

CRESTON FIRE STATION REPORT



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EXECUTIVE SUMMARY

The development of a fire station in a community, particularly one supporting a volunteer or composite fire department is a complex project. Plans must reflect the current needs of the department, forecast growth and future development of the department and its community and consider future regional relationships. While the current staffing model may depend solely on volunteers, planners will need to think about what a staffing model might look like in the future and consider the addition of full time staffing to supplement operations. Other factors complicating the planning process include the opportunities presented by shared facilities. Commonly, municipal functions, community organizations, police, fire, ambulance, search and rescue as well as emergency management functions are included in design considerations.

Creston's fire station fulfills a wide array of roles in its support of a safe and protected community. While some of the functions are obvious such as providing accommodations for fire trucks and fire fighter's turnout gear, some are less obvious, but equally important. This facility serves as an organizational anchor for both career and volunteer personnel. It provides a connection point between staff members that is critical to the recruitment and retention of volunteers. This connection helps keep fire fighters in the department and provides essential supports for the better understood occupational stress injuries we now know are affecting fire services across the country. Training is an essential and ongoing requirement for fire departments and a fire station must support the ongoing maintenance of critical skills in theory and practical skills programs. Finally, the support of proper decontamination processes starts and ends at the fire station. Programs and directives can only take these processes so far. The fire station must provide appropriate facilities to make them effective.

While there are few design regulations specifically referring to the design and construction of a fire station, a new fire station must comply with the following:

- ❖ British Columbia Architects Act (RSBC 1996)
- ❖ British Columbia Building, Plumbing and Fire Codes (current edition)
- ❖ Workers Compensation Act and Occupational Health and Safety Regulation, and
- ❖ Town of Creston Zoning and Development regulations and guidelines

The design of fire stations has advanced greatly over the last several decades. There is a better understanding of the use of space, necessary versus discretionary spaces and functions, and the challenges of keeping occupants safe from occupational health risks. Modern fire stations have incorporated these improved understandings into their design and do much to help fire service managers and their communities house and provide a sustainable and effective fire protection system with proactive support for employee engagement, wellness and fitness. Professional design support, therefore, becomes a critical element of any fire station design process.

Site selection is one of the most important discretionary decisions that will be made for any new fire station. The decision on where a fire station will be located will have direct impacts on several performance metrics. Volunteers must respond to a fire station to gear up and access their vehicles and equipment. Ideally the station will be located close to residential population centers. Fire deaths and injuries most frequently occur in residential occupancies, so locations that support quick access to people's homes are desirable.

This report is intended to provide guidance to the Creston Fire Station Select Committee and Creston Town Council in their deliberations on options for the development of a fire station. This important decision-making process will result in a fire station that must serve the needs of the Town of Creston, and its regional partners well into the future. The report provides a step by step evaluation of discretionary and non-discretionary factors that will need to be considered and understood as the decision-making process proceeds. It also outlines the functional uses that should be considered for the fire station.

The report should not be viewed as a replacement for professional building design and engineering guidance.

RECOMMENDATIONS:

1. The functional design of the fire station, including allocation of space for the various functions of the department, should be left to the professional design team led by the Town of Creston's Architects and Administration due to the complex regulatory and practical considerations involved in fire station design. Evaluative and consultative processes should focus on the discretionary aspects of the project identified in this report.
2. Decision making processes should be focussed on selection of one of the two downtown locations for the construction of a new fire station for the Town of Creston. These sites are Extra Foods Site 2 and Bunker Site 4. No other sites offer the combination of space, functionality and response time support that these sites provide.
3. Deadlines should be established for the inclusion of other occupants in the design of the fire station, including BC Ambulance and Search and Rescue. If those agencies are unable to make the necessary commitments, the project should focus on the development of a fire station that meets the needs of the Town and its regional partners and may include opportunities for expansion at some future time.
4. The design of the fire station should include considerations that allow for a reasonable amount of flexibility to permit adjustments necessary to safely and effectively support fire department operations over the anticipated life cycle of the facility. Facility design should articulate how additional space can be added specifically in terms of service, accommodation and fleet spaces.
5. Consideration should be given to the development of a long term strategic plan that provides planning guidance to future decision makers on the fire protection principles upon which the station has been developed. The plan should provide guidance on how future development of fire protection and other emergency services will be developed and how they will be accommodated, including satellite stations. This will have a bearing on the development and design consideration for the current project.

6. Creston Town Council's direction that the decisions made by the Select Committee will have no impact on current service levels should be clarified to specify no negative impacts on fire department response times. While site selection remains a discretionary function of the project, there are critical design limits, including overall response time that must be applied to that choice.
7. The Creston Fire Department Interim Measures Plan be utilized as a resource to inform the design of a new fire station for the Town of Creston as it pertains to essential systems required to meet WorkSafeBC and other regulatory requirements.
8. Design considerations for a replacement fire station should include amenity areas that include fitness and wellness facilities supporting physical and mental health of volunteer and career staff.
9. Clarification of Council's cost recovery directive may be required depending upon the nature of the partner agency. While inclusion of community agencies like Search and Rescue may be of value to the overall project, these agencies may not have the financial means to cover the additional spatial requirements their occupancy may require.
10. Design guidance for the fire station functional requirements including spatial requirements should reflect industry best practices as provided by Architectural design professionals.

CURRENT STATE

The Town of Creston identified the need to develop improved fire station facilities to house the Creston Fire Department in 2014. Early in the evaluative process the Town determined that a renovation of the current spaces was impractical due to site restrictions, age and structure of the building, site area and the extensive nature of the work required to meet operational and legislative requirements. Any renovation would be required to meet British Columbia Building Code requirements, including post disaster design standards. While these could be achieved with sufficient investments, the limitations of the site and costs made renovations impractical and the decision to proceed with a new fire station was made.

The Town hired architects Johnston and Davidson to do test siting and preliminary programmatic studies for the Town. This preliminary process evaluated a total of eight (8) sites and narrowed them to 5 sites, including the current fire station location. The feasibility study was presented to Town Council in January 2015.

In April 2016 a Request for Proposals was released for the schematic design and Design Development phase of the project. The project was awarded to Johnston Davidson in June of 2016. A series of public meetings were held in the Fall of 2016 with the four preferred sites for a new fire station location presented. The Public had an opportunity to contribute to the discussion on sites and as a result, the siting recommendations were narrowed to 2. The preferred sites were the Site 2 property on Cook Street and the Site 4 property on Vancouver Street. In January 2017, the final site decisions were made, and Site 2 was selected as the optimal location for the new fire station.

On Saturday December 9, 2017 the Town of Creston held a vote for community authorization to borrow money to fund the construction of the fire station. The result was the defeat of the borrowing bylaw. While the borrowing bylaw was defeated, the need for a new fire station remained.

Throughout 2017 a great deal of work was done in preparation to move forward with updated fire station facilities. Part of the review work revealed that there were serious deficiencies in the current station, including operational constraints, as well as serious occupational health and safety concerns. These had been identified early in the fire station planning process and were the impetus behind Administration and Council's efforts to move forward with a new fire station. With the defeat of the borrowing bylaw, an interim plan was required. FireWise Consulting was engaged to provide both an interim analysis and

recommendations on a transitional plan to identify and manage occupational health and safety concerns regarding the current facility. FireWise was also engaged to provide technical support and a final report to support Creston Town Council and the Creston Fire Station Select Committee efforts to evaluate options for replacement of the aging fire station.

The Creston Fire Station was reviewed extensively by FireWise Consulting and other experts to assess concerns raised by Firefighters in late 2017. Those concerns specifically dealt with health and safety concerns in the station, most of which were related to contamination from various sources and the lack of spaces and facilities to manage the contamination. Examination of the fire station confirmed the concerns and led to a set of 19 recommendations, forming a risk management plan to address the concerns. The plan recommendations were developed to safely bridge the time it would take to develop and implement plans to modernize the facility- either through renovations of existing spaces or the construction of a new fire station. This Interim Measures Report was presented to Town Council Administration and the Creston Fire Hall Select Committee on April 3 and 4, 2018. This report is included as **Exhibit 1**.

The Interim Measures Report was intended to address outstanding health and safety measures on an interim basis to allow safe delivery of services, reduced exposure of career and volunteer staff and to permit Council and Administration time to complete community consultation processes. This report provided insights into the operational shortfalls of the facility and should be considered a “call to action” behind the Town’s efforts to update the fire station with modern facilities.

Exhibit 2 is a copy of a report performed by an occupational hygienist engaged by the town to quantify the contamination concerns. This report confirmed suspicions of chemical and other contamination of the building. It also identified serious shortfalls in worker protections including air handling systems that permitted contaminants from the apparatus floor to penetrate the administrative areas. While the report does not provide absolute measurements, it does confirm that the contamination issues are real and serious.

The evaluation of the facility confirmed Town Administration’s observations that the facility limits the safe and effective operations of the department through a combination of design and spatial limitations. The following observations provide a high-level description of some of the observations that factored into the interim measures report and should serve as a basis for planning a new facility.

The fire station is a retrofitted grocery store providing approximately 8,000 square feet of space. An additional approximately 1,500 square feet of space in a separate building on site is used by the department

to accommodate the work experience fire fighters that have become an essential part of the Towns fire fighting force. The administrative spaces are an enclosed area to the rear of the building and accommodate training, administrative offices, kitchen, servicing and hygiene areas. These areas reflect a mix of operations and administrative spaces that are the basis of several of the recommendations presented in the Interim Measures report.

There are significant operational shortfalls existing within the current fire station that will require attention in any long-term plan. These include:

- The site is small and constrained at the rear with a narrow alley, to the north by a retaining wall and elevated neighbor, and to the south by another Town owned building occupied by Fire Department WEP personnel and BC Ambulance. The apron in front of the fire station does not allow full operations of the fire apparatus without using the front street. There is inadequate on-site parking for the combination of full time, WEP, BC Ambulance and volunteer fire staff. Volunteers routinely park on the street when deploying to the station for training and emergency responses.
- The current fire station site is very small in relation to the needs of both the fire department and BC Ambulance operations. On the consultant site visit in March, an incident involving a BC ambulance was noted as the staff tried to get the ambulance out of the bays with vehicles parked alongside the fire station wall. The rear of the ambulance impacted the door frame, damaging both. There is evidence indicating that this is not an uncommon occurrence. Turning radii, parking, and operational space is limited for fire and ambulance operations. Apparatus returning to quarters must utilize the street for at least part of their maneuvers.
- There is little physical or vapour separation and no walk off spaces between the outdoors, the apparatus bays and the administrative spaces. This permits dirt and contaminants to migrate into the administrative areas from both outside and the apparatus floor contaminating work and public spaces.
- All routes into the building from the apparatus floor go directly through the administrative offices.

- Current kitchen and change areas do not meet WorkSafeBC requirements.
- There are currently no hygiene facilities for decontamination of fire department personnel. There is only one shower provided in the men's washroom in the administrative section of the building and none provided for women. Decontamination facilities must be provided and be separated from the "clean" administrative areas of the department.
- There are insufficient washrooms provided for current and expected staffing and occupant loads.
- The apparatus floor is being used as the change and storage area for fire department personal protective equipment. This is not a safe practice and does not comply with NFPA 1500 requirements for a separate area for the storage and donning of fire protective clothing. All bays are full and are being multi-tasked for storage, servicing of equipment, dressing for calls, cleaning of equipment and a host of other functions.
- There is a cleaning area for washing protective clothing, but it is in the administrative wing of the building and requires contaminated clothing to be moved through the area. There are no facilities provided to clean the fire fighters personal clothing.
- The ceiling height of the fire apparatus bays is low, providing barely enough clearance for the fire apparatus. As a result, servicing of fire apparatus must occur outdoors, even in inclement weather.
- There are no proper storage spaces for spare PPE and other sensitive equipment. Currently all storage is in a mezzanine above the administrative spaces. This area is susceptible to contaminants and wide variations in temperature. Ceiling heights are less than 6 feet overall, making it a barely occupiable floor space.
- Heating, ventilation and air conditioning (HVAC) installations are not effective and **do not** serve the entire facility. As noted in the Interim Measures report, the heating system is fully located on the administrative side of the building with large ducts provided to move warm air into apparatus spaces. When the overhead doors are opened, there is pressurization of the apparatus spaces that

force exhaust and other contaminants into the administrative areas of the building. The exhaust fans installed on the apparatus floor are largely ineffective in terms of removal of exhaust contamination. Early results from occupational hygiene evaluations indicate the administration areas are at a negative pressure in relation to the apparatus bays and draw air and contaminants into those spaces.

- A training centre is being developed by the department that includes lecture areas as well as training props required to provide both didactic and practical skills training in a single centre. Consideration of this area while developing a new fire station would be prudent.
- While there are no requirements for the building to meet current Building Code requirements, it is important to note that the building was constructed prior to stringent Building Codes, including post disaster design, being enacted. Any consideration of significant renovations to the facility would be required to meet the full scope of the modern BC Building Code.

The observed deficiencies in the current fire station should serve as a planning guide for the development of improved services and spaces in a new facility.

DESIGN CONSIDERATIONS AND REQUIREMENTS

Design principles for the siting and construction of a fire station fall into two streams, discretionary and non-discretionary. Discretionary considerations are those where planners have some degree of flexibility over the process. These discretionary considerations range from site locations to the types of services that will be positioned in the station. Non-discretionary considerations include compliance with regulatory regimes like the British Columbia Building and Plumbing Codes and the WorkSafeBC requirements. The following sections will explore both sets of considerations.

Industry Standards like the National Fire Protection Association provide valuable insights into industry specific considerations related to fire fighting and safety programs. These standards, however, are of no legal force unless they are adopted by statute or regulation. Standards should form the basis of fire specific considerations for activities that may go on inside the station related to firefighting. For all other requirements, please refer to British Columbia Building Code and workplace safety Acts and Regulations.

Not all the considerations for a fire station fall directly into codes or standards but do exist in best practices. While a fire station is required to house fire trucks and equipment, its most important function is to accommodate the needs of the fire fighters who are necessary to operate the equipment and deliver the services.

Recruitment and Retention:

Volunteer recruitment and retention has been identified as the single biggest threat to the volunteer fire service today. Finding volunteers who are healthy, able and interested in the training, can tolerate the emotional highs and lows of emergency response and who are prepared to make multiyear commitments to their community are increasingly difficult to find. Volunteers are under pressure to meet obligations from their primary employer, family, other volunteer opportunities and the complexities of modern life. The commitment to training required to meet the challenges of modern firefighting alone is enough to dissuade volunteers from coming forward and encourages them to leave when life gets busier with the addition of marriage, children and work. Designing some of their needs into the fire station in a manner that makes it easier to be a part of a strong team just makes good business sense.

A fire station plays a critical role in supporting effective volunteer recruitment and retention strategies. Historically, one of the key draws of the volunteer (and career) service was the sense of “team” and the social connections that came with being a part of the department. While historically this sense of belonging

was anchored to social activities that are simply not permissible in the professional volunteer fire service of today, the need for volunteers to feel part of the team is as strong as ever. Consultation with the volunteer personnel on what their needs are, inclusion of health and wellness facilities within the station and the development of spaces that can accommodate reflective or social opportunities should be part of any design project.

Today's volunteer fire fighter tends to be much more aware of the health impact potentials of their decision to become a fire fighter. Increased cancer rates and the risk of heart disease due to diet, shift work and other factors are better understood every day. The inclusion of health and lifestyle considerations, including fitness areas, should form a part of station design. Emerging science is demonstrating that health and wellness is not just related to physical health. Mental health challenges require facility spaces that can be used to support quiet and reflective spaces for members to come together. Physical health plays a significant role in supporting mental wellness as well.

Social and amenity areas provide quiet spaces that allow post incident decompression spaces as well as areas where fire fighters can come together on a more social basis. These activities are essential to the development of a cohesive team that spends relatively few operational hours together. Where career fire department (and most "normal" workplaces) staff spend full shifts together working and socializing, volunteers are only together for responses and training, neither of which supports the development of team bonds.

Other fire services are evaluating the addition of amenity spaces that includes child care and other services, recognizing the challenges for parents to find appropriate care for children in the immediacy of emergency response requirements of a fire station.

Industry Standards:

Industry standards such as those provided by the National Fire Protection Association (NFPA) are a collection of industry best practices, generally supported with extensive scientific research. In terms of fire stations there are no NFPA standards solely devoted to the development of a fire station. The bulk of the referenced standards pertain to operations that will be performed by a fire department and will provide guidance on equipment, spaces and procedures to be followed. These Standards have informed the development of building design principles used by Architects and other professional building designers to

create functional and effective buildings capable of supporting effective and safe fire department operations.

There are, however, several that reference specific functions related to fire station development and operations. They include:

- NFPA 1500- Standard on Fire Department Occupational Safety and Health Program
- NFPA 1581- Standard on Fire Department Infection Control Program
- NFPA 1851- Standard on Selection, Care and Maintenance of Protective Ensembles for Structural Firefighting and Proximity Firefighting
- NFPA 1710- Standard for the Organization and deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments
- NFPA 1720- Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Volunteer Fire Departments

NON-DISCRETIONARY CONSIDERATIONS

The Creston Fire Station is being developed to accommodate a diverse range of uses and functions. The facility is intended to accommodate administrative and work spaces, vehicle storage and maintenance spaces, flammable liquid storage, training and meeting spaces, decontamination and hygiene spaces, laundry- heavy and light duty, storage, secure areas as well as facility service spaces. In addition the facility must support the safe and efficient deployment of resources to emergency events.

The following are the non-discretionary requirements that apply to all fire stations, new construction and renovations.

Foundational Design Principles:

Creston Town Council established several basic principles that are to be considered mandatory elements of the fire station project.

Emergency Operations Center (EOC):

The inclusion of the EOC in the fire station design is an important risk management and community preparedness decision. As the only post-disaster designed municipal facility in Creston it only makes sense to include this emergency management and command capability within the fire station. The function takes

advantage of already required floor spaces including offices, meeting room and the training room so there should be minimal spaces required to support this function. A benefit of adding this capability into the planning is the opportunity to include higher end computer and communications technology. This has the added benefit of supporting training and other Town business requirements.

Life Cycle Planning:

Council has been clear throughout the planning process that the decisions around this facility must be taken in consideration to the long-term infrastructure investment a fire station represents. The ability of the facility and site to meet the uncertain future needs of fire protection and community safety in Creston and the region must be factored into a flexible design that can readily accommodate change.

Facility Partnerships:

Council established a cost recovery principle governing the addition of any partner, such as BC Ambulance, seeking to be part of the facility. Any additional spaces required by a partner agency would be funded by that agency.

Service Levels:

Service levels are determined by Creston Town Council. The building design, including siting, must accommodate current service levels, including the Work Experience Program (WEP).

Staffing:

The fire station design must not constrain the fire department in its staffing model. Design considerations should be based on current staffing levels and contemplate increased numbers pending community growth or fire industry changes. The facility design cannot artificially constrain current recruitment and staffing levels.

Regional Response:

Regional partners have committed to significant investments in a new fire station in Creston and understandably will have expectations that any future design will reflect their needs. Design principles, starting with siting decisions, must consider regional needs, although not at the cost of effectiveness of response for Town of Creston residents.

Professional Design:

A fire station is a highly complex facility that provides accommodation, assembly, industrial storage, administrative and other functions necessary in the modern fire service. As a result, it requires professional

design in accordance with the Architects Act of British Columbia (RSBC 1996) and the British Columbia Building Code.

Article 1.2.10 of Architectural Institute of British Columbia (AIBC) Bulletin 31 (**Exhibit 3**) states:

“Any mixed-use building in excess of 470 square metres (5059 square feet) gross area, including mixed use buildings. A mixed-use building that contains assembly occupancy is assessed by the most restrictive use and therefore requires an architect when it exceeds 235 square metres (2530 square feet); “

AIBC Bulletin 31 Appendix A (**Exhibit 4**) further clarifies that both the Architects Act and the BC Building Code state that all buildings required to be built to post disaster standards, including fire stations, must be professionally designed and reviewed, regardless of size. As a result, professional design is a required element of any project to renovate or construct a fire station in British Columbia.

[British Columbia Building Code \(BCBC\) 2012:](#)

The proposed Creston Fire Station is considered a Group F Division 3- Low Hazard Industrial Occupancy. The building is categorized as having a major occupancy of F-3 and two minor occupancies A-2 Assembly and C Residential. As a result, the following some of the mandatory requirements for the facility including:

- BCBC 1.4.1.2: Post disaster construction,
- BCBC 3.2.2.84: the building must be sprinklered and the building can be constructed using either combustible or non-combustible construction
- BCBC 3.2.4.1: the building must be provided with a fire alarm system
- BCBC various: fire separations between various occupancies and exits must be provided
- BCBC 3.1.3.1: fire separations must be provided between major occupancies including:
 - Between F3 and C (residential occupancy: 1 hour)
 - Between A2 and C: 1 hour)
- BCBC 3.8.2.3: facilities including washrooms and access must be provided for people with disabilities. This accessibility requirement also pertains to parking and exterior access to the facility.
- All other BCBC and Plumbing Code requirements

The application of BCBC requirements related to post disaster design requirements is different than the approach in other provinces. Post disaster design is not a mandatory requirement in Alberta, for example.

The decision on using post disaster design concepts are up to the local authority and is based on a risk assessment process. When comparing pricing between jurisdictions, this means that any Alberta costing may be 20 to 30% lower than a similar building in British Columbia.

WorkSafeBC Regulations:

WorkSafeBC workplace safety and health regulations apply to all aspects of fire department facilities and operations. This section of the report will reference the requirements at a high level. For detailed information on the interpretation and content of the regulations and other requirements, please refer to the WorkSafeBC website at <https://www.worksafebc.com/en/law-policy/occupational-health-safety/occupational-health-safety-regulation> .

The Regulations are structured as follows:

The Core Requirements that apply to all workplaces include:

- Part 1: Definitions - A list of words used in the Occupational Health and Safety Regulations (OHSR) that have specific meanings.
- Part 2: Application -- A description of how the OHSR is applied.
- Part 3: Rights and Responsibilities -- Details about elements of a health and safety program, investigations and reports, workplace inspections, the right to refuse work and first aid.
- Part 4: General Conditions -- Requirements for such aspects of workplace safety as building and equipment safety, emergency preparedness, preventing violence, working alone, ergonomics, illumination, indoor air quality, smoking, and lunchrooms.
- Parts 5-19 deal with general hazards found in many workplaces, usually higher-hazard operations. Topics include the safe use of chemicals, confined space entry procedures, guarding of machinery and the use of mobile equipment. Basically, if the worksite is doing the work considered in these Parts, they apply.
- Part 32: Firefighting. This Part refers principally to operational activities, specialized PPE and other fire department specifics.

In terms of the design of a fire station, perhaps the most important OHSR requirement is the following:

OHSR Section 4.1: Safe workplace- A workplace must be planned, constructed, used and maintained to protect from danger any person working at the workplace.

When related to the FireWise Interim Measures Report, the context of this clause becomes clear. Planning considerations for a new facility must include design elements that manage identified hazards:

- Vehicle exhaust management practices that sees the removal of all exhaust fumes from the interior of the building,
- Chemical and carcinogen exposure facilities that effectively remove the risk of accidental exposures to personnel,
- Adequate facility space for safe operations,
- Changing areas and food service areas must be separated from possible contamination from operations
- Proper storage spaces for essential equipment and adequate protections from that equipment where required,

All decisions on what service spaces will be included in a new fire station and their relative size should be assessed against the requirements of WorkSafeBC.

[British Columbia Fire Service Minimum Training Standards:](#)

This policy document from the Fire Commissioner’s Office of British Columbia does not have a direct relationship to the construction of a fire station. It does, however, provide detailed guidance on the training requirements for any municipality who employs a fire service. The fire station is a key resource for the delivery of this training and this must be reflected in fire station design principles. Creston Fire Department is deemed a full-service fire department under the definitions provided in the Playbook and as a result has very stringent requirements to meet in terms of training and competency management.

[Fire Service Training:](#)

WorkSafeBC deems a worker to be qualified to perform the work assigned if they are “knowledgeable of the work, the hazards involved and the means to control the hazards, by reason of education, training, experience or a combination thereof”. In terms of fire services, the combination of experience and ongoing training is critical to meeting this WorkSafeBC principle. Due to the nature of emergency response and large team operations, a firefighter may not get the opportunity to perform critical skills in a “real life” form. Due to this and the life and death nature of many of the fire departments operations, training is critical to maintaining an acceptable level of safety and effectiveness.

The British Columbia Fire Commissioner's Office (FCO) developed a training "Playbook" that provides minimum training levels for fire departments, based upon the broad service levels they provide. This Playbook is intended to provide an industry recognized minimum standard of training that utilizes, and bridges to, the current National Fire Protection Association (NFPA) Firefighter qualifications. This is an important consideration as it provides a formal link between acceptable training standards required of an employer in terms of safe work practices, and internationally recognized standards and will form part of WorkSafeBC's formal assessments following an accident. The training requirements are expressly tied to the Service Level provided by a fire department, as formally determined by the Town. This document and program establishes the minimum Competencies necessary to perform the role of a firefighter, instructor/Evaluator and Team Leader at each designated Service Level, as well as for the delivery of in-house training in such Competencies.

Fire Service training is based on a balance of didactic, in classroom instruction and practical skills evolutions intended to link the theoretical with its practical application. Like community colleges that are providing technical skills training to adult audiences, the proximity of classroom to practical skills spaces are an important element supporting the delivery of these essential training requirements. Good fire station planning will recognize that many classroom delivered sessions, like CPR and First Aid, require adequate floor space for practical skills training and assessments. Similarly, classroom spaces will be close to the apparatus floor so that spaces using that equipment or personal protective equipment is close to hand lending itself to efficient transition from classroom to practical skills and back.

While the Playbook does not directly reference the design of fire stations, it does provide a definitive guide to the type of training required and the facilities a municipality will need to provide to effectively support the safe and efficient delivery of this required function.

DISCRETIONARY CONSIDERATIONS

Site Selection:

The fire station decision process should start with an evaluation of potential sites for the station. A fire station, particularly in a single station environment, requires careful consideration and must reflect several important design and performance expectations.

During the 2016-17 Creston Fire Station design process, a total of eight (8) possible sites were initially evaluated as part of the selection process. These sites included the current fire station site, several surrounding the downtown core, some in the north industrial area. As a result of extensive evaluation that included response times, access, site flexibility, size, and geotechnical assessments, the number of viable options was reduced to four (4) sites.



Figure 1: Possible fire station site locations as presented to the public in 2016

RCMP Site 1:

This site located on Cedar Street beside the RCMP Station was evaluated. The positives related to the site included:

- Good location related to major thoroughfares in the Town,
- Access to the station for the volunteers,

- Properly located to meet response time requirements in relation to planning requirements,
- “proximity to the RCMP set up something of a campus environment for emergency and protective services.
- The Town owned the property

The negatives identified included:

- Proximity of the site to the rail road tracks and a rail crossing,
- Utility rights of way that would need to be moved to accommodate constructions,
- Cedar Road runs thorough the center of the property creating facility siting and functional concerns, including a need for firefighters to cross the street
- Historical geotechnical concerns related to the previous use of the property

Extra Foods Site 2:

This site was identified as the preferred site for development of a new fire station following a significant professional and public evaluation. The positives for this site include:

- The location of the site is well within the response time area to meet fire department response time requirements,
- Good access to main arterial roadways allowing excellent access to all Town neighborhoods and to regional service areas including West Creston, Erickson and Canyon.
- The site allows drive through design with access with access from 16th Avenue and exit onto Cook Street reducing wear and tear on fire apparatus and removing the need to maneuver vehicles on roadways to enter and access the facility,
- Site is flat and connected to utilities and will require minimal investments to ready for construction, and
- Has sufficient space to accommodate all current and forecasted fire department requirements.

Negatives identified included:

- The Town does not currently own the property, and
- Traffic control measures would be required due to exiting onto a major roadway.

Petro Canada Site 3:

This site on Northwest Boulevard was evaluated and found not to be a viable option.

The identified positives included:

- Site size was adequate for the requirements of the department, and
- Good access to the Town's arterial road system

The negatives identified with the site included:

- The site is very narrow and extends a long distance from the road. This would restrict the building design and negatively influence the viability of the preferred drive through design.
- The site is located a long way from where most volunteer fire fighters live and work. This results in longer travel times to get to the hall and return times to fires in residential areas of Creston and all of Erickson and Canyon.
- Backing in to the site from the street is not an option as the frontage is on Highway 3, and
- The site is not currently owned by the Town.

Bunker Site 4:

This site at the corner of Vancouver Street and Highway 3 was evaluated carefully. The site provided several positives:

- Use of an abandoned construction site would cleanup a community eyesore,
- Good location close to the Town Office and current fire station,
- Site supports development of drive through bays and two-dimensional access to the site,
- Site size met the minimum requirements for the fire station
- Fire department response times met

The negatives identified included:

- Little site space to support future growth or service changes,
- Current construction on site would have to be evaluated carefully to determine if it could be used or would need to be removed,
- Access issues related to Highway 3
- Grade issues due to site elevation differences with streets and neighboring properties, and
- Site is not currently owned by the Town

Current Fire Station Site:

The current fire station was evaluated both in terms of renovation and as a possible site for the construction of a new fire station.

Renovation was not seen as a viable consideration. The current building would need to be made BC Building Code compliant, including those provisions related to post-disaster standards. While certainly possible, there would be very little of the building that would be reusable. The property line to the north would require the addition of significant retaining wall investments to meet seismic and modern engineering requirements. The entire roof structure would need to be removed, elevated and replaced. Further, the building's 8,000 square foot area is insufficient for the needs of the department and would require the addition of some 6-8,000 square feet of space. Even with the removal of the building currently supporting BC Ambulance, there would be insufficient space to meet the spatial requirements even of a standalone fire station when parking and site movement of fire apparatus are considered.

Fire Department Response Time Calculations:

Fire department response times are one of the key benchmarks used to measure the effectiveness of fire department operations. It is important to understand the different things that factor into a fire departments response time. It is significantly more than just the time it takes to drive to the site. In terms of a volunteer fire department it includes dispatch times, drive time for the volunteers to the fire station, muster time that it takes to gear up and crew the truck and then the drive time to the fire or emergency event.

Fire deaths in Canada occur predominantly in residential occupancies. The British Columbia Fire Commissioner's Office data is out of date, but figures from 2012 and 2013 Annual reports show that 71% and 76% respectively of all fire deaths in BC occurred in people's homes. The Ontario Fire Marshal produced a comparative analysis of fire deaths in Ontario that showed for the period of 2006-2015 a full 85% of fire fatalities happened in the victim's homes. Proximity of fire protection services to residential areas should be seen as an essential planning principle when making siting decisions.

Response times are divided into several components:

1. **Pre-notification:** The time between onset of a fire and discovery and/or notification. While the municipality has little direct control over this part of the overall response time, public education and awareness programs, including an effective inspection program can help. This part of the overall response time is not included in the benchmark.
2. **Public Safety Answer Point (PSAP)** has two benchmarks to meet. The first is to answer the call within 15 seconds. The second is to transfer the call, where the dispatch and 911 call answer centre are different.

3. **Dispatch Interval:** The dispatch interval is the call handling time from the line pickup in the 9-1-1 call answer center to the time alerting tones are set off for the firefighters. The call handling pickup is the point at which the response time measurement occurs. This must occur within 90 seconds, 90 percent of the time.
4. **Drive Time to Station:** The time it takes volunteer staff to get from where they are to the fire station. General staffing directives will require full crews before moving fire apparatus so this is a cumulative time around groups of firefighters. Specifically, this measure is based on the slowest of each group of 3 to 4 fire fighters. This is the first of decision points that planners get to influence through their choice of site locations for the fire station.
5. **Muster or Chute Time:** Once at the fire station the firefighters must dress in their gear and mount their fire apparatus. In career fire departments the measure is 90 seconds or less. Building design and layout of spaces is critical to managing this most effectively to reduce this interval.
6. **Drive Time:** This is the time it takes for the fire truck to drive from station to emergency site.
7. **Assembly Time:** Once on scene it takes up to 2 minutes for the crews to ready their equipment to fight the fire.

Fire station planning process can influence many of these factors and reduce the time it takes for firefighters to assemble and respond to the event. These considerations must form the basis of all decisions related to siting. The Town of Creston is in an enviable place in that there are effective sites available that can accommodate all these considerations.

The following is provided purely for informational purposes and represents industry best practices. This is not a legislated requirement but does provide a planning principle that should be applied to performance measurement and benchmarking. The following chart illustrates those times provided by the **NEPA 1720** *National Fire Protection Association (NFPA) Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Volunteer Fire Departments* Provides context to industry best practices for volunteer fire department response times. While not a legislated requirement, they do provide a valuable measuring tool.

- i. **Urban Zones** with >1000 people/sq. mi. call for 15 staff to assemble an attack in 9 minutes, 90% of the time.
- ii. **Suburban Zones** with 500-1000 people/sq. mi. call for 10 staff to assemble an attack in 10 minutes, 80% of the time.

- iii. **Rural Zones** with <500 people/sq. mi. call for 6 staff to assemble an attack in 14 minutes, 80% of the time.
- iv. **Remote Zones** with a travel distance =8 mi. call for 4 staff, once on scene, to assemble an attack in 2 minutes, 90% of the time.

The Town of Creston’s 2016 census sets the population density at 1,622 people per square mile. This is considered an urban zone in terms of response planning. While the Town is not required to meet this standard, it does provide valuable planning insights into industry best practices and should serve as a guiding principle for decisions related to fire station development and fire department organizational principles.

[British Columbia Building Code \(2012\) Fire Department Response Time:](#)

While the bulk of British Columbia Building Code requirements place an onus on the building owner for building design, this Clause provides the authority having jurisdiction some latitude for choices. If a municipality chooses to accept fire response standards below the threshold described below, developers will be required to develop subdivisions differently. Requirements could include the application of greater limiting distances between buildings, adoptions of residential sprinklers and a reduction in permissible openings in opposing faces of homes.

The following excerpt from the BC Office of Housing and Construction Standards Bulletin # B13-04 (**Exhibit 3**) provides clarification to planners in the province on the determination of fire department response times in relation to the application of limiting distance requirements for buildings.

“For the purpose of the application of Clauses 3.2.3.1.(8)(a), 9.10.14.3.(1)(a) and 9.10.15.3.(1)(a) of the BC Building Code, fire department response time shall be considered to be the time from the receipt of notification of a fire by the fire department, to the arrival, at the building or building site, of the first firefighting vehicle that is staffed and equipped to fight a fire for the purpose of limiting the exposure to adjacent buildings.”

This response time calculation applies to specific BC Building Code requirements as follows:

- *3.2.1.3.(8)(a) the time from receipt of notification of a fire by the fire department until the arrival of the first fire department vehicle at the building exceeds 10 min in 10% or more of all fire department calls to the building, and*

- *9.10.14.3.(1)(a) the time from receipt of notification of a fire by the fire department until the first fire department vehicle arrives at the building exceeds 10 min in 10% or more of all calls to the building, and*
- *9.10.15.3.(1)(a) the time from receipt of notification of a fire by the fire department until the first fire department vehicle arrives at the building exceeds 10 min in 10% or more of all calls to the building, and*

The first vehicle is required to be a front-line fire fighting vehicle with suppression crews, water and hoses. The bulletin clarifies as follows:

“A firefighting vehicle is one that has integral firefighting equipment and does not include support vehicles, such as pickup trucks or other passenger vehicles.”

Where those performance metrics cannot be met, more restrictive provisions of the BC Building Code must be applied in relation to unsprinklered buildings.

Response times will be one of the first considerations. In terms of volunteers, planners need to consider both the time it takes to get from home or work to the station as well as travel time from station to the incident location. While every second counts from a life safety perspective, there are other response time considerations that must be considered. For example, the BC Building Code permits relaxed regulations on limiting distances between buildings and permits openings like windows for residential construction if a fire truck can respond to that location within 10 minutes, 90% of the time. Where the fire department cannot meet these requirements, the limiting distance between buildings must be increased and unprotected openings are restricted. This has a serious impact on how close together homes may be built and could result in increased development costs for homeowners.

The Town of Creston has been approving development permits and applying the BC Building Code based on the current location of the fire station. The only reason that the reduced limiting distances between buildings were permitted was that the balance of safety between spatial separation and response time was met. If decisions are made that lengthen the response times to those homes by moving the fire station to areas further away from volunteers and residential neighborhoods, it will put them outside nationally accepted standards for safe construction.

Spatial Requirements:

Architectural and industry best practices come together to provide highly accurate and effective guidance on designing spaces that will meet the reasonable needs of the department. There are many considerations that should be considered when evaluating what spaces are required and the relative size required to service those needs.

Site space is another area where there is some discretion available. There are specific site requirements to meet safe movements of fire apparatus. The site

Building Code:

The BC Building Code contains minimum acceptable areas for specific uses and functions. These must be complied with throughout the design process.

Volunteer Fire Department:

A volunteer fire department will require more space for activities including fitness, training and amenity areas, including lockers, change and PPE storage areas. This is due to the reality that volunteer fire departments will have more staff per unit than a career department. This increased number of staff is reflected in required training spaces, numbers of staff turning out for serious calls and other functions of the department.

For example, a career fire department with two trucks staffed would have at most 8 members on duty. This means their front-line storage of turnout gear is limited to 8 with the rest of their shifts being off the floor. On shift training will include their station complement of 8. Fitness and other amenity areas will also see use predicated on these on shift numbers, in general terms. Many career departments will have more than one station and while their overall numbers of vehicles might not increase, those vehicles will be spread through these multiple facilities, reducing the size of the building.

Creston Fire Department, as a single station organization, must store all of its apparatus in their only fire station. All 30-40 firefighters are housed here, including all of their service requirements, storage, training and other functions. Fire training is done in larger groups due to the need to provide consistent training to all staff and the need to schedule delivery to evenings and weekends respecting the best times for volunteers to attend.

Decisions on spatial allocations must be carefully considered based on the needs of a volunteer fire department.

Building Methodology:

Combustible versus Non-combustible Construction:

The BC Building Code permits this fire station to be of either combustible or non-combustible construction or a combination thereof. There may be construction and financial benefits to evaluating which construction methodology is considered. For example, the City of Leduc, Alberta chose to go with wood frame construction for the accommodation, training and administrative areas of the building and non-combustible for the apparatus bays. This approach provided a solid and secure building that met tight budget requirements. The facility met all applicable Building Code requirements.

Public Private Partnerships (PPP):

PPP's are not a common approach to the building of a fire station so there are few true examples to use to illustrate the approach.

The City of Brooks, Alberta developed a fire station in partnership with a commercial developer. While not a true PPP project, it is an interesting example of a shared site and plan. In this case, the developer wanted to develop a commercial subdivision and the City needed to replace an old and out of date fire station. The siting and other factors for a fire station were met so the City negotiated the development of the fire station as part of the commercial development. The fire station is located as a part of the complex and can utilize the large commercial parking areas for staff parking and training evolutions. Most of the operational training was moved off site to a separate training area with public education and classroom instruction remaining at the fire station. Much of the cost of servicing and site development was already covered by the development, so the City was able to build an 18,000 square foot facility at a substantially reduced cost.

Design Considerations:

Communities frequently see the design of a fire station as an exercise illustrating the confidence and strength of both the community and their emergency services. Design considerations should reflect community development standards and reflect the community's expectations. Community design standards like the Official Community Plan can provide significant guidance on what an important

community facility should reflect. In many communities, the fire station design is considered an important element of their statement of self.

What is the planning timeframe for the current construction? Current building design efforts have not included any additional spaces for fire department vehicles. If the current plan continues to maximize use of constructed space, there will need to be a discussion and decision on how future needs for space will be addressed.

The Committee will need to determine how to approach the design costs for energy efficiency and sustainability. Initial plans included Leeds Silver designation. The designation is not a required element of building design. The cost of the certification may be an area that the Committee may wish to evaluate in terms of its value to the overall project.

In Creston's case, the fire station will be the first and only municipal building that visitors passing through the community will see. Two of the three most desirable locations for a new fire station are located on major thoroughfares through the Town. Is there a statement that the community would wish to communicate to those visitors that could be included in a new fire station design?

Regional Considerations:

The Regional District is committing a significant investment into the fire station project. Consideration of the Regional expectations and needs of this station should form part of the Committee's discretionary evaluative process. The region may have specific needs for support from this station that none of the smaller stations in the area can deliver. Services like training and PPE cleaning and decontamination may be areas of future collaboration. Future regional staffing models should be considered in terms of the design and future use of the station.

Co-location:

Decisions are required on the types of community functions that could or should be included in the design of the facility. Decisions that include housing of important elements of the Town's information technology infrastructure have already been determined. What other municipal functions could be accommodated in the fire station design or functional use plan.

Should community organizations have access to areas of the fire station and if so what types? Is the fire station a public use building?

Functional Spaces:

Functional spaces should be directed by industry best practices and the application of Codes and Standards to the design process. Without a strong understanding of the needs of a fire department, informed decisions on spaces is not possible.

Financial:

A clear and commonly accepted definition of “affordable” must be developed as it relates to the design and construction of the fire station. Affordable could have a range of meanings from “cheap at all costs” to a more moderate approach that balances need versus wants for spaces and balances cost versus operational costs and maintenance into the future when making decisions. Current discussions are hampered without that common understanding.

The Committee should be evaluating opportunities that the Town may wish to explore regarding grants. There may be regional grants or grants that will support the development of important functions within the facility.

Are there other revenue sources available to the Town and region that could help defray some of the costs of developing a new fire station?

CONCLUSION

The design and building of a new fire station is a challenging and technically demanding project. It can very quickly be overwhelmed by the myriad of opinions and considerations ventured by everyone with an interest in it. Decision making authorities can simplify the process by adopting a few basic practices.

The Town of Creston has followed a proper process to develop the recommended course of action adopted by Council in 2017. The design work provided by the Architects developed a functional fire station that would meet the Town and Regional needs for years to come and offered a flexible design that would enable the fire department to grow with the community with minimal need for future investments in the facility. Public consultations developed siting decisions that supported effective deployment strategies that met not only the Towns requirements but also supported effective service delivery into the Regional District in all directions effectively and efficiently. This review was only able to identify one caution in the final design. Careful consideration should be given to cuts to space allocations done by Administration. While Administrations concern for budgets and costs are laudable, there is no flex space contained in the final design. This forces the fire department to develop in relation to station constraints, instead of being supported by their new facility.

Understanding the legal framework governing the design and construction of a fire station is essential. The British Columbia Architects Act and the British Columbia Building Code are clear that these types of buildings must be built to rigorous standards and that professional design is a requirement. The detailed spatial analysis and orientation of the various uses within the buildings should be left to those professionals. Their expertise is based on their access to decades of real world observation of how fire station design has evolved and integrates fire industry standards like those from the National Fire Protection Association into well-defined design principles. This ensures that the building will meet all regulatory requirements and reflect the needs of the customer.

RESOURCES:

1. Whole Building Design Guide: <http://www.wbdg.org/building-types/community-services/fire-station> provides a simple explanation of some high level considerations in the design of fire stations and other facilities.
2. WorkSafeBC Regulations: <https://www.worksafebc.com/en> This site provides comprehensive regulatory and explanatory materials related to safe and healthy workplaces
3. The Ontario Fire Marshal's Office comparative analysis reports on fire fatalities https://www.mcscs.jus.gov.on.ca/english/FireMarshal/MediaRelationsandResources/FireStatistics/OntarioFatalities/FatalFiresSummary/stats_fatal_summary.html
4. The BC Fire Commissioner's Office annual fire loss reports: <https://www2.gov.bc.ca/gov/content/safety/emergency-preparedness-response-recovery/fire-safety/fire-reporting/annual-reports>
5. British Columbia Fire Service Minimum Training Standards- Structural Firefighters Competency and Training Playbook <https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/fire-safety/playbook.pdf>
6. 2018 Canadian Construction Cost Guide http://www.altusgroup.com/wp-content/uploads/2017/05/altusgroup_costguide2017_web.pdf

EXHIBITS:

Exhibit 1: Creston Fire Department Interim Measures Report April 4, 2018

Exhibit 1A: Interim Measures Report Exhibits

Exhibit 2: Occupational Hygienist Report April 2018

Exhibit 3: Architectural Institute of British Columbia (AIBC) Bulletin 31

Exhibit 4: AIBC Bulletin 31 Appendix A

Exhibit 5: BC Building Code Bulletin #B13-04 Fire Department Response Times

Exhibit 6: VFIS NFPA 1500 Compliance Checklist