes)</u>
 - o Local Government Act Enforcement
 - o Relationship of Provincial codes and local building bylaws
 - Double regulating sometimes occurs

- ex. Secondary Suites
- "the owner shall" assigns responsibility whether permitting or not
- Permitting provides oversight
- o Alternate Solutions
 - Requirements by Code
 - Requirements by AHJ
- Working with what we've got! (10 minutes)
 - o Value of code expertise to design community
 - Integrated design
 - [note: use Ex. of misconceptions that delay plan review.]
 - Without alternate solutions, examples of ways you can use wood in buildings that are required to be non-combustible.
- Future of Codes (15 minutes)
 - No crystal ball on the political winds
 - Accessibility, modernization, Energy, modernization, wood, affordability, modernization
 - o Performance based approach, examining historical requirements with science
 - Heavy timber, engineered timber, CLT
 - Trade agreements and harmonization
 - Energy efficiency national trend (not just a BC trend anymore)
 - Modernization [note: opportunity to report out on consultations]
 - Uniform building code
 - Binding Provincial Code interpretations
 - Provincial guidance and expert evaluation of alternative solutions and new technologies
 - Random third party assessments (audits)
 - Mandatory certification of building officials
 - Online portal to the built environment
- <u>Questions & Answers (15 minutes)</u>

Knowles, Jessica D OHCS:EX

From:	Kuan, Steven Y OHCS:EX
Sent:	Thursday, July 5, 2012 10:12 AM
To:	Rotgans, Trudy OHCS:EX; Nutting, Alison OHCS:EX; Hutchinson, Jarrett OHCS:EX
Subject:	Six-storey wood delegation from Quebec
Follow Up Flag:	Follow up

Flag Status: Flagged

Trudy, Alison, Jarrett,

See note from Sukh Johal of BCWoodWorks! below regarding a delegation from Quebec.

I think the Branch is going to do a presentation at one session at the Wood Solution Fair. Two months ago, we were discussing what the topic should be, but I haven't heard from Bob what we have decided. Jarrett, do you know?

Steven

From: Sukh Johal [mailto:sjohal@wood-works.ca] Sent: Thu, July 5, 2012 9:51 AM To: Kuan, Steven Y OHCS:EX Subject: Re: Project Photos

Try contacting Dana Westermark at Oris (see attached vcf).

While I have your attention we will have a Quebec delegation visiting here (Oct 20-24). This group of Gov't officials, bldg officials, developer, architects and engineer are part of a Six storey exploratory group who plan on changing the Quebec bldg code to allow Six storey wood construction. They would like to meet their BC counterparts to discuss strategies and issues found. Will anyone from BPSB be attending our Wood Solutions Fair (Oct 23rd, 2012) where I can arrange such meetings...? Sent by Sukh Johal (Blackberry) Make it a great day!

From: Kuan, Steven Y OHCS:EX [mailto:Steven.Kuan@gov.bc.ca] Sent: Thursday, July 05, 2012 12:39 PM To: Sukh Johal Subject: Project Photos

Hi Sukh,

Hope you stayed warm nicely during the cold spring. It looks like summer is finally here.

I mentioned to you before that I would like to take some pictures of 6-storey wood buildings under construction, particularly the Remy. Now that the good weather is here, I think it's good time. These photos will be used mainly by me for presentations, education and training.

First of all, let me know if it is fine for me to take photos. If yes, could you connect me with the person(s) so I could arrange an appropriate time? If no, do you have a few that you could share?

Thanks.

Steven Kuan, Ph.D., P.Eng., FEC Senior Seismic Engineer Building and Safety Standards Branch Office of Housing and Construction Standards Ministry of Energy and Mines and Minister Responsible for Housing Mailing address: PO Box 9844, STN PROV GOVT, Victoria, BC V8W 9T2 Office location: 6th Floor, 614 Humboldt Street, Victoria, B.C. V8W 9T2 Tel: (604) 218-0296 email: <u>steven.kuan@gov.bc.ca</u>

Knowles, Jessica D OHCS:EX

From: Sent: To: Cc: Subject: Lam, Roger OHCS:EX Monday, June 18, 2012 11:31 AM Nutting, Alison OHCS:EX Kuan, Steven Y OHCS:EX; Rotgans, Trudy OHCS:EX Thoughts on Wood

Hi Alison,

I had meant this to be a more rigorous policy document but at the end it is just some of my thoughts on policy issues around the wood file.



W

Key derations for Woo

Roger Lam, MCIP Senior Policy Analyst Building and Safety Standards Branch Office of Housing and Construction Standards p: 250.356.0087 f: 250.357.3765

Please consider the environment before printing this email <u>http://housing.gov.bc.ca/</u>

Key Considerations for Wood Projects

Research:

Research is laced throughout all of the wood-related projects. The primary source of research is through FPInnovations who are proposing a series of fire related testing and some acoustical testing for Cross Laminated Timber.

Two key research activities are occurring:

- 1. WIDC related research (on CLT) to establish fire resistance ratings and acoustics testing.
- 2. Engineered heavy timber related research (on CLT)

Some questions:

- 1. What is the timeline for all of this research?
- 2. Will the research on the engineered heavy timber be timely in supporting the WIDC project?

Interrelationships:

• Establishing performance characteristics of engineered heavy timber

Legal Analysis:

s.13, s.14

Site Specific Building Regulation:

The site specific building regulation in a very general sense will modify the requirement for this building to be built of non-combustible construction, allowing for combustible construction. To compensate for the building being of combustible construction specific measures will be put in place to mitigate the additional risk. Some additional specific requirements might include non-combustible stairs that exit to the exterior of the building, sprinklering in all concealed spaces, and additional requirements for penetrations.

There is a question of timing for the development of the building regulation:

- 1. If the regulation was developed in advance of the design teams starting their designs, it would provide clear direction. The risk of this approach is that the design is inconsistent with the building regulation and that there is sufficient pressure to amend the regulation.
- 2. If the regulation was developed following the final design of the building there would be the flexibility to create a site specific building regulation that fits the design. The risk is that without direction, the design team may design a building where it is not possible to identify sufficient measures to mitigate additional risk and the building is deemed to not be at an acceptable level of safety.
- 3. An intermediate measure may be to develop the site specific building regulation to a level where it is essentially ready to be adopted. Instead of immediately adopting the regulation, provide it to the design teams as a firm guide on how to design building. Once the final design is selected amend the site specific building regulation if required before submitting the regulation to the Minister for approval. The risk is that even with direction, the design team may design a building where it is not possible to identify sufficient measures to mitigate additional risk and the building is deemed to not be at an acceptable level of safety.

Combustible vs. Non-Combustible

We know the limitation on which buildings can be built of combustible materials is arbitrary and set based on experience and professional and technical judgement. The question is whether we now have enough knowledge and expertise to reassess this limitation. When this topic was broached at the

s.13, s.14

national level in 2009 there was no interest. Since this time, there has been increasing interest and pressure from the wood-based sector to re-examine current limitations.

From a policy perspective:

- There is a rationale for opening this debate if only because current requirements are arbitrary and do not seem to adequately consider recent innovations in both technology and practice
- Moving beyond this artificial distinction in the code is a pre-requisite for moving towards a performance and risk-based building code
- While initial feedback from some stakeholders is that there has been a recent material bias in the code towards wood products, this can also be seen as a process of correcting an imbalance in the code. Another viewpoint is that the code should be materials agnostic and instead seek to ensure all buildings achieve an acceptable level of risk regardless of materials.

The challenge as this debate begins to unfold is the whether a combustible material can be used as an alternative solution for a non-combustible building material. While this is essentially the core issue of the combustible vs. non-combustible debate, it would seem to be premature to allow for AHJs to arbitrarily make their own determinations in advance of a satisfactory conclusion. In the interim it is proposed that BSSB issue a directive to the effect that combustible and non-combustible materials are not equivalent.

Use of Building Code to advance policy objectives

Over the last five years there has been sustained effort by many parties to change the building code to achieve policy or economic objectives. Just a decade ago the primary objective of building codes was to safeguard public safety. As a result of a number of initiatives related to green, accessibility, and wood the focus has swung away from primarily safety concerns to social, economic and environment objectives.

40 years ago steel and concrete was in the same place as wood is now and they went through a considerable process of research and development of CSA standards. Wood has now been in the same place for about 5 years where they are making an active push to see expanded use in the code. However, it seems that wood is going about in a different way. They are lobbying decision makers rather than starting from the research and testing. This may be because there is a sense that the code is weighted heavily against the use of wood and there is a need to circumvent a more typical process. It could also be that they are riding on the success of recent changes to allow energy and water efficiency objectives in the code.

The key policy question is why and how we change the code. Is the code an appropriate tool for policy change? Should BC have a code change process or should everything be dealt with at the national level? How do we deal with innovation, are site specific building regulations for pilot projects sustainable, desirable or even a technically sound way of proceeding?

Knowles, Jessica D OHCS:EX

From: Sent: To: Subject: Rotgans, Trudy OHCS:EX Friday, October 5, 2012 11:09 AM Nutting, Alison OHCS:EX FW: PTPACC handout for discussion with Sheila re: wood



Presentation on Innovation and...

BC Presentation on Innovation and the Codes for PTPACC and CCBFC Executive

Thank you for providing me the opportunity to provide a brief BC update. I would like to take this time to talk more generally about our experience with recent BC Code changes and some of the challenges I see affecting the code development system in Canada.

In BC we are increasingly feeling pressure to adopt standards ahead of their implementation in the national codes, or to develop BC variations to the codes. For example:

- We adopted a BC variation to allow 6-storey residential wood-frame construction;
- We adopted new CSA reference standards for concrete ahead of the national codes; and
- We have felt great pressure from municipalities to adopt an EnerGuide 80 requirement for all new Part 9 homes (Vancouver has adopted this standard).

Our sense is that the code system is being challenged by the pace of innovation. New technologies, materials, techniques and approaches to construction and regulation of construction are challenging fundamental concepts.

In each of the recent cases where BC has varied from the national codes it has been the result of effective lobbying, whether from the wood sector, the concrete sector or from local government and non-governmental organizations. Traditionally, the codes were intended to provide minimum standards for health and life safety. Increasingly, we are being asked to use the code as a tool to achieve policy objectives – whether for environmental, social or economic reasons.

While the National code system is still the preeminent reference document on building codes in Canada there is a very real danger that regional pressures to adopt innovative code changes will lead to inharmonious codes. In BC, our top priority is to harmonize with the national code system, but increasingly we are being asked by our decision makers to move more quickly or in a different direction from the national system.

My intention is not to provide answers on how we resolve this growing tension between regional variations and national harmony. Rather, it is to give you my observation that this may be the single biggest issue affecting the future of a national code system.

The groups lobbying us for change are asking difficult questions that challenge our understanding of the philosophical underpinnings of the codes. I have to admit we are struggling more and more to defend a number of the key fundamentals of the code. What we are observing is that construction has become much more complex with the use of advanced computer modeling, scientific testing and access to international studies and research. The framework for building codes was established a long time ago and has been continued to today; so are the many theories behind code provisions. But they are now being challenged in how to continue making buildings safe under present day construction trends and code enforcement practices.

Let me present you with some of the questions we are facing and that we believe are relevant to a national codes system:

- 1. Should the codes be materials "agnostic" and focus only on performance and risk-based approaches?
 - The wood lobby feels that combustible materials (i.e. wood) are unfairly prejudiced in the codes.
 - What is the basis for keeping the distinction between combustible and non-combustible materials in the codes? Our research shows that the basis is historical and largely experience based rather than scientific.
 - Is it possible to be materials "agnostic"; what science or research would be required to achieve consensus?
- 2. How does the national code system, which is currently on a five year cycle, keep pace with innovation?
 - How do we resolve pressure to adopt variations and reconcile this with the national code system?
 - What is the value of harmony over regional variation?
- 3. How do we address the issue of increasing pressure to use the code as a tool to achieve social, environmental or economic policy objectives?
 - Do we embrace the opportunity to use the code as a more comprehensive document dealing with all aspects of construction?
 - Do we look for other avenues to channel the non health and life safety objectives such as other types of codes (i.e. national model energy code)?
- 4. How do we manage the increasing pressure to accept codes and standards from other countries or regions of the world?
 - It is difficult for us to argue that standards that have been developed and used in European countries for years are not good enough for Canada.
 - Yet there are cases where the different regulatory system and quality of construction in Canada may result in unacceptable risks.

I want to close by talking about the latest BC variation we are considering and what I see as the challenges and implications:

• We are looking at creating a new "engineered heavy timber" class of building materials in the codes, rather than wait for the outcome of any changes to have combustible materials treated in the code. This would be similar to heavy timber but allow for greater application and would allow us to accept many innovative wood products like cross laminated timber. The implication is that we may delay the debate on combustible vs. non-combustible construction.

• We are also re-examining the issue of fire sprinklers for all buildings. We have about 25 municipalities that have adopted fire sprinkler requirements that go beyond the code. Some of them require all single family houses to be sprinklered. This is a current issue because we have a proposal to roll back these bylaws as part of our Modern Building Regulatory System proposal. We are forming a working group with a group of stakeholders in partnership with the Office of the Fire Commissioner and the Fire Chiefs Association of BC.

In closing, the purpose of this presentation is to highlight the issues we are facing in BC in adopting innovation in the BC codes and to raise some provocative questions.

Trudy Rotgans, MAIBC, MCIP Executive Director Building and Safety Standards Branch

Office of Housing and Construction Standards Ministry Responsible for Housing Province of BC

Knowles, Jessica D OHCS:EX

From:	Nutting, Alison OHCS:EX
Sent:	Wednesday, July 25, 2012 9:39 AM
То:	'Marnie'
Subject:	FW: Fire safety in wood construction
Attachments:	OIB-Guidelines - Definitions.doc; OIB-Guideline 2.doc
Follow Up Flag:	Follow up
Flag Status:	Flagged

Hi Marnie,

I'm not sure if the materials Dr Mikulits has sent will be useful for your purposes, but I'm forwarding his note and attachments along to you.

We should probably plan to have a check-in next week if that works for you.

Talk to you soon,

Alison

From: Ho Yee, Brian OHCS:EX Sent: Wednesday, July 25, 2012 9:27 AM To: Nutting, Alison OHCS:EX Subject: FW: Fire safety in wood construction

Hello Alison,

Here is a response to our inquiries from one of our contacts, Dr. Mikultis. I hope that this information will be able to help Marnie with the scoping review. Thanks.

Brian Ho Yee Policy Analyst Building and Safety Standards Branch Ministry of Energy and Mines Tel: 250-356-0517 Email: <u>Brian.HoYee@gov.bc.ca</u>

From: R Mikulits [mailto:Mikulits@oib.or.at] Sent: Friday, July 20, 2012 8:03 AM To: Ho Yee, Brian OHCS:EX Subject: AW: Fire safety in wood construction

Dear Brian,

I would like to apologize for answering to your e-mail with such a delay, but unfortunately it got lost during the very busy period of May and June, and I rediscovered it just now when tidying up before the holiday period.

Attached please find the OIB guideline 2 on safety in case of fire (sorry for the translation, but I have no better one for the moment). It is the newest edition from 2011 and will be taken over by the provincial jurisdictions during this year (meanwhile the edition from 2007 is still in force, but concerning your topic the changes are negligible). Of interest for you

might be for example table 1b including the fire resistance requirements. Only where the additional requirement A2 is indicated, wooden structures would not be possible, since A2 means "non-combustible" (see also cl. 0, third paragraph).

Please look also to the document with the definitions, since table 1b refers to "Building Categories" (BC) which are defined in the definitions.

With best regards Rainer Mikulits

Dr. Rainer Mikulits Österreichisches Institut für Bautechnik (OIB) Schenkenstraße 4 A-1010 Wien Tel.: ++43 (0)1 533 65 50 Fax: ++43 (0)1 533 64 23 E-Mail: <u>mikulits@oib.or.at</u> ZVR 383773815

Von: Ho Yee, Brian OHCS:EX [mailto:Brian.HoYee@gov.bc.ca]
Gesendet: Mittwoch, 23. Mai 2012 20:08
An: R Mikulits
Cc: Gisborne, Carolyn OHCS:EX
Betreff: Fire safety in wood construction

Hello Dr. Mikulits,

Carolyn Gisborne and I are Policy Analysts with the Building and Safety Standards Branch of the British Columbia provincial government. Our goal is to create a terms of reference for a scoping review on fire safety in wood construction and how that affects the building code requirements for wood buildings in differing jurisdictions. In addition, we would like to develop a matrix table which illustrates where British Columbia's Building Code is positioned, in relation to other jurisdictions, regarding fire safety in wood construction. Dr. Brian Meacham mentioned that you might be an invaluable resource regarding this subject. As the Managing Director of the Austrian Institute of Construction Engineering, we were hoping that your knowledge of building regulations in Europe and your expertise in the drafting of building codes in Austria could help us in understanding and expanding our knowledge on this topic. If you would be willing to provide more information it would be greatly appreciated. We could send more specific questions or set up time for a conference call whenever it is convenient for you. Thank you very much for any direction you can provide.

Brian Ho Yee Policy Analyst Building and Safety Standards Branch Ministry of Energy and Mines Tel: 250-356-0517 Email: <u>Brian.HoYee@gov.bc.ca</u>

OiB - Guidelines

Definitions

Edition: October 2011

Waste collection area

Fully enclosed space used for efficient technical and hygienic collection and interim storage of waste

Waste collection point

Open or partially closed or covered facility used for efficient technical and hygienic interim storage of waste.

Exhaust emissions

Gaseous combustion product occurring in the heat-producing appliance when burning solid, liquid, and/or gaseous fuels, including the solid or liquid components floating in it and any excess air.

Exhaust emission system

System for discharging exhaust emissions from heat-producing appliances for solid, liquid, or gaseous fuels to the atmosphere; connectors are not part of the exhaust emission system.

Wastewater

Water which is modified as a result of use and any water flowing into the drainage system, such as domestic sewage, industrial, and commercial wastewater as well as condensates.

Connecting pipe

Connection between riser pipe and heating appliance

Energy equivalent system noise level (L_{A,eq,nT})

A-weighted, energy equivalent, continuous sound level, which is measured in a room during operation of an HVAC system in this room with the time weighting 'fast' ÖNORM EN ISO 10052 and ÖNORM EN ISO 16032 and based on a reverberation time of 0.5 s.

Maximum system noise level (LAF, max, nT)

maximum A-weighted energy equivalent continuous sound level, which is measured in a room during operation of a HVAC system outside this room with the time weighting 'fast' ÖNORM EN ISO 10052 and ÖNORM EN ISO 16032 and based on reverberation time of 0.5 s.

Adjustment value (L_z)

Increase or decrease in level for certain types of noise sources or characteristics.

Recreation room

Room used by people for long periods (e.g. living room and bedroom, kitchen-diner, office, classroom), does not, however, include bathroom and toilets.

Externally induced cooling demand (CD*):

Cooling demand where internal thermal loads and air change rate are set at zero for calculating the cooling demand (infiltration n_x is set at 0.15).

Ambient noise level, structural component based

Ambient noise level applying adjustment values (rating level) resulting from the location-based ambient noise level for the respective position of the structural component in the building.

Significant ambient noise level

Basis for determining the requirements for sound insulation of structural components applying adjustment values (rating level).

Significant, location-related ambient noise level

Ambient noise level applying adjustment values (rating level) resulting from location-related environmental noise situation at 4 m above the ground.

Accessibility

Barrier-free (accessible) within the meaning of OIB Guideline 4 refers to structures that can be accessed and used by people with a disability in the usual manner without particular difficulty and essentially unaided.

Weighted construction soundproofing measure (R'w)

Single-digit indication for construction soundproofing measure determined in accordance with ÖNORM EN ISO 717-1 from the values of R⁺ (in the third octave bands 100 Hz to 3150 Hz).

Resulting weighted construction soundproofing measures for external structural components overall ($R'_{res,w}$)

Single-digit indication for construction soundproofing measure which is determined for an external structural component that consists of several sub-areas with different dimensions and different soundproofing measures (e.g. an exterior wall with windows and outer doors).

Structure

A construction which is in contact with the ground where knowledge of structural engineering is required for professional erection.

Accommodation facility

Building or building parts which are used to accommodate people and have more than 10 guest beds.

Facings

Layers on a building part that help ensure compliance with one or more requirements with regard to fire prevention, thermal protection, sound insulation, and weather proofing; facings generally consist of an outer layer, sub-structure, and damp course or thermal insulation.

Surfacing

Outer layer of a structural component, which does not fall into the facing category, such as flooring, decorative cladding, acoustic boards; surfacing is generally applied to facing or a bare wall or ceiling.

Generally accessible area

Area inside or outside a structure, which is designed for regular exploitation or use by various people, such as residents, customers, suppliers. This does not include buildings or building parts containing no more than two flats or terraced housing, which are exclusively for residential use, as well as areas inside a residential unit and rooms used for business purposes in which less than 15 people are present at the same time.

Operational structure

Structure or part of a structure used for the production (manufacture, processing, recycling, distribution) or storage of products or goods.

Noise rating level (L_r)

The A-weighted, energy equivalent, continuous sound level based on the reference time of any noise, which is provided with adjustment values where necessary.

Fire compartment

Area separated by walls or ceilings of parts of a building forming a fire compartment.

Fire wall

Wall with higher specifications forming a fire compartment.

Conditioned gross floor area

Area corresponding to the definition in ÖNORM B 1800 (note detailed definitions according to OIB Guideline).

Conditioned gross volume

Volume corresponding to the definition of gross volume in ÖNORM B 1800 (note detailed definitions according to OIB Guideline).

Durability of supporting structure

Ability of supporting structure and its supporting components not to unexpectedly modify supporting structure behaviour as a result of time-dependent changes to characteristics taking account of environmental conditions and scheduled maintenance measures.

Opening, usable width

The usable width of an opening represents the smallest clear width of the door opening, which following installation (assembly) of the door post or frame enables free passage without restriction with a door leaf opened to 90° (frame to door leaf or door leaf to door leaf in the case of double-leaf doors or frame to frame). Door latches and emergency exit door fittings are not taken into account when determining the usable width of an opening. Panic bars lead to a reduction in usable opening width by 10 cm per door leaf. The usable width of an opening can reach a maximum of the floor width.

Opening, usable height

The usable height of an opening represents the lowest clear height of the door opening which following installation (assembly) of the door post or frame enables free passage without restriction when the door is opened. In the case of a straight floor, the usable height of the opening corresponds to the floor height. Fittings at a height, such as a door stop, are not taken into account when determining the usable height of an opening.

Impact

A force or strain impacting on the supporting structure.

Final energy demand (FED)

Quantity of energy that must be supplied to the heating system and all other energy systems in order to cover the heating demand, hot water demand, cooling demand, lighting energy demand, and household or business electricity demand determined at the system boundary of the respective building.

Energy certificate

A certificate issued in accordance with OIB Guideline 6 regarding the overall energy efficiency of a building implementing Directive 2010/31/EU and Energy Certificate Template Law (EAVG).

Non-bearing façade

System essentially comprising the components

- substructure,
- anchoring, connecting, and fixing elements,
- thermal insulation (damp course),
- rear ventilation opening or air gap,
- external layer

which are required to fulfil meaningful complementary functions.

Non-bearing, ventilated façade

Façade with an air gap between the thermal insulation layer (or if the latter is not present, exterior wall) and outer layer which only has air openings at the base in the outer layer and is connected to outside air.

Non-bearing, rear ventilated façade

Façade with a rear ventilation opening between the thermal insulation layer (or if the latter is not present, exterior wall) and outer layer, which is connected to outdoor air via ingoing air openings at the base and outgoing air openings at the top of the outer layer thereby allowing a constant flow of air ('rear ventilation').

Façade, not rear ventilated

Façade which is not connected to outdoor air either at the base or at the top via an air opening. An air gap may be present between the outer layer and the thermal insulation layer (or wall materials).

Heat-producing appliance

Heat-generating device in which combustion products occur that need to be discharged into outdoor air.

Fire escape level

Difference in height between the floor level of the highest floor above ground and the lowest point of the area surrounding the building following completion.

Escape route

Route allowing building users to reach a place of safety outdoors in the surrounding area unaided in the event of an emergency — generally a public thoroughfare.

Garage

Building or part of a building for parking vehicles.

Building in building category 1 (BC1)

Free-standing building accessible externally on at least three sides on its own premises or from vehicular and pedestrian areas for fire-fighting purposes with no more than three above ground floors and a fire-escape level of no more than 7 m consisting of one flat or business unit, each with a gross floor area of the above ground floors of no more than 400 m².

Building in building category 2 (BC2)

Building with no more than three above ground floors and a fire-escape level of no more than 7 m, consisting of a maximum of five flats or business units with total gross floor space of the above ground floors of no more than 400 m²; terraced housing with no more than three above ground floors and a fire-escape level of no more than 7m, consisting of flats or business units, each with a gross floor area of the above ground floors of no more than 400 m².

Building in building category 3 (BC3)

Building with no more than three above ground floors and a fire-escape level of no more than 7 m which does not fall into building class 1 or 2.

Building in building category 4 (BC4)

Building with no more than four above ground floors and a fire-escape level of no more than 11 m, consisting of a flat or business unit without restriction of the floor are, or of several flats or business units, each with a gross floor area of the above ground floors of no more than 400 m².

Building in building category 5 (BC5)

Building with a fire-escape level of no more than 22 m, which does not fall into building classes 1, 2, 3, or 4, as well as buildings that only have floors below ground.

Buildings

Covered structures enclosed on most or all sides which people can access.

Conditioned buildings

Buildings the interior climate of which is heated, cooled, ventilated, or humidified using energy; buildings as a whole or parts of a building, which have been designed as or converted into individual units can be described as conditioned buildings.

Other conditioned buildings

Buildings that are used neither as residential buildings nor as non-residential buildings in building categories 1 to 12.

Building value

The building value is to be determined on the basis of reconstruction costs. Value-influencing circumstances such as the location of the property, restrictions under building law or public law as well as significant deviations from standard building costs are not to be taken into account.

Usability of supporting structure

Ability of the supporting structure and its supporting components to meet the criteria for usability and function, e.g. deformation, vibration and crack width restrictions.

Floor

Section of a building between the floor levels of rooms on top of one another or clear section between floor level and ceiling level, if the respective stipulated room height is reached. Sections of buildings, which are offset to one another up to and including half floor height, are considered to be floors.

Floor, operational structure

All rooms located on the same level as well as rooms or parts of rooms offset at a height on this level. Balconies, galleries, and stages in a room are not considered an individual floor insofar as their net floor area is less than half of the net floor area of the room in which they are located. The following are not considered individual floors:

- Rooms above the last floor above the ground, which is used solely for housing building service systems for heating, ventilation, air conditioning, and sanitary purposes,
- service rooms if the number of constantly open hatchways to floors above or below is greater than the number of closed areas, e.g. press basement,
- ancillary areas within a room which are functionally connected to this room, e.g. foreman's office,
- machine rooms for lifts,
- accessible walkways and landings, e.g. grating in high bay racking for reaching individual storage levels.

Above ground floor

Floor, the external peripheries of which lie in total over more than half the adjacent area following completion. Above ground floors do not include those in which there are no flats, business units or parts of these (e.g. non-extended roof areas).

Above ground floor, operational structure

Floor, the external peripheries of which lie in total over more than half the adjacent area following completion.

Underground floor

Floor, the external peripheries of which lie in total over more than half the adjacent area following completion.

Major renovation

Renovation where more than 25 % of the surface area of the building envelope is subject to renovation unless the total cost of the renovation of the building envelope and technical systems in the buildings amount to less than 25 % of the building value where the value of the land on which the building has been constructed is not taken into account in the calculation.

Floor area

Gross floor area or net floor area in accordance with definition in ÖNORM B 1800.

Main fire compartment

Area separated from parts of a building by fire walls.

Main entrance or main stairs

Connecting passage leading to recreation rooms or rooms used on a daily basis

Building services system

The energy systems in a building which are required in order to meet heating demand, hot water demand, cooling demand as well as the necessary requirement for ventilation and lighting.

Heating energy demand (HEB):

The part of the final energy demand to be applied to heating and hot water supply.

Heating degree days (HDD)

Annual heating degree days (HDD)_{20/12}.

Heating technology energy demand (HTED)

Heating technology system losses

Space heating demand (HWB)

Amount of heat to be supplied to conditioned rooms in order to maintain their specified target temperature.

Space heating demand, residential building equivalent (HWB*)

Space heating demand for non-residential buildings where for the air renewal rate and internal heat loads (without taking account of lighting), the provisions for residential buildings with a gross floor area of more than 400 m² are applied.

Height of handrails, balconies, and balustrades

Vertical distance between finished standing area and, in the case of stairs, finished front edge of steps, and the top edge of the handrail, balcony or balustrade.

Cooling demand (KB):

Amount of heat to be extracted from conditioned rooms in order to maintain their specified target temperature.

Storage areas

Net floor area for storage of products and goods which is delimited by fire walls, structural components forming fire compartments, or exterior walls.

Characteristic length (l_c)

Measurement of the compactness of a building represented as the ratio of heated volume VB to the surrounding surface area AB of the heated volume.

Open walkway

Walkway on the outside of a building, half of which at least is uncovered and has primarily uniformly distributed unlockable openings above the parapet height.

LEK value

Characteristic value for thermal protection of the building envelope taking account of the compactness and characteristic length of the building.

Light entry area

Net glass area of a window not including frame and glazing bars.

Reverberation time (T)

Time in seconds in which the noise level in a room falls by 60 dB after the noise source has been switched off.

Side access or side stairs

Gangways or stairs, which are constructed in addition to main corridors and main stairs, as well as gangways or stairs which do not lead to recreational rooms or rooms used on a daily basis (e.g. attics, basement ante-rooms, gallery, or storage areas as second levels in living areas, service stairs, etc.) Stairs with staggered tread, such as samba staircases or spar staircases, are not considered staircases within the meaning of OIB Guideline 4.

Conditioned net floor area

Area corresponding to the definition in ÖNORM B 1800 (note detailed definitions according to OIB Guideline).

New build

Construction of new buildings and buildings where after demolishing existing structural facilities, old foundations or existing supporting external structural components are fully or partially reused. A change of use from unconditioned to conditioned buildings or parts of buildings as well as extensions with a net floor area of more than 50 m² also constitute a new build.

New construction

See new build

Non-residential building

Buildings not primarily used for residential purposes.

Run-off rain water

Rain, including melt water, which flows off roof and ground surfaces or the external surfaces of buildings and is not changed through use.

Usable area - garage, roofed parking spaces, multi-storey car parks

Total parking and driving areas with the exception of access to and exits from garages, roofed parking spaces, and multi-storey car parks.

Process water

Water obtained from rain water, ground water, or local sources and wells, which is used (e.g. for toilet flushing, washing, or watering), satisfies the technological requirements of the respective process and is not designated for human consumption.

Surface area of building envelope

Surface area of building envelope according to definition in ÖNORM B 8110-6.

Parapet height

Vertical distance between finished standing area and floor level of the lower storey profile or balustrade.

Multi-storey car park

Multi-storey car parks are structures where motor vehicles may be parked which have openings on all parking levels that cannot be locked, covering, as a minimum, one-third of the total covered external wall area on at least two sides of their roofed external walls.

Characterising burst

a noise event characteristic of operations with a limited duration and which is noticeably set apart from other noise and can be clearly classified.

Basic planning level (L_{PB})

Computable value for measuring and assessing sound emissions in rooms.

Terraced housing

Building with more than two separate self-contained flats or business units built directly adjacent to one another, not arranged one on top of another, separated by at least one vertical wall, each with gross floor area of the above ground floors of no more than 400 m² and each with their own entrance from the outside for each flat or business unit respectively. For classification in a building class in accordance with the OIB Guideline, each flat or business unit must be considered separately in terms of the fire escape level.

Escape route

Route which enables building users to reach a safe location outside within the adjacent area generally with assistance (e.g. by means of fire brigade rescue devices)

Average sound absorption coefficient ($\alpha_{m,B}$)

Sound absorption coefficient produced on average over all room demarcation areas.

- S_i 'i' partial area of room demarcation areas in m²
- α_i sound absorption coefficient of " partial areas of room demarcation areas
- n Number of room demarcation areas

Weighted soundproofing measure (R'w)

Single-digit indication for soundproofing measure determined in accordance with ÖNORM EN ISO 717-1 from the values of R⁺ (in third octave bands 100 Hz to 3 150 Hz).

Alpine huts in extreme positions

Lodging facilities which only have simple furnishings and can only be reached on foot in a walking time of over an hour and are not normally accessible by mechanical means of ascent.

Weighted standard sound level differential (D_{nT,w})

Single-digit indication for sound level differential determined in accordance with ONORM EN ISO 717-1 from the values of D_{nT} (in third octave bands 100 Hz to 3 150 Hz).

Safety category

Category depending on fire prevention infrastructure:

- Safety category K 1: No special measures,
- Safety category K 2: automatic fire alarm system
- Safety category K 3.1: automatic fire alarm system and a works fire brigade on stand-by during working hours recognised in accordance with respective federal state legislation with at least group level,
- Safety category K 3.2: automatic fire alarm system and a works fire brigade on permanent stand-by (round the clock) recognised in accordance with respective federal state legislation with at least group level,
- Safety category K 4.1: advanced automatic fire response equipment,
- Safety category K 4.2: automatic fire response equipment.

Spectrum adjustment value (C_{tr})

Value which is added to the single-digit number indication R_w or R'_w or $D_{nT,w}$ in order to take account of the 'road traffic noise' sound level.

Characterising peak level in business premises (L_{A,Sp})

value measured using the time weighting 'F' (fast) and A weighting or calculated maximum value of a characterising peak level.

Weighted standard impact sound pressure level (L'nT,w)

Single-digit indication for standard impact sound pressure level determined in accordance with ONORM EN ISO 717-2 from the values of L_{nT} (in third octave bands 100 Hz to 3 150 Hz or in octave bands 125 Hz to 2 000 Hz).

Riser pipe

Vertical interconnecting duct between distribution pipe and connecting pipe or branch line within the meaning of OIB Guideline 6.

Roofed parking space

(4) Roofed parking spaces are roofed areas where motor vehicles may be parked which are enclosed on no more than two sides by walls or other building components (e.g. railings).

Branch line

Interconnecting duct between riser pipe and tap connection.

Supporting structure

Part of a structure consisting of an arrangement as per plans of interconnecting supporting structural components.

Separating ceiling

Ceiling between flats or business units as well as between other parts of the building.

Separating wall

Wall between flats or business units as well as between other parts of the building (e.g. staircases)

Flight of stairs

Uninterrupted series of more than one step between two accessible levels (landing floor ceiling).

Drinking water

Water for human consumption which is suitable for drinking or use without risk to human health.

Connecting piece

Structural component or components for connection between heat-producing appliance outlet and exhaust gas system.

Sales area

Areas where goods are offered for sale. These include, for example, till areas, lobby areas, showrooms, demonstration areas and consulting rooms, rooms used for catering purposes as well as all other rooms used for customer traffic Offices and storage areas, which are not separated from a sales area by walls and ceilings forming a fire compartment, also constitute sales areas.

Sales outlets

Buildings or parts of buildings which are used to sell goods in accordance with regulations.

Meeting places

Building or buildings for events involving more than 120 people.

Distribution pipe

Pipeline between heat supply system and vertical riser pipe.

Heat storage system

Systems engineering process area in which heat contained in a medium is stored

Heat distribution system

Systems engineering process area in which the required quantity of heat is transported from heat supply to heat emission.

Residential building

Building completely or primarily used for residential purposes.

Flat

All individual rooms or collection of rooms which are structurally self-contained and designed for residential use and enable the running of a household.

Flat stairs

Main stairs in flats as well as in buildings or parts of building with no more than two flats and in terraced housing.

Reliability of supporting structure

Ability of a supporting structure or structural component to meet the stipulated requirements

OiB - Guideline 2

Safety in case of fire

Edition: October 2011 - Revised

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This Guideline is based on the outcome of sessions held by the Federal State expert group used by the Landesamtsdirektorenkonferenz (Conference of Provincial Office Directors) to draw up a proposal for harmonising building regulations. The work of this committee was coordinated by the OIB in accordance with the order of the Landesamtsdirektorenkonferenz (Conference of Provincial Office Directors) within the meaning of Section 2(2)(3) of the Articles of Association of the OIB and continued in the experts' forum for structural guidelines. A resolution was passed on the Guideline by the General Assembly of the OIB in accordance with Section 8(12) of the Articles of Association.

0 Preliminary remarks

The cited standards and other technical regulations shall apply in the version promulgated in the document "OIB Guidelines – Cited standards and other technical regulations".

In this Guideline the various requirements for the fire behaviour of building materials and the fire resistance of components are ranked according to the various European classes. These are minimum requirements.

If, in this Guideline, requirements for the fire resistance class in conjunction with requirements for building materials are ranked as class A2, this shall be deemed to have been complied with if

- the elements which are essential in terms of the load-bearing capacity comply with class A2 components, and

- the other elements consist of class B building materials.

Unless a burn-through can be excluded, space-enclosing components must also be thickly covered on both sides with class A2 building materials.

This Guideline does not apply to buildings with a maximum 15 m² gross floor area that are accessible externally on at least three sides on their own premises or from vehicular and pedestrian areas for fire-fighting purposes, and in which there is no increased fire risk in any particular spaces.

For buildings with mixed uses, the requirements for safety in case of fire for the individual areas of use shall be deemed to have been complied with if the provisions of the Guidelines to be applied for the respective uses are observed.

The requirements of this Guideline may be deviated from if the protective objectives are achieved to the same extent as in the application of this Guideline, whereby the OIB Guideline "Variations in fire protection and fire protection programmes" must be applied.

1 Definitions

The definitions contained in the document "OIB Guidelines – Definitions" shall apply.

2 General requirements and load-bearing capacity in the event of fire

If, in this Guideline, requirements for the fire behaviour of components are combined with the fire resistance of building materials, then the requirements for the fire behaviour shall only relate to parts of the structure that are required in order to attain the fire resistance class. The requirements of Table 1a shall apply with respect to the fire behaviour of building materials for any additional cladding, linings, etc. which are installed.

2.1 Fire behaviour of construction products (building materials)

- 2.1.1 Unless otherwise specified, the requirements of Table 1a shall apply. Construction products which are not listed in Table 1a must comply with class E. Non-substantial parts which are negligible in terms of their contribution to causing a fire shall not be taken into consideration.
- 2.1.2 Unless the fire escape level is more than 11 m, and each dwelling or business unit on each floor can be reached from at least one point via suitable openings in the facade and is no more than 7 m above the surrounding area, then
 - (a) buildings belonging to building class 1 which only fall under building class 4 due to the slope only need to comply with the requirements for building class 2 with respect to fire behaviour,
 - (b) buildings belonging to building classes 2 or 3 which only fall under building class 4 due to the slope only need to comply with the requirements for building classes 2 or 3 with respect to fire behaviour.

2.2 Fire resistance of components

- 2.2.1 Unless otherwise specified, the requirements of Table 1b shall apply.
- 2.2.2 Unless the fire escape level is more than 11 m, and each dwelling or business unit on each floor can be reached from at least one point via suitable openings in the facade and is no more than 7 m above the surrounding area, then
 - (a) buildings belonging to building class 1 which only fall under building class 4 due to the slope only need to comply with the component requirements for building class 2,

- (b) buildings belonging to building classes 2 or 3 which only fall under building class 4 due to the slope only need to comply with the component requirements for building classes 2 or 3.
- 2.2.3 The various stiffening and supporting components required for the stability of walls and ceilings must be effective in the event of fire over any period of time which corresponds to the fire resistance required for these walls and ceilings.

3 Spread of fire and smoke within the building

3.1 Fire compartments

- 3.1.1 For floors which are above ground, a fire compartment must not exceed a net floor area of 1 200 m² or if used as an office, a net floor area of 1 600 m² and a longitudinal dimension of 60 m, unless it extends over more than 4 floors which are above ground. In underground floors, a fire compartment must not exceed a net floor area of 800 m². Fire compartments must be isolated from each other using fire compartment-forming components (e.g. walls, ceilings). By way of derogation from this, the requirements for partition walls in accordance with Tables 2a, 2b, and 3 shall apply with respect to the walls of staircases that isolate fire compartments.
- 3.1.2 If mechanical stresses are expected (e.g. as a result of mountings knocked over in the event of fire) then fire compartment-forming walls must also comply with "performance criterion M" whilst taking into account the various requirements in accordance with Table 1b.
- 3.1.3 Fire compartment-forming walls must go at least 15 cm above the roof. They only need to go up to the roof covering provided that the spread of fire is effectively restricted by other measures.
- 3.1.4 Openings in fire compartment-forming walls or ceilings must have closures that have the same fire resistance as the fire compartment-forming wall or ceiling, and must be designed in a self-closing manner, unless closed using other measures in the event of fire. By way of derogation from this, doors and gates may be designed in El₂ 30-C format unless the following total surface areas of all doors and gates are exceeded:
 - (a) 5 m² per joint amount of wall between two fire compartments, unless the amount of wall is more than 50 m²,
 - (b) 10 m² per joint amount of wall between two fire compartments, unless the amount of wall is more than 50 m².
- 3.1.5 If ceilings isolate fire compartments that are on top of each other, then there must either be an external wall strip overlapping the ceiling which is at least 1.2 m high in El 90 format, or the fire compartment-forming ceiling must be extended using a component of the same fire resistance class that overhangs at least 0.8 m horizontally. For buildings belonging to building class 5, class A2 building materials must be used in any case.
- 3.1.6 Doors, gates, windows, and other openings in external walls that connect to fire compartmentforming walls must be at least 0.5 m from the middle of the fire compartment-forming wall, unless the horizontal spread of fire can be limited by other equivalent measures. For buildings whose external walls forms an angle of less than 135 degrees to the fire compartment-forming wall, the distance of such openings from each other must be at least 3 m. These distances shall not apply to the area of lateral wall stringers for arcades, entrances, passages, garage doors, loggias, etc.
- 3.1.7 When measured horizontally, roof openings and openings in dormers and similar roof structures must be at least 1 m from the middle of the fire compartment-forming wall.
- 3.1.8 If roof openings and skylights adjoin higher buildings of another fire compartment, these must be provided within a distance of 4 m in such a way so that a flashover can be effectively restricted.

3.2 Partition walls and partition ceilings

- 3.2.1 Dwellings and business units must be separated using partition walls and partition ceilings both from each other as well as from other building parts (e.g. corridors) in accordance with the requirements of Table 1b. Several business units which are used as offices or for office-like functions and outlets may be considered as a single business unit for up to a maximum of two permitted fire compartment areas. By way of derogation from this, the requirements in accordance with Tables 2a, 2b, and 3 shall apply with respect to the walls of staircases.
- 3.2.2 The following applies to doors in partition walls:
 - (a) Tables 2a, 2b, or 3 for doors in walls of staircases,
 - (b) El₂ 30 format for doors and El 30 format for associated skylights of the same width in partition walls from corridors to dwellings or from dwellings to business units which are used as offices or

for office-like functions; this does not include terraced houses and buildings belonging to building class 2 with no more than two dwellings,

- (c) El₂ 30-C format for other doors in partition walls,
- (d) El₂ 30 format for doors or closures in ceilings to non-extended roof areas; this does not include buildings belonging to building classes 1 and 2.
- 3.2.3 Other openings in partition walls or partition ceilings must have closures that have the same fire resistance as the respective partition wall or partition ceiling. These must be designed in a self-closing manner, unless closed using other measures in the event of fire.

3.3 External wall strip overlapping the ceiling

There must be an external wall strip overlapping the ceiling which is at least 1.2 m high in El 30-ef and A2 format or EW 30-ef and A2 format. This requirement shall not apply unless

- (a) there is a component that overhangs at least 0.8 m horizontally in REI 30 and A2 format or EI 30 and A2 format, or
- (b) there is a suitable technical fire protection device (e.g. extinguisher system)

3.4 Shafts, channels, pipes, and other fixtures

If there are shafts, channels, pipes, and other fixtures in walls or ceilings, or if such structures cut through walls and ceilings, efforts must be made using suitable measures (e.g. partitions, jackets) to ensure that the fire resistance class of these components is not impaired or that the spread of fire and smoke is effectively restricted for the corresponding fire resistance.

3.5 Facades

- 3.5.1 For buildings belonging to building classes 4 and 5, facades (e.g. external wall thermal insulation composite systems, ventilated curtain, ventilated or non-ventilated facades) must be designed in such a way so that the spread of fire via the facade surface to the second floor above the source of the fire, or the falling of large facade parts, as well as any risks to individuals are effectively restricted.
- 3.5.2 The various requirements in accordance with Point 3.5.1 shall be deemed to have been complied with for external wall thermal insulation composite systems with thermal insulation of max. 10 cm using expanded polystyrene (EPS) or class A2 building materials.
- 3.5.3 The various requirements in accordance with Point 3.5.1 shall be deemed to have been complied with for external wall thermal insulation composite systems with class E thermal insulation of more than 10 cm if an all-round fire protection barrier made of mineral wool with a height of 20 cm is attached and dowelled in the ceiling area, or a fire protection barrier made of mineral wool with a lateral encroachment of 30 cm and a height of 20 cm is attached and dowelled in the lintel area of windows and French doors; this shall apply to all floors.
- 3.5.4 For external wall thermal insulation composite systems in buildings belonging to building class 5, only class A2 insulation layers or thermal insulation are permitted for the soffits of protruding or stepping building parts (e.g. bay windows, balconies, or loggias outside); this does not include protruding or stepping building parts with a depth of no more than 2.0 m.
- 3.5.5 The following requirements shall apply to external wall thermal insulation composite systems in buildings belonging to building classes 4 and 5:
 - (a) Only class A2 insulation layers or thermal insulation are permitted for walls and ceilings in open thoroughfares or passages through which the only escape route or access route for the fire service leads. The use of other insulating materials is possible for the base area.
 - (b) If the means of escape is only given in one direction, then only class A2 insulation layers or thermal insulation of more than 10 cm thickness are permitted for walls to open pergolas. The use of other insulating materials is possible for the base area.
- 3.5.6 Double facades must be designed in such a way for buildings belonging to building classes 4 and 5 so that
 - (a) the spread of fire via the facade surface to the second floor above the source of the fire, the falling off of large facade parts as well as any risks to individuals, and
 - (b) the spread of fire through the gaps in the area of partition ceilings and fire compartment-forming ceilings
 - is effectively restricted.
- 3.5.7 Curtain facades must be designed in such a way for buildings belonging to building classes 4 and 5
so that

- (a) the spread of fire via the facade surface to the second floor above the source of the fire, or the falling of large facade parts, as well as any risks to individuals, and
- (b) the spread of fire via the connection joints and cavities within the curtain facade in the area of partition ceilings and fire compartment-forming ceilings

is effectively restricted.

3.6 Lifts

- 3.6.1 Lifts that connect fire compartments to each other must be guided in separate shafts which must be isolated from fire compartment-forming walls and ceilings. Depending on the use of areas accessed via the loading points of lifts, there must be suitable fire protection measures in place to ensure that the spread of fire and smoke is effectively restricted.
- 3.6.2 The shaft fencing of lifts must be designed in A2 format, with the exception of such fencing in buildings belonging to building classes 1 and 2. By way of derogation from this, lining in A2 format on the inner surface of the shaft shall suffice in buildings belonging to building classes 3 and 4.

3.7 Heat-producing appliances and connectors

- 3.7.1 Heat-producing appliances and connectors may not be arranged in rooms in which risks may arise for individuals according to their location, size, nature, or intended purpose (e.g. along escape routes outside of dwellings or business units, in non-extended roof areas).
- 3.7.2 Heat-producing appliances and connectors must be a certain distance from combustible components, linings and fixtures, or shielded from such items in such a way so that they cannot be ignited under any temperatures that occur during operation.
- 3.7.3 Connectors must not be guided through ceilings, in walls or in inaccessible or unventilated cavities.

3.8 Chimneys

- 3.8.1 Chimneys must be resistant to soot fires, unless soot fires can be excluded on the basis of the heatproducing appliances to be closed (e.g. oil fireplaces with forced draft burners or condensing technology, gas fireplaces).
- 3.8.2 If there are chimneys in walls or ceilings, or if they cut through walls and ceilings, efforts must be made using suitable measures to ensure that the fire resistance class of these components is not impaired or that the spread of fire and smoke is effectively restricted for the corresponding fire resistance.
- 3.8.3 Chimneys must be a certain distance from components with combustible building materials so that they cannot be ignited under any temperatures that occur during operation.

3.9 Rooms with increased fire risk

- 3.9.1 Boiler, fuel storage, and waste collection rooms shall in any case apply as rooms with increased fire risk.
- 3.9.2 Walls and ceilings of rooms with increased fire risk must be designed in REI 90 or EI 90 format and lined inside the space in A2 format. A reduction is permitted in external components unless there is a risk of the spread of fire to other building parts or this is necessary for safeguarding an escape route.
- 3.9.3 Doors and gates or other closures must be designed in El₂ 30-C format. A reduction is permitted in external components unless there is a risk of the spread of fire to other building parts or this is necessary for safeguarding an escape route.
- 3.9.4 Floor coverings in boiler and waste collection rooms must comply with A2_{fl}. Mastic asphalt in B_{fl} format is also permitted in waste collection rooms.
- 3.9.5 A boiler room is required for
 - (a) heat-producing appliances for the production of useful heat for room heating or hot water with a nominal thermal capacity of more than 50 kW and
 - (b) heat-producing appliances for solid fuels with automatic firing.
- 3.9.6 By way of derogation from Point 3.9.5, a boiler room is not required for
 - (a) air heaters and radiant heaters, provided that such items are only used to heat the installation room, and
 - (b) heat-producing appliances for solid fuels with automatic firing with a nominal thermal capacity of less than 50 kW that have a storage container with a capacity of no more than 1.5 m³.

- 3.9.7 Rooms in which solid fuels are stored must be designed as fuel storage rooms within building parts with communal areas if
 - (a) the net floor area of such a room is more than 15 m² or the room height is more than 3.0 m, or
 - (b) more than 1.5 m³ of solid fuels which are used for the automatic firing of the associated heatproducing appliance are stored.
- 3.9.8 The joint installation of containers for solid fuels in the form of pellets and the associated heatproducing appliance with automatic firing is permitted in a boiler room provided no more than 15 m³ of solid fuels are stored and the storage tanks are protected by way of appropriate measures against any form of dangerous warming.
- 3.9.9 The storage of liquid fuels with a flashpoint greater than 55°C in amounts of more than 500 litres within building parts with communal areas must be arranged in a fuel storage room that must be no higher than the second floor above ground.
- 3.9.10 The joint installation of storage tanks for liquid fuels with a flashpoint greater than 55°C and the associated heat-producing appliance is permitted in a boiler room provided no more than 5 000 litres are stored and the storage tanks are protected by way of appropriate measures against any form of dangerous warming (e.g. appropriate distances, shields, jackets).

3.10 Initial and advanced fire response

- 3.10.1 If required for the intended purpose, sufficient and appropriate initial fire response resources (e.g. portable fire extinguishers) must, however, be provided in any case in buildings with dwellings or business units.
- 3.10.2 In buildings belonging to building class 5 with more than six floors above ground, there must be wall hydrants on each floor with shape-retaining D hoses and suitable connections for the fire service for fire fighting purposes. By way of derogation from this, a dry extinguishing pipe with suitable connections for the fire service for fire fighting purposes must be provided on each floor in buildings which are used exclusively for residential purposes.

3.11 Smoke detectors

At least one stand-alone smoke detector must be installed in dwellings in all communal areas (with the exception of kitchens) as well as in corridors via which the escape routes from communal areas run. The smoke detectors must be installed in such a way so that smoke from a fire can be detected and notified early on.

3.12 Smoke extraction system from underground floors

There must be suitable measures in place to ensure that smoke is able to be extracted outside. This shall be deemed to have been complied with for each underground floor for fire compartments with a net floor area of more than 200 m² if the fire compartment has openings to the outside with a geometric surface area of at least 0.5 % of the total surface area of the fire compartment. The required closures for wall or ceiling openings must also be able to be opened using firefighter equipment.

4 Spread of fire to other structures

4.1 External walls facing the property or building site boundaries shall qualify as fire compartmentforming walls in accordance with Table 1b if their distance is less than 2 m. No components (e.g. roof overhangs, porches, bay windows, balconies) may protrude within this distance range. Openings must have closures that have the same fire resistance as the fire compartment-forming wall, and must be designed in a self-closing manner, unless closed using other measures in the event of fire.

Wall coverings and cladding (e.g. external wall thermal insulation composite systems) must be designed in A2 format for fire compartment-forming walls with property or building site boundaries. This requirement shall not apply:

- (a) for buildings belonging to building classes 1, 2, and 3, or
- (b) if this wall cannot be built on.
- **4.2** The various requirements in accordance with Point 4.1 shall not apply
 - (a) if the adjacent property or building site is excluded from any future development due to factual or legal circumstances (e.g. vehicular and pedestrian areas within the meaning of spatial planning regulations, public parks, or bodies of water), and
 - (b) alpine huts are located in extreme positions.

- **4.3** By way of derogation from Point 4.1, a fire compartment-forming wall shall not be required for external walls whose distance from the property or building site boundaries is less than 2 m but more than 1 m if there are appropriate fire protection measures in place that are adapted to the structural conditions of the external walls. These fire protection measures must ensure that the spread of fire is prevented to the same extent as for the installation of a fire compartment-forming wall at the property or building site boundaries.
- **4.4** The requirements of Points 3.1.3, 3.1.6, and 3.1.7 shall apply to fire compartment-forming walls at the property or building site boundaries based on the property or building site boundaries.
- **4.5** Connection openings in fire compartment-forming walls at the property or building site boundaries for the purpose of the joint use of individual rooms or groups of rooms in adjacent buildings are only permitted if the overall safety in case of fire is not affected.
- **4.6** Unless the distance between buildings on the same property or building site is at least 4 m, then additional fire protection measures must be provided where necessary that are adapted to the structural conditions of the external walls.

5 Escape routes and emergency exits

5.1 Escape routes

- 5.1.1 Each part of a room must be accessible via a footpath not exceeding 40 m in length, with the exception of non-extended roof areas:
 - (a) a direct exit outside to a safe location within the adjacent area, or
 - (b) a staircase or external staircase, each with an exit outside to a safe location within the adjacent area in accordance with Table 2a or 2b, or
 - (c) two staircases or two external staircases or a staircase and an external staircase, each with an exit outside to a safe location within the adjacent area in accordance with Table 3.
- 5.1.2 In cases such as those stated in Point 5.1.1(c), there must be at least two escape routes which are independent of each other and which lead in the opposite direction to the staircases or external staircases for dwellings or business units on each floor with communal areas. For dwellings which do not extend over more than two floors, this only applies to the opening level.
- 5.1.3 The two escape routes in accordance with Point 5.1.2 must run jointly over a length not exceeding 25 m. One of the escape routes may lead through another fire compartment. This fire compartment must be accessible via a footpath not exceeding 40 m in length, and must have an exit outside to a safe location within the adjacent area, or have an exit via a staircase or external staircase.
- 5.1.4 If staircases are designed in a manner similar to atria or halls, then a number of fire protection measures must be provided which either deviate from or are in addition to the requirements of Tables 2a, 2b, or 3.

5.2 **Emergency exits**

- 5.2.1 In cases such as those stated in Point 5.1.1(c), the escape route via a staircase or external staircase may be replaced by an emergency exit with fire service equipment or by a fixed emergency exit system to the external walls of the building.
- 5.2.2 An emergency exit with fire service equipment is only permitted if the following requirements have been complied with:
 - (a) each dwelling or business unit can reached on each floor via the facade,
 - (b) suitable building openings are available,
 - (c) travel distance for the fire brigade to the building is no more than 10 km,
 - (d) suitable access points, access roads, installation, and movement areas are installed for the necessary fire service equipment.
- 5.2.3 A fixed emergency exit system to the external walls of the building is only permitted if the following requirements have been complied with:
 - (a) each dwelling or business unit can reached on each floor via the facade,
 - (b) suitable building openings are available,
 - (c) a safe location outside within the adjacent area can be reached.

5.3 Corridors, stairs and doors along escape routes outside of dwellings or business units

5.3.1 If escape routes are guided via corridors to staircases in accordance with Tables 2a, 2b, or 3, then

the ceilings of corridors lying on top of each other

- (a) must be designed in REI 60 format for buildings belonging to building classes 3 and 4, and
- (b) must be designed in REI 90 and A2 format for buildings belonging to building class 5
- 5.3.2 With the exception of open pergolas, corridors must be divided up every 40 m by doors in E 30-C format.
- 5.3.3 Flights and landings of stairs within buildings
 - (a) must be designed in R 30 or A2 format for buildings belonging to building class 2,
 - (b) must be designed in R 60 format for buildings belonging to building classes 3 and 4, and
 - (c) must be designed in R 90 and A2 format for buildings belonging to building class 5
- 5.3.4 By way of derogation from Point 5.3.3, the provisions of Tables 2a, 2b, and 3 shall apply for flights and landings in staircases.
- 5.3.5 The requirements for corridors shall apply to closed pergolas.
- 5.3.6 Wall and ceilings of pergolas must comply with the requirements for load-bearing components and ceilings in accordance with Table 1b. By way of derogation from this, it shall be sufficient for open pergolas to be designed in A2 format for buildings which belong up to and including building class 4 provided there are escape routes to two different staircases or external staircases and the stability of the pergola is ensured when exposed to fire.
- 5.3.7 Windows which open out onto open pergolas must be designed in EI 30 format, either in the form of fixed glazing or also installed in such a way so that they close automatically in the event of fire. Alternatively closures in EI 30 format which close automatically in the event of fire may be placed in front of the windows. Doors which open out onto open pergolas must be designed in El₂ 30 format. These requirements shall not apply if
 - (a) no point of any part of a room is more than 40 m away from a safe location outside within the adjacent area, or
 - (b) there are escape routes to two different staircases or external staircases, or
 - (c) there are escape routes to a staircase or external staircase and to a fixed emergency exit system, or
 - (d) glazing in the external wall is installed initially above a parapet height of 1.5 m, and the parapet of the pergola is closed and designed in E 30 format.

5.4 Escape route orientation lighting

For buildings belonging to building classes 4 and 5, escape route orientation lighting must be installed in staircases, external staircases and corridors outside of dwellings or business units along escape routes as well as along the fixed emergency exit system to the external walls of the building.

6 Fire fighting

6.1 Accessibility for the fire service

Buildings must in principle be accessible for fire fighting purposes. The required access roads, installation and movement areas for fire vehicles must be sufficiently paved and able to bear loads. For buildings belonging to building classes 1, 2, and 3, they shall be sufficient in terms of accessibility if the access point to the building which is furthest away, and which is required for opening purposes, can be accessed via a footpath not exceeding 80 m in length from the installation areas for fire vehicles. For buildings belonging to building classes 4 and 5, the deployment options for the fire service must be taken into account with respect to the distance of the installation areas from the building. Additional fire protection measures may be required for buildings for which accessibility for the fire service for fire fighting purposes is insufficient.

6.2 Extinguishing water supply

Additional fire protection measures may be required for buildings for which a sufficient extinguishing water supply cannot be ensured. A sufficient extinguishing water supply shall exist if there is a minimum extinguishing water rate of 1 l/ (m2.min) in relation to the largest fire compartment surface area.

7 Other provisions

This Point contains provisions which are in addition to or deviate from the various requirements in accordance with Points 2 to 6.

7.1 Agriculture and forestry residential and farm outbuildings

- 7.1.1 Classification under a particular building class must be carried out separately for adjoining buildings or building parts which are separated from each other in terms of fire compartments.
- 7.1.2 The outbuilding section must be separated from the residential area by continuous fire compartmentforming walls or ceilings in REI 90 and A2 format or EI 90 and A2 format. By way of derogation from this, designs in REI 60 or EI 60 format shall be sufficient for agricultural buildings which are not used throughout the year and which have a net floor area of no more than 1 200 m² (e.g. alpine huts).
- 7.1.3 Stables must be separated from overlying building parts by walls in R 30 format.
- 7.1.4 Workshops and garages for fuel-powered vehicles or machines must be separated from adjacent building parts of the outbuilding section by walls or ceilings in REI 90 and A2 format or EI 90 and A2 format.
- 7.1.5 Depending on the size and use, the various requirements in accordance with Table 1b as well as with respect to the permitted size of a fire compartment in accordance with Point 3.1.1 may be deviated from with respect to the required fire resistance of load-bearing components in floors of farm outbuildings which are above ground.
- 7.1.6 Farm outbuildings must be far enough away from the property or building site boundaries to ensure that the spread of fire to neighbouring buildings is prevented as much as possible, whilst also taking into account the deployment of the fire service. By way of derogation from Points 4.1 and 4.3, the distance from the property or building site boundaries for external walls of farm outbuildings must be equal to 6/10 of the height of the facing external wall, which must be at least 3 m, unless the external wall does not have any defined fire resistance.
- 7.1.7 The OIB Guideline 2.1 "Safety in case of fire in operational structures" may be used for agricultural and forestry farm outbuildings; for buildings with a net floor area of more than 1 800 m², the stables for livestock must be separated from other areas by walls or ceilings in REI 60 or EI 60 format.

7.2 School and nursery buildings and other buildings of similar use

- 7.2.1 With the exception of buildings with just one floor which is above ground, buildings belonging to building classes 1 and 2 must be classified as buildings belonging to building class 3.
- 7.2.2 Walls that border staircases, central cloakrooms, physics rooms, chemistry rooms, workshops including associated teaching aid rooms, training kitchens, etc. must be designed as partition walls. Ceilings between floors which are above ground must be designed as partition ceilings.
- 7.2.3 By way of derogation from Point 5, Points 5.1.1(b) and 5.2 do not need to be applied to floors with classrooms or group rooms.
- 7.2.4 Physics and chemistry rooms must have two separate exits. Doors to central cloakrooms, physics rooms, chemistry rooms, workshops including associated teaching aid rooms, training kitchens, etc. must be designed in El2 30-C format. A design in E 30-C format shall be sufficient unless an impairment is expected as a result of radiant heat.
- 7.2.5 For floors which are above ground, a fire compartment must not exceed a net floor area of 1 600 m².
- 7.2.6 Heat-producing appliances for a central heat supply must in any case be installed in a boiler room which must meet the requirements of Points 3.9.2 to 3.9.4. This does not include gas boilers with a nominal thermal capacity of no more than 50 kW if they are installed in a room that is protected against any unauthorised entry.
- 7.2.7 Escape route orientation lighting must be installed in staircases, external staircases, and corridors along escape routes, unless the gross floor area is more than 3 200 m². If the gross floor area is greater than 3 200 m², then safety lighting shall be required.
- 7.2.8 There must be suitable alarm systems in place which will warn individuals within the building in the event of any danger.
- 7.2.9 Stand-alone smoke detectors must be installed in buildings or building parts in which nurseries or similar uses are housed in all communal areas as well as in corridors via which the escape routes from communal areas run.
- 7.3 Lodging facilities, student residences, and other buildings of similar use

- 7.3.1 With the exception of buildings with just one floor which is above ground, buildings belonging to building classes 1 and 2 must be classified as buildings belonging to building class 3.
- 7.3.2 For floors which are above ground, a fire compartment must not exceed a net floor area of 1 600 m².
- 7.3.3 Walls of sleeping areas to areas for other uses (e.g. kitchens including associated storage areas, dining rooms, sauna areas, etc.) must be designed as partition walls. Ceilings between floors which are above ground must be designed as partition ceilings. The requirements with respect to the fire behaviour of railings on balconies and loggias in accordance with Table 1a and the fire resistance of balcony slabs in accordance with Table 1b shall not apply to lodging facilities with no more than six floors which are above ground.
- 7.3.4 A single escape route via a staircase or an external staircase in accordance with Point 5.1.1(b) is only permitted in lodging facilities with no more than 100 guest beds provided that the walls between the corridors and guest bedrooms or the corridors and other rooms are designed in REI 30 or EI 30 format. Doors within these walls must comply with El₂ 30-C.
- 7.3.5 By way of derogation from Point 5.2.1, the second escape route may only be replaced by an emergency exit with fire service equipment if there are no more than 100 guest beds within the lodging facility and there are no more than 30 guest beds on each floor located on a different level; there must also be an automatic fire alarm system with automatic alarm transmission to the central receiving station of a permanently manned public alarm receiving centre.
- 7.3.6 By way of derogation from Point 5.2.1, the second escape route may only be replaced by a fixed emergency exit system to the external walls of the building if the various requirements in accordance with Point 5.2.3. have been complied with for each guest bedroom.
- 7.3.7 Floor coverings in communal areas (e.g. restaurant, bar) must comply with C_{fl}-s2, whereby wood and materials are permitted in D_{fl} format. Wall and ceiling coverings must comply with C-s2, d0, whereby wood and materials are permitted in D format.
- 7.3.8 Heat-producing appliances for a central heat supply must in any case be installed in a boiler room which must meet the requirements of Points 3.9.2 to 3.9.4. This does not include gas boilers with a nominal thermal capacity of no more than 50 kW if they are installed in a room that is protected against any unauthorised entry.
- 7.3.9 Escape route orientation lighting must be installed in staircases, external staircases and corridors along escape routes as well as along the fixed emergency exit system to the external walls of the building in lodging facilities with no more than 60 guest beds. Safety lighting shall be required in lodging facilities with more than 60 guest beds.
- 7.3.10 With respect to measures regarding the early detection of fires and raising alarms, lodging facilities must comply with the following requirements depending on the number of guest beds:
 - (a) If there are no more than 30 guest beds, then interconnected smoke detectors must be installed in the guest bedrooms as well as corridors via which the escape routes run, and must also be connected to the electricity supply. The smoke detectors must be installed and operated in such a way so that smoke from a fire can be detected and notified early on,
 - (b) For between 31 to 100 guest beds, an automatic fire alarm system must be installed for the entire lodging facility,
 - (c) For more than 100 guest beds, an automatic fire alarm system with automatic alarm transmission to the central receiving station of a permanently manned public alarm receiving centre must be installed for the entire lodging facility.

Staff beds shall count as guest beds unless the staff bed area is separated from the guest bed area by way of partition walls or partition ceilings.

- 7.3.11 In lodging facilities with more than 100 guest beds, there must be wall hydrants on each floor with shape-retaining D hoses and suitable connections for the fire brigade for fire fighting purposes.
- 7.3.12 The various provisions in accordance with Points 7.3.1 to 7.3.11 shall apply mutatis mutandis for student residences and other buildings of similar use.
- 7.3.13 Points 7.3.1 and 7.3.6 shall not apply to alpine huts located in extreme positions. By way of derogation from Point 7.3.10(c), an automatic alarm transmission to the central receiving station of a permanently manned public alarm receiving centre shall not be required.

7.4 Outlets

- 7.4.1 By way of derogation from Table 1b, any load-bearing components of free-standing outlets may only be manufactured with one single floor in R 30 or A2 format.
- 7.4.2 Outlets with a retail space of more than 600 m² and no more than 3 000 m² and with no more than

three floors which are openly connected must meet the following requirements:

- (a) Rooms which do not belong to outlets must be separated by fire compartment-forming walls or ceilings.
- (b) Table 4 shall apply with respect to the various requirements for fire compartments for retail spaces.
- (c) By way of derogation from Point 5, Points 5.1.1(b) and 5.2 do not need to be applied to floors with retail spaces.
- (d) Escape route orientation lighting must be installed along the escape route in outlets with a retail space of no more than 2 000 m². Safety lighting shall be required in outlets with a retail space of no more than 2 000 m².
- 7.4.3 For outlets with a retail space of no more than 1 800 m², the extinguishing water demand and the need for advanced fire response devices must be stipulated and provided in consultation with the fire service whilst taking into account the various fire loads and technical fire protection devices.
- 7.4.4 A fire protection programme that corresponds to the OIB Guideline "Variations in fire protection and fire protection programmes" is required for outlets with a retail space of more than 3 000 m² or for outlets with more than three floors which are openly connected.

8 Operational structures

The provisions of OIB Guideline 2.1 "Safety in case of fire in operational structures" shall apply.

9 Garages, roofed parking spaces, and multi-storey car parks

The provisions of OIB Guideline 2.2 "Safety in case of fire in garages, roofed parking spaces, and multi-storey car parks" shall apply.

10 Buildings with a fire escape level in excess of 22 m

The provisions of OIB Guideline 2.3 "Safety in case of fire in buildings with a fire escape level in excess of 22 m" shall apply.

11 Special buildings

A fire protection programme that corresponds to the OIB Guideline "Variations in fire protection and fire protection programmes" is required for the following special buildings. meeting places for more than 1 000 people,

hospitals,

retirement and nursing homes,

prisons,

Other special buildings and structures to which the requirements of this Guideline do not apply based on the intended purpose or design.

Table 1a: General requirements for fire behaviour

	Building classes (BC)	BC 1	BC 2	BC 3	BC 4	BC 5
1 Fa	acades	<u> </u>				
11	External wall thermal insulation composite	F	n	П	C-d1	C-d1
4.0	systems					0 0.
1.2	Facade systems, ventilated curtain, ventilated or no	n-ventilated		т <u> </u>	Τ =	
1.2.1	Classified overall system or	E	D-d1	D-d1	B-d1 (1)	B-d1 (2)
1.2.2	Classified individual components	I –				
	- External layer				A2-01 (3)	A2-01 (4)
	- Substructure - rod-snaped / punctiform			D / A2	D / A2	C / A2
4.0	- Insulation layer or thermal insulation				B(3)	B(4)
1.3	Other external wall cladding or coverings				B-01 (5)	B-01 (0)
1.4	Railings on baiconies, loggias, etc.	- 	-	-	B(5)	В(б)
2 6	stridors and staircases outside of dweilings: clade	ding and cove	rings as wen a	is suspending	ceilings	
2.1	Wall cladding (/)	1	·· I· <u> </u>	·••	Τ_	1 <u> </u>
2.1.1	Classified overall system or	-	D	D	С	В
2.1.2	Classified individual components	İ	1_	1_		-
	- External layer	-	D	D	C (5)	B
	- Substructure	-	D	D	A2 (5)	A2 (5)
~ ~		-				A2
2.2	Suspended ceilings	-	D-du	D-d0	C-s1, d0	B-s1, d0
2.3	Wall and ceiling coverings	-	D-d0	D-d0	C-s1, d0	B-s1,d0
2.4	Floor coverings	-	Dfl	Dfl	Cfl-s1 (8)	Cfl-s1
3 St	aircases: cladding and coverings as well as susp	ending ceiling	js			
3.1	Wall cladding (7)		. ,			
3.1.1	Classified overall system or	-	D	С	В	A2
3.1.2	Classified individual components					
l	- External layer	-	D	C (5)	В	A2
	- Substructure	-	D	A2 (5)	A2 (5)	A2 (5)
	- Insulation layer or thermal insulation	-	С	С	A2	A2
3.2	Suspended ceilings	-	D-s1, d0	C-s1, d0	B-s1, d0	A2-s1, d0
3.3	Wall and ceiling coverings	-	D-s1, d0	C-s1, d0	B-s1,d0	A2-s1, d0
3.4	Floor coverings					
3.4.1	in staircases in accordance with Table 2a, 2b	-	Dfl-s1	Cfl-s1	Bfl-s1	A2fl-s1
3.4.2	in staircases in accordance with Table 3	-	Dfl-s1	Cfl-s1 (8)	Cfl-s1	A2fl-s1 (9)
4 Ro	oofs with a slope ≤ 60°				·	
4.1	Roofing (overall system) (10)	B _{ROOF} (t1)	B _{ROOF} (t1)	B _{ROOF} (t1)	B _{ROOF} (t1)	B _{ROOF} (t1) (11)
4.2	Insulation layer or thermal insulation in roof	E	E	E	B(12)	B(13)
- N/	structure				、 <i>'</i>	``'
5 NG	Shextended root areas: floor structures and cove	rings				
5.1		1	<u>п</u>	Т	т_	۱ <u> </u>
5.1.1	Classified overall system or	-	E	D	D	В
5.1.2	Classified individual components	1				1
	- External layer	-	C	C	B	B
	- Insulation layer or thermal insulation				B(12)	B(13)
5.2	Floor coverings	-	Eti	Dti	Ctl-s1	BtI-s1
(1) W	bod and wood materials in D format are also permitted in the o	classified overall	system complies	with class D-d0;	around and a fire	escane level of
(2) no	more than 13 m if the classified overall system complies with	n class D-d0;		5 WIICH are above		escape level of
(3) An	external layer in B-d1 format or wood and wood materials in	D format is perm	nitted for an insula	ation layer/thermal	insulation in A2 fo	rmat;
(4) An pe	rmitted for buildings with no more than five floors which are a	yer/thermal insul bove ground and	ation in A2 format 1 a fire escape lev	;; wood and wood rel of no more thar	materials in D form	nat are also
(5) W	ood and wood materials in D format are also permitted;					
(6) W	ood and wood materials in D format are also permitted for bui	ildings with no m	ore than five floor	s which are above	ground and a fire	escape level of
(7) If t	here are no wall and ceiling coverings in corridors and stairca	ases, then the re	quirements for wa	Il and ceiling cove	rings in accordanc	e with line 2.3 or
3.3	shall apply to the cladding (as an overall system) or the extern	ernal layer of the	cladding;	· <u>-</u>	5	
(8) Ha	irdwoods (e.g. oak, beech, ash) with a minimum thickness of	15 mm are perm	itted;			
(10) W	th respect to roofs with a slope $< 20^{\circ}$, provided there is a top	layer with 5 cm	gravel or equivale	nt substance, ther	a covering in E fo	rmat shall
SU					- AQ: h	an anti- a farm
(11) W	s, wood and wood materials in D format are also permitted for	or battens. counter	and formwork mus	mwork:	s A2; by way of de	rogation from
(12) Cla	ass E EPS, XPS, and PUR are also permitted in the following	j cases:				
- 0	n roofs with a slope $< 20^{\circ}$ or on the top floor ceiling, or no roofs with a slope $> 20^{\circ}$ which are manufactured in A2 form	nat and which al	o comply with the	required fire resis	tance in accordan	ce with Table 1b
wit	the respect to the performance characteristics E and I;		o comply with the	required file resis		
(13) Cla	ass E EPS, XPS, and PUR are also permitted for roofs with a	slope < 20° or c	n the top floor cei	ling provided they	are manufactured	in A2 format
an	a also comply with the required fire resistance in accordance	with radie to w	ith respect to the	performance chara	acteristics E and I.	

	Building classes (BC)	BC 1	BC 2	BC 3	BC 4	BC 5
1	Load-bearing components (with the except	ion of ceilings a	nd fire compart	tment-forming w	valls)	
1.1	In the top floor	-	R 30	R 30	R 30	R 60 ⁽¹⁾
1.2	In other floors above ground	R 30 ⁽²⁾	R 30	R 60	R 60	R 90 and A2
1.3	In underground floors	R 60	R 60	R 90 and A2	R 90 and A2	R 90 and A2
2	Partition walls (with the exception of walls	of staircases)				
2.1	In the top floor	Not applicable	REI 30 El 30	REI 30 EI 30	REI 60 EI 60	REI 60 ⁽¹⁾ El 60 ⁽¹⁾
2.2	In floors above ground	Not applicable	REI 30 El 30	REI 60 EI 60	REI 60 EI 60	REI 90 and A2 EI 90 and A2
2.3	In underground floors	Not applicable	REI 60 El 60	REI 90 and A2 EI 90 and A2	REI 90 and A2 EI 90 and A2	REI 90 and A2 EI 90 and A2
2.4	Between dwellings or business units in terraced houses	Not applicable	REI 60 El 60	Not applicable	REI 60 EI 60	Not applicable
3	Fire compartment-forming walls and ceiling	gs				
3.1	Fire compartment-forming walls at the property or building site boundaries	REI 60 EI 60	REI 90 ⁽³⁾ El 90 ⁽³⁾	REI 90 and A2 EI 90 and A2	REI 90 and A2 EI 90 and A2	REI 90 and A2 EI 90 and A2
3.2	Other fire compartment-forming walls or ceilings	Not applicable	REI 90 El 90	REI 90 EI 90	REI 90 El 90	REI 90 and A2 EI 90 and A2
4	Ceilings and sloping tops with a slope \leq 60	0				
4.1	Ceilings above the top floor	-	R 30	R 30	R 30	R 60 ⁽¹⁾
4.2	Partition ceilings above the top floor	-	REI 30	REI 30	REI 60	REI 60 ⁽¹⁾
4.3	Partition ceilings above other floors above ground	-	REI 30	REI 60	REI 60	REI 90 and A2
4.4	Ceilings within dwellings or business units in floors above ground	R 30 ⁽²⁾	R 30	R 30	R 30	R 90 $^{(1)}$ and A2
4.5	Ceilings above underground floors	R 60	REI 60 ⁽⁴⁾	REI 90 and A2	REI 90 and A2	REI 90 and A2
5	Balcony slabs	-	-	-	R 30 or A2	R 30 and A2
(1)	 A fire resistance of 60 minutes without A2 shall suffice for both top floors for buildings with no more than six floors which are above ground; A fire resistance of 60 minutes without A2 shall suffice for both top floors for buildings with no more than six floors which are above ground; 					
(2)	(2) Not required for buildings which are only used for residential purposes or as offices or for office-like functions; (3) A design in PEL60 or EL60 format shall suffice for the walls between dwellings or business unit as well as at the property or					
(3)	building site boundaries for terraced houses;					
(4)	(4) The requirement R 60 shall suffice for terraced houses and buildings with no more than two dwellings or two business units used as offices or for office-like functions.					

Table 1b: General requirements for the fire resistance of components

Table 2a: Requirements for staircases or external staircases along a singleescape route in accordance with Point 5.1.1 (b) in buildingsbelonging to building classes 2, 3 and 4

Subject matter	BC 2 ⁽¹⁾	BC 3	BC 4		
1 Walls of staircases	•				
1.1 In floors above ground ⁽²⁾	REI 30 EI 30	REI 60 El 60	REI 60 ⁽³⁾ EI 60 ⁽³⁾		
1.2 In underground floors	REI 60 EI 60	REI 90 and A2 EI 90 and A2	REI 90 and A2 EI 90 and A2		
2 Ceiling above the staircase ⁽⁴⁾	REI 30 EI 30	REI 60 EI 60	REI 60 ⁽³⁾ EI 60 ⁽³⁾		
3 Doors in walls of staircases					
3.1 to dwellings, business units, and other rooms	El ₂ 30	El ₂ 30-C	El ₂ 30-C-S _m		
3.2 to corridors in floors above ground ⁽⁵⁾	-	E 30-C	El ₂ 30-C		
3.3 to corridors and rooms in underground floors	El ₂ 30	El ₂ 30-C	El ₂ 30-C		
4Flights and landings in staircases	R 30	R 60	R 60 and A2		
5 Railings in staircases	-	-	B ⁽⁶⁾		
6 Fume outlet					
6.1 Location	At the highest point of the staircase ⁽⁷⁾	At the highest point of the staircase	At the highest point of the staircase		
6.2 Size	Geometric free	Geometric free	Geometric free		
6.3 Trigger device	In the attack level of the fire service as well as at the highest point of the staircase landing with access points to communal areas; independent from the public electricity grid ⁽⁷⁾	In the attack level of the fire service as well as at the highest point of the staircase landing with access points to communal areas; independent from the public electricity grid and via a smoke-sensitive element on the ceiling	In the attack level of the fire service as well as at the highest point of the staircase landing with access points to communal areas; independent from the public electricity grid and via a smoke-sensitive element on the ceiling		
7 External staircases	A2 format, and no impairment as a result of exposure to flames and dangerous levels of radiant heat in the event of fire	A2 format, and no impairment as a result of exposure to flames and dangerous levels of radiant heat in the event of fire	A2 format, and no impairment as a result of exposure to flames and dangerous levels of radiant heat in the event of fire		
(1) Does not apply to terraced houses a	nd buildings with no more than	n two dwellings;			
(2) Requirements for fire resistance are not required for external walls of staircases which consist of A2 building materials and are not affected by other building parts connected to these external walls in the event of fire;					
(3) The components must consist of A2 building materials on the staircase;					
(4) Such requirements may be deviated from it the spread of fire from adjacent parts of the structure to the staircase is prevented by way of suitable measures.					
(5) EI 30 format shall suffice for glass surfaces surrounding doors which have surfaces that are no more than three times the door leaf area					
(6) Hardwoods (e.g. oak, beech, ash) wi	th a minimum thickness of 15	mm are permitted;	for a second second in the second		
(7) The fume outlet shall not be required 0.5 m ² , are installed on each floor; s external equipment.	ur windows which lead directl uch windows must also be ab	y outside, and which have a le to be opened in their curre	rree cross-section of at least nt state without the need for		

external equipment.

Table 2b: Requirements for staircases or external staircases along a singleescape route in accordance with Point 5.1.1(b) in buildingsbelonging to building class 5

Subject matter	BC 5 with mechanical ventilation system	BC 5 with automatic fire alarm system and fume outlet	BC 5 with double door system and fume outlet	
1 Walls of staircases and double do	ı or svstems			
1.1 In floors above ground ⁽¹⁾	REI 90 and A2	REI 90 and A2	REI 90 and A2	
1.2 In underground floors	REI 90 and A2	REI 90 and A2	REI 90 and A2	
2 Ceiling above the staircase ⁽²⁾	REI 90 and A2	REI 90 and A2	REI 90 and A2	
3 Doors in walls of staircases				
3.1 to corridors in floors above ground (3)	E 30-C	E 30-C-S _m	Not applicable	
3.2 to dwellings, business units, and other rooms	El ₂ 30-C	El ₂ 30-C-S _m	Not permitted	
3.3 to corridors and rooms in underground floors	El ₂ 30-C	El ₂ 30-C-S _m	Not applicable	
4 Doors in walls of double door sys	tems			
4.1 to corridors and staircases	Not applicable	Not applicable	E 30-C	
4.2 other rooms	Not applicable	Not applicable	El ₂ 30-C	
staircases	R 90 and A2	R 90 and A2	R 60 and A2	
6 Railings in staircases	В	В	В	
 Mechanical ventilation system 	Suitable for individuals to be able to rescue themselves from the fire zone, prevents the penetration of smoke into the staircase in the event doors to the fire zone are closed, and dilutes and removes any smoke which penetrates into the staircase after briefly opening the doors to the fire zone	INOT APPIICABIE	Not applicable	
8 Automatic fire alarm system	Not applicable	In the staircase, including generally accessible areas such as corridors and cellar areas, within the scope of "equipment protection" with internal raising of alarm	Not applicable	
9 Fume outlet				
9.1 Location	Not applicable	At the highest point of the staircase	At the highest point of the staircase	
9.2 Size	Not applicable	Geometric free cross-section of 1 m ²	Geometric free cross-section of 1 m ²	
9.3 Trigger device	Not applicable	In the attack level of the fire service as well as at the highest point of the staircase landing with access points to communal areas; independent from the public electricity grid and via the automatic fire alarm system, as well as an additional manual control panel with position indicator	In the attack level of the fire service as well as at the highest point of the staircase landing with access points to communal areas; independent from the public electricity grid and via a smoke-sensitive element on the ceiling of the staircase, as well as an additional manual control panel with position indicator	
9 External staircases	A2 format, and no impairme radiant heat in the event of	ent as a result of exposure to fla fire and/or penetration of smoke	ames and dangerous levels of	
(1) Requirements for fire resistance are not	required for external walls of stat	ircases which consist of A2 building	materials and are not affected by	
 (2) Such requirements may be deviated from measures. 	if the spread of fire from adjacer	nt parts of the structure to the stairca	se is prevented by way of suitable	
incosures.				

Table 3: Requirements for staircases or external staircases along escape routes in accordance with Point 5.1.1(c)

Subject matter	BC 2 ⁽¹⁾	BC 3	BC 4	BC 5	
1 Walls of staircases					
1.1 In floors above ground ⁽²⁾	REI 30 El 30	REI 60 El 60	REI 60 El 60 REI 90 and 42	REI 90 and A2 EI 90 and A2 REI 90 and A2	
1.2 In underground floors	EI 60	El 90 and A2	El 90 and A2	El 90 and A2	
2 Ceiling above the staircase ⁽³⁾	REI 30	REI 60	REI 60	REI 90 and A2	
3 Doors in walls of staircases				<u></u>	
3.1 to dwellings	-	El ₂ 30	El ₂ 30	El ₂ 30	
3.2 to business units	El. 30	El. 30-C	Fla 30-C	El. 30-C	
3.3 to corridors in floors above ground ⁽⁴⁾	-	E 30-C	E 30-C	E 30-C	
3.4 to corridors and rooms in underground floors	El ₂ 30	El ₂ 30-C	El ₂ 30-C	El ₂ 30-C	
4 Flights and landings					
4.1 in staircases	R 30	R 60	R 60	R 90 and A2	
in staircases into which only 4.2 doors in E 30-C or El ₂ 30-C format lead	-	R 30 or A2	A2	R 30 and A2	
5 Fume outlet					
5.1 Location	-	At the highest point of the staircase (5)	At the highest point of the staircase	At the highest point of the staircase	
5.2 Size	-	Geometric free cross- section of 1 m ^{2 (5)}	Geometric free cross- section of 1 m ²	Geometric free cross- section of 1 m ²	
5.3 Trigger device	-	In the attack level of the fire service as well as at the highest point of the staircase landing with access points to communal areas; independent from the public electricity grid ⁽⁵⁾	In the attack level of the fire service as well as at the highest point of the staircase landing with access points to communal areas; independent from the public electricity grid	In the attack level of the fire service as well as at the highest point of the staircase landing with access points to communal areas; independent from the public electricity grid and via a smoke- sensitive element on the ceiling	
6 External staircases	-	R 30 or A2 format, and no impairment as a result of exposure to flames and dangerous levels of radiant heat	A2 format, and no impairment as a result of exposure to flames and dangerous levels of radiant heat in the event of fire	A2 format, and no impairment as a result of exposure to flames and dangerous levels of radiant heat in the event of fire	
(1) Does not apply to terraced houses a	nd buildings v	with no more than two dwe	llings;		
(2) Requirements for fire resistance are not required for external walls of staircases which consist of A2 building materials and are not affected by other building parts connected to these external walls in the event of fire:					
(3) Such requirements may be deviated from if the spread of fire from adjacent parts of the structure to the staircase is prevented by way of suitable measures					
(4) EI 30 format shall suffice for glass surfaces surrounding doors which have surfaces that are no more than three times the door leaf area:					
(5) The fume outlet shall not be required if windows which lead directly outside, and which have a free cross-section of at least 0.5 m², are installed on each floor; such windows must also be able to be opened in their current state without the need for external equipment.					

Table 4: Requirements for fire compartments for retail spaces

	Fire compartment surface area in m ²	Number of floors which are openly connected	Ceilings between floors within a fire compartment	Fire protection equipment
1	> 600 and ≦ 1 200	1 2 3	Not applicable REI 60 REI 60	Smoke extracted via wall and/or ceiling openings with a geometric surface area of at least 0.5 % of the retail space
2	> 1 200 and \leq	1	Not applicable	Smoke and heat exhausting system with automatic activation and central manual activation option by the fire service from a safe location in the event of fire
	1 800	2 3	REI 60 REI 90	Automatic fire alarm system and smoke and heat exhausting system with control via automatic fire alarm system
		1	Not applicable	Automatic fire alarm system with automatic
3	> 1 800 and ≦ 3 000	2	REI 90 and A2	alarm transmission to the central receiving station of a permanently manned public alarm receiving centre and smoke and heat exhausting system with control via automatic fire alarm system
				Advanced automatic fire response equipment (AAF) and smoke and heat exhausting system activated at the very least by smoke- sensitive activating elements every 200 m ² of ceiling surface area.
		3	REI 90 and A2	For a fire compartment surface area of at least 2 400 m ² , an automatic fire alarm system with automatic alarm transmission to the central receiving station of a permanently manned public alarm receiving centre in conjunction with a smoke and heat exhausting system with control via the automatic fire alarm system shall suffice.

Knowles, Jessica D OHCS:EX

From:	Rotgans, Trudy OHCS:EX
Sent:	Monday, April 15, 2013 1:06 PM
То:	Gisborne, Carolyn; Green, Tracy OHCS:EX; Ho Yee, Brian OHCS:EX; Hutchinson, Jarrett OHCS:EX; Jensen, Jun'ichi OHCS:EX; Kuhnert, Lyle OHCS:EX; May, Zachary OHCS:EX; Nicol, John OHCS:EX; Nutting, Alison OHCS:EX; Thompson, Bob R OHCS:EX
Subject:	FW: External Fires
Attachments:	ExternalOrigin_FullReport.pdf
Follow Up Flag:	Follow up
Flag Status:	Flagged

FYI - interesting study. This is in line with the advice that Sereca gave us during the 6 storey wood project.

Best regards,

Trudy

From: Garis, Len [mailto:LWGaris@surrey.ca] Sent: Monday, April 15, 2013 11:21 AM To: Rotgans, Trudy OHCS:EX Subject: External Fires

As discussed

Len Garis Fire Chief City of Surrey 604-543-6701

Adjunct Professor in the School of Criminology and Criminal Justice University of the Fraser Valley

"Only those who risk going too far can possibly find out how far one can go"

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Fires that Commence on Balconies of Multi-Residential Buildings

The Importance of an External Fire Area of Origin for Residential Fire Outcomes



Fire Chief Len Garis and Dr. Joseph Clare

January 2013



SCHOOL OF CRIMINOLOGY & CRIMINAL JUSTICE



CENTREGEOSO PUBLIC SAFETY & CRIMINIA 2014 STOOL RESEARCH

Executive Summary

- 1. The purpose of this study was to examine the significance of fires that occur on the exterior of multiresidential buildings. This research was motivated by the findings of previous investigations into sprinkler systems and the storage of propane in these types of buildings, which suggested there are existing vulnerabilities associated with fires that commence in external, recreational areas such as balconies and patios.
- 2. Data was provided by the British Columbia Office of the Fire Commissioner and included all fires reported to the Office between October 2006 and October 2011. From a total of 37,942 fires that were reported, 2,638 fires that occurred in multi-residential buildings were retained for this analysis.
- 3. Overall, 9.7% of the multi-residential building fires originated from an outside area (either the exterior balcony (including open porch or deck) or court/patio/terrace area). There were no fatalities recorded as having been associated with these outside-origin fires, and there was no difference in the frequency of injury associated with outside fires (in relation to all others). The damage associated with outside fires was 2.4 times greater than the average loss associated with all other multi-residential structure fires.
- 4. There is clear indication that there is a vulnerability associated with fires that commence on the exterior of multi-residential buildings, in relation to all other fires. The analysis revealed that, , relative to the remainder of the multi-residential structure fires examined, fires that commenced on the building exterior were:
 - a) 5.5 times less likely to activate a smoke alarm and 1.4 times more likely to require visual sighting of some other means of personal detection.
 - b) 1.5 times more likely to require the fire department to apply water and 1.5 times more likely to have been controlled by makeshift firefighting aids.
 - c) 3.3 times less likely to have burned out on their own, 5.4 times less likely to have been controlled by the removal or shut-off of the fuel supply, and 3.5 times less likely to have been controlled by sprinkler systems.
 - d) 1.1 times less likely to be contained to at least the room of origin of the fire, 1.9 times more likely to extend as far as the building of origin, and 4.1 times more likely to extend beyond the property of origin.
- 5. These vulnerabilities should be ameliorated to an extent by the recent amendments to the British Columbia Building Code that mandate additional fire protection for mid-rise, multi-residential buildings, including (but not restricted to) sprinklers on balconies, fire-resistant exterior cladding, and additional fire separations in roof areas.
- 6. In addition to these measures, however, it is worth exploring the fire safety implications of rethinking the recreational use of propane on balconies and the significance of unplanned fuel loads in these areas as a result of them being used for storage. Keeping in mind these legitimate uses for these areas of the buildings, it is worth considering enhancing the fire protection systems in place on balconies and common recreational by either (a) prohibiting storage in these areas, (b) providing strategies for early detection of fire events, or (c) extending sprinkler protection to cover these areas, where possible. Whichever combination of techniques are selected, reducing the exposure to these vulnerabilities needs a systems approach (involving the building resident, the building responsible person, the built-in fire protection strategies, and the fire service) and must operate within a realistic framework about legitimate use, storage requirements, and costs of fire protection.

Background and Purpose of this Research

Recent research into the significance of sprinkler systems for fire outcomes [1, 2] and the fire implications for the storage/use of propane in multi-residential buildings [3] has raised concerns that fires that occur on the exterior of multi-residential buildings expose vulnerabilities in existing fire safety strategies and systems. This research note summarizes the findings from a retrospective analysis of five-years of fire incident data reported in British Columbia (BC) examining how the built-in fire protection systems have performed historically when confronted with fires in multi-residential buildings that commence on the building exterior.

Identifying Relevant Cases for Analysis

Data was provided by the BC Office of the Fire Commissioner (OFC), including all fires reported to the OFC between October 2006 and October 2011. The overall data set of 37,492 fires was sorted and incidents were retained for analysis if they had occurred in an apartment, tenement, flat, townhouse, or condominium¹ and fires were classified as originating outside if they were identified as having started on an exterior balcony (including open porch or deck) or a court/patio/terrace area.²

Table 1 demonstrates the number of BC reporting areas that provided data, along with the number of multi-residential structure fires, the number of fire-related deaths and injuries, and the estimated average property loss associated with each fire. Overall, 9.7% of the fires that were reported in multi-residential buildings originated from the outside area. With respect to fire-related fatalities, there were none that resulted from fires that originated outside the building. The injury rate per 1,000 fires was equivalent for fires that originated outside (70.6 injuries) compared to the remainder of the fires (89.4 injuries).³ Interestingly, however, the difference between the estimated property losses (in dollars) as a result of fire origin indicated that the damage as a result of fires that originated outside the multi-residential buildings was 2.4 times greater than for damage caused by all other multi-residential fires.⁴

TABLE 1. FREQUENCY OF STRUCTURE FIRES, DEATHS, INJURIES, AND AVERAGE LOSS (\$) FOR FIRES IN MULTI-RESIDENTIAL BUILDINGS AS A FUNCTION OF AREA OF FIRE ORIGIN

Area of origin for the fire	# Reporting locations	# Fires	# Deaths	# Injuries	Avg. \$ loss*
Originated outside	44	255	0	18	\$138,376
Did not originate outside	102	2,383	36	213	\$58,016
Total	106	2,638	36	231	\$80,348

* Missing values were excluded from this average loss calculation, resulting in outside n = 241 and not outside n = 2,318.

How the Fire was Initially Detected by Area of Origin

Figure 1 shows the process by which multi-residential structure fires were initially detected as a function of the area of origin for the fire. As can be seen, the fires that occurred on the outside of these multi-residential buildings were 5.5 times less likely to be detected as a result of an activated smoke alarm and

¹ Property classification values: PR3210, PR3220, PR3230, PR3240, PR3250, and PR3290.

² Fire origin area values: OA7200 = exterior balcony and OA9200 = court/patio/terrace.

³ Rate-ratio difference here was non-significant, Z = -0.96, p > .10.

⁴ Significant independent samples *t*-test: t (df = 2,557) = 2.10, p < .04.

1.4 times more likely to require visual sighting of some other means of personal detection.⁵ These patterns have obvious implications for the typical built-in fire protection systems in these buildings, exposing a gap in the monitoring coverage typically provided by smoke alarms.

FIGURE 1. PROCESS OF INITIAL DETECTION FOR FIRES IN MULTI-RESIDENTIAL BUILDINGS AS A FUNCTION OF AREA OF FIRE ORIGIN



Method of Fire Control by Area of Origin

Figure 2 displays the relative frequencies at which a range of methods of fire control were utilized to respond to these multi-residential structure fires, as a function of the fire area of origin. These patterns demonstrate that fires that commenced on the outside of multi-residential buildings were 1.5 times more likely to require the fire department to apply water and 1.5 times more likely to have been controlled by makeshift firefighting aids. In contrast, these external fires were also 3.3 times less likely to have burned out on their own, 5.4 times less likely to have been controlled by the removal or shut-off of the fuel supply, and 3.5 times less likely to have been controlled by sprinkler systems.

FIGURE 2. METHOD OF FIRE CONTROL FOR FIRES IN MULTI-RESIDENTIAL BUILDINGS AS A FUNCTION OF AREA OF FIRE ORIGIN

Originated outside (n = 255)

Did not originate outside (n = 2,383)



Spread of Fires by Area of Origin

The relative extent to which these multi-residential structure fires spread are displayed in Figure 3 as a function of the fire area of origin. Despite some variations in the relative percentages at which fires were confined to the object, part of room, and room of origin as a function of the area of fire origin, when these percentages are combined to examine how often fires were confined to at least the room of origin it revealed that outside origin fires were 1.1 times less likely to be contained to this level (76.1% for outside fires vs. 86.1% for the rest of the incidents). In contrast, the fires that originated outside were 1.9 times more likely to extend as far as the building of origin and 4.1 times more likely to extend beyond the property of origin, relative to the remainder of the multi-residential structure fires examined.⁶

FIGURE 3. EXTENT OF FIRE SPREAD FOR FIRES IN MULTI-RESIDENTIAL BUILDINGS AS A FUNCTION OF AREA OF FIRE ORIGIN



Discussion and Conclusions

In summarizing these findings, fires that commenced on the exterior of these multi-residential buildings were:

- a) Less likely to activate a smoke alarm and more likely to require visual sighting of some other means of personal detection.
- b) More likely to require the fire department water application.
- c) Less likely to have burned out on their own, less likely to have been controlled by the removal/shut-off of fuel, and less likely to have been controlled by sprinklers.
- d) More likely to extend as far as the building of origin and beyond.

These vulnerabilities should be ameliorated to an extent by the recent amendments to the British Columbia Building Code that mandate additional fire protection for new mid-rise, multi-residential buildings, including (but not restricted to) sprinklers on balconies (to additional code levels required under NFPA 13), fire-resistant exterior cladding, and additional fire separations in roof areas [4].

In addition to these measures, however, it is worth exploring the fire safety implications of re-thinking the recreational use of propane on balconies and the significance of unplanned fuel loads in these external areas as a result of them being used for storage. Keeping in mind these legitimate uses for these areas of the buildings, it is worth considering enhancing the fire protection systems in place on balconies and common recreational by either

a) Prohibiting storage in these areas;

- b) Providing strategies for early detection of fire events; or
- c) Extending sprinkler protection to cover these areas, where possible.

Whichever combination of techniques are selected, reducing the exposure to these vulnerabilities needs a systems approach (involving the building resident, the building responsible person, the built-in fire protection strategies, and the fire service) [5] and must operate within a realistic framework about legitimate use, storage requirements, and costs of fire protection.

Refe	rences
[1]	L. Garis and J. Clare, Sprinkler systems and fire outcomes in multi-level residential buildings,
	2012, Centre for Public Safety and Criminal Justice Research, School of Criminology and

- Criminal Justice, University of the Fraser Valley.
 [2] L. Garis and J. Clare, *Sprinkler systems and residential structure fires: exploring the impact of sprinklers for life safety and fire spread*, 2013, Centre for Public Safety and Criminal Justice Research, School of Criminology and Criminal Justice, University of the Fraser Valley.
- [3] J. Armstrong, J. Clare, and L. Garis, *Propane-fuelled vehicles and multi-residential building storage risk: examining the frequency of propane-fuelled structure and vehicle fires*, 2013, Centre for Public Safety and Criminal Justice Research, School of Criminology and Criminal Justice, University of the Fraser Valley.
- [4] Office of Housing and Construction Standards. *Mid-rise wood frame | Building Provisions*. [cited 2011 3 November]; Available from: http://www.housing.gov.bc.ca/building/wood frame/6storey form.htm.
- [5] Manitou Incorporated, Surrey Fire Service high-rise fire service study, City of Surrey, British Columbia Final Report, 2008, Manitou, presented to Fire Chief Len Garis: New York. p. 47.

Author Biographical Information

Len Garis is the Fire Chief for the City of Surrey, B.C., President of the Fire Chiefs Association of British Columbia and is an Adjunct Professor in the School of Criminology and Criminal Justice at the University of the Fraser Valley and a member of the Institute of Canadian Urban Research Studies, Simon Fraser University. Contact him at <u>len.garis@ufv.ca</u>

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Acknowledgements

Special thanks to Rebecca Denlinger, BC Fire Commissioner and her staff for the provision of the BC data discussed in this report. This work would not have been possible without the contributions of these individuals.

Knowles, Jessica D OHCS:EX

From:	Kuan, Steven Y OHCS:EX
Sent:	Friday, August 3, 2012 2:40 PM
To:	Rotgans, Trudy OHCS:EX; Nutting, Alison OHCS:EX; Hutchinson, Jarrett OHCS:EX
Subject:	WoodWorks!BC seminars Mid-Rise and Wood First
Follow Up Flag:	Follow up
Flag Status:	Flagged

I didn't see this earlier. Note the interesting presentations by Sukh and Werner which may have good info for us. I hope that they will repeat both together in Vancouver and/or Victoria later or repeat at the Wood Solutions Fair in October.

Steven



SummerClusterSe minarsAgendalas...





Summer Wood Cluster Seminars by Wood WORKS! BC

Okanagan Tour

- 1 August 13th 2012 **Penticton** at the Penticton Lakeside Resort Zinfandel Room
- 2 August 14th 2012 Kelowna at the Prestige Inn Regatta Room
- 3 August 15th 2012 Vernon at the Prestige Hotel & Conference Centre Okanagan Salon
- 4 August 16th 2012 Kamloops at the Four Points by Sheraton Sundial Room

Presenters PLYWOOD 101 by Paul Jaehrlich from Certiwood

Overview of the Canadian plywood industry. Learn how to specify the right panel grades and species for the job. Best practices painting in exterior applications. Important facts about imported plywoods. Eligible LEED points, indoor air quality and which plywood glues to avoid. Plywood's manufacturing process and its quality control. An in-depth look at plywood's unique engineering properties.

Mid-Rise Three years later by Sukh Johal from Wood WORKS! BC

Overview of where we are at since the changing of the BC Building Code in 2009 to allow for six story residential buildings of wood construction. Learn how the development community has taken hold of this new opportunity to build more cost effective multi-family housing in your community.

Time	Item	Ву
10:30-10:45	Welcome, coffee and registration	Bill Billups
10:45-11:45	Mid-Rise – Three years Later	Sukh Johal
11:45-12:10	Complementary Linch	All
12:10-1:10	PLYWOOD 101	Paul Jaehrlich
1:10-1:30	Close	Bill Billups

Register now! For your free lunch seminar!

Email **Linda Shauer** at <u>lshauer@wood-works.ca</u> NOW and be sure to indicate which of these great venues you will be attending

From the desk of: Bill Billups, AScT. Technical Advisor #110 – 1692 Atkinson Street, Penticton BC V2A 6B5 Phone: 1-877-929-9663 Ext. 2 Cell: 1-250-462-1994 Email: <u>wbillups@wood-works.ca</u>





Summer Wood Cluster Seminars by Wood WORKS! BC

Kootenay Tour

- 5 August 27th 2012 **Revelstoke** at the Hillcrest Hotel Mt. Revelstoke Room
- 6 August 28th 2012 Golden at the Prestige Inn Percel Room
- 7 August 29th 2012 Cranbrook at the Prestige Rocky Mt. Resort Hotel Fernie Salon
- 8 August 30th 2012 **Nelson** at the Prestige Lakeside Resort Monashee Salon

Presenters PLYWOOD 101 by Paul Jaehrlich from Certiwood

Overview of the Canadian plywood industry. Learn how to specify the right panel grades and species for the job. Best practices painting in exterior applications. Important facts about imported plywoods. Eligible LEED points, indoor air quality and which plywood glues to avoid. Plywood's manufacturing process and its quality control. An in-depth look at plywood's unique engineering properties.

Wood First and the Demo Projects by Werner Hofstätter from Wood *WORKS*! BC

Overview of where we are at since the passing of the Wood First Act in BC and what its impact has been on the design community. Werner will run through the Wood Use Matrix and show you six BC Demonstration Projects recently completed across BC that show wood innovation at its best.

Time	Item	Ву
10:30-10:45	Welcome, coffee and registration	Bill Billups
10:45-11:45	Wood First and the Demo Projects	Werner Hofstätter
11:45-12:10	Complementary Lunch	All
12:10-1:10	PLYWOOD 101	Paul Jaehrlich
1:10-1:30	Close	Bill Billups

Register now! For your free lunch seminar!

Email **Lorna Malone** at <u>Imalone@wood-works.ca</u> NOW and be sure to indicate which of these great venues you will be attending

From the desk of: Bill Billups, AScT. Technical Advisor #110 – 1692 Atkinson Street, Penticton BC V2A 6B5 Phone: 1-877-929-9663 Ext. 2 Cell: 1-250-462-1994 Email: wbillups@wood-works.ca



REGISTRATION

Okanagan Tour

- August 13th 2012 **Penticton** at the Penticton Lakeside Resort Zinfandel Room 1
- 2
- August 13th 2012 **Ferricion** at the Prestige Inn Regatta Room August 14th 2012 **Kelowna** at the Prestige Hotel & Conference Centre Okanagan Salon August 16th 2012 **Kamloops** at the Four Points by Sheraton Sundial Room 3
- 4

Kootenay Tour

- August 27th 2012 **Revelstoke** at the Hillcrest Hotel Mt. Revelstoke Room 5
- August 28th 2012 **Golden** at the Prestige Inn Percel Room 6
- August 29th 2012 Cranbrook at the Prestige Rocky Mt. Resort Hotel Fernie Salon 7
- 8 August 30th 2012 – **Nelson** at the Prestige Lakeside Resort – Monashee Salon

Name	
Company	
Address	
Phone	Email

Be sure to circle which venue you will be attending!

You must register before August 3rd !!!!!!!! for the Okanagan Tour

And before August 15th !!!!!!!!!! for the Kootenay Tour

Knowles, Jessica D OHCS:EX

From:	Rotgans, Trudy OHCS:EX
Sent:	Friday, June 15, 2012 8:58 AM
То:	Jensen, Jun'ichi OHCS:EX; May, Zachary OHCS:EX; Kuhnert, Lyle OHCS:EX
Cc:	Green, Tracy OHCS:EX; Nutting, Alison OHCS:EX; Hutchinson, Jarrett OHCS:EX
Subject:	FW: Construction Fire Safety final
Attachments:	image001.jpg; C635703_R01FINAL.PDF; C635703_R01FINALAppendixAtoF.PDF
Follow Up Flag:	Follow up
Flag Status:	Flagged

Fyi - it would be worth reading this report and familiarizing yourselves with it.

Thank you,

Trudy

-----Original Message-----From: Ben Henzler [mailto:Ben.Henzler@bcfii.ca] Sent: Friday, June 15, 2012 8:34 AM To: Rotgans, Trudy OHCS:EX Cc: Nicol, John OHCS:EX; Thompson, Bob R OHCS:EX Subject: FW: Construction Fire Safety final

Trudy — attached for your records is an e-version of the final report from CFT on Construction Fire Safety. I will also forward a couple of hard copies to you when I receive them from Brad. Thanks to you and your staff for supporting the project and helping shape it.

The broad engagement by interested parties in creating the report has generated some interest. As has been the case with other reports, I believe you would agree to sharing it with the people/associations Brad is requesting below, in addition the normal FII practice of posting funded studies on our website. Unless I hear otherwise, I will proceed on that basis.

Thanks and Regards, Ben Henzler Director, Wood First

Forestry Innovation Investment
604.601.5322
www.naturallywood.com<http://www.naturallywood.com/>





#800-1901 Rosser Avenue Burnaby, B.C. V5C 6R6 Office: (604) 684-2384 (CFTI) Fax: (604) 684-2402 cft@cftengineering.com

SUMMARY OF REQUIREMENTS FOR CONSTRUCTION FIRE SAFETY IN BRITISH COLUMBIA,

ANALYSIS AND RESEARCH OF CONSTRUCTION FIRE RISKS,

AND IDENTIFICATION OF AREAS OF POTENTIAL IMPROVEMENT THROUGH LEGISLATIVE CHANGE IN BRITISH COLUMBIA

Prepared For:

Forestry Innovation Investment Ltd. 1200 - 1130 West Pender Street Vancouver, BC V6E 4A4

June 12, 2012

C6357.03

Building Code Consultants • Certified Professionals • Fire Protection Englishers

EXECUTIVE SUMMARY

The purpose of this report is to put forward recommendations for potential changes and means of enforcement to current legislative requirements addressing fire safety at construction sites. The report summarizes key fire and life safety risks at construction sites as identified by research conducted through literature review, and also through the analysis of data regarding fires at construction sites in British Columbia over a five year period, in order to compare these risks with fire and life safety risk mitigation strategies required under current legislation. The report also examines the mechanisms for enforcement of these legislated requirements. In addition, the report reviews construction site safety requirements and practices from other jurisdictions, such as the Province of Alberta and the United States.

The recommendations are based on the findings from the research of actual fires as well as other literature sources, and are put forward for discussion for the purposes of improving fire safety at construction sites through potential changes to legislative requirements and enforcement practices in British Columbia.

The report identifies fire and life safety risks that are unique to construction sites as opposed to occupied buildings. These risks include the following:

- Lack of completed fire separations (passive protection),
- Lack of functional/commissioned fire suppression and alarm systems (active protection),
- Inadequate water supply for manual firefighting,
- Fire Department response inefficiencies,
- Increased risk of incendiary fires due to periods where the site is unoccupied, and the incompleteness of security devices,
- Hazardous operations that take place at construction sites (e.g. hot works).

Recommendations for potential changes include the following:

- Provision of a link to the BC Fire Code construction fire safety requirements from Division B, Part 3 and Division B, Part 9 of the BC Building Code.
- Assignment of a Fire Safety Coordinator for construction sites.
- Provision of a fire warning system during inactive periods (e.g. after hours.).
- Additional guidance with respect to construction fire safety responsibilities.
- Specific requirements with respect to water supplies to construction sites.
- Requirement to conduct a fire risk assessment prior to construction commencing.
- Requirement for a pre-construction meeting with the Fire Department and Authority Having Jurisdiction.
- Provision of detailed guidelines with respect to the development and implementation of the construction fire safety plan.
- Development of fire protection industry practices.
- Provision and maintenance of Fire Department access.
- Procedures for the management of ignition sources and combustible content.
- Procedures for monitoring compliance with fire prevention requirements.

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1.0 INTRODUCTION

1.1 Background - CFT Engineering Inc. was contracted by Forestry Innovation Investment Ltd. (FII) to prepare this report assessing fire risks during the course of construction for all types of projects (i.e. both combustible and noncombustible construction, and all building heights). Previously, CFT Engineering Inc. was contracted by Forestry Innovation Investment Ltd. (FII) to prepare reports on the potential risks in increasing wood frame height limitations in the National Building Code 2010 from three storeys to four storeys for Group B, Division 3 occupancies, and on Building Code requirements for construction with heavy timber. Please refer to CFT Engineering Inc. reports "Research to Increase Wood Frame Height Limitations in the NBC 2010 from Three to Four Storeys", dated March 31, 2011, last revised August 4, 2011, and "Review of Heavy Timber Requirements in the NBC 2010, and Potential Additional Heavy Timber Requirements", dated November 29, 2011.

A meeting was held on December 8, 2011, between members of the Building Safety Standards Branch, WorkSafe BC, the Wood Enterprise Coalition, and CFT Engineering Inc, in order to discuss construction fire risk and explore the potential for collaboration with respect to protection measures and enforcement relating to construction fire safety. The meeting minutes are attached in Appendix A.

A stakeholders meeting was held on May 30, 2012 at the offices of CFT Engineering Inc. to review Draft 3 of this report (see minutes in Appendix B). At the meeting there was general concurrence with the report. The AIBC (Architectural Institute of British Columbia) and APEGBC (Association of Professional Engineers and Geoscientists of British Columbia) raised concerns about the recommendations that the role of the CRP (Coordinating Registered Professional) be expanded to include coordination of the fire risk assessment and construction fire safety plan. The concerns related to training members that provide CRP services and the limitations of professional liability insurance that excluded construction safety or fire safety on construction sites. The recommendations in Part 10 of the report were revised to reflect those concerns. Minor revisions were also incorporated in the recommendations to address the issues raised by the stakeholders.

1.2 Purpose of Report - The purpose of the report is to review current legislation regulating fire safety and current industry practice in order to identify potential areas of improvement, and provide recommendations for potential changes to legislation and enforcement practices governing construction fire safety in British Columbia. Recommendations are based on findings from research of actual construction site fires, a review of existing literature on construction site fire safety as well as construction fire safety requirements in other jurisdictions.

1.3 Sources of Information - The following documents and publications have been reviewed as part of this study:

- National Building Code (NBC) 2010,
- National Fire Code (NFC) 2010,
- British Columbia Building Code (BCBC) 2006,

- British Columbia Fire Code (BCFC) 2006,
- Vancouver Building By-Law (VBBL) 2007,
- Vancouver Fire By-Law (VFBL) 2000,
- International Building Code (IBC) 2012,
- Workers Compensation Act (WCA),
- NFPA Fire Protection Handbook, 20th Edition (2008),
- NFPA 10 "Potable Fire Extinguishers",
- NFPA 13 "Standard for the Installation of Sprinkler Systems",
- NFPA 14 "Standard for the Installation of Standpipe and Hose Systems",
- NFPA 51B "Fire Prevention During Welding, Cutting and Other Hot Work",
- NFPA 82 "Incinerators and Waste and Linen Handling Systems and Equipment",
- NFPA 241 "Safeguarding Construction and Demolition Sites",
- NFPA 730 "Guide for Premises Safety",
- NFPA 731 "Standard for the Installation of Electronic Premises Security Systems",
- NFPA 1231 "Standard for Water Supply for Suburban and Rural Firefighting",
- The American Water Works Association "Distribution Requirements for Fire Protection",
- Construction Confederation the Fire Protection Association "Fire Prevention on Construction Sites" 2000,
- Alberta High Intensity Residential Fires Working Group "Final Report" 2007,
- Health and Safety Executive "Fire Safety in Construction",
- The Association of Professional Engineers and Geoscientists of BC (APEGBC) "Structural, Fire Protection and Building Envelope Professional Engineering Services for Five and Six Storey (Mid-Rise Buildings) Wood Frame Residential Building Projects",
- Canadian Wood Council (CWC) "A Technical Note on Fire Safety and Security on Construction Sites in British Columbia",
- The Building and Safety Standards Branch (BSSB) Technical Advisory Group (TAG) "Response to Stakeholder Issues Connected to Mid-Rise Wood Frame Residential Construction" 2008.

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2.0 CURRENT LEGISLATIVE REQUIREMENTS FOR CONSTRUCTION FIRE AND LIFE SAFETY IN BRITISH COLUMBIA

2.1 Objectives of Legislative Requirements - The objective of the legislative requirements regulating construction sites is to provide a framework for reducing or eliminating identifiable risks to fire and life safety. The introduction of the BC Fire Code summarizes its three broad objectives as safety, health, and fire protection of buildings and facilities. The introduction to the BC Building Code states the same broad objectives, with the addition of accessibility for persons with disabilities.

2.2 Code and other Legislative Requirements - The regulations that govern construction sites with respect to fire and life safety are primarily contained in the BC Fire Code, the BC Building Code, and Occupational Health and Safety Standards. The administration and enforcement of Occupational Health and Safety Standards are responsibilities of WorkSafe BC per the mandate under Section 111 of the BC Workers Compensation Act. The enforcement of Building and Fire Codes is the responsibility of the Authority Having Jurisdiction in each municipality. The administration of Building and Fire Codes is a responsibility of the Minister of Forests and Range and the Minister Responsible for Housing, while the development of Codes is undertaken by the Ministry of Energy and Mines' Office of Housing and Construction Standards' Building and Safety Standards Branch.

A summary of the key requirements from the BC Fire Code, the BC Building Code and the BC Occupational Health and Safety Standard are as follows:

- 2006 BC Fire Code:
 - Fire Safety Plan (Subsection 2.8.2, Articles 3.3.2.9, 5.2.3.7 and 5.6.1.2),
 - Designation of personnel with fire safety duties (Clause 5.6.1.2.(2)(a)),
 - Means for sounding a fire alarm (Subclause 5.6.1.2.(2)(b)(i) and Article 5.6.1.9),
 - Means for notifying the Fire Department (Subclause 5.6.1.2.(2)(b)(ii)),
 - Training of alarm procedures for all personnel (Subclause 5.6.1.2.(2)(b)(iii)),
 - Predetermined response procedures for personnel assigned with duties in the case of a fire (Subclause 5.6.1.2.(2)(b)(iv) and Article 5.6.1.19),
 - Housekeeping (Clause 5.6.1.2.(2)(c)),
 - Firefighting facilities maintenance (Clause 5.6.1.2.(2)(d)),
 - Access to firefighting equipment (Sentence 5.6.1.4.(1)),
 - Fire Department vehicle access (Sentence 5.6.1.4.(2) and Sentence 3.3.2.5.(1)),
 - Fire Department use of available elevators, hoists and lifts (Appendix Note A-5.6.1.4.(2)),
 - Portable extinguishers (Article 5.6.1.5),

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- Progressive standpipe installation (Sentence 5.6.1.6.(1)),
- Provision of one usable exit (Article 5.6.1.8),
- Service line shut-offs (Article 5.6.1.10),
- Clearances for internal combustion engines (Sentence 5.6.1.11.(1) and Sentence 5.6.1.11.(2)),
- Clearances for certified heating equipment (Sentence 5.6.1.11.(3)),
- 1 h fire separations in partially occupied buildings (Article 5.6.1.14),
- Provisions of alarms or watch tours at 1 h intervals in partially occupied sites (Article 5.6.1.14),
- Use of bitumen heating equipment (Article 5.6.1.17),
- Fastening of temporary enclosures (Article 5.6.1.18),
- Maintenance, inspection and storage of hot work equipment (Subsection 5.2.2),
- Protection of hot works areas (Sentence 5.2.3.1.(1), Clause 5.2.3.1.(2)(a)), Sentence 5.2.3.1.(3), Article 5.2.3.2, Article 5.2.3.4 and Article 5.2.3.5),
- Fire watch for hot works (Clause 5.2.3.1.(2)(b), Clause 5.2.3.1.(2)(c), Article 5.2.3.6 and Article 5.2.3.3),
- Outdoor Storage of materials (Section 3.3),
- Storage of flammable and combustible liquids (Part 4), and
- Requirements when smoking is permitted (Subsection 2.4.2).
- 2006 BC Building Code:

-

- Requirement to conform with Section 5.6 of the British Columbia Fire Code (Sentence 8.1.1.1.(3))
- Barricade requirements (Article 8.2.1.3),
- Suspended construction activities (Article 8.2.1.5), and
- Housekeeping (Article 8.2.5.2).
- BC Occupational Health and Safety Standard:
 - Training required for workplace response to fire or emergency (Sentence 4.16.(2)),
 - Physical capabilities of workers assigned with firefighting duties (Sentence 4.16.(4)),
 - Illumination levels and inspection and testing requirements of emergency lighting (Section 4.69), and
 - Procedures for checking on workers well being when working alone (Section 4.20).
- Other Applicable Standards Adopted through Articles of the 2006 BC Fire and Building Codes:
 - CAN/CSA-W117.2 "Safety in Welding, Cutting and Allied Processes" (BC Fire Code Sentence 5.2.1.1.(2)),

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-	NFPA 51 "Design and Installation of Oxygen-Fuel Gas Systems for
	Welding, Cutting and Allied Processes" (BC Fire Code Sentence
	5.2.2.4.(1)),
-	CAN/CSA-B139-M "Installation Code for Oil Burning Equipment" (BC
	Building Code Clause 6.2.1.4.(1)(a)),
-	Gas Safety Regulation (BC Building Code Clause 6.2.1.4.(1)(b)),

- Electrical Safety Regulation (BC Building Code Clause 6.2.1.4.(1)(c)),
- Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation (BC Building Code Clause 6.2.1.4.(1)(d)),
- CAN/CSA B365-M "Installation Code for Solid-Fuel Burning Appliances and Equipment" (BC Building Code Clause 6.2.1.4.(1)(e)), and
- NFPA 82 "Incinerators and Waste and Linen Handling Systems and Equipment" (BC Building Code Article 6.2.6.1).

As shown above, the majority of legislative requirements which specifically address construction fire safety are contained in the BC Fire Code. The BC Building Code addresses fire and life safety at construction and demolition sites through the requirement in Part 8 of the BC Building Code to conform with the BC Fire Code. There are also supplementary requirements from the BC Occupational Health and Safety Standard. A more detailed description of some of the key requirements follows.

2.3 The Fire Safety Plan - As required by the BC Fire Code, the measures for safeguarding a construction site are compiled into a fire safety plan which is intended to be unique to each site in order to address site specific hazards. The BC Fire Code requires that fire safety plans contain the following information:

- A list of site personnel responsible for duties related to fire and life safety,
- The procedure for controlling fire and life safety risks and hazards in and around the structures on site,
- The procedure for notifying the Fire Department in the event of a fire, and
- The maintenance procedure for the site's firefighting facilities.

The fire safety plan also provides the Fire Department with site specific information which is used to improve the effectiveness of the Fire Department response in the event of a fire.

To clarify the requirements of construction fire safety plans, on August 17, 2009 the Ministry of Public Safety and Solicitor General's Office of the Fire Commissioner released a bulletin for fire safety planning on construction and demolition sites. The bulletin is a checklist intended to assist industry in meeting the fire safety requirements in BC. A copy of the bulletin is provided in Appendix C.

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2.4 Code Requirements for Active Systems for Fire Protection on Construction Sites -

Active systems include fire detection and notification systems, and fire suppression systems. For construction sites, the BC Fire Code requires that a system is provided to alert site personnel of a fire. The majority of buildings regulated under Division B, Part 3 of the BC Building Code or the Vancouver Building By-Law are required to have a fire alarm system that will notify occupants of a fire upon fire or smoke detection, a sprinkler water flow or from activation of a manual pull station. The fire alarm in a completed building will not only notify all occupants, but will automatically relay the alarm to the Fire Department. In buildings under construction, fire alarm systems are not installed until the later stages of construction, and even when they are installed, they are often deactivated for periods until the building is complete.

To meet the requirements for alerting site personnel, manual air horns are typically provided throughout sites for workers to manually notify others of a fire emergency. The site notification requirement provides a means for manual notification of a fire incident but does not require any automatic detection system to alert occupants of the construction site.

2.5 Requirements for Passive Systems for Fire Protection on Construction Sites - Passive fire and life safety protection features include the construction of fire separations for safe egress and exiting, fire separations to limit the spread of fire, and fire separations designed to protect adjacent properties or occupied portions of the site.

The BC Fire Code requires that at least one usable exit be maintained at all times. In addition, the BC Fire Code requires a 1 h fire separation to be constructed between occupied areas and areas under construction for sites where there is phased occupancy.

2.6 Requirements for Manual Suppression Systems on Construction Sites - The BC Fire Code requires that extinguishers be provided in areas where flammable liquids, gases or other combustible materials are stored, adjacent to cutting or welding, on or near internal combustion engines and adjacent to oil-fired equipment, gas-fired equipment and bitumen heating equipment. It is a requirement of the BC Fire Code to inspect, test and maintain portable extinguishers in accordance with NFPA 10 "Portable Fire Extinguishers". Providing sufficient size and distribution of portable extinguishers is essential in order to provide a means to suppress a fire in its early stages.

The BC Fire Code requires that where standpipe systems are required as per Division B, Part 3 of the BC Building Code, they be installed progressively during construction. The standpipe system is required to be connected to a water supply, which may also require a fire pump to achieve the required flow-rate at the topmost hose connection. For completed buildings, the BC Building Code requires a water supply that conforms with NFPA 14 and/or NFPA 13 where a standpipe system and/or automatic sprinklers are installed. However, it is not always part of construction practice to provide an adequate water supply to a partially completed standpipe system, as fire pumps may not commissioned until the later stages of construction, or the connection to the City water supply is delayed.
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2.7 Requirements for Limiting Combustible Materials - The BC Building Code and BC Fire Code require that combustible refuse in sufficient quantities to constitute a fire hazard be moved to a safe location, and that proper containers or enclosures be used for waste materials. Storage of combustible materials, including combustible or flammable liquids, is required to conform with Parts 3 or 4 of the BC Fire Code, which specifies the requirements for fire separations, maximum permitted quantities, and required fire protection measures.

2.8 Requirements for Barricades on Construction Sites - The BC Building Code requires that barricades of at least 1.8 m in height provide a complete perimeter around structures when openings are left unprotected, which may allow access into the structures. There is also a barricade requirement in the BC Fire Code requirement for outdoor storage of goods.

2.9 Requirements for Hot Works on Construction Sites - The use of hot works is covered by the BC Fire Code in Subsection 5.2 "Hot Works". Hot works operations include cutting, grinding, welding, brazing, soldering, thermal spraying, thawing of piping, and torch applied roofing.

To mitigate the fire risk presented by the use of hot works, the BC Fire Code requires that hot works are monitored with a fire watch both during hot work and after the completion of hot works. For a fire watch, personnel equipped with fire extinguishing equipment monitor areas endangered by hot works. The Fire Code requires that a fire watch continue for a period of 1 hour after completion. A final inspection 4 hours after completion is also required to confirm that the area where hot works was performed does not still present a risk of a fire occurring.

2.10 Requirements for Smoking on Construction Sites - Smoking is allowed on construction sites, but only in permitted areas in accordance with the BC Fire Code, Subsection 2.4.2. Permitted smoking areas are required to be separated from conditions where smoking may create a fire or explosion hazard. Some sites may implement a no smoking policy, but when smoking is permitted, adequate signage and ashtrays must be provided in smoking areas in accordance with Article 5.6.1.16 of the BC Fire Code.

2.11 Requirements for Heating Equipment on Construction Sites - Temporary heating equipment is used on construction sites to control temperature, as well as moisture. For example, temporary heating may be used to prevent freezing and to maintain a warm working environment. Temporary heating may also be used to reduce moisture in order to expedite drying processes for construction materials like drywall or wood, and for the curing of concrete.

The BC Fire Code requires that the clearance between combustible materials and temporary heating equipment conform with Part 6 of the BC Building Code, or in conformance with minimum clearances shown on certified heating equipment.

In addition, there is a requirement that where temporary enclosures such as fabrics and films are used, these must be securely fastened to prevent the enclosure material from being blown against the heaters or other ignition sources.

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3.0 ENFORCEMENT OF LEGISLATED REQUIREMENTS

3.1 Authority Having Jurisdiction - The Authority Having Jurisdiction has the responsibility for auditing that legislated fire and life safety requirements are conformed with at construction sites. The ultimate responsibility of fire and life safety on construction sites lies with the owner, who typically delegates the implementation of fire and life safety practices to the general contractor. This can lead to inconsistencies with respect to fire safety at construction sites, since the enforcement of Code requirements varies between municipalities. Some municipalities require the submission of a construction fire safety plan for review and acceptance prior to work commencing at the site. The submission process of construction fire safety plans is intended to reinforce the requirement for the contractor to identify the risks and implement a mitigation strategy to meet the Code requirements, which addresses hazards unique to the site. For example, the City of Vancouver Building By-Law requires that complex projects employ a full-time construction safety officer, which is not a requirement in all jurisdictions. This greater level of enforcement gives the Vancouver Building Department more control of construction fire safety since the work of the construction safety officer is subject to review, and the Vancouver Building Department has the authority to require changes to construction fire safety plans.

3.2 Enforcement Considerations Coinciding with the Allowance of Mid-Rise Wood Frame Residential Construction - In January of 2009, through a local government act, the Province of British Columbia amended the BC Building Code to allow the construction of five and six storey wood frame residential buildings which became effective in April of 2009. Prior to the implementation of these changes, the Building and Safety Standards Branch held several Technical Advisory Group (TAG) meetings to address safety issues pertaining to the proposed changes. Each suggestion put forward by the TAG was reviewed and assessed against two criteria: whether it addressed the incremental risk of raising the allowable height of wood-frame residential buildings from four to six storeys, and whether they were specific to five and six storey residential wood-frame construction. Some of the key recommendations put forward by the TAG were as follows:

- Improve site security,
- Ban drywall heaters,
- Incremental protection such as install standpipes, sprinklers, temporary wireless alarms, fire separations and fire doors as construction progresses, and
- Consistent requirement and enforcement of the fire safety plans per the BC Fire Code.

We understand that the action taken to address the concerns raised by the TAG was to implement a requirement for a designated site fire safety supervisor, and the issuance of the Office of the Fire Commissioner's Construction Fire Safety Plan Bulletin, the purpose of which is to provide consistent requirements regarding the information necessary to submit a complete construction fire safety plan. This bulletin is included in Appendix C.

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4.0 CODES, ENFORCEMENT AND REFORM OF CONSTRUCTION FIRE SAFETY IN OTHER JURISDICTIONS

4.1 Construction Fire Safety Practices and Reform in Alberta - The 2006 Alberta Fire Code has additional or more detailed "unique to Alberta" requirements for construction and demolition sites, addressed in Section 5.6. Key requirements that differ from the BC Fire Code are as follows:

- There is a requirement for protection of adjacent buildings or facilities from fires originating from buildings, parts of buildings, facilities and associated areas undergoing construction, alteration or demolition operations.
- There are additional requirements for access for firefighting, including the requirement for a means for firefighters to carry out firefighting on all levels of the building, and the provision for the use of existing elevators, hoists or lifts to assist emergency personnel in reaching all levels of the building. This is also a requirement of the BC Building Code, but the wording in the Alberta Fire Code is more specific.
- There are extensive additional requirements for the progressive installation of standpipe systems, such as the provision of readily accessible Fire Department connections on the outside of the building at the street level, and the provision of at least one hose outlet at each floor, and that the standpipes shall be not more than one floor below the highest forms, staging, and similar combustibles at all times.

Since the issuance of the 2006 Alberta Fire Code, the Government of Alberta established a committee to study large-loss building fires in Alberta, following a number of high intensity residential fires, including a large loss fire at a condominium complex construction site. The aim of the study was to recommend changes to the Alberta Fire Code to mitigate key risk factors as identified by the study.

The key recommendations relating to construction site fire safety arising from the study were to consider new or improved fire and life safety requirements to address:

- Protection of existing buildings adjacent to construction, alteration, or demolition work,
- Improved access for emergency personnel to and within buildings under construction or demolition,
- New requirements for hot application roofing materials such as bitumen and torch applied membranes,
- The need to develop and implement a model fire safety plan for construction companies and permit issuing authorities to use as a reference in establishing plans that will also take site security and arson prevention into consideration,

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- The need to develop and implement a system requiring construction companies to appoint a trained "Work Site Fire Safety Officer" responsible for the Fire Safety Plan,
- The need to develop and implement a communication strategy to provide the construction industry with more information on how to recognize and respond to fire safety hazards.

Following the study, several Standatas (Alberta Fire Code interpretations) were issued by the Safety Codes Council of Alberta, which particularly address construction and demolitions sites. These include clarifications to the requirement for water supplies and access for firefighting requirements, clarification regarding the protection of adjacent buildings, and clarifications regarding the development and content of the fire safety plan.

Examples of methods to protect adjacent property listed in the Alberta Fire Code and related Standata are as follows:

- Use of water curtains,
- Provision of spatial separation,
- Use of fire resistive construction methods, and
- Erection of temporary fire barriers such as a fire tarpaulin.

The Standata addressing the fire safety plan includes the requirements for the fire safety plan to specifically include:

- Assignment and responsibility for fire safety duties to workers,
- Emergency procedures to: provide fire warning, notify the Fire Department, evacuate the site and conduct first aid training,
- Control of fire hazards on the site, and
- Procedures to ensure maintenance of firefighting measures.

In addition, this Standata includes specific conditions where no fire safety plan is required (projects with a value under \$5,000.00), where a "small buildings" generic fire safety plan may be adopted, and when a customized fire safety plan is required to be submitted to the Fire Department for approval.

The Standata that addresses water supplies and access for firefighting includes a requirement that the owner, developer or contractor responsible for a construction or demolition site is will:

- Incorporate measures which provide the Fire Department with unobstructed access routes (interior and exterior), and also unobstructed access to hydrants and manual firefighting equipment (e.g. portable extinguishers, standpipes),
- Verify that water supply systems are operational and sufficient for firefighting operations.

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4.2 Construction Fire Safety Practices in the United States - The International Building Code (IBC) is widely adopted as the governing Building Code by jurisdictions in the United States. Chapter 33 of the 2012 IBC is dedicated to safeguards during construction. This chapter specifically addresses the following:

- A minimum of one lighted stairway to be provided where a building is constructed to at least 50 ft. or four storeys,
- Where standpipes are required for the building, at least one standpipe is to be installed when the progress of construction is not more than 40 ft. in height above the lowest level of Fire Department vehicle access. The standpipes are required to be extended as construction progresses to within one floor of the highest point of construction having secured decking or flooring,
- An approved water supply is required for fire protection as soon as combustible material arrives on site.

NFPA 241, "Standard for Safeguarding Construction, Alteration and Demolition Operations" provides a comprehensive guide and standard for construction, alteration, and demolition operations. The NFPA standards provide the framework for fire and life safety practices in the United States. NFPA 241 provides guidance on the construction of temporary offices and storage areas, typical processes and hazards such as temporary heating equipment, flammable and combustible liquids and flammable gas storage and handling, temporary electrical work and lighting, and requirements for fire protection. Some significant items to note from NFPA 241 are as follows:

Chapter 4

- Spatial separation requirements for temporary construction-related buildings and the buildings under construction based on the temporary structure exposing wall length are provided in a table.
- Service areas for equipment shall not be located within structures under construction.

Chapter 7

- In all buildings over one storey in height, at least one stairway shall be provided that is in usable condition at all times. This stairway is required to be extended upward as each floor is installed for new construction, and must be maintained for each floor remaining during demolition, and is required to be lighted.
- In all new buildings in which standpipes are required or where standpipes are existing in a building to be altered or demolished, such standpipes shall be maintained in conformity with the progress of the building construction in such a manner that they are ready for use.
- At least one approved fire extinguisher shall be provided in plain sight on each floor at each usable stairway, as soon as combustible material accumulates.

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Chapter 8

- Portable fire extinguishers or charged hose lines are required during forming/stripping operations using combustible forming material.
- Firewalls and exit stairways where required for the completed building, shall be given construction priority for installation. Fire doors with approved closing devices and hardware shall be installed as soon as practical, and preferably before combustible material is introduced. Fire doors shall not be obstructed from closing.
- A water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material accumulates on the site, and there shall be no delay in the installation of fire protection equipment.
- Where underground water mains and hydrants are to be provided, they shall be installed, completed, and in service prior to construction work.
- If automatic sprinkler protection is to be provided, the installation shall be placed in service as soon as practicable.
- There are more extensive standpipe requirements, such as the provision of readily accessible Fire Department connections on the outside of the building at the street level, and the provision of at least one hose outlet at each floor, and that the standpipes shall be not more than one floor below the highest forms, staging, and similar combustibles at all times.

4.3 Construction Safety Plan Bulletin, Surrey Fire Service, BC - The Surrey Fire Service issued a bulletin in 2011, which is intended to aide owners and contractors in developing a construction fire safety plan (CFSP) that addresses fire and life safety issues unique to a particular construction site. The bulletin was the result of research conducted to identify key risk factors during construction, and to summarize the appropriate risk mitigating features that should be in place at various stages of construction, with an emphasis on implementation of existing BC Building Code and BC Fire Code requirements.

The bulletin gives guidance on how to prepare a CFSP, and emphasizes the need to develop the plan in conjunction with the Surrey Fire Services. Another key requirement of the bulletin is to update the CFSP as the construction progresses, as fire and life safety risks will differ depending on the construction operations taking place on site, and the degree to which active and passive fire protection is available. It also emphasizes the need to develop a site specific plan, since a generic plan is not practical when considering the varying complexity of construction sites. The bulletin provides a checklist which the Surrey Fire Service will use to assess the adequacy of the CFSP (included in Appendix C of this report). This bulletin includes general items to be included, and also specific issues to be addressed for the differing phases of construction.

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5.0 ANALYSIS OF DATA FROM REPORTED CONSTRUCTION FIRES

5.1 Occurrence of Construction Fires in British Columbia - Over the five year period from 2005 through 2009, a total of 275 fires were reported as occurring on construction sites in BC. These fires were reported through the fire reporting system maintained by Emergency Management BC's Office of the Fire Commissioner. Losses as a result of these fires included 10 injuries, one fatality and equipment and property loss valued at over \$53 million. The losses from these fires have created concern over the current state of construction fire safety practices in BC.

The data from the construction site fires during this five year period was analyzed to determine the most frequent causes of fires on construction sites, as well as the potential impact of the type of construction and the location of the initial fire (ground floor or second storey and above). This information can be used to identify effective mitigation strategies that are or could be employed during the construction phase of a project to protect against the most frequent fire scenarios. Analysis of the fires reported to the Office of the Fire Commissioner can be found in Appendix F "Analysis of Reported Fires in British Columbia 2005 through 2009".

The data from the reported fires in BC indicates that the number of fires attributed to having incendiary or suspicious sources are significantly greater than fires from any other sources. Of the 275 fires reported, 62.9% of the fires were reported as incendiary. A further 21.5% of fires were reported with reasons that could not be determined. As a result of the 173 incendiary fires reported, seven persons were injured and over \$26 million of property was lost. It can therefore be concluded that the predominant risk of construction fires is incendiary risk. The greatest portion of incendiary fires occur between the hours of 5:00 pm and 4:00 am, as seen in Figure 1 "Number of Incendiary Fires Occurring on Construction Sites vs. Time of Day". This indicates that the after hour security measures provided did not deter incendiary acts to the same extent as the presence of workers on site.



Figure 1: Number of Incendiary Fires Occurring on Construction Sites vs. Time of Day

Incendiary Fires Occurring vs. Time of Day

Location of the source of the fire was also significant factor, with more than half the construction fires starting on the ground floor.

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6.0 ANALYSIS OF LITERATURE REVIEW REGARDING CONSTRUCTION FIRE SAFETY

6.1 Wood Works BC - The Wood Enterprise Coalition has issued a draft document that addresses prevention of risks during the course of construction. This document emphasizes the inherent greater risk potential of a construction site versus a completed building. A completed building is designed to incorporate passive and active fire protection systems that work together to mitigate the risk of fire and life safety through the following features:

- Compartmentation,
- Means of escape,
- Fire alarm and detection systems,
- Fire suppression systems,
- Access for facilities for firefighting.

On a construction site, many of these built-in fire and life safety features are not fully functional. Therefore, alternative mitigating features are required while these active and passive systems are being installed, and priority should be given to implementing these systems as soon as practicable, to minimize the period of time when such systems are not fully functional.

The document identifies typical combustibles and ignition sources that are present at construction sites, and focuses on removing one of the elements of the fire triangle (fuel, oxygen or ignition source) as an effective strategy when considering the mitigation of fire risks.

6.2 Health and Safety Executive (UK) - The Health and Safety Executive document, "Fire Safety in Construction", contains guidance with respect to implementing appropriate fire safety standards during construction. Some of the key elements contained in this document are as follows:

- Conducting a fire risk assessment, including identifying sources of ignition, fuel and oxygen.
- Identification of persons most at risk as a result of the construction operations.
- Strategies for reducing the risk, such as removal or reduction of sources of ignition, removal or reduction of fuel sources, and removal or reduction of oxygen (e.g. providing closures for reducing the amount of oxidizers on site).
- Recording, planning, informing and instructing, such as drawings, emergency plans, training procedures, and identified risks.
- Provision of firefighting equipment.
- Provision of emergency lighting.
- Liaison with the Fire Department.
- Enforcement of fire safety legislation at construction sites.

The document contains detailed information on typical sources of ignition, and types of combustibles typically found on construction sites, and suggests potential mitigating strategies that can be adopted to protect against the hazards identified in the fire risk assessment.

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7.0 INFORMATION/ANALYSIS OBTAINED FROM SITE VISITS

Site visits were also performed by CFT Engineering to highlight the predominant risks for different sites, and also to assess the methods used on site to implement legislative requirements for construction site safety. One lowrise, one midrise and one highrise project under construction were visited. Field review reports that include analysis of the site visit case studies are included in Appendix E.

At all three sites, the legislative requirements for fire and life safety at construction sites was largely adhered to. Procedures were in place for notifying the Fire Department in the event of an incident, and also horns were installed for the notification of site personnel. At least one exit was available from each floor area. Other safety procedures that were noted at all three sites were formal hot works policies including fire watch, correct placement of temporary heating equipment, and site smoking policies.

Hazards that are specific to construction activities that were noted at one or more of the sites visited were as follows:

- Accumulation of combustibles, including styrofoam, flammable and combustible liquids, wood and cardboard.
- Insufficient or delayed communication with the Fire Department with respect to availability of active fire protection systems, such as standpipes.
- Delay in charging installed fire protection systems, such as sprinklers and standpipes.
- Water supply for firefighting not available in highrise building due to the delay in fire pump installation.

Although the above listed deficiencies were noted, the majority of fire safety procedures required under Section 5.6 of the BC Fire Code, which regulates fire safety at construction sites, were followed. However, there were varying levels of proficiency with respect to applying the requirements, which could be attributed to the generic nature of the BC Fire Code requirements, which in many cases do not provide specific details with respect to how to implement the requirements.

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8.0 LEVEL OF FIRE RISK DUE TO CONSTRUCTION ACTIVITIES

8.1 Construction Phases - Construction sites present a significantly greater fire risk than the fire risk in completed buildings. This is because of the incompleteness of building elements that provide passive fire protection, and also because active systems are not fully installed/operational or commissioned during construction stages.

The level of risk may be higher during some construction phases than others, based on the hazards attributed to the activities conducted and the level of protection provided by the active and passive fire protection systems that are available during that phase. In order to illustrate the potential for the level of risk to vary, the typical activities conducted during construction have been broken down into five stages. Where the building under construction is built of combustible materials (e.g. wood frame), the inherent risk will be greater than where noncombustible building materials are used. The five stages reviewed are as follows:

- 1. Foundation Operations This includes excavation, footings, foundation walls (or slab), waterproofing, backfill and compaction, and underground plumbing.
- 2. Framing Operations This includes wood or steel framing, exterior wall and roof sheathing, exterior trim and siding (and/or stucco/brick), windows and exterior doors, and roofing.
- 3. Rough Plumbing, Mechanical, Electrical Operations This includes installation of water and waste/vent systems and associated piping, duct work, venting and furnace installation, and wiring and electrical panel installation.
- 4. Insulation and Drywall Operations This includes wall insulation, drywall installation, tape and texture.
- 5. Paint, Trim and Finishes Operations This includes finished flooring, cabinets, counter tops, wall tile, mirrors, shower doors, final electrical (including fixtures), final plumbing (including fixtures), and final mechanical.

These construction phases may be completed in sequence; however, it is common for construction operations to be performed simultaneously. Figure 2 "Fire Risk Curve Over the Course of Construction" includes two arbitrary time lines of the five construction phases, one with the phases being completed in sequence, and one with expected periods of overlap where multiple construction operations are performed simultaneously. The risk-time curves are based on Appendix D "Quantification of Risk Over Construction Phases" which assigns arbitrary values of fire risk for individual construction operations as well as cumulative risk due to multiple risk factors being present simultaneously.



Figure 2: Fire Risk Curve Over the Course of Construction

Typically, the construction sequence is to first complete the supporting structure, floors and building envelope while the completion of framing, drywall, door installation and the sealing of penetrations is undertaken at later stages. This may create a condition where the incomplete structure is susceptible to rapid fire spread due to the lack of fire separations.

A common phasing practice for wood frame construction which also presents an inherent increased fire risk is top-down construction. In top-down construction, the supporting structure is completed, followed by the installation of drywall at the uppermost floor first, with progress downward. This creates a greater potential for the collapse of all floors in the event of a fire than when the framing is protected with drywall on the ground floor first. Based on the statistical analysis of the 275 construction fires discussed in Section 5.0 of the report, the fire source is most frequently at the ground floor level.

From the above analysis, it can be concluded that the greatest level of risk is present when the framing is near completion and the installation of drywall has yet to commence. At this point, the greatest amount of unprotected framing is exposed.

8.2 Phased Occupancy - When a building under construction is partially occupied, there is also a greater inherent fire and life safety risk, due to exposure to the occupied areas to risk from a fire incident in the building portion under construction. The BC Fire Code requires a 1 h fire separation be provided between the occupied portions of the site and areas under construction. The Code also requires that either alarms be provided for the site or watch tours monitor the site at intervals of 1 h or less.

8.3 Water Supply During Construction - The water supply needed to fight fires in buildings under construction can be significantly greater than the flow needed for firefighting in completed buildings. This is because completed buildings are typically protected with automatic sprinkler

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systems which will provide containment, control and/or extinguishment. The required water demand is reduced where sprinklers are installed, since manual hose stream demand is supplementary to automatic suppression. Also, there may be a delayed Fire Department response due to the absence of detection systems and automatic signaling to the Fire Department, allowing more time for a fire to spread before manual firefighting commences.

As addressed by the BC Building Code, the water supply for firefighting for completed buildings that are provided with automatic sprinklers and/or standpipes is required to be designed in accordance with NFPA 13 and NFPA 14 respectively. For unsprinklered buildings, the BC Building Code requires that an adequate water supply be provided. The BC Building Code does not provide specific design criteria, but references the following documents as useful guidelines with respect to calculating adequate water supply requirements: Insurance Services Office (ISO) "Needed Fire Flow Guide", the American Water Works Association "Distribution Requirements for Fire Protection" and NFPA 1231 "Standard for Water Supply for Suburban and Rural Firefighting".

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9.0 FIRE DEPARTMENT RESPONSE TO CONSTRUCTION FIRES

The primary goal of the Fire Department is to assist occupants who may be endangered by a fire and to minimize the impact of the fire to adjacent buildings. For fires occurring on construction sites, the number of occupants are typically limited to workers onsite unless phased occupancy has been granted. In cases where the site is expected to be vacant and adjacent properties are at risk of exposure, protection of the adjacent occupied properties may become the Fire Department's first priority.

The priorities of the Fire Department response can be determined upon arrival to the site, but they can be predetermined to some extent by a Fire Department pre-incident response plan. The effectiveness of pre-incident planning is dependent on the information provided to the Fire Department. The following information is valuable for pre-incident response planning:

- Site personnel muster point,
- Personnel assigned to meet and inform the Fire Department,
- Location of nearest hydrant(s),
- Locations of firefighting systems,
- Status of firefighting systems,
- Completeness of exit stairs and passageways to exit stairs,
- Material hazards present on site,
- Site plans and building diagrams.

To aide pre-incident planning, it is important to provide the Fire Department with an up to date construction fire safety plan. For occupied buildings, the Fire Department typically has a greater familiarity with the building layout and the fire suppression systems. Even if the Fire Department periodically tours a construction site, the changing environment of the site might reduce the effectiveness of the planned response. When the Fire Department responds to a site with no occupants expected to be in the building, the response will typically be less aggressive as to not endanger the lives of those fighting the fire. Unfamiliarity with the level of completion of the building structure and fire separations will reduce the effectiveness of firefighting efforts for a fire on a construction site.

Firefighting access is typically gained through the exit stairs where a connection can be made to the standpipe within the stair. Because of the rated fire separation provided for exit stairs in a completed building, firefighters are provided with a barrier to adjacent spaces for staging the response within the stair. For buildings under construction, the Fire Department may have limited numbers of available exit stairs to access the area where the response is needed. The BC Fire Code requirement for exit stairs in construction sites requires that one usable exit be provided that is accessible and useable at all times.

The BC Fire Code requirement provides a safeguard for occupant egress but does specifically require the completion of the fire separation for the usable exit which would assist the response of the Fire Department within the building.

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10.0 CONCLUSION AND RECOMMENDATIONS

The legislation that regulates fire safety at construction sites in British Columbia is intended as a mechanism to reduce or eliminate identifiable risks from site specific hazards that are unique to the construction industry. Most of the legislative requirements are contained in Subsection 5.6 of the BC Fire Code, which is intended to apply to construction sites as well as demolition sites. Part 8 of the BC Building Code also requires compliance with Subsection 5.6 of the BC Fire Code, for buildings under construction. However, because of the broad spectrum of construction sites, ranging from single dwelling units to large highrise developments, the legislative requirements tend to be generic in nature. The key element of fire safety in construction is the development of a working active fire safety plan after analysis of the site has been completed. The Code requirements are intended to provide fire safety procedures that are applicable to all construction sites, such as emergency notification procedures and assignment of personnel to take responsibility for construction fire safety. The intent of the fire safety plan is also to develop site specific procedures designed to mitigate risks that are unique to a particular construction site. However, current requirements lack sufficient guidance on how to incorporate this into the construction fire safety plan, and in general, construction fire safety plans and risk mitigation have not been a high priority.

Because of the limited detail and awareness with respect to the implementation of site specific mitigating features, there is the potential for an inconsistent approach to the management of risk with respect to fire and life safety within the construction industry. Additional guidance and education is needed with respect to the management and mitigation of risks, including details of mitigating strategies that should become industry practice. In addition, more emphasis should be placed on the need to update the fire safety plan and construction site procedures as construction progresses, to adequately address the changing nature of the hazards based on the construction phase and availability of passive and active fire protection features. Training of construction workers and the involvement of the responding Fire Department and the Authority Having Jurisdiction prior to construction commencing can lead to a more effective fire prevention and risk mitigation strategy for each individual project.

The following recommendations are put forward for consideration with respect to potential modifications to the current legislated requirements governing fire and life safety at construction sites in British Columbia, and are based on the analysis from the research conducted as well as some of the regulations and recommended practices in other jurisdictions.

10.1 Linking of Construction Fire Safety within the BC Building Code and Fire Code -

Currently, Division B, Part 8 of the BC Building Code contains the requirements relative to construction sites, and also contains the requirement for conformance with Section 5.6 of the BC Fire Code. However, the majority of fire and life safety requirements are contained in Division B, Part 3 or Part 9 of the BC Building Code. In order to increase the awareness of the requirements for construction fire safety of professionals and contractors involved in the

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construction industry, it is recommended that there be a reference to the BC Fire Code requirements relating to construction fire safety within Division B, Part 3 and Division B, Part 9, Article 9.10.1.2, of the BC Building Code. Division B, Part 1, Subsection 1.1.4 of the BC Building Code should be revised to include a reference to the construction fire safety plan.

10.2 Assignment of a Fire Safety Coordinator - In order to provide continual monitoring of risks throughout the different construction phases, it is recommended that the assignment of a fire safety coordinator be required, by Section 5.6 of the BC Fire Code. The fire safety coordinator should have the overall responsibility of coordinating fire protection and risk mitigation issues before construction commences through to building occupancy. This coordinator should keep workers up to date with emergency procedures on a regular basis, monitor the site relative to the fire safety plan, provide a single point contact with the fire service and be trained to identify basic hazards.

10.3 Fire Warning and Alarm - It is recommended that BCFC Article 5.6.1.9 be amended to include a fire warning system when the site is not active, such as after hours. A fire warning system may be a fire watch or active detection systems or a combination of fixed detection and manual fire watch, potentially supplemented by lighting and security cameras.

10.4 BC Building Code Part 2, Division C, Article 2.2.7.3 (Appendix), Coordinating Registered Professional - Division C, Appendix A should provide general direction to inform the owner and constructor that as part of the project planning, a CFSP is required by the BC Fire Code, Section 5.6, "Construction and Demolition Sites".

10.5 Adequate Water Supply for Firefighting - BCFC Article 5.6.1.4 should be amended to require the provision of a water supply for firefighting to the site as soon as combustible material arrives onsite. This may require early coordination with the City, Engineering Department, consultants and trades, or a temporary water supply for firefighting could be provided.

10.6 Fire Risk Assessment Management - BC Fire Code Division B, Appendix A 5.6 should add an explanatory note stating that in order to enable the development of practical risk reduction and/or prevention strategies at a construction site, it is essential that a risk assessment of potential fire hazards be carried out. This assessment should identify potential scenarios for ignition and propagation of a fire, and identify mitigation or prevention strategies for each identified scenario. This risk assessment should be a mandatory exercise, and the findings should become the basis of the detailed fire risk management adopted on site. The findings and recommendations would form the approach to risk mitigation in the construction fire safety plan. This task should be undertaken by the onsite fire safety coordinator, potentially assisted by a knowledgeable professional, and coordinated with construction personnel, consultants, the Fire Service and local Police Department.

When risks to adjacent structures, services, adjacent property, urban wildland interface or complex sites are identified, the analysis needs to consider potential fire risks to these adjacent exposures from the site under construction. For complex sites or higher risk sites, a review and analysis should be completed by a knowledgeable professional.

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10.7 Pre-Construction Meeting - It is recommended there be a suggestion within the BC Fire Code, Division B, Appendix A, for a pre-construction meeting upon issuance of building permit (this is a requirement in many local municipalities). This meeting should provide the opportunity to obtain clarification of expectations from the Authority Having Jurisdiction and an opportunity to clarify roles and responsibilities during construction and review the fire risk analysis. The Fire Department and/or local assistant to the fire commissioner should be invited to this meeting.

10.8 Construction Fire Safety Plan (CFSP) - Universal and detailed guidelines should be provided to the industry with respect to the development of a construction fire safety plan and the implementation of construction practices. Currently, the BC Fire Code outlines minimum key components of a fire safety plan, such as designation and organization of site personnel responsible for carrying out fire safety duties, emergency procedures to be followed, measures for controlling fire hazards, and maintenance procedures for firefighting facilities.

These minimum requirements should be expanded to include the requirement for submission and review of the CFSP by the responding Fire Department and/or the Authority Having Jurisdiction prior to construction commencing. The CFSP review process should include an analysis of the fire risk assessment and proposed actions to mitigate the risks, which will include unique hazards associated with the individual construction site. The type and severity of the risk will vary depending on factors such as the project size, complexity and proximity to other buildings.

Because of the changing nature of a construction site, a requirement to update the CFSP at regular intervals and make changes as necessary to address hazards associated with a particular construction phase should be considered. In addition, because arson is the most frequent cause of fire on construction sites, consideration should be given to a requirement for the CFSP to include measures specifically designed to address this risk.

The City of Surrey and the Office of the Fire Commissioner have both produced construction fire safety bulletins which contain detailed guidelines with respect to fire safety planning. These documents are reproduced in Appendix C. The universal guideline should capture the work done by the City of Surrey and the Office of the Fire Commissioner and include the roles and responsibilities to achieve the objectives of fire risk management at all construction sites. The following are some of the issues that should be addressed in the universal guideline:

- Pre-construction meeting with local Fire Department with on site fire safety coordinator.
- Identification of roles and responsibilities, emergency contacts and procedures.
- Review fire safety plan procedure for unique hazards and risk mitigation features.
- Review Fire Department access, onsite firefighting water supplies and available fire protection systems.
- An individual and an alternate should be assigned to implement and maintain key aspects of the CFSP, including:
 - Egress systems during construction,
 - Safety of the public,
 - Available hoists and elevators,

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- Storage of combustible and flammable liquids,
- Forming and stripping and waste material, (combustible load),
- Available onsite water supply for systems and hose stations,
- Available onsite water supply for firefighting for responding fire service,
- Written procedure and fire watch for hot works and record keeping,
- Written program for after hours security measures on site and contact information,
- Use and supervision of temporary heating equipment,
- Development of a policy for progressive installation of active and passive fire protection systems,
- Written policy for security measures on site,
- Identification and mitigation of fire risks to adjacent properties,
- Phased construction in an occupied building.

-

10.9 Development of Fire Protection Practice to Mitigate Risk during Construction - It is recommended that guidelines be established and reviewed with WorkSafe BC with respect to existing requirements for provision of passive and active fire protection at construction sites, as well as new concepts that should become industry practice. Industry practice cannot be legislated, but through a combination of legislation, comprehensive guidelines and education, these practices should become the standard practice for all sites. Key fire safety features/practices are summarized below:

- The provision of an unobstructed stair to each floor level, that discharges to ground level.
- Construction sequencing such that fire compartments, firewalls and the installation of closures through fire separations be given priority.
- Construction sequencing for "bottom-up" construction, to allow for fire protection systems to be progressively installed and to minimize the volume of unprotected combustible construction.
- Provision of fire separations between occupied areas and construction areas.
- The installation of security measures, such as provision of exterior lighting, fencing, potential use of security cameras, signage and protection of outdoor storage areas.
- Exposure protection for adjacent buildings, where required.
- Standpipe installation progressive with building construction.
- Charged sprinkler system when available and practical (active during the night, possibly off during the day if work is undertaken in that area). The sprinkler system should be provided with temporary water flow alarm/device deactivation.
- Onsite portable fire protection stations (use of garden hose in conjunction with, portable fire extinguishers and/or hose stations).
- Early installation of fire pumps where required for standpipes, hydrants and hose stations (important for highrise buildings).
- Requirement for watchman rounds on an hourly basis, and a means to verify that the security round has taken place and covered all areas.

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10.10 Provision and Maintenance of Fire Department Access - A Code conforming Fire Department access route to the construction site should be available as soon as work commences at the site. A drawing showing the layout of the site and the fire protection features such as location of standpipes, muster points, and fire stations should be available at the main Fire Department response point.

10.11 Management of Ignition Sources and Combustible Content - It is recommended that procedures be developed and implemented to control sources of ignition and also to prevent accumulation of combustible materials. These include:

Control of Ignition Sources

- Management of hot works through a formal program involving a permit process that documents and coordinates the use of hot works between management, the fire watch and the workers performing hot works.
- Management of roofing operations involving heat sources and hot processes.
- Management of temporary heating equipment.
- Management of fuel fired equipment.
- Designation and enforcement of permitted smoking areas on site.

Control of Combustible Content

- Implementation of a procedure for prompt waste material removal.
- Procedures for the storage and prevention of excessive accumulation of combustible building materials.
- Separation of combustibles from ignition sources by at least 3 m.
- Location and quantities of dangerous goods, including flammable or combustible liquids, and information relating to their specific hazards (Material Safety Data Sheets).
- The use of less hazardous materials where practical.

10.12 Responsibility and Enforcement - The current legislative requirements do not include specific procedures for monitoring compliance with fire safety requirements at construction sites. It is recommended that a method be established such that regular auditing of fire safety at construction sites is carried out. Ownership and responsibility for construction fire safety should be clearly established. This could be achieved through the requirement of regular field reviews undertaken by either the authority having jurisdiction or knowledgeable professional. Schedules similar to those that currently exist for auditing design compliance with Division B, Part 3 of the BC Building Code could be adopted for this purpose.

CFT Engineering Inc.

Construction Fire Safety

Prepared by,
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Katarina Burgess, P.Eng., CP.
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Prepared by, CFT Engineering Inc.

for John Bolduc, BASc, EIT

JB/mc

Prepared by, CFT Engineering Inc. Brad Walton, AScT

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APPENDIX A

Minutes of Meeting

Meeting Date: Thursday December 8, 2011 (11:00 am to 1:00 pm)

Location: WorkSafe BC 6951 Westminster Highway, Richmond

Attendees:

	John Ivison	-	Wood Enterprise Coalition
	Steven Kuan	-	Building Safety Standards Branch
	John Nicol	-	Building Safety Standards Branch (via phone)
	Michael Carter	-	Manager, WorkSafe BC
	Alan Brose	-	WorkSafe BC
	Dave Stewart	-	WorkSafe BC
	Don Schouten	-	WorkSafe BC
	Dean Albrecht	-	WorkSafe BC
	Brad Walton	-	CFT Engineering Inc.
	Samir Eidnani	-	CFT Engineering Inc.
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Subject: Course of Construction Fire Safety

Prepared by: Samir Eidnani

The purpose of this meeting was to discuss the fire risk in projects and the potential for collaboration and enforcement strategy of fire protection measures related to safety and fire risk mitigation.

- 1. <u>Background</u> John Ivison provided information on the background of project. John noted that the existing guidance may require revisiting to address the practicality of onsite safety and the relationship to professional requirements. There is potential to improve response and provide intervention at an earlier stage of a fire occurring on a construction site. Some potential jurisdictional barriers exist, a change in process is anticipated via the current reference to Part 8 of BC Building Code. The intent is to have construction sites develop a practical plan rather than the token plans that are often provided currently. British Columbia is a leader in construction and the intent is to improve safety on construction sites.
- 2. Brad Walton noted that the requirements for Course of Construction Fire Safety planning currently applies to all construction sites regardless of the type of construction. The City of Surrey had hired CFT to assist in the development of a Bulletin on this issue and has implemented measures to improve Course of Construction Fire Safety in Surrey, a Course of Construction Fire Safety plan must be submitted concurrently with a Building Permit application and be accepted by the Fire Department. Clarification is required relative to enforcement of Course of Construction Fire Safety. The current requirements addressing

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Course of Construction Fire Safety have been around for a long time, but may not always be practiced in the field. There is a sense that real construction practice does not incorporate many of the basic requirements of existing Course of Construction Fire Safety. Brad stated that, it is widely felt by industry stakeholders that this issue may potentially be coordinated with existing occupational health and safety requirements. In the past, enforcement has been the limiting factor and the result is that the intent of the various guidance is not being met. The Fire Chiefs' Association of British Columbia may be interested in supporting new initiatives.

- 3. John Ivison identified that there is a multiplicity of guidance on construction fire safety including the latest draft CWC technical Note and the existing fire Commissioner's bulletin. This however is not being translated into practical measures on site. Some sites have competing jurisdictions with Building Inspectors having jurisdiction on some sites and the Fire Service on others. Some Building Officials have limited knowledge of fire risks control and mitigation.
- 4. Brad Walton asked if there was potential for the WorkSafe Prevention Officer or the Onsite Safety Officer (qualified coordinator) to be engaged in the compliance role. Typically, the Fire Department will visit a small percentage of randomly chosen construction sites to review items for enforcement relative to construction safety. Not all construction sites through out the province are reviewed by the fire service.
- 5. John Ivison stated that there are resources available via the existing fire protection consultants, to produce reasonable Fire Safety Plans for sites specific designs. There are sufficient resources available for plan development; however, how can we implement responsibility for the site and ensure sufficient training to back up the existing requirements, it is suggested that support is required from WorkSafe BC. Any fire safety plan requires sufficient skill in fire risk analysis. Some plans have reached the lowest common denominator and may only be a sign with the site instructions on them. While there are sufficient resources to enable full and complete fire safety plans to be prepared, at some stage continuity has to be maintained on the site through the site safety manager or others. For instance fire protection consultants may not typically inspect the site and some continuity between the professionals and the site personnel may be necessary until all parties are fully up to speed.
- 6. Alan Brose of WorkSafe BC noted that under the Fire Service Act, the Local Assistant to the Fire Commissioner (LAFC) has a broad scope of responsibility to address these concerns and this is an item that they would suggest that Fire Inspectors would review. Additionally, Municipalities have Building Inspectors available as part of the Building Department who may be able to assist with enforcement.
- 7. Brad Walton noted the Fire Service presently does not have sufficient training programs or staff to review construction sites through out the province. This issue will be reviewed concurrently with the BC Fire Chief's Association for their comment.
- 8. John Ivison stated that typical Fire Service Training is presently concentrated on occupied buildings based on expected occupant loads and occupancy classifications, rather than construction sites. There is a risk to firefighters, and some fire services will not enter

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buildings that have fires during construction. The risk to working firefighters responding to this type of fire should be considered as increased risk associated with constructing these buildings.

- 9. Brad Walton stated that the BC Building Code and BC Fire Code cover the scope of the entire province and smaller municipalities are not provided with sufficient resources. Note that some Fire Services and local LAFC role are staffed with volunteers.
- 10. Brad Walton noted that the analysis of Fire Risk for some construction sites may require a professional fire risk analysis. During stages of construction, compliance with the BC Building Code requirements are not feasible due to the fact that the building fire safety measures are typically incomplete until the time of occupancy. For example, spatial separation requirements between buildings and property lines is reduced for a sprinkler protected building, or may be based on noncombustible cladding, or fire rated assemblies. During construction sprinklers are not charged or functioning until later stages such that the location of the building relative to neighboring buildings exceeds what would be permitted by the Building Code. Special risk such as hot work/spray painting and other issues require special attention.
- 11. Brad Walton noted the National Fire Protection Association has developed a detailed standard on Construction Fire Safety Requirements (NFPA 241) which has specific requirements for construction site egress and exiting, construction of fire compartments, installation of closures in fire separations and the requirement for water supply for construction site. Water supply to a construction site involves coordination with the Municipal Engineering Department and in many cases water supply is not available until well into the construction process. Separate permit is a possible solution to enable the water supply for the standpipe to be provided as intended by the fire code, at an early stage of the project.
- 12. Brad Walton noted that insurance companies are no longer a predominant player relative to fire protection; however, in the past they had provided detailed site specific requirements. Insurance requirements seem to be inconsistent because of the market forces with limited loss control or engineering offered.
- 13. John Ivison noted that there is significant litigation underway for the Remy Project, the fire which occurred in Richmond, BC recently. John Ivison noted that the specific cause of the fire has not been determined although it appears that hot work may have been identified as the cause. Although the fire code requires wet down of combustibles when they cannot be effectively shielded or covered, this is typically not being followed on site. The use of pressure washers to wet down will enable sparks to be extinguished without excessive wetting. As sites are open to the weather this minor wetting should not be a significant issue.
- 14. Brad Walton provided a summary of existing standards as required throughout BC including Part 8 of the 2006 BC Building Code, Sections 2.8, 5.2 and 5.6 of the 2006 BC Fire Code, and the BC Office of the Fire Commissioner's Bulletin for Fire Safety Planning for construction and demolition sites.
- 15. Alan Brose requested clarification for the term "partially occupied building". Brad Walton

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confirmed this is a state where phased occupancy for a building under construction may be provided. For example, one stage of the building is occupied by owners and the public while the adjacent stage of the same project is under construction. This can place new occupants at risk if special measures are not taken. John Ivison stated good engineering is vital to reduce risk for these unique situations.

- 16. Steven Kuan noted that the relationship between the onsite contractor and the onsite team and project consultants differs greatly between the type of project being built. A private public partnership project versus a design build project verses a standard construction project. All may require different relationships between contractor and consultants.
- 18. Brad Walton requested clarification for WorkSafe BC's intended involvement in this type of program. It was noted that there may be a potential for more specific fire prevention training as an opportunity for WorkSafe BC personnel
- 19. John Ivison noted that there is an opportunity to do more onsite to enhance worker safety, as major fatalities have occurred in other jurisdictions including noncombustible construction.
- 20. Alan Brose noted that unless specifically triggered, Fire Safety is not a primary focus of WorkSafe BC enforcement.
- 21. Don Schouten noted that WorkSafe BC tends to have specific requirements for workers safety on construction sites, such as where fall protection is required and work safe regulation does require access throughout a site, to ensure that an injured worker is acceptability evacuated from a site, and the regulations concerning may different aspects of safety.
- 22. John Ivison stated that risk in construction is increased, as we are now building higher buildings. This has raised concerns, primarily with the fire service. John noted that while there has always been an opportunity to work with WorkSafeBC this has not happened in the past. There is therefore an opportunity for coordination between many of the authorities on this subject.
- 23. Don Schouten noted that although fire prevention is not a prime focus of site inspections it may become important if obvious violations are noted. This will then bring it into focus as an important issue. Michael Carter suggested that there could be an opportunity for coordination for training with fire service personnel on this issue. Don Schouten noted that the owner of the construction site and the employer of trades needs to be motivated to address an increased level of fire prevention on-site and this would require a multi prong approach involving many parties. Don noted that there are significant secondary benefits to reducing risk on sites including more efficient work parties.
- 24. Brad Walton stated that there are opportunities for all stakeholders to work together on this issue in the future. WorkSafeBC therefore agreed to participate in the stakeholder consulting process.

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- 25. Alan Brose noted that there may be a potential for collaboration on industry training programs.
- 26. Brad Walton noted the majority of developers and construction groups are good operators; however, there is a bottom 10% who may have the same commitment or culture on site to address these issues.
- 27. Don Schouten noted that it is a responsibility of the General Contractor on the site to inform all the subtrades below them of these concerns. Brad Walton noted that the Building Code and Fire Code contains some measures related to Course of Construction Fire Protection; however, it would be beneficial to foster this relationship between WorkSafe BC and the British Columbia Fire Service relative to training opportunities to meet training needs of both fire service and site managers/ others.
- 28. John Ivison noted that it may be possible to produce new guidance, or to share new Bulletins with WSBC in order that they can distribute them through their own network.
- 29. Alan Brose noted that it may be possible WorkSafe BC to link to external resources to highlight the issues and to make it available to WorkSafe BC officers. Alan agreed, but noted that this issue must be carefully reviewed within the bounds of the WorkSafe BC mandate and they must be careful not to cross the bounds they are required to work within. John Ivison noted it is not suggested that WorkSafe BC would provide a comprehensive guide on the topic.
- 30. Don Schouten noted that, Course of Construction Fire Safety is a culture that must be encouraged onsite, in the same manor that site safety concerns have become widely embraced by the construction industry. Many small operators grow to build larger and larger buildings, but typically the smaller construction operators may not be up to speed with the type of culture to provide a safe construction site. Due diligence from all players, including WorkSafe BC, is required to achieve a culture that embraces construction safety. Dave Stewart summarized by saying that to the extent that it is within their jurisdiction, as requested. This issue will be reviewed and confirmed. He expressed that this is a take away issue for WorkSafeBC. Alan also requested a summary of the scope of this project. John Ivison will request this of FII.
- 31. John Ivison noted that the scope is very broad covering all construction including noncombustible construction, other than one and two family dwellings.
- 32. Don Schouten noted that WorkSafe BC has a Construction Safety Association which is funded by an industry levy where communication with industry personnel is possible. He suggested that a document that is brief and easy to understand and comprehend would be useful for addressing this issue through multiple channels, and additionally noted that WorkSafe BC has had a lot of success with communication using posters, in order to simplify the message, such that it may become the apart of the site culture.
- 33. John Ivison noted that the WSBC Safety Conference may be a good platform to launch any

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new initiatives on fire safety. Additionally an agenda of the wood industry is to reduce construction site fires as wood is considered to be a carbon captured material with benefits related to environmental concerns. The burning of the construction material releases huge emissions that was previously considered to be captured. The scope, extent and application of various guidance need to be assessed and clarified. Certain organizations would have an interest in seminars and information including the Construction Safety Association, which is supported by WSBC. It was also noted that sustainability is now an important part of the WSBC mandate.

- 34. Brad Walton noted that over the past two decades he has witnessed a very positive change relative to general safety procedures. There has effectively been a culture change on construction sites, and that it would be beneficial as a long term goal to have fire safety issues and fire protection have the same positive attitude shift.
- 35. John Ivison to Alan Brose, "Is there a requirement for the site personnel to review these items on the construction site?" Alan Brose states, "No. The Principal Contractor has responsibilities and the employee must comply with the Health and Safety Regulations Act. This is the responsibility for all employers including the General Contractor and all Sub-Contractors. Item 1.15.2.E. covers this responsibility for all employers." Brad Walton noted that the qualified Coordinator, as noted in Item 20.3(2), of the Occupational Health and Safety Regulation could address these items in the future if training was available.

The meeting closed with a consensus that the development community and WSBC share the same goals and there is the potential for closer cooperation in the future. The development of a PowerPoint presentation on construction fire risk to be presented at the annual safety conference is a possibility. There is recognition that risk is higher in the course of construction and this has been an accepted risk based on the previous incidence of fires in construction. Recent trends in arson and other risks suggest that more vigilance, preplanning and mitigation measures are necessary. The focus of WorkSafeBC is worker safety. Most of the fires have not resulted in injury or deaths. However, fires elsewhere in non-combustible construction suggest fatalities can occur. The risk is increasing due to demographic and other problems.

This meeting confirmed that there may be some overlap of authority between WorkSafe BC, Occupational Health and Safety regulation, the British Columbia Building Code and Fire Code requirements relating to construction fire safety. It was agreed that the primary responsibility lies with the owner of the construction site, as well as the general contractor. There is enforcement via the local Fire Department and municipal Building Department. Further analysis and development would be required to have a "qualified coordinator" whose duties are specified by OHS regulations addressing construction fire risk mitigation. This is not the current mechanism in the regulations although it is required in Vancouver.

Additional investigation and research would be necessary to determine further if there is a potential for WorkSafe BC/Fire Service joint educational programs, including industry stakeholders. Communication and information sharing through online links is a good start. The consensus was that it is a good idea to reinforce the requirements and the implications on site. Certain support may be available from Homebuilders, WEC, CWC, FII and other agencies to enable seminars to be

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designed and delivered in conjunction with the various stakeholders.

These minutes are intended to summarize the main points of the discussions at this meeting. If you believe that the minutes are incomplete or incorrect, please notify the undersigned immediately.

Prepared by, CFT Engineering Inc Samir Eidnani, P.Eng., CP

cc: All present

SE/kd

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APPENDIX B



Minutes of Meeting

Meeting Date: Wednesday May 30, 2012

Location:	CFT Engineering Inc.	Offices, 1901	Rosser Avenue,	Burnaby, BC
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Attendees:	John Caviglia	-	City of Surrey Fire Department (FCABC)
	Dave Burgess		City of North Vancouver Fire Department (FCABC)
	Gordon Richards	-	Gage-Babcock & Associates (AIBC)
	Frank Durante	-	City of New Westminster (BOABC)
	Tom De Wolf	-	Axiom Builders Inc. (BCCA)
	Bill May	-	Protection Engineering (APEGBC)
	Doug Wilson	-	Peak Construction Group (BCCA)
	Brad Walton	-	CFT Engineering Inc.
	Tina Burgess	-	CFT Engineering Inc.
	John Bolduc	-	CFT Engineering Inc.
Subject:	Construction Fire Sa	afety Res	search and Industry Evaluation

Prepared by: John Bolduc/Tina Burgess

The purpose of this meeting was to review the draft construction fire safety research report in order to obtain comments, specifically with respect to the recommendations proposed in the report.

1. <u>Background</u> - Copies of the technical research report were circulated and approximately 45 minutes was provided for a brief review. Brad Walton lead a general discussion and overview, providing a summary of the research and literature review culminating to the recommendations which were the objective of the research project. The 12 specific recommendations were presented and discussed. The discussions for each recommendation are summarized below:

Section 10.1, Linking of Construction Fire Safety within the BC Building Code and Fire Code

2. There was general agreement that there is a need to raise the awareness of BC Fire Code requirements for construction fire safety within the BC Building Code. The link between the BC Fire Code and the BC Building Code with respect to construction fire safety is currently located in Part 8, whereas most professionals who work within the fire and life safety field are generally more familiar with Part 3. There was also some discussion on the issue of water supply sizing. Water supplies are addressed as a separate recommendation.

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- 3. Brad suggested that the section on CRP responsibilities might also be a means of linking the BC Building Code and BC Fire Code requirements. Gordon agreed with the recommendation in that the Code should bring forward attention to construction fire safety. However, he expressed concerns relating to liability for the CRP, and the need for a discussion regarding liability later on.
- 4. Brad clarified that this recommendation is specific to the appropriate location of the reference in the BC Building Code to the BC Fire Code with respect to construction fire safety, and on this point it was generally agreed that this was a good idea.

Section 10.2, Assignment of a Fire Safety Coordinator

- 5. The question was asked whether there is currently a training program or certification program available for a fire safety coordinator. The BCIT course has been shut down and the JI program is being redeveloped. It was noted that the requirement for adequate training may be specified by WorkSafe BC.
- 6. Brad discussed how the responsibilities of a fire safety coordinator are typically fulfilled by a person who also has other roles onsite. Doug stated that there is an assigned CSO on every site that his company is involved with.
- 7. There was general agreement with respect to the benefits of having an assigned fire safety coordinator. Brad stressed the need for a single point of contact with the AHJ and Fire Department. He also identified that the fire safety coordinator must be a knowledgeable person for larger projects or those with specific risks. Frank outlined the necessity for auditing by the AHJ to evaluate the quality/performance of a fire safety coordinator.

Section 10.3, Fire Warning and Alarm

- 8. Brad noted that a considerable amount of fires on construction sites are incendiary. It was commented that the requirement for an out-of-hours fire watch is generally a condition of the insurance policy, but that the requirement should be clearer in the Fire Code.
- 9. Dave suggested that specifics be added to this requirement. Brad responded that the best means of implementation of this recommendation is site specific, but that suggested methods (and specific) should be provided in a guideline, produced by the Office of the Fire Commissioner or BC Fire Chief's Association.

Section 10.4, BC Building Code Part 2, Division C, Article 2.2.7.3 (Appendix), Coordinating Registered Professional Responsibilities

10. This proposed recommendation generated a discussion regarding how the legislated requirements for construction fire safety should be most appropriately implemented and audited. Although there was agreement that the mechanisms for implementing and auditing construction fire safety practices are not consistently applied in BC, and there is a need to develop procedural methods to address the adequacy of construction site fire safety, there was no consensus on how this could best be achieved.

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- 11. Gordon stated that this role is typically the responsibility of the AHJ, and that the CRP for a project may not have the required expertise to develop or audit construction fire safety plans and procedures. Dave mentioned that the Fire Department/AHJ identifies construction fire safety as the responsibility of the owner. Tom De Wolf provided his opinion that the contractor should be responsible for construction fire safety planning.
- 12. Brad noted that an important function of the preliminary assessment is to address potential exposure to adjacent sites. John C suggested that the wording of the recommendation to be changed to <u>exposure</u> as opposed to <u>adjacent structure</u> to make it clear that exposures may not be limited to adjacent structures.
- 13. Brad clarified that the recommendation addresses two issues: exposure to adjacent properties and construction fire safety at the site, and suggested, based on this discussion, they should be separated.
- 14. Gordon explained that the schedule requirements are currently applicable only after occupancy, and voiced his concerns of requiring the architect/CRP to take responsibility during the construction phase. Bill echoed this concern.
- 15. Tina stated that it is important that the responsibility for construction fire safety is clearly defined to reduce the risk that requirements for construction fire safety are not clearly identified or implemented.

It was agreed that Brad, Gord and Bill would try to refine this recommendation to address the concerns raised.

Section 10.5, Adequate Water Supply for Firefighting

- 16. There was consensus that an adequate water supply should be available early on in the construction process. Brad described how water supplies are given a high priority for construction sites in the United States, and are generally available as soon as combustibles start accumulating.
- 17. Brad also noted that one of the issues in BC is that there is often a time lag between the commencement of construction and obtaining the clearance from engineering departments to allow connections to be made to water supplies. Doug agreed that the hold up with municipal engineering departments is a large concern because the "garden hose" water supply is often the only supply available, even when the site is approaching occupancy. Doug also mentioned that the requirement may be unenforceable because of the imposed slowdown to the construction schedule.
- 18. Brad suggested that there is more than one way to provide a water supply, for example a forestry hose.

19. Frank suggested that a change in the Code requirement would result in a change to the process for local engineering departments.

Section 10.6, Fire Risk Assessment Management

20. Gord expressed his concern with the reference to a CRP with respect to the fire risk assessment. However, it was generally acknowledged that there is a need for a formal requirement to conduct a risk assessment prior to construction commencing.

Section 10.7, Pre-Construction Meeting

21. This was generally accepted as a valuable recommendation. Brad pointed out that early involvement of the police department may provide an incentive for more active police surveillance at the site.

Section 10.8, Construction Fire Safety Plan (FSP)

- 22. Brad stated that a new guideline similar to the one developed by the City of Surrey could be administered by the Fire Commissioner's office. Dave mentioned that alternatively the administration could be through the Building Policy Branch.
- 23. It was acknowledged that adequate training on how to develop a construction fire safety plan is crucial. Doug Wilson noted that training is normally provided on site. Frank mentioned that training is not usually an issue with experienced construction companies, but legislated requirements should address the lowest common denominator.
- 24. Brad suggested the importance that openings in firewalls be closed at night. Gord mentioned that in practice the doors are typically installed last. Brad suggested that even string closures for doors could provide the necessary protection for doors in firewalls. Doug suggested that this requirement may be impractical because of the extension cords and air hoses that typically pass through these doors.
- 25. Brad suggested that this may be one of the requirements which might benefit the wording <u>where practical</u>, and that goal should be to change industry practice. Doug stressed the need for careful wording, because what might be observed as a "where practical" Code article might be applied more rigidly in the future. Frank suggested with some confidence that the industry will evolve to work with new obligations.
- 26. The necessity for industry practice changes with respect to the development of the construction fire safety plan was generally acknowledged.

Section 10.9, Development of Fire Protection Practice to Mitigate Risk During Construction

27. Gordon mentioned that the use of combustible firewalls may have contributed to the severity of some of fires at construction sites.

- 28. Frank stressed the importance of a qualified fire watch. Brad suggested that it should be required to have security patrols that use punches or other record devices in order to potentially audit a fire watch.
- 29. Dave explained the advantages of cross-municipality consensus and application. He also noted the importance of coordination of the AHJ and Fire Department.
- 30. Brad explained how the Fire Code used to have a more intricate scheme for fire watch. He also explained how hot work permit programs were a part of what was required by the Fire Code, but also by insurance providers (and records kept of hot work permits on site).

Section 10.10, Provision and Maintenance of Fire Department Access

- 31. The group agreed on the importance of the requirement for maintaining Code conforming access to the site. Brad mentioned that Fire Department access should be shown in preliminary planning.
- 32. Dave explained that Fire Department access goes further than fire protection on construction sites. Access routes need to be maintained even at the excavation stage, since emergency response also include rescue and medical emergencies.

Section 10.11, Management of Ignition Sources and Combustible Content

33. This was generally acknowledged as "common sense". It was agreed that formal procedures should be common industry practice.

Section 10.12, Responsibility and Enforcement

34. Dave spoke to the resource implications that would be a part of required auditing. Brad responded that it would be up to the AHJ how auditing would be managed. Frank suggested that auditing could be limited to receiving reports via fax or email. Dave suggested that the wording specifically say <u>may be audited</u>. John C mentioned that small municipalities could benefit from some auditing from the CRP. More discussion/suggestions with respect to how to allocate responsibilities with respect to auditing and implementation of construction fire safety requirements is needed.

General Discussion/Conclusion

35. Doug Wilson expressed that it would be advantageous if the implementation of this concept did not require another new consultant on site. The meeting was adjourned and it was requested that any additional comments be submitted to CFT within one week.

These minutes are intended to summarize the main points of the discussions at this meeting. If you believe that the minutes are incomplete or incorrect, please notify the undersigned immediately.

Prepared by, CFT Engineering Inc.

Brad Walton, AScT

cc: All present

JB/mc

C6357.03_MOM03

APPENDIX C



OFC BULLETIN

April 17, 2009

Fire Safety Planning for Construction and Demolition Sites

The purpose of this Information Bulletin is to provide the construction and demolition industry with an easy to follow checklist to assist them in meeting the fire safety requirements of British Columbia's Building and Fire Codes. The goal is to prevent fires in and around construction/demolition sites and reduce the fire risk to life and property.

This bulletin only covers provincial building and fire code requirements. Specifically:

- British Columbia Building Code 2006, Division B, Section 8.1 makes reference to the British Columbia Fire Code (BCFC) 2006, Division B, Section 5.6 which applies to buildings, parts of buildings, and associated areas undergoing construction or demolition operations, including renovations.
- BCFC, Division B, Section 5.6.1.2 (1) states: "Prior to the commencement of construction/demolition operations, a fire safety plan shall be prepared for the site."

The owner or owner's authorized agent is responsible for carrying out the provisions of the BCFC, which includes establishing a work site fire safety plan to ensure that:

- Fire hazards will be controlled.
- Emergency responders will be notified of a fire emergency.
- Emergency responders will not be delayed in carrying out their duties.
- Firefighting operations will be managed effectively, without unnecessary delays.
- Designated supervisory staff will be appointed and organized to respond to fire emergencies.
- Instructions including schematic diagrams describing the type, location and operation of building fire emergency systems will be established.
- Building facilities, systems, equipment and devices will be properly inspected and maintained.

The fire safety plan not only reflects the unique characteristics of building, operation and construction techniques (including the construction/demolition trades), but also considers the available firefighting infrastructure. For this reason, the fire safety plan must be prepared by the owner or owner's authorized agent in cooperation with the <u>local fire department</u> and other applicable regulatory authorities.

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Prior to commencing any work at a site, it's important for the owner or authorized agent of the owner to:

- ensure they are also in compliance with the laws, regulations and requirements of the BCBC, the BCFC, local government and other regulatory authorities; and
- contact the local fire department and other regulatory authorities such as the <u>British</u> <u>Columbia Safety Authority</u> and <u>WorkSafeBC</u>.

Fire safety planning and risk management assessments of the site done prior to, during and after building construction/demolition is completed, are essential to prepare for and manage fire hazards. Planning and assessment will identify and lead to methods and processes that will minimize or contain potential fire hazards. All site safety activities should be coordinated through the planning and assessment process.

BCFC provisions are included in the fire safety plan and are applied depending on the project's scope and conditions of the site, e.g. the size and type of the building and its proximity to adjacent buildings.

At a minimum, a fire safety plan should include the following information:

1. Emergency procedures and information needed to plan for an emergency:

- □ Who is the designate and backup person responsible to sound the fire alarm (horn)?
- □ Who is the designate and backup person responsible to notify the fire department (9-1-1)?
- □ Is instruction given to site personnel on the procedure to follow when an alarm is sounded?
- □ Are exit routes clearly visible within the site and on all floors?
- □ Is the muster point (or meeting place) known by all site personnel?
- □ Is there a list of on-site personnel, and is it updated and current? (Can everybody on-site be accounted for?)
- □ Are there assigned personnel to meet the fire department upon arrival and give information, such as the location of the fire or injury?
- □ Are there persons assigned as site fire wardens (ensuring various trades are represented)?
- □ Are there personnel directed and trained to confine or control the fire?

2. Training of site personnel on evacuation procedures:

- □ Is site orientation provided?
- □ Are regular site fire safety meetings a part of regular safety meetings?
- □ Are simulated fire drills conducted when applicable and warranted?

3. Assigned site personnel must be responsible to install and maintain fire safety duties such as:

- □ Controlling combustibles on the site and around the buildings.
- General site housekeeping.
- Removing excess pallets, garbage/waste material and other combustibles on a regular basis.

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- □ Maintaining separation of combustibles from open flame devices.
- Maintaining clear unobstructed access route(s) for fire department apparatus and to fire hydrants.
- Designating and maintaining at least one exit from every floor.
- □ Separating access routes from materials stored on-site, combustibles, etc.
- Parking of vehicles or delivery trucks should not obstruct fire department access to the site, and
- □ adjacent buildings (off-site parking and storage may be considered).

4. Firefighting Services - Hydrant, Siamese Connection, Sprinkler, Access Route:

- □ Are they installed, tested and activated at the start of construction?
- □ Are firefighter access route(s) to the building provided?
- Are firefighting services (standpipes, hydrants) maintained and accessible?
- □ Do drawings provided to the fire department show the location of firefighting systems as they become operational?
- □ Is the site address sign visible and legible to emergency crews form the street? (if they must be provided according to bylaw)

5. Fire Extinguishers:

- □ Is there sufficient quantity and type on-site? Such as:
 - 2-A:10-B:C on movable equipment?
 - 4-A:40-B:C in all other locations?
- \Box Is the servicing up-to-date (within the last year)?
- □ Are they provided at or near fuel operated equipment?
- □ Are they mounted with proper signage at exit locations within the required travel distance?
- Are they adjacent to any hot works operations (e.g. cutting torch, welding, torching, etc)?

6. Hot Works Operations:

- □ Is the area clear of flammable and combustible materials?
- □ Is a fire watch assigned during a hot works operation and for 60 minutes after its completion?
- □ Is there a final inspection of the hot works area 4 hours after completion?
- □ Are the hot works in the proximity of combustible or flammable materials?
- □ Have provisions been made for protection of such materials by non-combustible materials, thermal barrier or other means?
- □ Is the work being performed by trained or certified personnel?
- □ Is a fire extinguisher present at all times? Such as:
 - 2-A:10-B:C on movable equipment?
 - 4-A:40-B:C in all other locations?
- □ Is proper ventilation provided as required?
- □ Are the hot tar pots on-site complete with fire extinguishers, trained personnel, and located away from combustible materials?

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7. Flammable and Combustible Storage:

- □ Are flammable and combustible liquids properly stored, handled and used in and around the building?
- Are non-petroleum based compressed gases properly stored, handled and used in and around the building?
- □ Is the storage area separated from combustible material by 3 metres?
- □ Is the storage area locked and vented?
- □ Is the storage area protected from vehicular/ industrial motorized traffic?
- Do containers and/or storage areas have proper signage/placards in place?
- Is there a current or updated list of dangerous goods on-site such as material safety data sheets (MSDS), as per the <u>Workplace Hazardous Materials Information System</u> (WHMIS)?
- Are portable extinguishers provided in close proximity to storage and work areas such as:
 - 2-A:10-B:C on movable equipment?
 - 4-A:40-B:C in all other locations?
- □ Is the storage area away from egress and access routes to the site?

8. Electrical Installations and Petroleum Gases:

□ Do the electrical installations, storage and use of petroleum gases comply with the requirements of the Safety Standards Act and pursuant regulation? (contact the British Columbia Safety Authority 1-866-566-7233)

9. Security:

- □ What type of on-site security is provided: e.g. locked gate, monitored alarm and/or CCTV, 24 hour or nightly walk around?
- Do security personnel have knowledge of and understand their role in the site's fire safety plan?
- □ Can the fire department effectively communicate with the security personnel during an emergency?
- Do security personnel have access (keys) to locked areas?

10. Contact Personnel:

- □ Is there a list of names and telephone numbers of persons to be contacted during and after normal operating hours or in the event of an emergency?
- Are the contact personnel able to respond in a timely fashion?
- □ What is their estimated response time?

11. Building Diagrams:

- □ Are diagrams available on-site? These diagrams should indicate:
 - Plans of each floor area;
 - Muster point(s);
 - Location of nearest hydrant(s);
 - Location of fire protection equipment;
 - Exit paths; and,
 - Service rooms.

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The fire safety plan must be reviewed and updated as construction/demolition progresses and then periodically afterwards to provide the greatest value. The plan that is developed for a building construction site should evolve into the plan that will be used to maintain and protect the building and its occupants after completion. It's very important that all supervisory staff remain familiar with the plan throughout the process so they are familiar with how it pertains to their responsibilities.

It may be beneficial to owners to obtain the services of a consultant who specializes in fire safety planning. This consultant would oversee the fire safety plan's development and implementation. This is especially useful to owners who have neither the time nor the expertise to develop their own plan as well as when a fire department isn't available to them.

Contact: Stephen Watt Codes and Standards Coordinator 1-888-988-9488

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The contents of this OFC Bulletin are not intended to be provided as legal advice and should not be relied upon as legal advice.

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SURREY FIRE SERVICE

Construction Fire Safety Plan Bulletin



The B.C. Fire Code requires building owners/contractors to comply with the requirements of the BC Fire Code 5.6 Construction and Demolition Sites



CITY OF SURREY FIRE SERVICE

8767 132 Street Surrey B.C., V3W 4P1 Fire Prevention: 604-543-6780 Fax: 604-594-1237 www.surrey.ca



This bulletin is provided by the Surrey Fire Service to assist owners, contractors, and workers on the requirements of a Construction Fire Safety Plan (CFSP). The document is intended to provide a brief overview of existing information that has previously been developed. Each site and construction project will have site specific issues that will need to be addressed in the CFSP.

During the construction phase, a building is at its most vulnerable state. A CFSP is a part of a system that is intended to protect the building during this vulnerable stage. Once a building is completed, there are a number of life safety systems in place to protect the building and its occupants. These include fire alarm systems, sprinklers, and fire compartmentalization. During construction these fire safety measures may or may not be installed or fully operational. Therefore, the CFSP must address hazards that could be present during construction.

The leading causes of fire in buildings under construction or demolition are:

- Incendiary/suspicious events.
- Smoking on site.
- Open flames/embers.
- Heating equipment.

While minimizing the fire hazards at a construction site, the CFSP must also take into account the impact a fire would have on the neighboring building(s).

It is the owner's responsibility to develop a Construction Fire Safety Plan that meets the requirements of the BC Building and

Revised July 29, 2011

Fire Codes and the referenced standards and publications listed within this bulletin. It may be beneficial for owners or contractors to obtain the services of a Fire Safety Planning specialist to assist in ensuring an adequate plan is developed for their site.

In order to reduce hazards and the spread of fire, the following minimum requirements need to be reviewed and incorporated in your construction fire safety plan.

Fire Safety Plan Minimum Requirements

Section 5.6, Division B of the BC Fire Code requires that for any building or parts of buildings undergoing construction, renovation, or demolition operation, a fire safety plan be prepared for the site prior to any work commencing. Part 8, Division B of the BC Building Code provides requirements for safety measures at construction and demolition sites. The fire safety plan shall be prepared by the owner or owner's authorized agent in cooperation with the Surrey Fire Service and shall be reviewed after any significant changes to the project. The minimum requirements for a fire safety plan shall include the following (BCFC, Div B, 5.6.1.2/2.8.2.1):

- 1) The designation and organization of site personnel to carry out fire safety duties.
- 2) The emergency procedures to be followed in the event of a fire, including:
 - a) sounding the alarm,
 - b) notifying the Fire Department,
 - c) instructing site personnel on the procedures to be followed when the alarm sounds,
 - d) firefighting procedures
- 3) Measures for controlling fire hazards in and around the building.
- 4) A maintenance procedure for firefighting facilities.
- 5) Documents, including diagrams, showing the type, location and operation of the building fire emergency systems.
- 6) List of all emergency response numbers and list of names, addresses, and telephone numbers of persons to be contacted during and after normal operating hours in the event of an emergency.

Summary of Part 8, Division B, BC Building Code - Safety Measures at Construction and Demolition Sites

Part 8, Division B of the BC Building Code provides details for protection of the public and adjacent properties. Prescriptive requirements related to construction sites are addressed in the following Subsections:

- 8.2.1. Fencing and Barricades
- 8.2.2. Excavation
- 8.2.3. Use of Streets or Public Property
- 8.2.4. Direction of Vehicular Traffic
- 8.2.5. Waste Material

Unique Details for Construction Fire Safety Plans

Since projects vary in size and complexity, it is unreasonable to expect that a single template can serve to develop a CFSP for all projects. A more detailed CFSP may be necessary to meet the minimum fire safety requirements. A project specific CFSP will address items such as phases of

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construction (excavation, structure, etc...) or phased occupancies. The degree to which additional mitigating risk reduction measures are applicable will depend on the project size, scope, proximity to other buildings, and unique site conditions.

Fire Safety Training

The assignment of a WorkSafe BC qualified coordinator as required by the WorkSafe General Conditions Occupational Health & Safety (OHS) regulation should be complete prior to construction. The qualified coordinator should also address construction fire safety concerns and maintain a site copy of the accepted CFSP. Workers should be kept up to date with emergency procedures as per WorkSafe General Conditions OHS Part 4:

4.16 Training

- 1) All workers must be given adequate instruction in the fire prevention and emergency evacuation procedures applicable to their workplace.
- 2) Workers assigned to firefighting duties in their workplace must be given adequate training, by a qualified instructor, in fire suppression methods, fire prevention, emergency procedures, organization and chain of command, firefighting crew safety and communications applicable to their workplace.
- 3) Retraining for firefighting duties must be provided periodically, but not less than once a year.
- 4) A worker not covered by Part 31 (Firefighting), who is assigned to firefighting duties, must be physically capable of performing the assigned duties safely and effectively before being permitted to do them.

Enforcement

Course of construction fire safety falls under numerous jurisdictions. Therefore, violations may result in enforcement from a number of different regulatory bodies or authorities, including insurance providers. Enforcement for violations may include:

- Issuance of order by Surrey Fire Service under the Fire Code,
- Issuance of a Stop Work Order or removal of Building Permit by the Building Division,
- Removal of Business License,
- Action by WorkSafe BC

Features for Coordination

- 1. Passive Protection:
 - 1.1 Provision at each floor level of an unobstructed stair discharging to grade level.
 - 1.2 Coordination during construction of fire compartments and fire walls.
 - 1.3 Management of fuel fired equipment.
 - 1.4 Management of temporary heating equipment. All temporary heating equipment shall be listed and used in accordance with manufacturer's instructions.
 - 1.5 Management of roofing operations involving heat sources and hot processes. These

operations must be conducted by a qualified agency.

- 1.6 Maintaining a high standard of Housekeeping on site.
- 1.7 Providing and maintaining a Fire Department access to site complying with BC Building Code Division B Subsection 3.2.5. (BC Fire Code Division B, Article 5.6.1.4)
- 1.8 Providing 1 h fire separation between occupied areas and areas under construction (BC Fire Code Division B, Article 5.6.1.14).
- 2. Fire Protection:
 - 2.1 Activated (charged) standpipe installed progressively with building construction.
 - 2.2 Activated (charged) sprinkler system upon installation of ceiling membrane. Where practical, the system should be activated when construction is not taking place but may be turned off during operating hours.
 - 2.3 Onsite fire protection stations that may include portable fire extinguishers possibly supplemented by garden hose for ease of use by all personnel.
 - 2.4 Early installation of fire pumps where required for fire protection water supply.
 - 2.5 Coordination such that the municipal water supply is available onsite when grade level construction begins (required by NFPA 1, Article 16.4.3.1.1 upon accumulation of combustible material).
 - 2.6 "Watch" during demolition or construction with partially occupied buildings (BC Fire Code Article 5.6.1.15).
 - 2.7 Fire alert warning system (Article 5.6.1.9).
 - 2.8 Temporary heating equipment to comply with Division B Articles 5.6.1.11 and 12 of the BC Fire Code.
 - 2.9 Fire watch during hot works operations and for a period not less than 60 minutes after, and a final watch 4 hours after completion (BC Fire Code Division B Articles 5.2.3.1 and 5.2.3.3).
- 3. Additional Items:
 - 3.1 Install doors in firewalls, close the doors during non-operating hours, and put doors on fusible links during construction.
 - 3.2 Provide temporary water flow alarms on sprinklers.
 - 3.3 Timing for issuance of sprinkler permit (sprinkler drawings must be reviewed by numerous consultants and accepted by Municipal Authorities prior to issuance of permit and commencement of installation of sprinklers).
 - 3.4 Exposure protection sprinkler systems.
 - 3.5 Completion of a pre-construction meeting with the City of Surrey Fire Department prior to start of construction.

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3.6 Development of a fire risk assessment for more complex sites. This will identify time frames and processes where risk may be greater and extra measures may be required (in accordance with the Society of Fire Protection Engineers guidelines).

Referenced Standards and additional North American Standards/Guides which relate to course of construction fire protection are listed below:

Existing Referenced Standards/Bulletins

- Section 2.8, 5.2 and 5.6, Division B of the 2006 BC Fire Code
- Part 8, Division B of the 2006 BC Building Code
- Office of the Fire Commissioner (OFC) of BC, OFC Bulletin- April 17, 2009
- Standata Fire Code Interpretation FCI-09-03 (AFC)

Further Resources and Additional Recognized North American Standards

- NFPA 1, Fire Code.
- NFPA 101,Life Safety Code
- NFPA 5000, Building Construction and Safety Code
- NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations
- SFPE Engineering Guide to Fire Risk Assessment

For complex sites where a more robust fire safety plan is required, review of further additional standards is recommended; see relevant items from NFPA 241 below.

Summary of NFPA 241, Standard for Safeguarding Construction, Alteration and Demolition Operations

NFPA 241 provides a comprehensive guide for construction, alteration, and demolition operations. This standard provides guidance on the construction of temporary offices and storage areas, typical processes and hazards such as temporary heating equipment, flammable and combustible liquids and flammable gas storage and handling, temporary electrical work and lighting, and requirements for fire protection. Some significant items to note from NFPA 241, Chapter 7:

- As noted in Article 7.5.6.1, in all buildings over one storey in height, at least one stairway shall be provided that is in usable condition at all times. This stairway is required to be extended upward as each floor is installed for new construction, and must be maintained for each floor remaining during demolition.
- As noted in Article 7.6, in all new buildings in which standpipes are required or where standpipes are existing in a building to be altered or demolished, such standpipes shall be maintained in conformity with the progress of the building construction in such a manner that they are ready for use.
- As noted in Article 7.7.4, at least one approved fire extinguisher shall be provided in plain sight on each floor at each usable stairway, as soon as combustible material accumulates.

Chapter 8 of NFPA 241 provides details on safeguarding construction and alteration operations, and provides comments on scaffolding, shoring and forms, construction material and equipment storage,

building separation walls such as fire cut-offs and temporary separation walls. Some significant items to note from NFPA 241, Chapter 8:

- As noted in Section 8.2.5, portable fire extinguishers or charged hose lines are required during forming/stripping operations using combustible forming material.
- As noted in Section 8.6.1, firewalls and exit stairways where required for the completed building, shall be given construction priority for installation. Fire doors with approved closing devices and hardware shall be installed as soon as practical, and preferably before combustible material is introduced. Fire doors shall not be obstructed from closing.
- As noted in Article 8.7.2.1/.2, a water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material accumulates on the site, and there shall be no delay in the installation of fire protection equipment.
- As noted by Article 8.7.2.3, where underground water mains and hydrants are to be provided, they shall be installed, completed, and in service prior to construction work.
- As noted by Article 8.7.3.1, if automatic sprinkler protection is to be provided, the installation shall be placed in service as soon as practicable.
- Section 8.7.4 discusses the standpipe requirements.

Conclusion

The protection of a construction site from fire is paramount to the owners, contractors, the community and the Surrey Fire Service. The implementation of this bulletin can assist in reducing the inherent risks associated with construction sites.

The CFSP should take into account any potential hazards that may be present during the building's construction period. The CFSP should have the potential to be developed into the final Fire Safety Plan for the building and the occupants of the building upon completion.

It is the owner's responsibility to ensure the construction fire safety plan is developed for each project. When important components of the approved construction fire safety plan need to be altered, the owner or owner's authorized agent must consult with the Surrey Fire Service.

Please review the information within this bulletin as well as the attached checklist when developing a fire safety plan.

Questions regarding Construction Fire Safety Plans can be directly addressed to the Surrey Fire Prevention Office at 604 543 6780.



Surrey Fire Service Fire Prevention Division

Name: Date: Address: Building Permit #:

ltem #	Description	Acceptable	NA				
0.0	General Requirement:						
0.1	Name and contact of fire safety director (Should be Onsite WCB Qualified Coordinator)						
0.2	Name and contact of owner, all consultants, and contractors						
0.3	Updated List of Site Personnel						
0.4	Site address, posted and visible from street						
0.5	Contact numbers for nearest hospital						
0.6	Contact numbers for emergency services - police/fire/ambulance (911)						
0.7	Site Schematic showing the following:						
	Existing and proposed buildings						
	Site office						
	First aid station and safety station						
	Location of fire extinguishers						
	Location of emergency air horn						
	Hazardous materials storage						
	Emergency vehicle routes in and out of site						
	Emergency exits from site						
	Location of fencing and barricades						
	Fire department connections and hydrants						
	Designated gathering location						
	Parking for vehicles and delivery trucks						
0.8	Emergency procedures in the event of a fire						
0.9	Training of Site Personnel on Excavation Procedures						
0.10	Access for Firefighters (BC Fire Code 5.6.1.4)						
	Clear access to fire hydrants, portable extinguisher,						
	and connections maintained at all times						
0.11	Portable Fire Extinguishers (BC Fire Code 5.6.1.5)						
0.12	Provision for Egress (BC Fire Code 5.6.1.8)						
	At least one usable exit at all times						
0.13	Control and Removal of Waste Materials (BC Building Code 8.2.5)						
0.14	Water Supply (NFPA 241 8.7.2)						
	No delay in installation of fire protection (standpipe or sprinklers)						
0.15	Completion of Site Fire Safety Meetings and Fire Drills (BC Fire Code 2.8.3)						
0.16	Prohibition of Smoking in Areas with Potential for Ignition (BC Fire Code 2.4.2)						



Surrey Fire Service Fire Prevention Division

Item #	Description	Acceptable	NA					
1.0	Excavation Phase:							
1.1	Building Services to be Shut - Off (BC Fire Code 5.6.2.1)							
	Existing gas, electrical, water, steam and other services							
	shall be shut off, capped, and labeled							
1.2	Building Services to be Maintained (BC Fire Code 5.6.2.2)							
	For services remaining during excavation							

Item #	Description	Acceptable	NA			
2.0	Structure to Grade:					
2.1	Scaffolding, Shoring, and Forms (NFPA 1 16.4.1) Combustible forms shall not accumulate					
22	Forming and Stripping (NFPA 241 8.2.5) Fire extinguishers or charged hose lines are required					

Item #	Description	Acceptable	NA					
3.0	Superstructure:							
3.1	Standpipe System (BC Fire Code 5.6.1.6) In conformance with BC Building Code Subsection 3.2.5, installed progressively							
3.2	Fire Warning System (BC Fire Code 5.6.1.9)							
	Automatic or Manual							
3.3	Exit Stairs (BC Fire Code 5.6.1.8 & NFPA 241 7.5.6.1)							
	At least one stairway usable at all times							
3.4	Sprinkler System (NFPA 241 8.7.3)							
	Installed as soon as practical							
3.5	Fire Cutoffs (NFPA 241 8.6.1)							
	Firewalls and exits stairs given construction priority							
	Fire doors with required closures, closing devices and hardware to be installed as soon							
	as practical and kept closed or placed on fusible link							

Item #	Description	Acceptable	NA				
4.0	Additional Requirement for Certain Applications:						
4.1	Phased Occupancy Adjacent to Area Under Construction (NFPA 241 8.6)						
	Adding spatial separation, exit exposure etc. (BCBC)						
4.2	Fire Separation from Occupied Areas (BC Fire Code 5.6.1.14 & NFPA 241 8.6.2)						
	Minimum 1 hour fire separation if building is partially occupied during construction						
4.3	Watch/Site Security (BC Fire Core 5.6.1.15)						
	When a portion of the building is occupied during construction						
4.4	Temporary Heating Equipment (BC Fire Code 5.6.1.11 and .12)						
1	Exhausts 500 mm away from combustible materials,						
	Exhaust piping kept 150 mm away						
4.5	Combustible and flammable liquid storage and handling (BC Fire Code 5.6.1.17)						
	In conformance with BC Fire Code Part 4						
4.6	Fencing and Barricades (BC Building Code 8. 2.1)						
	To protect the public, maintain access						
4.7	Safety of Streets (BC Building Code 8.2.3 and .4)						
	Also traffic directing						
4.8	Torch-Applied Roofing Systems (NFPA 1 16.6)						
L	Permits shall apply with Section 1.12						
4.9	Cutting and Welding Operations (BC Fire Code 5.6.1.7)						
	Shall conform to BC Fire Code section 5.2						
4.10	Hoists and Elevators						
	Available to the fire department whenever necessary						
4.11	Pre-construction meeting						
4.12	Safe Conducting of Hot Works (BC Fire Code 5.2.3)						
	Shall be included in the fire safety plan						

APPENDIX D

· Quantification of Risk Over Construction Phases

Individual Contribution to Risk from Construction Stages (In Sequence)

Foundation Change -1 Risk Framing Change Risk **Plumbing and Electrical** Change -1 Risk Insulation and Drywall Change -1 -1 -1 Risk -2 -3 -1 -3 -3 -3 Paint, Trim and Finishes Change -1 Risk



Individual Contribution to Risk from Construction Stages (With Overlaps)

Foundatio	n							
Change	1	0	0	-1	0	0	0	0
Risk	1	1	1	0	0	0	0	0
Framing								
Change	0	0	0	1	1	1	0	0
Risk	0	0	0	1	2	3	3	3
Plumbing	and E	lectrica	al					
Change	0	0	0	0	1	0	0	0
Risk	0	0	0	0	1	1	1	1
Insulation	and D	rywall						
Change	0	0	0	0	0	0	0	-1
Risk	0	0	0	0	0	0	0	-1
Paint, Trim	n and	Finishe	es					
Change	0	0	0	0	0	0	0	1
Risk	0	0-	0	0	0	0	0	1

0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
3	3	3	3	3	3	3	3	3
-1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
-1	-1	0	0	0	0	0	0	0
-2	-3	-3	-3	-3	-3	-3	-3	-3
0	0	-1	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0



APPENDIX E



FIELD REVIEW REPORT

Construction Fire Safety Research

Project:	Five & Six Storey Wood Frame Residential			Report No.: 1
Address:	North	Vancouver		Date: October 19, 2011
Owner:	Anon	ymous		Project No.: C6479
Contractor:	Anon	ymous	Weather: Sunny, cool	
In Attendance:		John Bolduc Samir Eidnani Brad Walton John Ivison	- - -	CFT Engineering Inc. CFT Engineering Inc. CFT Engineering Inc. Wood Enterprise Coalition

Distribution:

Wood Enterprise Coalition johnivison@wecbc.ca John Ivison

Report by: _

John Bolduc



FIELD REVIEW REPORT

Construction Fire Safety Research

It is understood that the field reviews provided for this project are not intended to identify deficiencies for action by contractors and owners in regard to fire safety for their sites, but to survey typical fire risks present in construction and the efforts taken to mitigate these risks.

INTRODUCTION: The site consists of three residential midrise structures constructed of combustible construction over a common noncombustible parkade structure. The parkade structure is three levels and has a building area of approximately 5,600 m². The project is phased and progress is such that the parkade and one of the three structures are nearing completion. The first building that is nearing completion is the largest of the three structures, having a building area of approximately 2,500 m². The structure is separated by a noncombustible (masonry) firewall and is therefore considered as two buildings. The structure is five storeys above grade on one side of the firewall and six storeys above grade on the other side of the firewall. The other two buildings, considered as Phase 2 of the project, consist of a six storey building with a building area of approximately 1,000 m² and a five storey building with a building area of approximately 900 m². The construction of exterior building faces for the project are constructed with a 1 h fire-resistance rating.

1.1	Fire Department access is provided to the site via existing streets. Water supply is available for the site.
1.2	The method for contacting the Fire Department is dialing 911 on a cellular phone. Air horns are located at every exit stair landing as a method of notifying the rest of the site in the occurrence of a fire or any other emergency incident.
1.3	Portable fire extinguishers are located throughout the site. Extinguishers are located at stair landings and are highly visable.
1.4	Exit routes are east to identify and the muster point is logically located at the main entrance to the site, which was identified in the site orientation.
1.5	Phased occupancy is expected for when the first six storey wood frame building is complete and the second building is still in the construction stage.

Building Code ConsultantsCertified ProfessionalsFire Protection Engineers#800 - 1901 Rosser Avenue, Burnaby, BCV5C 6R6Telephone: (604) 684-2384Fax: (604) 684-2402



FIELD REVIEW REPORT

Construction Fire Safety Research

1.6	Exit stairs in the structure observed vary in completeness, coinciding with the varied completion of phased compartmentalization throughout the building. Three exit stairs are provided for the structure, all of which are constructed of combustibles. One exit stair is near completion (i.e. doors not installed, sprinkler and standpipe provided, fully framed and minimal penetrations). The other two exit stairs, located in the portion of the building with less complete compartment framing, are at a lesser level of completeness (i.e. standpipe provided, framing incomplete, doors not installed and sprinkler heads not installed).
1.7	Firestopping of service penetrations between parkade slabs and the combustible buildings above are complete.
1.8	Masonry firewall separating the building is complete with one exception that doors in the corridor for the firewall have not been installed. We understand that the doors are on back order.
1.9	For the building that is nearing completion, temporary sprinkler water flow switches are installed in order to sound an audible alarm. Security is instructed to contact the Fire Department upon activation of an audible alarm.
1.10	Watchman services are provided by after hours security, scheduled to arrive on site at 4:00 pm. The head of security is notified of any hot work permits. Security performs fire watches after hot work operations. Fire watch continues for a duration of 4 hours after the completion of hot works.
1.11	The most substantial use of hot works on this site is for construction of suspended slab assemblies. Hot work permits are issued when hot works are performed in suspended slabs. Wetting of surfaces is not performed in conjunction with hot works on suspended slabs.
1.12	Some hot works are performed by plumbing contractors on site. Hot work permits are issued when hot works are performed for plumbing. Hot work for plumbing is restricted to normal site hours.
1.13	Hard wired telephone connection installation (Telus) has not been completed. Efforts to relay alarm activations directly to the Fire Department have been hindered by the completion of the phone line connection.



FIELD REVIEW REPORT

Construction Fire Safety Research

1.14	Smoking is prohibited on site or in the structure. Smoking is only acceptable when off of the slab structure for the buildings (on adjacent grade).
1.15	Temporary heating for drying operations is provided with propane fueled heaters. In addition to drying practices that follow the product specifications for positioning the heater, the heaters are mounted in drywall framed mounts that ensure that the heater is positioned a safe distance away from walls. Heaters are cUL, ULC listed for use.
1.16	Municipal hot water connections have been completed for some areas which has reduced/replaced the need for propane fueled heaters in these areas.
1.17	For balconies, surfacing is applied with a cold liquid method, opposed to to torch applied (hot works) method used for surfacing of roof assemblies.
1.18	Incomplete lighting in the corridors that is wired to provide construction lighting is provided with a simple means of protecting the lighting from contact with the walls. A small piece of sheet metal is threaded directly to the lighting wire to provide a reflective/noncombustible barrier between the active light and the combustible wall.
1.19	Minimal combustible hazards are present in the site office (i.e. oxygen for first aid).
1.20	MSDS Sheets are available in the site office (construction trailer).

JB/mc

C6479_S01



FIELD REVIEW REPORT

Construction Fire Safety Research

Project:	Three Town	Storey Wood Fra houses	ame	Report No.: 2
Address:	North	Vancouver		Date: October 19, 2011
Owner:	Anony	mous		Project No.: C6479
Contractor:	Anony	mous		Weather: Sunny, cool
In Attendan	ce:	John Bolduc Samir Eidnani Brad Walton John Ivison	-	CFT Engineering Inc. CFT Engineering Inc. CFT Engineering Inc. Wood Enterprise Coalition

Distribution:

Wood Enterprise Coalition johnivison@wecbc.ca John Ivison

Report by:

John Bolduc



FIELD REVIEW REPORT

Construction Fire Safety Research

It is understood that the field reviews provided for this project are not intended to identify deficiencies for action by contractors and owners in regard to fire safety for their sites, but to survey typical fire risks present in construction and the efforts taken to mitigate these risks.

INTRODUCTION: The site is approximately 2,500 m² with three residential townhouse buildings constructed over a common underground parkade structure. Each townhouse structure has a building area of approximately 500 m². The townhouses are three storeys in height and are protected with automatic sprinklers in accordance with the City of North Vancouver By-Law. Because of the sloping site, one of the three townhouses has a 1 h rated step to maintain its three storey building height.

2.1	Fire Department access is provided by existing streets adjacent to the site. Water supply is available for the site.
2.2	Access to townhouse units provided through temporary staircases.
2.3	Phased occupancy expected for completed townhouses. As a result, there will be a period where spatial separation issues may be present when drywall compartments are incomplete in the adjacent townhouses.
2.4	Parkade sprinkler system activated but not verified for the parkade for protection during construction.
2.5	Housekeeping on site presents potential fire hazard. Combustible material is present between the construction trailer and the nearest townhouse, behind the construction trailer, and underneath the construction trailer, including wood, cardboard, flammable liquids and styrofoam.
2.6	Combustible painting well ventilated. Paint stored off-site after hours.

JB/mc

C6479_S02



FIELD REVIEW REPORT

				Construction Fire Safety Research
Project:	29 St Highr	orey Noncombusti ise	ble	Report No.: 3
Address:	Burna	aby		Date: October 19, 2011
Owner:	Anon	ymous		Project No.: C6479
Contractor:	Anon	ymous		Weather: Sunny, cool
In Attendance:		John Bolduc Samir Eidnani Brad Walton John Ivison	- - -	CFT Engineering Inc. CFT Engineering Inc. CFT Engineering Inc. Wood Enterprise Coalition

Distribution:

Wood Enterprise Coalition johnivison@wecbc.ca John lvison

Report by:

John Bolduc



FIELD REVIEW REPORT

Construction Fire Safety Research

It is understood that the field reviews provided for this project are not intended to identify deficiencies for action by contractors and owners in regard to fire safety for their sites, but to survey typical fire risks present in construction and the efforts taken to mitigate these risks.

INTRODUCTION: The site includes a 29 storey noncombustible residential highrise and 2, two storey combustible residential townhouse buildings. The buildings are connected with a below grade parkade structure. Sprinklers are provided for the highrise and the parkade, but not for the townhouse structures. Exposing building faces are positioned such that they permit 100% unprotected openings and there are no construction requirements for the building faces. Construction has progressed in a "bottom up" manner. Occupancy for the site is expected in three months.

3.1	Fire Department access is provided to the site via existing streets. Water supply is available for the site.
3.2	Three methods are provided for workers to alert the site of a fire incident; horns located on each floor, worker's radios and communication with the skip operator.
3.3	Watchman services are provided after hours by one person whose shift is from 5:00 to 5:00 and another whose shift is from 6:00 to 6:00.
3.4	An infrared security camera system was provided for the site for the first three quarters of the project. Incentive was provided by WorkSafe BC for installation of the security system.
3.5	Firestopping of service penetrations between the parkade slab and the combustible townhouses above is complete.
3.6	Phased occupancy of the parkade was recently granted. Phased occupancy is intended to continue with opening the sales centre in townhouse portions of the project adjacent to the highrise.
3.7	Alarm is monitored for the parkade occupancy where security is to contact the Fire Department in the case of an alarm for water or smoke (for the parkade).

Building Code ConsultantsCertified ProfessionalsFire Protection Engineers#800 - 1901 Rosser Avenue, Burnaby, BCV5C 6R6Telephone: (604) 684-2384Fax: (604) 684-2402



FIELD REVIEW REPORT

Construction Fire Safety Research

3.8	Sprinkler system is installed but not charged.
3.9	Hard-wired telephone connection installation has not been completed. Efforts to relay alarm activations directly to the Fire Department are hindered by the completion of the phone line connection.
3.10	Noncombustible exit stairs are complete with standpipes provided and doors installed. The standpipes were installed progressively (six to seven floors behind highest floor). Hoses are not provided for connection to standpipes.
3.11	The fire pump is not installed and will likely remain uninstalled until the end of the project (reason being that early activation in the construction phase would void the warranty).
3.12	Temporary water for construction use was supplied for upper floors via a pump installed for construction use only (pump is no longer required).
3.13	Siamese connection is provided; however, information about location/completeness of the siamese connection is not officially relayed to the local Fire Department. Therefore, a delay might occur due to lack of coordination when the Fire Department arrives to use the installed siamese connection in the event of a fire.
3.14	A mechanical dust collection system is provided for the area where cutting pieces is performed. The traps are emptied and the room is cleaned (reasonably) at the end of each day.
3.15	Temporary heating/drying provided for the site mainly with electric heaters. Some propane heaters are also used. Propane heaters provide specification for placement to ensure spacing of 40 in. on sides, 40 in. for back and 54 in. in front of the heater.

JB/mc

C6479_S03

APPENDIX F

Appendix F - Analysis of Reported Fires on Construction Sites in British Columbia 2005 through 2009

Description		Occurrences Injuries	Deaths	Max Loss Value	Average Loss Value
Combustible	Construction	207	7	1 1600000	173290
1 Storey		125	1	1 1400000	29969
	Incendiary/Suspicious	83	1	0 280000	17282
	Cannot Be Determined	27	0	1 1400000	79463
	Flying Embers from Wood Burning Appliance	3	0	0 60000	20000
	Playing with Source of Ignition	2	0	0 500	250
	Inadequate Control of Open Fire	1	0	0 0	0
	Ignorance of Hazard - With Portable Space Heater	1	0	0 60000	60000
	Ignorance of Hazard - With Machinery	1	0	0 0	0
	Human Failing - Open Fire	1	0	0 500	500
	Human Failing - Undetermined	1	0	0 0	0
	Suspected Impairment - With Candle	1	0	0 1500	1500
	Suspected Impairment - With no Explanation	1	0	0 3000	3000
	Illegal Operations - Lighter	1	0	0 0	0
2 Storey		68	1	0 4900000	159659
	Incendiary/Suspicious	50	1	0 4900000	190867
	Cannot Be Determined	12	0	0 400000	84818
	Flying Embers from Wood Burning Appliance	1	0	0 150000	150000
	Torch Too Close	1	0	0 7500	7500
	Smoker's Material	1	0	0 10	10
	Ignorance of Hazard - Smoker's Material	1	0	0 1000	1000
	Ignorance of Hazard - Spontaneous Combustion	1	0	0 60000	60000
	Ignorance of Hazard - Portable Cooking Equipment	1	0	0 37000	37000
3 Storey		10	0	0 146000	26750
	Incendiary/Suspicious	7	0	0 146000	37786
	Human Failing - Construction Wiring	1	0	0 2500	2500
	Torch Too Close	1	0	0 500	500
	Ignorance of Hazard - Explosive	1	0	0 1	1
4 Storey		4	5	0 1600000	5250125
	Incendiary/Suspicious	2	5	0 3000000	2500000
	Torch Too Close	1	0	0 1600000	1600000
	Human Failing - Halogen Bulb	1	0	0 500	500
Heavy Timber	Construction	7	0	0 150000	51428
1 Storey		3	0	0 45000	15000
	Incendiary/Suspicious	2	0	0 45000	22500
	Cannot Be Determined	1	0	0 0	0
2 Storey		2	0	0 150000	75000
	Incendiary/Suspicious	1	0	0 150000	150000
	Cannot Be Determined	1	0	0 0	0
3 Storey		1	0	0 100000	100000
	Cannot Be Determined	1	0	0 100000	100000
4 Storey		1	0	0 65000	65000
	Incendiary/Suspicious	1	0	0 65000	65000

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Noncombustible Construction 24 3 0 1030000	7873 8075
	8075
i Storey 8 U U 30000	
Cannot Be Determined 3 0 0 0	0
Incendiary/Suspicious 4 0 0 30000	12025
Tampering with Safety Devices - Portable Generator 1 0 0 16500	16500
2 Storey 8 0 0 103000	14038
Incendiary/Suspicious 3 0 0 3000	1000
Cutting or Welding Too Close 2 0 0 5000	2550
Smoker's Material 1 0 0 103000	103000
Cannot Be Determined - Heating Equipment 1 0 0 1000	1000
Cannot Be Determined 200	200
3 Storev 3 3 0 50	50
Suspected Impairment - Lighter and Oxidizing Material 1 0 0 50	50
Illegal Operations - Ignited Insulation 1 0 0 0	0
Cannot Be Determined - Garbage Ignited 1 1 0 0	Ő
6 Storev 1 0 0 0	ő
Electronic Communications Part Failure 1 0 0 0	0
8 Storev 2 0 0 10000	5900
Electrical Cord Failure Igniting Cardboard 1 0 0 10000	10000
	1800
20 Storey 1 0 0 0	0000
Cannot Be Determined - Cardboard Ignited 1 0 0 0	0
BH Linknown	200
Torch Too Close 1 0 0 200	200
	200
Construction Type Undetermined 37 0 0 1000000	467073
1 Storey 20 0 0 6375000	323560
Incendiary/Suspicious 12 0 0 52000	4917
Undetermined 4 0 0 6375000	1598000
Undetermined - Cooking Equipment 1 0 0 10200	10200
Playing with Source of Ignition 3 0 0 10000	3333
2 Storey 6 0 0 250000	77052
Incendiary/Suspicious 4 0 0 74313	38078
Undetermined 2 0 0 250000	155000
4 Storev 1 0 0 1000000	10000000
Incendiary/Suspicious 1 0 0 1000000	10000000
9 Storev 1 0 0 65681	65681
Ignorance of Hazard - Electricity 1 0 0 65681	65681
BH Unknown 9 0 0 150000	31389
Human Failing - Spark and Shrubs 1 0 0 0	0
Cannot Be Determined 5 0 0 150000	52400
Incendiary/Suspicious 2 0 0 10000	5250
Portable Space Heater Too Close to Combustibles 1 0 0 0 0	0

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Incendiary and Suspicious Fires Reported

Incendiary/Suspicious	173
Other	102
Incendiary/Suspicious Including Illegal Operations and Playing with Sources of Ignition	181
Other	94
Incendiary/Suspicious	173
Illegal Operations and Playing with Sources of Ignition	8
Other	94



Knowles, Jessica D OHCS:EX

From:	Nicol, John OHCS:EX
Sent:	Thursday, August 9, 2012 11:00 AM
To:	Nutting, Alison OHCS:EX
Subject:	Re: CFT Construction Fire report for FII

Follow Up Flag:Follow upFlag Status:Flagged

I have gone through the June 12 version of the CFT Report in detail – after having seen the Executive Summary a couple of months ago, which Brad Walton provided me so I could write a story on construction fire safety for the BC Fire Prevention Officers Newsletter/Magazine "Fire Away" (Spring 2012 Issue). The report is considerably broader than initially envisaged. It looks at construction fire safety generally rather than focusing solely on mid-rise wood frame buildings. On the plus side, it can therefore provide some useful context for our residential sprinklers working group. On the minus side, the broader fire stats data set may undermine rather than support the rationale for taking action to strengthen construction fire safety in mid-rise wood frame construction.

Of the 207 fires reported in combustible buildings over the 5 year period from 2005 to 2009, 93% occurred in buildings 2 storeys or less. Only four occurred in 4-storey buildings (the highest combustible buildings allowed at the time) – one of these ignited by a halogen light bulb causing \$500 damage. As you may recall, this kind of data is a key element of risk analysis and our mid-rise wood frame consultants concluded that there would be no increase in risk to go from 4 to 6 storeys in wood frame. It was this absence of increased risk, and the comparatively low incidence of construction fires in 4-storey that led OFC and our branch to conclude that increasing construction fire safety protection for mid-rise wood frame could not be justified, notwithstanding the concerns expressed and the suggestions made by the Technical Advisory Group.

To be clear, I can't find any fault with any of the recommendations. They touch on most of the issues I looked at during my examination of construction fires during the mid-rise wood frame project and respond to the same concerns that some people had back in 2008. And

I can find no information that I know to be factually incorrect – but bear in mind that I'm not a technical expert.

John

Knowles, Jessica D OHCS:EX

From: Sent:	Thompson, Bob R OHCS:EX Tuesday, October 30, 2012 9:19 AM
To:	Nutting, Alison OHCS:EX; Nicol, John OHCS:EX
Cc:	Hutchinson, Jarrett OHCS:EX; Jensen, Jun'ichi OHCS:EX; May, Zachary OHCS:EX; Kuhnert, Lyle OHCS:EX; Rotgans, Trudy OHCS:EX
Subject:	RE: Construction Fire Safety
Follow Up Flag:	Follow up
Flag Status:	Flagged

s.13

Bob Thompson Senior Codes Administrator

From: Nutting, Alison OHCS:EX
Sent: Tuesday, October 30, 2012 9:13 AM
To: Nicol, John OHCS:EX
Cc: Hutchinson, Jarrett OHCS:EX; Thompson, Bob R OHCS:EX; Jensen, Jun'ichi OHCS:EX; May, Zachary OHCS:EX; Kuhnert, Lyle OHCS:EX; Rotgans, Trudy OHCS:EX
Subject: RE: Construction Fire Safety

Hi John,

BSSB would not be involved in distributing information about the symposium and it's unlikely that we would commit to participating or presenting at the event.

Do others have any comments?

Alison

Alison Nutting Manager, Policy and Codes Development

Building and Safety Standards Branch Office of Housing and Construction Standards Ministry of Energy, Mines and Natural Gas and Minister Responsible for Housing Tel: 250 387-3852 Fax: 250 387-8164

From: Nicol, John OHCS:EX
Sent: Tuesday, October 30, 2012 8:43 AM
To: Nutting, Alison OHCS:EX
Cc: Hutchinson, Jarrett OHCS:EX; Thompson, Bob R OHCS:EX; Jensen, Jun'ichi OHCS:EX; May, Zachary OHCS:EX; Kuhnert, Lyle OHCS:EX; Rotgans, Trudy OHCS:EX
Subject: Construction Fire Safety

I've just gotten off the phone with John Ivison, a fire safety consultant who has worked with FII on a Construction Fire Safety Report they commissioned from CFT Fire Engineering. That report isn't considered final yet (most recent draft is on G: drive) but they are trying to generate further conversation on the topic. CFT plans a 1 hour presentation on it to Fire Safety Consultants in January and Ivison is trying to drum up interest in a 1-day symposium on the topic in the coming months. He asked me:

- 1. Would BSSB be willing to help distribute information about such a symposium to a wide audience of our stakeholders?
- 2. Might somebody from BSSB consider participating in/presenting at such a symposium?

s.13

Any thoughts???

John

Knowles, Jessica D OHCS:EX

From:	Nicol, John OHCS:EX
Sent:	Tuesday, November 6, 2012 8:30 AM
То:	Nutting, Alison OHCS:EX
Subject:	RE: Construction Fire Safety

Follow Up Flag:Follow upFlag Status:Flagged

John will get back to me when he and FII have a clearer idea of what they want to do and when. In the meantime, the 1 hour seminar in January is a CFT undertaking to discuss their report with the fire services guys in the lower mainland.

John

From: Nutting, Alison OHCS:EX Sent: Thursday, November 1, 2012 12:29 PM To: Nicol, John OHCS:EX Subject: RE: Construction Fire Safety

John, we discussed this issue at our manager's meeting. Could you follow up with John and clarify who the sponsor is for this event? If it's FII could we have a contact name for who is managing this? We're not committing resources at this time, but we'd like to know more about the intent and line-up for the symposium. If it is an FII event, I'd like to talk to someone at FII to get more information.

Thanks. Alison

Alison Nutting Manager, Policy and Codes Development

Building and Safety Standards Branch Office of Housing and Construction Standards Ministry of Energy, Mines and Natural Gas and Minister Responsible for Housing Tel: 250 387-3852 Fax: 250 387-8164

From: Nicol, John OHCS:EX
Sent: Tuesday, October 30, 2012 10:17 AM
To: Thompson, Bob R OHCS:EX; Hutchinson, Jarrett OHCS:EX; Nutting, Alison OHCS:EX
Subject: RE: Construction Fire Safety

I'm inclined to agree with Bob. We helped FII set up the contract to get this report done. s.13

1

John

From: Thompson, Bob R OHCS:EX Sent: Tuesday, October 30, 2012 9:57 AM To: Hutchinson, Jarrett OHCS:EX; Nutting, Alison OHCS:EX Cc: Nicol, John OHCS:EX Subject: RE: Construction Fire Safety

Are we going to do anything about construction fire safety? I think it sends a pretty clear message if we don't at least attend as a delegate (Steven?).

Bob Thompson Senior Codes Administrator

From: Hutchinson, Jarrett OHCS:EX
Sent: Tuesday, October 30, 2012 9:48 AM
To: Thompson, Bob R OHCS:EX; Nutting, Alison OHCS:EX; Nicol, John OHCS:EX
Cc: Jensen, Jun'ichi OHCS:EX; May, Zachary OHCS:EX; Kuhnert, Lyle OHCS:EX; Rotgans, Trudy OHCS:EX
Subject: RE: Construction Fire Safety

I agree with Alison. We've already said no to other private ventures of this sort.

Jarrett Hutchinson Manager, Building Policy and Codes Development

From: Thompson, Bob R OHCS:EX
Sent: Tuesday, October 30, 2012 9:19 AM
To: Nutting, Alison OHCS:EX; Nicol, John OHCS:EX
Cc: Hutchinson, Jarrett OHCS:EX; Jensen, Jun'ichi OHCS:EX; May, Zachary OHCS:EX; Kuhnert, Lyle OHCS:EX; Rotgans, Trudy OHCS:EX
Subject: RE: Construction Fire Safety

s.13

Bob Thompson Senior Codes Administrator

From: Nutting, Alison OHCS:EX
Sent: Tuesday, October 30, 2012 9:13 AM
To: Nicol, John OHCS:EX
Cc: Hutchinson, Jarrett OHCS:EX; Thompson, Bob R OHCS:EX; Jensen, Jun'ichi OHCS:EX; May, Zachary OHCS:EX; Kuhnert, Lyle OHCS:EX; Rotgans, Trudy OHCS:EX
Subject: RE: Construction Fire Safety

Hi John,

BSSB would not be involved in distributing information about the symposium and it's unlikely that we would commit to participating or presenting at the event.

Do others have any comments?

Alison

Alison Nutting Manager, Policy and Codes Development

Building and Safety Standards Branch Office of Housing and Construction Standards Ministry of Energy, Mines and Natural Gas and Minister Responsible for Housing Tel: 250 387-3852 Fax: 250 387-8164

From: Nicol, John OHCS:EX
Sent: Tuesday, October 30, 2012 8:43 AM
To: Nutting, Alison OHCS:EX
Cc: Hutchinson, Jarrett OHCS:EX; Thompson, Bob R OHCS:EX; Jensen, Jun'ichi OHCS:EX; May, Zachary OHCS:EX; Kuhnert, Lyle OHCS:EX; Rotgans, Trudy OHCS:EX
Subject: Construction Fire Safety

I've just gotten off the phone with John Ivison, a fire safety consultant who has worked with FII on a Construction Fire Safety Report they commissioned from CFT Fire Engineering. That report isn't considered final yet (most recent draft is on G: drive) but they are trying to generate further conversation on the topic. CFT plans a 1 hour presentation on it to Fire Safety Consultants in January and Ivison is trying to drum up interest in a 1-day symposium on the topic in the coming months. He asked me:

- 1. Would BSSB be willing to help distribute information about such a symposium to a wide audience of our stakeholders?
- 2. Might somebody from BSSB consider participating in/presenting at such a symposium?

s.13

Any thoughts???

John

Knowles, Jessica D OHCS:EX

From: Sent:	Nicol, John OHCS:EX Tuesday, June 11, 2013 10:45 AM
To:	Rotgans, Trudy OHCS:EX
Cc:	Thompson, Bob R OHCS:EX; May, Zachary OHCS:EX; Jensen, Jun'ichi OHCS:EX; Kuhnert, Lyle OHCS:EX; Nutting, Alison OHCS:EX
Subject:	RE: Sereca report on fire loss statistics and building code objectives
Follow Up Flag:	Follow up
Flag Status:	Flagged

s.13

John

-----Original Message-----From: Rotgans, Trudy OHCS:EX Sent: Tuesday, June 11, 2013 8:47 AM To: Nicol, John OHCS:EX Subject: RE: Sereca report on fire loss statistics and building code objectives

Thanks John, if you have some comments, please let me know. Keith just left them with me for our interest.

Best regards,

Trudy

From: Nicol, John OHCS:EX
Sent: Tuesday, June 11, 2013 8:45 AM
To: Rotgans, Trudy OHCS:EX
Subject: Sereca report on fire loss statistics and building code objectives

A copy of this report was left on my desk -- possibly by you. I have read it but am not sure if you or someone else wanted comments on it.

John

Knowles, Jessica D OHCS:EX

From: Sent: To: Subject: Attachments: Rotgans, Trudy OHCS:EX Tuesday, January 8, 2013 9:05 AM Thompson, Bob R OHCS:EX FW: Midrise breakdown request.pptx Midrise breakdown request.pptx

From: Rotgans, Trudy OHCS:EX Sent: Thursday, November 22, 2012 10:55 AM To: 'Georges Tessier QC' Subject: FW: Midrise breakdown request.pptx

Best regards,

Trudy

From: Nicol, John OHCS:EX Sent: Thursday, November 22, 2012 10:32 AM To: Rotgans, Trudy OHCS:EX Subject: FW: Midrise breakdown request.pptx

From: Sukh Johal [mailto:sjohal@wood-works.ca] Sent: Thursday, November 22, 2012 10:25 AM To: Nicol, John OHCS:EX Subject: Midrise breakdown request.pptx

See below and above.

Regards,

WOOD WORKS!

Sukh Johal, Dipl. T (Civil), MBA Technical Advisor | BC Mid-rise Technical Lead Wood **WORKS!** BC | Canadian Wood Council 22320 Chaldecott Drive, Richmond, B.C., Canada, V6V-2W1 Tel: 1-877-929-9663 ext: 3 Cell: 604-657-3732 sjohal@wood-works.ca |sjohal@cwc.ca www.wood-works.org | www.cwc.ca

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From: Nicol, John OHCS:EX [mailto:John.Nicol@gov.bc.ca] Sent: November-19-12 2:05 PM To: Sukh Johal; Sukh Johal Subject: Request

Hi Sukh,

I'm wondering if you could help us out answering some questions from our colleagues at the Canadian Codes Centre related to mid-rise combustible construction in BC..

- Do you have current information on the number of projects of combustible residential buildings 5 and 6 storeys being prepared and built in BC? 126 projects

- Do you have any data on approved mixed occupancies combustible buildings of more than 4 storeys? (presumably approved as alternate solutions by the municipalities. See attached spreadsheet

 Has the City of Vancouver opened its construction regulation to combustible buildings over 4 storeys? Yes, we have some five storeys in the works.
 (does not include UBC endowment lands- which has already gone to six)

Whatever you can provide would be greatly appreciated. I'll look forward to seeing you again in ten days time at the Wood Design Lunch in Victoria.

Regards,

John Nicol

Ministry of Energy, Mines & Natural Gas Ministry Responsible for Housing Building & Safety Standards Branch Senior Policy Analyst 614 Humboldt Street Victoria, BC Monday & Wednesday phone 250-216-4338 Tuesday, Thursday & Friday phone 250-387-1473

Building Types	%
All six	37.6
Five on one	13.6
Five	29.6
Four on two	03.2
Four on one	13.6
Three on two	02.4





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> Contact: Sukh Johal, Dipl.T (Civil),MBA Technical Advisor Canadian Wood Council/ Wood*WORKS*!BC 1-877-929-9663 ext 3 sjohal@wood-works.ca

Canadian Wood Council Conseil canadie^{Page 4} du bois

Thompson, Bob R OHCS:EX
Tuesday, January 8, 2013 9:08 AM
'Nathalie.Lessard@rbq.gouv.qc.ca'
FW: Midrise breakdown request.pptx
Midrise breakdown request.pptx

Here is the data sent to Georges.

Bob Thompson Senior Codes Administrator Building & Safety Standards Ministry of Public Safety & Solicitor General Province of British Columbia 250 356-8903 250 213-6680 cell

From: Rotgans, Trudy OHCS:EX Sent: Tuesday, January 8, 2013 9:05 AM To: Thompson, Bob R OHCS:EX Subject: FW: Midrise breakdown request.pptx

From: Rotgans, Trudy OHCS:EX Sent: Thursday, November 22, 2012 10:55 AM To: 'Georges Tessier QC' Subject: FW: Midrise breakdown request.pptx

Best regards,

Trudy

From: Nicol, John OHCS:EX Sent: Thursday, November 22, 2012 10:32 AM To: Rotgans, Trudy OHCS:EX Subject: FW: Midrise breakdown request.pptx

From: Sukh Johal [mailto:sjohal@wood-works.ca] Sent: Thursday, November 22, 2012 10:25 AM To: Nicol, John OHCS:EX Subject: Midrise breakdown request.pptx

See below and above.

Regards, WOOD WORKS!

Sukh Johal, Dipl. T (Civil), MBA Technical Advisor | BC Mid-rise Technical Lead Wood **WORKS!** BC | Canadian Wood Council 22320 Chaldecott Drive, Richmond, B.C., Canada, V6V-2W1 Tel: 1-877-929-9663 ext: 3 Cell: 604-657-3732 <u>sjohal@wood-works.ca |sjohal@cwc.ca</u> <u>www.wood-works.org | www.cwc.ca</u>

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From: Nicol, John OHCS:EX [mailto:John.Nicol@gov.bc.ca] Sent: November-19-12 2:05 PM To: Sukh Johal; Sukh Johal Subject: Request

Hi Sukh,

I'm wondering if you could help us out answering some questions from our colleagues at the Canadian Codes Centre related to mid-rise combustible construction in BC..

- Do you have current information on the number of projects of combustible residential buildings 5 and 6 storeys being prepared and built in BC? 126 projects

- Do you have any data on approved mixed occupancies combustible buildings of more than 4 storeys? (presumably approved as alternate solutions by the municipalities. See attached spreadsheet

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John Nicol

Ministry of Energy, Mines & Natural Gas Ministry Responsible for Housing Building & Safety Standards Branch Senior Policy Analyst 614 Humboldt Street Victoria, BC Monday & Wednesday phone 250-216-4338 Tuesday, Thursday & Friday phone 250-387-1473

From:	Thompson, Bob R OHCS:EX
Sent:	Tuesday, January 8, 2013 3:30 PM
То:	'Nathalie.Lessard@rbq.gouv.qc.ca'
Subject:	RE: Midrise breakdown request.pptx

My source says about 40 are complete or under construction and another 60 or so are in the planning stages.

Bob Thompson Senior Codes Administrator Building & Safety Standards Ministry of Public Safety & Solicitor General Province of British Columbia 250 356-8903 250 213-6680 cell

From: <u>Nathalie.Lessard@rbq.gouv.qc.ca</u> [mailto:Nathalie.Lessard@rbq.gouv.qc.ca] Sent: Tuesday, January 8, 2013 9:38 AM To: Thompson, Bob R OHCS:EX Subject: RE : Midrise breakdown request.pptx

Thank you,

those information give the % on the type of building but I need the total amount of building builted if it is possible

thank you

Nathalie Lessard, architecte Domaine bâtiment et efficacité énergétique Direction de la Réglementation et du soutien technique Régie du bâtiment du Québec 545, boulevard Crémazie est, 7° étage Montréal (Québec) H2M 2V2 Tél: (514) 873-5935 Fax: (514) 873-1939





-----Message d'origine-----De : Thompson, Bob R OHCS:EX [mailto:Bob.Thompson@gov.bc.ca] Envoyé : 8 janvier 2013 12:08 À : Lessard, Nathalie Objet : FW: Midrise breakdown request.pptx

Here is the data sent to Georges.

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John Nicol

Ministry of Energy, Mines & Natural Gas Ministry Responsible for Housing Building & Safety Standards Branch Senior Policy Analyst 614 Humboldt Street Victoria, BC Monday & Wednesday phone 250-216-4338 Tuesday, Thursday & Friday phone 250-387-1473

From: Sent: To: Cc: Subject: Thompson, Bob R OHCS:EX Tuesday, September 25, 2012 10:24 AM 'Sefton Hyde-clarke' 'Peter Mitchell P.Eng' RE: APEGBC Technical and Practice Bulletin

Sefton,

I'm sure APEGBC would be flattered that the NBC wanted to use some of the material from their technical and practice bulletin on five and six storey wood frame construction. I suggest you contact Peter Mitchell, P.Eng., Associate Director, Professional Practice, at 604-412-4853 (toll free at 1-888-430-8035 ext 228) or by email at pmitchell@apeg.bc.ca.

Regards,

Bob Thompson Senior Codes Administrator Building & Safety Standards Office of Housing & Construction Standards Province of British Columbia 250 356-8903

-----Original Message-----From: Sefton Hyde-clarke [mailto: s.22 Sent: Tuesday, September 25, 2012 6:33 AM To: Thompson, Bob R OHCS:EX; Philip Rizcallah Subject: APEGBC Technical and Practice Bulletin

Hi Bob,

I've been trying to draft proposed changes with respect to environmental separations and Doug Watts highly recommends using some of the wording and figures found in the APEGBC technical and practice bulletin. Particularly from chapter 5. I'm wondering what we would need to do in order to use some of the wording or figures if we wanted to add it to an NBC appendix note. Do you have any idea how I can go about doing this?

Thanks and see you soon, Sefton

From: Sent: To: Cc: Subject: Thompson, Bob R OHCS:EX Thursday, August 30, 2012 10:48 AM 'Brad Walton' Kuhnert, Lyle OHCS:EX; 'Patrick.Shek@burnaby.ca'; 'Nishi, Ernie' RE: Request for Interpretation

Hi Brad,

I can't speak for the Interpretation Committee but BSSB hasn't provided any clarification in the 2012 BCBC. For what it's worth I think combustible trim is acceptable within reasonable limits: window trim, corner boards, etc. Our intent was to reduce the likelihood of exterior vertical fire spread and isolated pieces of combustible trim shouldn't significantly affect this.

Regards,

Bob Thompson Senior Codes Administrator Building & Safety Standards Office of Housing & Construction Standards Province of British Columbia 250 356-8903

From: Brad Walton [mailto:bwalton@cftengineering.com]
Sent: Tuesday, August 28, 2012 4:29 PM
To: Thompson, Bob R OHCS:EX
Cc: Kuhnert, Lyle OHCS:EX; Patrick.Shek@burnaby.ca; Nishi, Ernie
Subject: FW: Request for Interpretation

Hello Bob

Do you know if this request for Interpretation has been looked at or any formal written response but not posted on the web yet?

Or is there related clarification in the New BCBC

This affects many projects would be nice to get clarification

Thanks

Brad Walton, AScT. Principal

CFT Engineering Inc.

Phone (604) 684-2384

From: Tony Bartko Sent: 2012 August 28 4:00 PM To: Brad Walton Subject: Interpretations as requested... Tony Bartko, AScT, BCQ, BTech Project Manager



CFT Engineering Inc. Building Code Consultants - Fire Protection Engineers

800-1901 Rosser Avenue Burnaby, BC V6C 6R6 Phone (604) 684-2384 Fax (604) 684-2402 <u>TBartko@cftengineering.com</u>

From:	Thompson, Bob R OHCS:EX
Sent:	Tuesday, January 15, 2013 3:42 PM
To:	'Hyde-Clarke, Sefton'; 'Hanning, Dave'
Cc:	'Andrew Harmsworth (GHL)'
Subject:	RE: Roofing Operations in Combustible buildings exceeding 4 storeys in building height

Happy New Year Sefton,

Personally, I have no idea how roofing on our five and six storey condos is being done. Andrew might but I'd suggest contacting <u>WoodWorks</u> BC and talking to one of their technical advisors like <u>Sukh Johal</u>. These guys are on the ground with the developers, designers and builders and should be much more aware of what's happening in the field.

Regards,

Bob Thompson Senior Codes Administrator Building & Safety Standards Branch Office of Housing & Construction Standards Province of British Columbia 250 213-6680

From: Hyde-Clarke, Sefton [mailto:Sefton.Hyde-Clarke@nrc-cnrc.gc.ca]
Sent: Tuesday, January 15, 2013 2:08 PM
To: Thompson, Bob R OHCS:EX; Hanning, Dave
Cc: 'Andrew Harmsworth (GHL)'
Subject: Roofing Operations in Combustible buildings exceeding 4 storeys in building height

Hi Bob,

The TG on Hot Works had a teleconference today where they were discussing a concern they have with roofing operations in tall combustible buildings. You may be able to provide us with some useful information from BC. I have attached Dave Hanning, who is a member of the TG on Hot Works as well as Andrew Harmsworth, who may be able to provide additional input.

<u>Concern</u>

The issue under discussion was the placement of the roofing kettle. The current NBC does not allow the roofing kettle on the roof of any building, however, it can be placed inside the building on the floor directly beneath the roof. Current practice in Alberta and Ontario do not allow kettles inside the building due to the increased risk. The concern is amplified in combustible construction which has always been limited to 4 storeys. In this case, the tar can be pumped from grade to the roof. However, in light of the changes to the Code, we need to consider other options for safely getting the tar to the roof of buildings greater than 4 storeys. The tar cannot be pumped beyond the 4 storey limit since it cools too quickly. Since BC already has a few combustible buildings greater than 4 storeys, I was wondering if you have any experience with this issue. Did these buildings use torch-on roofs instead? Was this issue discussed?

Sefton Hyde-Clarke

Technical Advisor-Fire Safety NRC Construction Portfolio-Canadian Codes Centre Tel: 613-991-4807 - Fax: 613-952-4040 Website: <u>http://www.nationalcodes.ca/</u>

Sefton Hyde-Clarke

Conseiller technique - Sécurité incendie CNRC portefeuille Construction - Centre canadien des codes Tél. : 613-991-4807 - Télécopieur : 613-952-4040 Site Web : <u>http://www.nationalcodes.ca/</u>

National Research Conseil national Council Canada de recherches Canada

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From:Thompson, Bob R OHCS:EXSent:Thursday, October 25, 2012 3:40 PMTo:Douglas WattsCc:Grant Newfield; Andrew Harmsworth (GHL); Hyde-Clarke, Sefton; Randy BrownSubject:Re: Stage 1 Report for BC

Building & Safety Standards Branch has no objection to you using the illustrations or modified versions.

Bob Thompson Sent from my iPhone

On 2012-10-25, at 1:09 PM, "Douglas Watts" <<u>DWatts@rjc.ca</u>> wrote:

No issues from here. Bob?

Regards,

Douglas L. Watts, PEng, MAIBC, CP, BEP, LEED-AP, FEC Principal Building Science and Restoration

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Suite 300, 1285 West Broadway Vancouver, BC V6H 3X8 Canada Office: 604 738-0048 Direct: 604 739-6261 Fax: 604 738-1107 Email: <u>dwatts@rjc.ca</u> <u>www.rjc.ca</u>

Stay connected

<image002.gif> <image003.gif> <image004.gif>

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From: Grant Newfield
Sent: October-25-12 1:05 PM
To: Andrew Harmsworth (GHL); Hyde-Clarke, Sefton; 'Robert R. Thomson '; Douglas Watts
Cc: 'Randy Brown'
Subject: RE: Stage 1 Report for BC

No issues with us. The document does actually belong to BC Safety Policy Branch. I believe all the sketches were produced by GHL. Grant

From: Andrew Harmsworth (GHL) [mailto:ah@ghl.ca] Sent: October-25-12 1:00 PM To: Hyde-Clarke, Sefton; 'Robert R. Thomson '; Douglas Watts; Andrew Harmsworth (GHL); Grant Newfield
Cc: 'Randy Brown'
Subject: RE: Stage 1 Report for BC

Sefton

We are fine with that. Happy to assist if we can help.

Andrew

Andrew Harmsworth PEng, MSc, CP GHL Consultants Ltd. Building Codes and Fire Science <u>www.GHL.ca</u> 604 689 4449 <u>AH@ghl.ca</u> Sent from Samsung Galaxy Note. This email is intended solely for the use of the individual or entity named above and may be PRIVILEGED AND CONFIDENTIAL. If you are not the intended recipient, please advise.

"Hyde-Clarke, Sefton" <<u>Sefton.Hyde-Clarke@nrc-cnrc.gc.ca</u>> wrote:

Hi Bob, Doug, Grant and Andrew,

Randy and I were discussing the possibility of creating some diagrams for the upcoming Standing Committee meetings that would help members visualize the concepts that the JTG is proposing.

Appendix A of the Stage 1 Report: Building Code Provisions for Residential Buildings and Identification of Technical Process Risks (authored obviously by GHL and RJC) has a few diagrams that come very close to what I want to include in the agenda package. I wanted to make sure there aren't any issues if I were to create my own versions of some of the diagrams, particularly to show how to JTG agreed on the building areas. They would appear similar to the diagrams you developed though.

Sefton Hyde-Clarke Technical Advisor-Fire Safety

NRC Construction Portfolio-Canadian Codes Centre Tel: 613-991-4807 - Fax: 613-952-4040 Website: <u>http://www.nationalcodes.ca/</u>

Sefton Hyde-Clarke Conseiller technique - Sécurité incendie

CNRC portefeuille Construction – Centre canadien des codes Tél. : 613-991-4807 - Télécopieur : 613-952-4040 Site Web : <u>http://www.nationalcodes.ca/</u>

<image005.jpg>

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To: Subject: Rotgans, Trudy OHCS:EX FW: handout for today's joint meeting

Best regards,

Trudy Rotgans, Architect AIBC Executive Director

Building and Safety Standards Branch Office of Housing and Construction Standards

Tel: 250-888-0591

From: Rotgans, Trudy OHCS:EX Sent: Wednesday, May 2, 2012 7:13 AM To: 'Amelie.Chartrand@nrc-cnrc.gc.ca' Cc: 'Gribbon, Anne' Subject: handout for today's joint meeting



Presentation on Innovation and...

Good morning Amelie, I will hand this out today. Chris has added this item to the agenda. Could you please forward to Chris Tye and any others who will connect by phone? Thank you.

Trudy

BC Presentation on Innovation and the Codes for PTPACC and CCBFC Executive

Thank you for providing me the opportunity to provide a brief BC update. I would like to take this time to talk more generally about our experience with recent BC Code changes and some of the challenges I see affecting the code development system in Canada.

In BC we are increasingly feeling pressure to adopt standards ahead of their implementation in the national codes, or to develop BC variations to the codes. For example:

- We adopted a BC variation to allow 6-storey residential wood-frame construction;
- We adopted new CSA reference standards for concrete ahead of the national codes; and
- We have felt great pressure from municipalities to adopt an EnerGuide 80 requirement for all new Part 9 homes (Vancouver has adopted this standard).

Our sense is that the code system is being challenged by the pace of innovation. New technologies, materials, techniques and approaches to construction and regulation of construction are challenging fundamental concepts.

In each of the recent cases where BC has varied from the national codes it has been the result of effective lobbying, whether from the wood sector, the concrete sector or from local government and non-governmental organizations. Traditionally, the codes were intended to provide minimum standards for health and life safety. Increasingly, we are being asked to use the code as a tool to achieve policy objectives – whether for environmental, social or economic reasons.

While the National code system is still the preeminent reference document on building codes in Canada there is a very real danger that regional pressures to adopt innovative code changes will lead to inharmonious codes. In BC, our top priority is to harmonize with the national code system, but increasingly we are being asked by our decision makers to move more quickly or in a different direction from the national system.

My intention is not to provide answers on how we resolve this growing tension between regional variations and national harmony. Rather, it is to give you my observation that this may be the single biggest issue affecting the future of a national code system.

The groups lobbying us for change are asking difficult questions that challenge our understanding of the philosophical underpinnings of the codes. I have to admit we are struggling more and more to defend a number of the key fundamentals of the code. What we are observing is that construction has become much more complex with the use of advanced computer modeling, scientific testing and access to international studies and research. The framework for building codes was established a long time ago and has been continued to today; so are the many theories behind code provisions. But they are now being challenged in how to continue making buildings safe under present day construction trends and code enforcement practices.

Let me present you with some of the questions we are facing and that we believe are relevant to a national codes system:

- 1. Should the codes be materials "agnostic" and focus only on performance and risk-based approaches?
 - The wood lobby feels that combustible materials (i.e. wood) are unfairly prejudiced in the codes.
 - What is the basis for keeping the distinction between combustible and non-combustible materials in the codes? Our research shows that the basis is historical and largely experience based rather than scientific.
 - Is it possible to be materials "agnostic"; what science or research would be required to achieve consensus?
- 2. How does the national code system, which is currently on a five year cycle, keep pace with innovation?
 - How do we resolve pressure to adopt variations and reconcile this with the national code system?
 - What is the value of harmony over regional variation?
- 3. How do we address the issue of increasing pressure to use the code as a tool to achieve social, environmental or economic policy objectives?
 - Do we embrace the opportunity to use the code as a more comprehensive document dealing with all aspects of construction?
 - Do we look for other avenues to channel the non health and life safety objectives such as other types of codes (i.e. national model energy code)?
- 4. How do we manage the increasing pressure to accept codes and standards from other countries or regions of the world?
 - It is difficult for us to argue that standards that have been developed and used in European countries for years are not good enough for Canada.
 - Yet there are cases where the different regulatory system and quality of construction in Canada may result in unacceptable risks.

I want to close by talking about the latest BC variation we are considering and what I see as the challenges and implications:

• We are looking at creating a new "engineered heavy timber" class of building materials in the codes, rather than wait for the outcome of any changes to have combustible materials treated in the code. This would be similar to heavy timber but allow for greater application and would allow us to accept many innovative wood products like cross laminated timber. The implication is that we may delay the debate on combustible vs. non-combustible construction.

 We are also re-examining the issue of fire sprinklers for all buildings. We have about 25 municipalities that have adopted fire sprinkler requirements that go beyond the code. Some of them require all single family houses to be sprinklered. This is a current issue because we have a proposal to roll back these bylaws as part of our Modern Building Regulatory System proposal. We are forming a working group with a group of stakeholders in partnership with the Office of the Fire Commissioner and the Fire Chiefs Association of BC.

In closing, the purpose of this presentation is to highlight the issues we are facing in BC in adopting innovation in the BC codes and to raise some provocative questions.

Trudy Rotgans, MAIBC, MCIP Executive Director Building and Safety Standards Branch

Office of Housing and Construction Standards Ministry Responsible for Housing Province of BC