CITY OF VANCOUVER

CITY CLERK'S DEPARTMENT
Access to Information

File No.: 04-1000-20-2017-464

December 12, 2017

s.22(1)

Dear s.22(1)

Re: **Request for Access to Records under the Freedom of Information and Protection of Privacy Act (the "Act")**

I am responding to your request of November 21, 2017 for:

> **Copy of the report that Tri-Data conducted in 2009 (as authorized by Vancouver City Council on October 14, 2008, RFP #PS08043) for a Vancouver Fire & Rescue Services Operational Review.**

All responsive records are attached.

Under section 52 of the Act you may ask the Information & Privacy Commissioner to review any matter related to the City's response to your request. The Act allows you 30 business days from the date you receive this notice to request a review by writing to: Office of the Information & Privacy Commissioner, info@oipc.bc.ca or by phoning 250-387-5629.

If you request a review, please provide the Commissioner's office with: 1) the request number assigned to your request (#04-1000-20-2017-464); 2) a copy of this letter; 3) a copy of your original request for information sent to the City of Vancouver; and 4) detailed reasons or grounds on which you are seeking the review.

Please do not hesitate to contact the Freedom of Information Office at foi@vancouver.ca if you have any questions.

Yours truly,

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Encl.

:pm

CITY OF VANCOUVER

Consulting Services for Vancouver Fire and Rescue Services Operations Review

FINAL REPORT

December 2009

SYSTEM PLANNING CORPORATION

TriData Division

Final Report

Consulting Services for Vancouver Fire and Rescue Services Operations Review

Submitted to:

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December 2009

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Fire Chief Ray Holdgate and many others including firefighters, officers, civilian administrators, and other city staff members were extremely cooperative, gracious, and forthcoming during the project. They provided data, facilitated tours of the City and facilities, and discussed openly the opportunities and challenges facing the organization.

We particularly want to acknowledge the efforts of Wayne Oudijn, who acted as the designated project coordinator for the Steering Committee. He efficiently handled the administrative responsibilities of the project, coordinated our visits, handled data requests, and scheduled meetings. Mr. Oudijn also coordinated the very important draft report review process.

Members of the Steering Committee whose guidance was instrumental in making this project successful include:

James Ridge, Deputy City Manager

Ray Holdgate, Fire Chief

John McKearney, Deputy Fire Chief, Operations

Annette Klein, Director, Budget Services

Laura Lintunen, Assistant General Manager, VFRS Support Services

Rowan Birch, Assistant City Engineer

Rod MacDonald, President, IAFF Local 18

Gord Ditchburn, Vice President, IAFF Local 18

In addition we wish to thank the following individuals who met with us during the project. Without their valuable contribution this project would not have been possible.

Steve Salsman, Fleet Maintenance Division

Kim Singh, Acting Operations Manager, E-Comm

Fil Delgiglio, Captain, VFRS Facilities Maintenance

Jason Rude, Financial Analyst, Corporate Budget Services

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Sophronia Ho, IT and Management Information Specialist

Although we received valuable input from a variety of sources, the findings and recommendations contained in this report are those of the TriData project team. Principal members of the team and their areas of responsibility are shown below.

TriData Staff

Philip Schaenman	Corporate Oversight; Public Education, Performance Measurement, International Best Practices
Stephen Brezler	Project Manager; Fire Operations, Administration, and Fleet and Facilities
Harold Cohen	Deputy Project Manager; EMS, Training
Martha Word-Haley	Administration, Code Enforcement, IT
Hollis Stambaugh	Fire Investigation, Public Education
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Lorrie Jacobson	Senior GIS Analyst
Joe Laun	Inter-jurisdictional Comparisons
Alexis Bobrik	Project Support & Research
Maria Argabright	Project Support and Production Coordinator

We also want to thank Mercury Associates, Inc., who conducted an operational efficiency review of the fire department fleet maintenance program and the feasibility of possible consolidation with that of the city's central fleet maintenance operation. Findings and

recommendations of MAI's study were submitted in a separate report. Members of the MAI team included:

Randy Owen	Senior Vice President, Project Manager
Tony Yankovich	Senior Manager, Lead Consultant
Dave Robertson	Senior Consultant, Fleet Analyst
Ralph Filicko	Senior Consultant, Technology Analyst

FOREWORD

TriData, a division of System Planning Corporation located in Arlington, VA, was selected to conduct this study. TriData has conducted technical research on fire and EMS related issues for over 27 years and has undertaken over 150 studies of this type, including studies for Ottawa, London, Winnipeg, and Hamilton. Similar studies have also been completed for major cities in the U.S. including Seattle, Chicago, Houston, Fort Worth, Saint Paul, and Portland among others. In addition to its local government studies, TriData also conducts fire data analysis and topical research for the United States Fire Administration.

Mercury Associates, Inc. is an independent consulting firm headquartered in the Washington, DC area. Dedicated to providing objective, unbiased advice and technical guidance to organizations that operate fleets, its mission is to improve the quality of fleet management practices; the quality of goods and services utilized in the management and operation of fleets; and the quality of information and professional development services available to the fleet industry. Mercury Associates is a U.S. Small Business Administration and Department of Defense certified small business.

EXECUTIVE SUMMARY

TriData, a division of System Planning Corporation located in Arlington, VA. was selected by competitive bid to conduct a resource deployment study of the Vancouver Fire and Rescue Services (VFRS). TriData has conducted technical research on fire and EMS related issues for over 27 years.

In addition to a resource deployment study, a review of the VFRS fleet maintenance operation was also conducted. At question was the possibility of consolidating the fire department's fleet maintenance operation with the city's central fleet maintenance operation managed by EQS. The analysis of fleet consolidation was conducted by Mercury Associates, Inc. (MAI). MAI is an internationally recognized firm specializing in fleet maintenance for large government entities. The report by MAI was submitted to the city separate from this report.

Vancouver's current population of 578,041 includes a large number (52 percent) of residents having a first language other than English. The city is comprised of 23 distinctive, individual communities, and these create a blend of languages, cultures, and ethnicities.

VFRS provides excellent service and it is a lean organization. Fire services in Vancouver are provided at a much lower cost when compared to other, similar fire departments. Of the 10 cities used as comparable jurisdictions, the per capita cost for Vancouver is $137, well below the average of $179 of the 10 departments sampled. Of the comparison cities, six do not provide EMS transport, which can sometimes skew the results since more personnel and apparatus are needed for those cities that provide transport. When Vancouver is compared only to those cities which do not provide EMS transport, its cost per capita is still less; $137 versus $162. The primary reason for the lower cost is that fewer firefighters are on duty in Vancouver as compared to the average of the 10 cities; 134 versus 177. Clearly, the citizens are getting good value for the dollars spent on fire protection.

This report is divided into five major chapters with recommendations included in the various sections. Chapter VIII includes a table of the entire set of recommendations and the estimated cost for the proposed staffing and capital recommendations included in the report.

Major findings and recommendations listed by sections of the report are:

Management and Support

VFRS is organized similar to other metro-sized fire departments. Five assistant general managers (AGMs) report to the fire chief; four are uniformed (deputy chiefs) and one is a

civilian. A civilian advisor for human resources also reports to the fire chief. Administration and support activities are provided mostly by civilian personnel.

Planning is a serious problem for VFRS in part because it does not have a centralized planning function. Useful and reliable data is also in short supply which only makes planning more difficult. We recommend consolidating the corporate IT positions already assigned to VFRS along with two new positions, including a GIS analyst, to create a new planning section.

Strategic initiatives to improve management and support functions of the VFRS include:

- Expand the training for senior fire managers to include topics such as finance and budget, human resource management, data analysis and the use of computer systems
- Management and labour should evaluate the promotional process; include post secondary coursework as part of career development
- Improve management accountability such that senior fire leaders assume more responsibility for managing their respective budgets, personnel, and line items
- Improve the flow of information within the organization; top-down and bottom-up
- Reorganize the IT function to improve data analysis and add a new planning section

Population Growth, Risk and Demand Analysis

To assess the city's population growth, risk and demand, we analyzed the city's 23 planning areas using GIS and incident data. The planning areas are the same ones used by the Vancouver Planning Department.

Over the past 30 years Vancouver's population has been growing steadily and growth is currently averaging 6,000 more people in the city every year. The residential population downtown is also growing and the 2006 with the residential population downtown increasing to 43,000 permanent residents. By 2021 about 70,000 residents will reside downtown and this will increase the need for emergency services, particularly medical service. The number of fires with loss will remain fairly level over the next several years. Despite its growing in population, the city's fire incidents are not projected to increase.

Response Time, Fire Hall and Apparatus Location Analysis

Response time and service reliability from the city's 20 fire halls is generally good. VFRS is unique in that it has two-person rescues located throughout the city and these are used mostly to handle medical calls. Rescues also respond to other incidents such as structure fires

where they are integral to the city's fire suppression system because rescue unit personnel are needed to augment the staffing on fire units.

The response time clock starts when an individual calls 911 (or alternate emergency number) and stops when the first emergency provider arrives at patient's side or the scene of the incident. Vancouver is close to meeting NFPA 1710 with respect to travel times (both by incident type and by planning area). However there are issues with overall response times, mostly because of poor call processing and dispatch times. The computer aided dispatch system has been updated and this should improve the situation, albeit the fire department must monitor the situation closely and assess future dispatch time data.

In most planning areas the NFPA recommended travel-time goal of four minutes is being achieved. Unlike other communities where less than ideal response times are often related to the location of fire halls, or not having enough halls to cover the area, Vancouver's situation is related to less than ideal reliability because fire units are often unavailable because of training. To remedy this we recommend three additional fire units and three additional rescues during weekdays when demand is the highest and when training occurs most often.

Strategic goals and recommendations include:

- Implement a method for tracking unit reliability.
- Prepare a monthly response time report and distribute the report department wide.
- Conduct an annual performance review for the entire system and each planning.
- Expand the data analyzed to include other activities, e.g., primary search complete; ventilation completed; extinguishment started (complete) and begin tracking vertical response time as part of incident data collection, especially for medical calls.
- Use NFPA 1710 (and other standards) to develop performance goals, but consider each planning area on the merits of its particular situation.
- Move Fire Hall 17 closer to the center of the Sunset planning area.
- Consider adding a new station west of Fire Hall 21; at the same time plan for Fire Halls 21 and 18 to be moved eastward.
- Deploy five aerial ladders city-wide, one each at Fire Halls 1,7,18, 19, and 20.
- Deploy seven rescues 24/7 at Fire Halls 2, 4, 8, 9, 17, 21, and 22 and add three rescues during weekdays.

Fire Operations, EMS and Training

Services provided to the citizens of Vancouver overall are very good. VFRS is a quality-minded organization and it has a well-trained staff. A key aspect of this study was to determine whether the current deployment of resources is adequate for current demand and to make recommendations for future resource allocations based on projected call volumes and incident types.

Fire services are provided from 20 strategically located fire halls. Line firefighters and officers work an average of 42-hours each week on a four platoon schedule and these personnel are assigned to one of four shifts (A–D). Currently, 746 personnel are allocated for operations. The minimum required daily staffing of 134 includes one fire investigator. Eighty-one percent of the total fire department budget goes toward salaries and benefits for personnel assigned to operations. Salaries make up the largest portion of the budget ($52.4M).

Strategic goals and recommendations concerning fire operations include:

- Improve the organizational structure by realigning the command structure of operations and modify the budget to reflect actual costs.
- Add rescues during weekdays to handle the growing number of medical calls and add fire units to replace those that are unavailable because of training.
- Improve incident command, incident-scene safety, and increase the response complements sent on high-risk hazards.
- Improve hands-on and live-fire training and increase the capacity to conduct training on each of the four shifts.
- Reorganize the training division to include EMS and fire training programs.
- Strengthen emergency preparedness, urban search and rescue (USAR), and special operations by reorganizing the management structure.
- Eliminate quints and replace them with engines in some halls throughout the city.
- Consider revising the vacation and leave selection policy to provide greater flexibility for shift personnel as a way to reduce sick leave use.
- Consider 5.47 to be the department's staffing factor until such time as updated leave data is available, then revise the factor accordingly.

- Create a safety/ command adjunct position for each of the four shifts. Increase the weight of response for confirmed incidents at high-hazard occupancies; also when the incident requires a second or greater alarm.
- Work toward eliminating the duplication of special services in the region by developing a plan for certain cities to provide the nucleus of hazmat and technical rescue services to other communities.
- Modify the fire suppression resources to include 16 engines, 7 quints, and 5 ladders (This is a change from the current deployment of 13 engines, 10 quints and six ladders).
- Consider adding a weekday 'peak-load shift' with a five-shift configuration.
- Reorganize special operations and USAR under one of the deputy chiefs, with an assistant chief being responsible for both functions; also transfer the responsibility for technical rescue from Fire Hall 7 to a less busy and more centrally located hall.

If the entire slate of personnel changes for operations were implemented, including the fifth (weekday) shift, operational staffing would increase by 16 personnel from 739 to 755.

Fire Prevention, Investigation and Public Education

Prevention activities are considered to be plan review and fire inspections. Fire investigation and public education, which contribute to prevention, are separated organizationally from the rest of the prevention mission in Vancouver and treated as separate sections. As with other areas of the VFRS, data collection and use is a problem. As a result, the department is unable to determine details of the city's fire-problem areas, or which programs are having the best success. The absence of good data also hindered our ability to assess the level of effort going into various prevention activities, which then made it difficult to determine the number of personnel needed.

On the positive side, Vancouver is the best example in North America and probably the world in getting legislation passed to require residential sprinklers. Required since 1990, residential sprinklers are now in almost 40 percent of residential units. As a result, the city's fire losses have declined as more homes are sprinklered.

Strategic goals to improve prevention include:

- Move fire/arson investigation under the fire prevention division with fire code enforcement and public education.

- Improve technical expertise within prevention by requiring NFPA or comparable certifications for all positions and for promotions.
- Establish a continuous training program for operational officers and fire fighters in fire inspection, fire education and fire and arson investigation.
- Improve the use of data to determine code enforcement priorities, to analyze results, to establish consistent high quality standards for fire code enforcement, education and investigation.
- Reduce the cost of prevention by allowing for the hiring of both certified uniform and civilian personnel in many if not all fire prevention positions.

Recommendations specific to code enforcement, public education and fire investigation include:

- Hire a fire protection engineer (FPE) and eliminate the training officer.
- Move the responsibility for training on the by-laws and inspection techniques to the FPE.
- Return plans review back to fire prevention and move the review of all plans for fire alarms, fire sprinklers, fire pumps, standpipes, cooking hoods and other fire-related (e.g., smoke evacuation systems) and suppression systems to fire.
- Create a new function, Fire Plan Review & Construction Inspection, headed by the fire protection engineer with the captain for plan reviews and the occupancy inspector assigned.
- Eliminate the lieutenant customer service position and move the associated permit and inspection workload for fire works, tank removals and other permits issued by this position to the Fire Plan Review & Construction Inspection function.
- Adjust staff schedules to allow for non-overtime inspections of late night, week end and after hour club fire inspections.
- Move fire investigation into the same section with inspection and public education, which is typically where departments place this function.
- Increase the number of fulltime public educators to four or five.
- Expand the home safety program and target the effort to visit every un-sprinkled residential property over a five year period using line firefighters and neighbourhood volunteers.

- Set up a 'fire-safe home' request hotline for residents to call in their request for a smoke alarm.

Fire Apparatus and Facility Assessment

The city is facing a situation of having to replace large portions of the fire department fleet and many of the city's fire halls have reached the end of their useful life span.

The average age of first-line engines is excellent, but quints and ladders are approaching the 15-year period for replacement as are the rescues. Sixty-five percent of the current fleet is due for replacement within the next five years (2014). The projected cost to upgrade the fleet and replace 29 units over the next five years is approximately $16.0m.

The current state of facilities can be described as 'fair'. Although most of the city's 20 fire halls are in excellent locations response-time wise, many have outlived their useful lifespan. Of the city's 20 fire halls, 10 are over 30 years old and only 3 are between 6 and 10 years old. The highest priority is to replace Fire Halls 17 and 20 during the 2012 to 2017 planning period. Following is the table of facility needs, estimated cost, and suggested planning period.

Project	Estimated Cost	Suggested Planning Period
Replace Fire Hall 17	$13,000,000	2012 to 2017
Replace Fire Hall 20	$9,000,000	2012 to 2017
Replace Fire Hall 9	$9,000,000	2015 to 2020
Renovate Fire Halls 1	$1,000,000	2015 to 2020
Renovate Fire Hall 2	$1,000,000	2015 to 2020
Replace Fire Hall 6	$1,000,000	2018 to 2023
Renovate Fire Hall 8	$1,000,000	2018 to 2023
Renovate Fire Hall 22	$1,000,000	2018 to 2023
Total Capital Cost	$34,000,000	-

I. INTRODUCTION

The city of Vancouver requested the assistance of an outside firm to provide a resource deployment analysis for the Vancouver Fire and Rescue Services (VFRS). As part of the analysis the city desired a comprehensive risk and demand analyses to determine future resource needs for the city's 23 neighbourhoods. A review of the department's administrative support and training functions was also included as were reviews of the department's capital needs.

Scope of Work

Clearly, a number of concerns were at the core of this study. First was the fire department's request for additional personnel to support the department's fleet maintenance function. Within city government, some managers questioned whether additional staffing was required since it was believed that another city agency (EQS) already had the requisite staffing and facilities to handle fire fleet maintenance. EQS also had the overall responsibility to supply and maintain the vehicles for all other city agencies.

The result of these questions led to the decision for a broader review of the fire department. During our discussions with various officials, other concerns were also expressed. Among them were:

- Concern about the many older fire halls in the city: how should these be addressed and what are the priorities for repair or replacement?
- Changing city and demographics: how should future services change to meet changing demographics and population, particularly downtown?
- Vancouver is a small city geographically but very high density and 'vertical': how does this impact response time; demand, and services needed?
- Improvements in regional cooperation: Can regional fire and rescue services be improved in Vancouver?
- Seven rescues and 14 quints are due for replacement in 2012: This is a major expenditure for VFRS. Are all of these vehicles needed? What type of vehicles should be purchased?

To analyze fleet maintenance including the possibility of consolidation with EQS, TriData selected Mercury Associates, Inc. (MAI) to study the fleet maintenance operation. MAI is an internationally recognized firm specializing in fleet maintenance for large government entities. The analysis conducted by MAI was completed in parallel with this study. Throughout

the project, TriData and MAI shared important information concerning the fire fleet and recommendations for its future configuration and replacement. MAI's report, which included recommendations on staffing for fire maintenance, was submitted independently of this report.

This report includes a comprehensive assessment for each of the following topic areas.

- Analysis of current and future risks, response, and population growth
- Fire hall locations and response time
- Fire and EMS delivery and staffing
- Training
- Fire prevention, investigation, and public education
- Information technology
- Performance measurement and global concepts
- Administration, support, and internal communications
- Fleet and facility assessment

Project Methodology

This study was a complex undertaking, and the methodology was based on successful approaches developed by TriData over the past 26 years. Effective studies require input from all major stakeholders. Consequently, extensive interviews were conducted with key management and union officials, and information was gathered through station visits, conference calls, and e-mail exchanges.

The study began in October 2008 with a kick-off conference call involving the TriData study team and Vancouver's Project Steering Committee. During the kick-off call we reviewed the scope of work, goals of the study, and discussed the specific data and information needed for the analysis.

TriData project team members made their initial site visit to Vancouver in November 2008 where they met with representatives of the VFRS, familiarized themselves with the geography and area-specific risks, and visited fire halls. During this site visit, meetings were conducted with the fire chief, union officials, and other city agencies, including finance and planning. TriData personnel had an opportunity to interview senior staff members of the fire department and we held informal discussions with on-duty firefighters during our visits to the fire halls. At the end of the initial visit, the project team met with the Steering Committee to review the initial findings of the triage.

Over the next six months, TriData's project team made follow-up site visits to gather additional information and conduct additional interviews. Data and background information, including call statistics, budget information, personnel staffing allocations, apparatus rosters, and CAD and GIS data, were also collected and reviewed. Throughout the project, team members reviewed information collected from interviews and we analyzed data. The project team met regularly to compare information, share ideas, and solicit input on major findings and recommendations. While individual project team members were assigned specific responsibilities, the end product is a collaborative effort.

In April 2009, a conference call was conducted to brief the Steering Committee on our major findings and recommendations. During the conference call the draft review process and timing of the draft and final reports were also discussed. The draft report was reviewed prior to release of the final report.

Following the review of draft reports by various members of the fire department, a strategic planning exercise was conducted by TriData's project manager in September 2009. Sixteen representatives of VFRS's senior staff and members of the union participated. The session included additional opportunity for comment about the study and its findings. Following a day-long discussion of the study and the major issues confronting VFRS in the next few years, each group provided a report on those areas requiring the most attention over the next few years.

Overview of City of Vancouver

In the 1870s, Vancouver was founded as a sawmill settlement called Granville, and was renamed Vancouver after Captain George Vancouver in 1886. The city developed rapidly after the construction of the transcontinental railway in 1887. With the increased transportation to and from the city, Vancouver was able to shift from a rural settlement to a bustling metropolis. Throughout the years, Vancouver has expanded to become a 'city of neighbourhoods' with each neighbourhood having its own unique ethnic and socioeconomic mixes.

Vancouver's current population is 578,041 with 52 percent of its residents having a first language other than English. The city is comprised of 23 distinctive, individual communities, and this combination has created a blend of languages, cultures, and ethnicities that, serve to enhance the continuing development of Vancouver. The unique blend of neighbourhoods and extreme high population density impact fire and EMS service delivery.

Vancouver is the largest city in Western Canada, and the third largest in the country. The city also has Canada's largest and most diversified port, trading $75 billion in goods annually. It is home to a variety of different industries, including mining, forest, biotech, film and software

development. Vancouver is among British Columbia's youngest cities, and is consistently ranked one of the most livable cities in the world.

Organization of the Report

The report is organized as follows:

Chapter II, Management and Support – This chapter looks at the internal support functions such as payroll, internal communications, and information technology. This chapter also includes a review of performance measurement and comparisons of VFRS to other similar departments. A revised table of organization is also included.

Chapter III, Population Growth, Risk, and Demand Analysis – This chapter discusses the pressures on the fire system, including an analysis of future population changes and a projection of demand. These factors are important in evaluating future viability of the system and identifying resource needs related to future demand.

Chapter IV, Response Time, Fire Hall, and Apparatus Location Analysis – This section discusses fire suppression, including discussions of the command structure, staffing, leave and overtime, and the deployment of apparatus and staff. This chapter concludes with a presentation of deployment options.

Chapter V, Fire Operations, EMS, and Training – This chapter presents a geographic information system (GIS)-based analysis of station locations and resource deployment. The models are used to propose a slightly modified station configuration for the city that meets the demand while reducing redundancy of stations and apparatus coverage. This chapter also contains an in-depth review of response times.

Chapter VI, Fire Prevention, Investigation, and Public Education – This chapter discusses fire prevention and investigation functions. Included are organization, management, civilian vs. uniformed personnel, code enforcement and inspections, plans review, construction inspections, public education and fire investigations.

Chapter VII, Fire Apparatus and Facility Assessment – This chapter discusses the current state of fire and medical response vehicles and the assessment of the city's fire halls. This chapter includes recommendations for fleet and facilities upgrades and replacement.

Chapter VIII, Priority and Cost of Recommendations – This chapter includes a summary table of all recommendations and the evaluation process used to prioritize each recommendation. This section also includes a table comparing the current VFRS staffing level to that which is recommended by the analysis. Estimated costs for capital projects and personnel are also included in Chapter VIII.

II. MANAGEMENT AND SUPPORT

Administration and support activities are staffed primarily by civilian personnel. The fire department has an excellent cadre of civilian administrators and support staff. However, civilians are often seen as auxiliary personnel rather than integral to the effective management of the organization. Intentional or not, contributions by civilian staff members are not held to the same esteem as those of ranking uniformed personnel. Likewise, the culture of senior fire officials is to focus their primary attention on operational matters often at the expense of understanding and addressing management-related issues, which are often not understood and thus turned over to the civilian staff to address.

To its credit the current administration encouraged a change in the department's culture, going so far as to change some job titles to assistant general manager. On the positive side, the talent level and expertise among the civilian support staff and managers is excellent. Just as important, most civilians have been cross-trained to perform different jobs, and thus they can fill in at other positions, which contribute to a more efficient business-management function.

Important decisions about budgets and funding, human resource management, and information technology, although appropriately delegated to civilians, are underappreciated by the senior uniformed managers who do not understand these areas as much as they should. Consequently, there is a gap between the business side of VFRS management and the operational side. In the past, senior fire officers have come to administration without basic computer skills, which compounds the problem because they are unable to access important information.

Civilian managers and the fire chief have been encouraging senior fire officers to become more involved in business decision-making. For example, senior staff meetings are now conducted which should help bridge the gap. Likewise, there is problem with information flow from senior fire managers, who are exempt employees, with those in the union. We found that many firefighters were not very familiar with the 'on-goings' of the fire department with the union, not management, taking the lead on getting information to firefighters about departmental initiatives.

In VFRS, civilians are the lead administrators for finance and budget, human resources and information technology. With special training and educational credentials, these folks bring a wealth of knowledge and experience. This is a positive aspect of the current organization since many large fire departments still have uniformed officers' in-charge of these functions. That VFRS has transitioned to civilian managers in these roles is good because it expands the applicant pool of potential candidates to fill these positions. Still, senior uniformed members

need more exposure to these areas and they should be expected to address these areas when it involves their division.

On the negative side, VFRS does not require senior fire leaders to have a college degree, or equivalent, and thus they get little exposure to topics such as budgeting and human resource management prior to becoming senior executives. Best practice organizations require those aspiring to senior-level positions to have a college degree or at least relevant training in personnel, budgeting, and planning. When these are integrated within upper management's skill set, better organizational performance results. Just as importantly, education and training in business-related areas helps prepare senior leaders for greater responsibility, which is important for succession planning.

The 'Achilles heel' for VFRS is data collection and using data for decision-making. Effective planning relies on good data and its analysis. In most instances we found that data collection was not very good and where data is available, it does not appear that it is being used to any great extent for management decision-making. There are also problems with inconsistent data and errors within the same data set, probably because different individuals are collecting data, often from different sources or classifying it differently. Where data is available, it is often not in a format that allows it to be used for decision-making.

Major Strategies

To improve the department's planning, management and accountability, the following strategic goals are relevant for consideration:

1. Expand the training for senior fire managers to include topics such as finance and budget, human resource management, data analysis and the use of computer systems.
2. Cooperatively, management and labour should evaluate the promotional process, which at some point should be adjusted to include post secondary coursework as part of career development.[1]
3. Transition management accountability such that senior fire leaders assume more responsibility for managing their respective budgets, personnel, and line items; also realign the budget to reflect the table of organization.
4. Improve the flow of information within the organization; top-down and bottom-up.

[1] A review of the promotional system is not within the scope of this study. However, because of its relative importance to future leaders and the VFRS organization, such a study should be conducted.

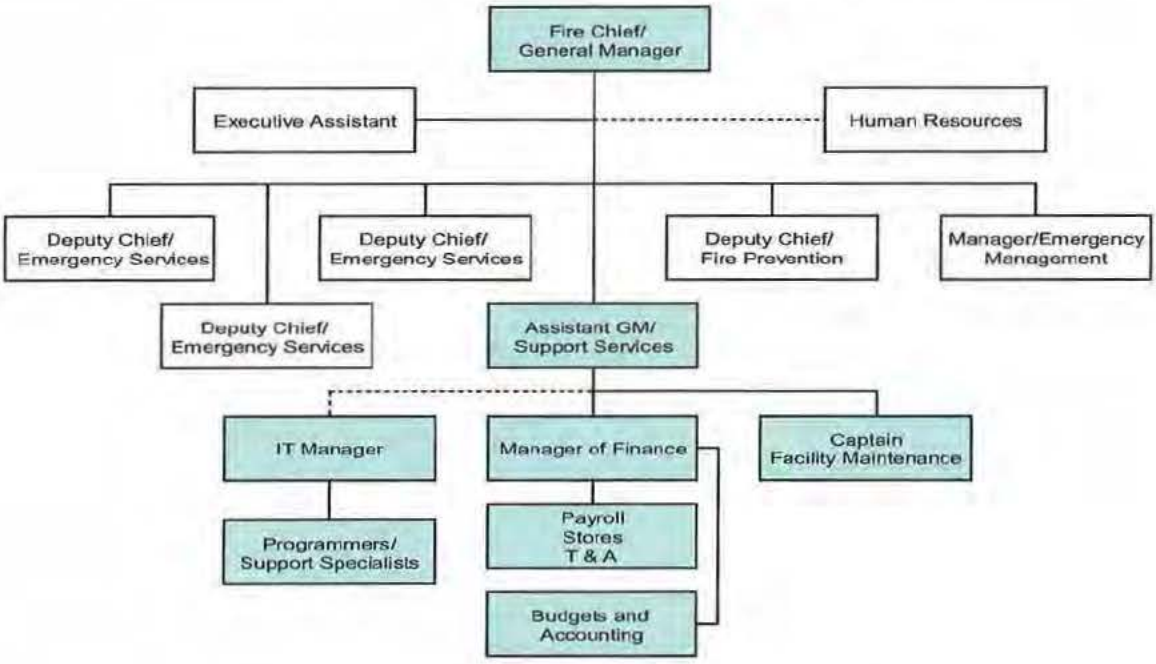
5. Reorganize the IT function internally and establish an IT plan to monitor major activities. At the same time, improve data analysis, and adopt performance measures for the same activities.
6. Reorganize support services and include a new planning section under the AGM.

Organization

VFRS is organized similar to other metro-sized fire departments. Five assistant general managers (AGMs) report to the fire chief, who is considered the department's general manager. Four AGMs are uniformed (deputy chiefs) and one is a civilian. A civilian manager of Human Resource Advisor also reports to the fire chief.

Figure 1 depicts the table of organization for the first level of management and Support Services, which is the focus of discussion in this chapter.

Figure 1: Organization of Support Services



The civilian (AGM) is responsible for the department's support services. In the current table of organization, the incumbent has overall responsibility for finance, facilities maintenance and information technology. There are three managers reporting to the AGM; one each for finance, information technology, and facilities maintenance (a uniformed captain).

The finance section has 10 employees, not including the manager. These individuals are responsible for supply, equipment storekeeping, time entry and attendance, payroll, purchasing, accounting and budgeting.

In addition to a manager, two programmers and two support specialists are assigned to the IT function. These positions are funded by corporate government and report to Corporate IT but also liaise with the AGM.

The responsibilities for IT include managing the department's servers, application systems and network requirements for the operation's specific needs; providing projects, software and hardware support to 22 sites. City standard hardware, software and network systems are maintained by Corporate IT staff, while Fire IT provides guidance to the department in following city standards. Computer requirements are coordinated through the IT Manager. The problem for IT is the dual reporting relationship and there is not a not a single point-of-contact for all IT projects and plans within VFRS.

Facilities maintenance is coordinated by a fire captain, who also reports to the AGM.

Following are the FTE positions authorized for Support Services.

Table 1: FTE Positions, Support Services

Position	Assignment	Exempt	Non-Exempt
Assistant General Manager	Support Services	*	
Manager	Finance & Administration	*	
Manager[2]	Information Technology	*	
Captain	Facilities Maintenance		*
Administrative Assistant IV	Administrative Support	*	
Administrative Assistant III	Administrative Support	*	
Payroll Supervisor	Finance & Administration		*
Storekeeper I – Equipment	Finance & Administration		*
Storekeeper I	Finance & Administration		*
Account Clerk II – Accounting	Finance & Administration		*
Payroll Clerk II	Finance & Administration		*
Storekeeper – Fire Department	Finance & Administration		*
Clerk III – Attendance	Finance & Administration		*
Driver Stores – Worker	Finance & Administration		*
Clerk Stenographer IV	Administrative Support		*
Clerk Typist III	Administrative Support		*
Clerk II (Vacant)	Finance & Administration		*
Clerk Typist II (Vacant)	Finance & Administration		*
Clerk III (Temporarily assigned to training)	Finance & Administration		*

[2] The manager of IT is funded by and reports to Corporate IT but is shown here for clarity.

Position	Assignment	Exempt	Non-Exempt
IT Programmers (2)	Finance & Administration		*
IT Support Specialists (2)	Finance & Administration		*
Clerk Typist II (Assigned to fire prevention)	Administrative Support		*
Clerk IV (Assigned to fire prevention)	Administrative Support		*

Including the AGM and managers for IT and finance/ administration, 25 FTE positions are allocated for support-related activities. Two positions are currently vacant and one position is temporarily assigned to assist at the training division. Five positions with access to sensitive management information are exempt.

Overall the support staff is sufficient for the workload and the present staff level is adequate to meet the department's current and near future needs. Most of the clerical and account staff are cross-trained in multiple areas. This is a good approach which allows flexibility. The coordination of activities within support services is also good; however, current vacancies for a Clerk II and Clerk Typist II do present challenges for the staff to juggle multiple responsibilities.

Recommendation 1: Fill the vacancies for Clerk II and Clerk Typist II.

As mentioned a fire captain is currently responsible for facility maintenance. The effectiveness of facilities management is not very good and the incumbent spends most of his time handling service calls for repairs from station officers, contacting vendors, and coordinating work efforts. Like other areas, there is little data about maintenance programs and costs. Planning is also not very good and facilities management is mostly reactive, not proactive. It is our opinion that the position could just as easily be filled by a civilian.

For a large and decentralized organization there is a need for someone to coordinate building repairs and maintenance. However, this could be done by a civilian just as easily and at a lower cost when salary and benefits are factored together.

Recommendation 2: Through attrition, replace the current fire captain in charge of facilities with a civilian. An alternative is to transfer the responsibility to central government which already performs already provide HVAC maintenance and janitorial services at Fire Hall 1 (headquarters).

Internal Processes

Critical internal processes include budgeting, time entry and attendance, payroll and IT.

Budget – Understanding and developing budgets are crucial to establishing accountability, operational efficiency and effectiveness and to developing future management expertise. With the exception of the deputy chief of prevention, deputy and assistant chiefs do not have accountability for their budgets even though the department's budget is logically

organized by division. Part of the problem stems from a license issue with the accounting platform (SAP) used by the city.

The fire department has also not been particularly good at planning for capital improvements such as new apparatus because the deputy and assistant chiefs did not meet regularly to discuss major issues and department needs. Fortunately the situation has improved and senior staff members are now engaged in regular discussions on executive topics such as the budget.

Recommendation 3: Include deputy chiefs in the budget development process by having them prepare (and defend) budgets for their respective divisions.

The level of detail within the fire department's operating budget is good. Programs within the operating budget are laid out nicely and there are sufficient line items to track expenditures within programs. The operating budget generally mirrors the fire department's table of organization, which is also a good practice. If in the future VFRS ever reorganizes, it should also modify the operating budget to reflect the revised table of organization.

One negative is that overtime is being accounted for within the training division program when it is actually used for overtime in fire operations. Quarterly transfers are made from the training division program to the 'fire halls' program to cover overtime. Program budgets for the various divisions should reflect the actual funding levels needed to support the program. Although budget transfers may be necessary to cover unforeseen contingencies, they should not become routine.

Following is one example of how the budget might be re-organized for better accountability. To show this we used a new table of organization which we discuss later.

Table 2: Example of Budget Realignment[3]

Cost Center	Lead Executive	Program Responsibility
Office of the Fire Chief	GM/ Fire Chief	All
Emergency Services	AGM/ Deputy Fire Chief	Fire Halls – General Fire Hall – Supplies Marine Firefighting EMS Training
Emergency Management	AGM/ Deputy Fire Chief	Special Operations USAR DFPS/ Preparedness 9-1-1 Communications

[3] The example of the budget alignment in Table 2 follows a proposed table of organization discussed later in this chapter.

Cost Center	Lead Executive	Program Responsibility
Fire Prevention	AGM/ Deputy Fire Chief	Code Enforcement Fire Investigation Public Education
Executive Services	AGM/ Civilian	Human Resources Payroll Planning & IT Fleet Services

Recommendation 4: Revise the organization of the operating budget so that funding levels for each function are reflective of what is needed to provide the desired level of service, rather than having overtime, say, for one function in another program budget. At the same time, realign the operating budget such that it includes the specific programs within each cost center. In addition to better cost accounting for the various programs, improved accountability will also be achieved from those responsible for the four major cost centers, who ultimately report to the fire chief.

Reportedly, there may be reasons such as corporate restrictions to limit changes to the way the budget is organized. Wherever possible however, the budget for each division should be an accurate representation of the actual costs to deliver services, including overtime.

Payroll – The payroll process is highly organized and efficient and provides very good support to department managers. A previous proposal was made to incorporate fire payroll into city payroll but this move was not made. Because of overtime and contractual language, fire payroll accounting is often the most complex payroll process in most cities. For this reason it should remain a specialized function within administration.

The support provided to operational command and other support functions is very good. Payroll has begun to train new battalion chiefs in payroll and attendance reporting which is a practice that should be continued. Payroll and attendance issues are communicated from payroll to and from fire fighters by battalion chiefs. Payroll coordinates with the training department and communicates daily with time-entry staff.

Payroll also serves as an information source for fire administration and human resources and as a resource for deputy chief and human resources for past and current practices. Four times a year, 'mini-editions' of recent staff alterations is prepared by a deputy chief and distributed to the fire halls. The communication between payroll and corporate human resources and payroll is good as there are bi-weekly meetings with corporate HR, Sustainment Team Lead and corporate payroll.

No changes are recommended for the payroll function.

Time Entry and Attendance – Time and attendance is a very labour intensive manual process and as such probably provides the greatest opportunity of any of the administrative processes for increasing efficiency through use of a computer system. The current process has multiple data entry levels and information is also relayed via voice mail from battalion chiefs to the clerks who enter the information. Staffing needs for each shift are derived partly from personnel reporting off sick and these together are part of the time entry reporting process.

Recommendation 5: Evaluate (and purchase) available software products for time and attendance reporting and scheduling specifically designed for fire departments. Commercially available systems have the capability to customize leave rules based on union contracts and city policy. It may be possible for employees to directly enter leave requests report off sick into these systems, which is then used to call other personnel for needed overtime. The time saved by battalion chiefs not having to schedule personnel could then be used to improve the department's pre-planning activities.

Information Technology – Information technology is not fully integrated into the decision making and management of the department. Information technology management does not participate in weekly staff meetings, nor does it really plan or implement major computer projects within the fire department operation, areas where it should be the lead. An example is the recently implemented fire data management system (FDM), which was led by an assistant chief without much support from IT. Information technology solutions to management issues can potentially have the largest impact on improving efficiency and effectiveness. All information technology projects should be planned and managed by IT professionals with strong support from business users.

Recommendation 6: Establish an Information Technology Steering Committee made up of top officers and managers from all departmental functions to develop a long range IT plan, establish IT priorities and monitor IT activities.

Computer systems within VFRS must be able to access information from other city departments and they should not duplicate already available programs. For example, fire code inspection and building code inspection can use the same computer system when the data can be accessed by address as well as by permit number. Reportedly, property related data, including address history, permits, and occupancy owners, are available to the fire department. However, there are other software applications of value to the fire department, particularly for planning.

Recommendation 7: Incorporate, as a first step in planning new software systems for use in VFRS, evaluation of the potentially suitable computer systems already used (or planned) in other city departments.

Planning within the VFRS is not a central function even though there are well-qualified individuals working on various aspects planning for their individual function. Effective planning

relies on good data and a concentrated effort to use data for planning purposes. The current approach is not working and the use of data to manage the organization and the various divisions within is not at the level one would expect for a large organization such as VFRS. Part of the problem could be the recent changeover to a new computer system (FDM). However, there were too many episodes where data is being collected by different individuals and the department cannot point to one individual with the overall responsibility for planning.

The absence of a centralized planning function hinders 'forward-thinking'. As a result, VFRS reacts to problems rather than being out in front. A key part of planning is collecting data and then using it to make decisions. There is also a need to have qualified technicians such as Geographic Information System specialists' and someone who can provide research and write reports. Although the city already has a GIS department, they were less than familiar with the fire department's operation. Likewise, their workload was such that we had difficulty getting GIS information for this project. Planning should also include someone familiar with the finance and budget systems.

Recommendation 8: Create a planning section under Support Services. This section should include the current IT staff, a GIS analyst, and a staff analyst. The facilities maintenance coordinator should also be assigned here since a major part of facility management is planning for capital facility maintenance, upgrades or replacement.

Human Resource Management – The human resource consultant is paid out of the city HR budget. Organizationally, the incumbent reports directly to the fire chief. He does not participate in department staff meetings, which is unusual because of the importance of HR on just about every decision the department might make. As a practical matter, the key function performed by the HR manager is to handle department grievances.

There are also areas where HR should be involved more such as updating position descriptions, improving internal communications, improving career development, or developing programs to improve employee relations in the workplace. That HR is mostly reactive should be a concern, as it is for planning. As a core management function a better fit is probably to have it report to the AGM, Support Services where its core responsibilities should be expanded.

Recommendation 9: Reorganize HR under Support Services with the individual responsible for HR activities reporting to the AGM. The current situation is such that HR expertise is not being used to the extent it could to assist top management. Examples of gaps include developing position descriptions and career paths, improving internal and external communications, and monitoring/ improving employee morale.

Internal Communications – Internal communications are poor and there is a palpable disconnect between fire management and fire fighters. For the most part, management does not communicate directly with fire fighters and they do not take time to meet informally

with firefighters in the fire halls. These are missed opportunities to get first-hand opinions and information. Fire fighters obtain information about the department mostly through union representatives or through official policy directives. Although both are okay, policy directives rarely give the 'why' for a certain policy. For the union, it may not know the entire slate of reasons, or it may 'spin' information to meet its objectives. We found many firefighters who appeared to be 'out-of-the-loop' on important issues.

Good news about the department or happenings in the department are rarely touted, thus many firefighters have a very negative view of fire management. Regular station visits by managers can solicit concerns from field personnel and my help dispel rumours and misunderstandings. Creation of cross-sectional committees for planning, information technology, etc. can also be used to increase the opportunity for communication between management and line personnel such that firefighters are included in departmental decisions.

Recommendation 10: Fire management should create direct channels of communication to firefighters through monthly news letters and impromptu visits to fire halls where they meet informally to discuss topics of interest to firefighters.

Proposed Reorganization

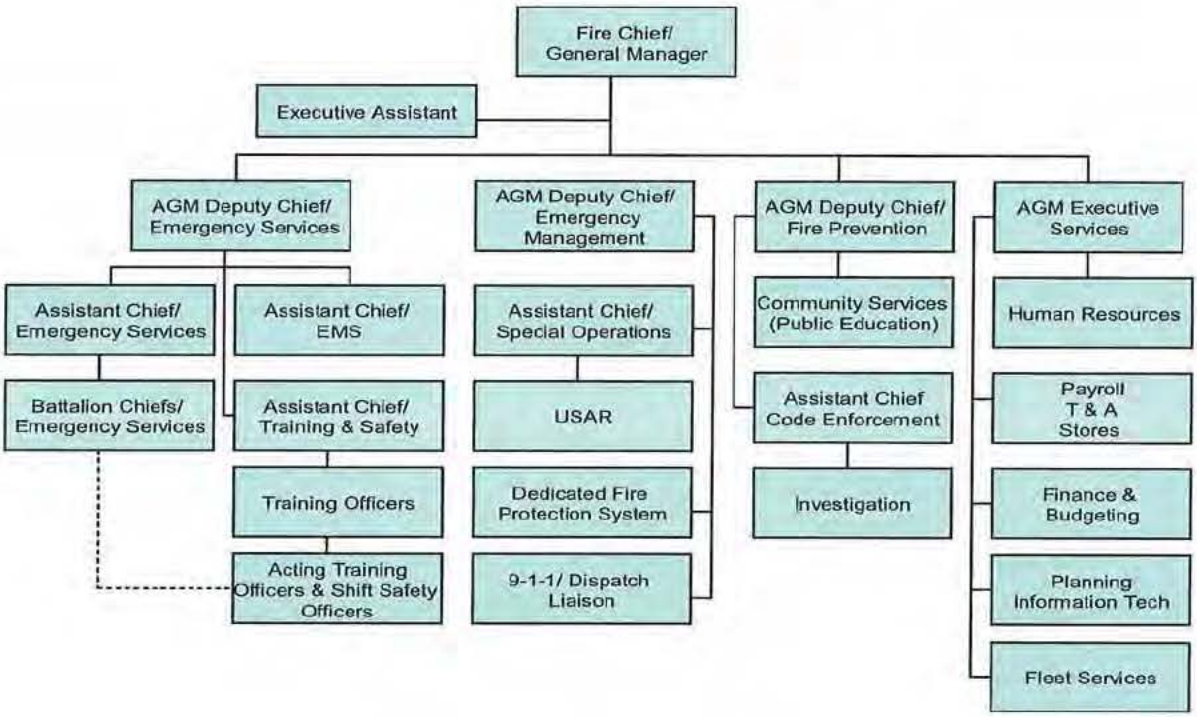
To improve the effectiveness of management and reduce the span of control, VFRS should consider the possibility of reorganizing. A proposed new table of organization is depicted in Figure 2, but other variations might be considered to the same end, such as putting training under emergency management.

Major elements of the proposed reorganization include:

- Reduction of deputy chiefs from four to three
- Increase of assistant chiefs from six to eight (four on shifts)[4]
- Creation of a planning unit and HR under the AGM, Support Services
- Addition of a GIS and research analyst for planning
- Consolidation of Special Operations and USAR

[4] The increase of assistant chiefs from six to eight depends on whether the department merges training and EMS under one assistant chief as we recommend in a later chapter. In that case, the number of assistant chiefs would increase from six to seven.

Figure 2: Proposed Organization of VFRS



Discussion of the particulars concerning reorganization for functional areas such as prevention and emergency services are discussed within the various chapters of the report. Organizational charts for these functions are also included to provide the additional detail needed.

Performance Measurement and Best Practices

The use of performance measurement is a relatively new process for the fire service. Widely adopted by government agencies for areas like public works where outputs are easily measured, its use among emergency service organizations is new and few are using performance measurement effectively. Part of the reason is because fire and EMS delivery is considered a public service. Even so, with fewer resources and greater competition among city agencies for them, VFRS should strive to articulate its performance more effectively and demonstrate the correlation between the communities' expectations, available resources, and performance outcomes.

As was mentioned there is a severe problem in the fire department of analyzing data. In many cases data is available but not in a format that makes it easily used. As a result it is often difficult for the organization to realistically determine how well it is meeting its stated mission and whether internal programs are meeting stated goals. Clearly, VFRS collects a lot of

information in many areas; however, little of the information is in a useful format. During this study we also found contradictions in data on many occasions.

Performance Measurement Development – On a city-wide and fire department specific basis, Vancouver should participate in a multiple city measurement programs such as the excellent International City Manager's Association (ICMA) government services measurement or use their measures as guides to establish measures for use in the daily management of the fire department.

Another excellent potential source or standards of performance measures for a specific fire function is the Ontario Fire Marshal's Office which has defined specific training standards, certification qualifications, and risk assessment programs. The OFM and ICMA both have as part of their approach a similar process. In the following section we give examples of such a process and examples form other cities.

Step 1 – Define service level objectives: Service level objectives should be defined for VFRS and for each the major functions within the department.

Corpus Christi, Texas, a city that participated in the ICMA program, identified three service level objectives that related to prevention services: (1) enforce fire codes, (2) perform fire investigations and (3) provide educational programs and presentations. It must be pointed out that these objectives would be better stated if they focused on the end results (e.g., reduce fires, reduce deaths and injuries caused by fire, and reduce property loss due to fires) which are better objectives than enforcing fire codes. The focus should be on the desired outcome or purpose of enforcing the fire codes not on the activity per se.

Step 2 – Define specific measures of performance for each objective: Under each service level objective, various measures evaluate what is being done to achieve the objective and, in some cases, how well it is being done. Under each objective, three types of measures should be evaluated:

1. Output or workload measures describe the amount of work done.
2. Efficiency measures evaluate the efficiency with which the work is done, i.e., the amount of work done per the amount of resources required to do the work.
3. Effectiveness measures characterize how well a function or activity is being performed, e.g., reducing fires, reducing fire losses, prosecuting arson cases, etc.

Using the Corpus Christi example, a few measures are identified below for each of the three service level objectives identified for prevention.

Service Level Objective (Example): Enforce Fire Codes

- Output or Workload Measures
  - Number of plans submitted in total and by type of plan
  - Number of fire inspections in total and by type of inspection
  - Number of 1st, 2nd and 3rd re-inspections performed
  - Number of unique buildings inspected
- Efficiency Measures
  - Number of plans reviewed per reviewer
  - Number of plans reviewed per hour
  - Number of inspections performed per inspector
  - Number of inspections performed per hour
- Effectiveness Measures
  - Percentage of plans approved within a specified number of working days
  - Percentage of plans requiring re-submittal
  - Percentage of existing buildings inspected per year
  - Percentage of existing buildings with fire sprinkler systems
  - Percentage of inspections requiring re-inspections
  - Percentage of inspections resulting in violations

Properly Interpreting the Results: It must be emphasized that care is required in defining measures and interpreting the results. For example, the question must be constantly asked if the measure or group of measures present a true evaluation of whether the objective is being achieved. If a small percentage of inspections result in all (or most) violations being corrected does this constitute a well-planned code enforcement effort? It could indicate one of several conclusions:

- There is a substantial degree of voluntary compliance.
- Inspections are not thorough and are not detecting violations.
- Inspectors are reluctant to issue violations.
- Policy may require multiple re-inspections to obtain compliance prior to issuing a written violation.

In Arlington, Texas for example, the degree of code violations as reflected by re-inspection rates was 49 percent (2,649/5,404) and 40 percent (1,767/4,385) over two years which appeared to be constant with customary re-inspection rates which often range between 30 percent

and 50 percent. However, a closer examination of the data revealed that Arlington's re-inspection rate only reflected re-inspections required due to life safety violations, not minor violations, such as out-of-date fire extinguishers.

The conclusion drawn from this data shifted from one that suggested fire code compliance in Arlington was acceptable or at least comparable to other cities to a serious conclusion that Arlington's voluntary code compliance was alarmingly low because 40 percent to 50 percent of the buildings inspected had life safety violations.

Other potential measures for other service level objectives are:

Service Level Objective (Example): Perform Fire Investigations

- Output or Workload Measures
  - Number of fires of suspicious or incendiary origin by type of fire
  - Number of open cases per investigator or investigation caseload
  - Number of fires investigated per investigator
  - Number of arrests by type of structure
- Efficiency Measures
  - Number of active cases being worked per investigator
  - Number of causes determined by fire companies
  - Percentage of fires for which a fire investigator was called out
- Effectiveness Measures
  - Percentage of fire scenes secured before evidence can be contaminated
  - Arson clearance rate
  - Juvenile fire setting clearance rate
  - Percentage of cases actually prosecuted of cases turned over for prosecution
  - Percentage of cases convicted of cases prosecuted

Comparisons to National Statistics: Investigation caseload (number of cases per investigator) is a workload indicator that can be compared nationally. A reasonable caseload has been found to be about 100 to 150 fires investigated per investigator. A reasonable weekly caseload per investigator is about one to two a week. As far as we can tell, Canada does not have a caseload indicator for investigators, so Vancouver could us U.S. information. A clearance or closure rate is the number of cleared arson cases as a percentage of the total number of arson fires. This is the most frequently used performance effectiveness measure for fire investigation.

Multiple Functions Impact Effectiveness: It should be emphasized that many effectiveness measures require multiple functions performing well to achieve success. For example, estimated dollar value of fire incident saved is dependent upon fire prevention requiring fire sprinkler systems in structures and enforcing the fire by-laws. Likewise, fire operations must limit the destruction after the fact and arson clearance rates are dependent upon good fire investigation work, police collection and storage of evidence, fire investigator testimony, prosecutors preparing cases and judges administering fines and other penalties.

Step 3 – Collect and report data monthly, quarterly and annually: Performance data for departmental functions and for VFRS overall should be presented in top VFRS management meetings monthly and should be included in annual reports. Performance evaluations of managers should include their function performance in achieving functional and departmental objectives.

Step 4 – Evaluate performance based on measures, explain changes in performance and modify objectives and measures to achieve desired results: All performance measures should constantly be evaluated to determine if they are measuring the intended results and are not creating unintended consequences in performance.

Performance Metrics by Function – To assist the fire department we developed a list of possible measures that could be used for the various functions of the organization (Table 3). Obviously the list does not include all of the possible measures. In addition to our ideas for measuring performance, we included some recommended by the International City/ County Management Association (ICMA) and the Commission on Fire Accreditation International (CFAI), which partnered with the ICMA to develop performance metrics for the fire service. Information pertaining to the ICMA performance measures and indicators can be found on the ICMA's website.[5]

Table 3: Performance Metric Examples

Functional Area	Examples of Performance Metric
Management / Administration	• Service delivery costs per capita • Cost per hour for administrative support • Ratio of staff support to managers • Staff hours per year for data entry: T &A; payroll; budget • Ratio of managers (uniformed and support) to line staff
Human Resource Management	• Average time to process a grievance • Average time to complete the grievance process • Percentage of grievances resolved before leaving

[5] http://icma.org/main/bc.asp?bcid=137&hsid=1&ssid1=50&ssid2=220&ssid3=325

Functional Area	Examples of Performance Metric
	management control (to arbitration) • Sick leave used per 1,000 work hours • Accident leave per 1,000 work hours • Accident leave per 100 incident hours • Working days/ hours for external recruitment • Working days/ hours to reclassify a position
Operations	• Time for the first-unit to arrive; 90th percentile • Time to assemble the entire first alarm assignment; 90th percentile • Time for application of water or extinguishing agent; 90th percentile • Time to complete primary search in a structure fire; 90th percentile • Time to complete ventilation; 90th percentile • Total unit time on-scene for each incident type (measures total workload) • Fire staffing per 100,000 population • Fire stations per square kilometre • Time from call to dispatch; 90th percentile • Time from dispatch to turnout (wheels rolling); 90th percentile • Fires per 100,000 population • Fire-related injuries per 100,000 population • Fire-related fatalities per 100,000 population • Fire personnel injuries per 1,000 incidents • Fire dollar loss per structure (residential and commercial) • Fire dollar loss per capita • Fire loss saved per planning area and property type
Training	• Average training cost/ employee/ year • Average training hours per responder/ year • Cost per hour of instruction per curriculum
Fire Prevention – Code Enforcement	• Rate of voluntary compliance (percentage of inspections performed without major violations) • Percentage of structures equipped with sprinkler systems • Percentage of residential structures with sprinklers • Percentage of existing structures inspected annually per inspector • Calendar days from initial inspection to full compliance • Code enforcement expenditures per capita • Calendar days from complaint to inspection • Number of inspectors per 100,000 residents • Number of inspectors per occupancy • Percentage of inspections verified by supervisor

Functional Area	Examples of Performance Metric
– Investigation	• Arson rates per 100,000 population • Fire investigators per 100,000 population • Arson clearance rates • Juvenile fire setting clearance rate • Total labour and overhead cost per fire investigated • Staff hours per fire investigation • Percentage of cases actually prosecuted of cases turned over for prosecution • Percentage of cases convicted (of those prosecuted)
– Public Education	• Fire safety educators per 100,000 population • Percentage of school aged population reached with fire safety programs • Percentage of senior population reached with fire safety programs • Percentage of adult population reached with fire safety programs • Percentage of population trained in fire extinguisher use • Percentage of population trained in AED use

In Table 4 we depict examples of best practices in a variety of areas, and the level to which VFRS is incorporating the best practice, if at all.

Table 4: Examples of Best Practices

Best Practices	Assessment
Current strategic plan complete with goals, objectives, and timetables.	Non-existent
Effective and efficient organizational structure.	Fair
Organization mission and vision statements.	In-place
Up-to-date website for the organization.	Good
Electronic mail accounts are in place for all personnel.	No; a decision by fire management was made not to provide email for all personnel
The organizational chart mirrors the department's budget and division managers are responsible for their area of the budget.	Good but improvement is needed
Policies and procedures are up-to-date and available to all employees; also maintained electronically	Fair
Policies are reviewed on a predetermined schedule and reviewed by others before implementation: legal, labour, HR, etc	No
Internal and external communication procedures are in-place and well understood; senior commanders routinely communicate with line personnel face-to-face.	No
A designated public information officer.	Yes
The city's by-laws clearly articulate the mission and responsibilities of the department to respond to and handle non-fire incidents including EMS, hazmat and technical rescue	No
Financial data such as overtime spending is collected and analyzed	Yes
The department has developed a 'staffing factor" based on leave data; it also analyzes the relationship between leave, overtime, and staffing.	No

Best Practices	Assessment
Annual and other leave such as sick, injury, FMLA, training are tracked in 'hours' and the data is analyzed.	Yes
The department has a plan and strategy to improve minority hiring.	Yes
The organization has a succession plan, even if an informal one; officers routinely mentor those within their sphere of influence about their future opportunities.	No
Position descriptions or written job statements are in place for all budgeted positions	Yes, but very outdated
Position descriptions are based on measurable knowledge, skills, and abilities (KSA's)	No
Promotional procedures and decisions about promotion are based on multiple factors including written examinations, assessment centers, performance appraisals, and seniority	No
Education and professional standards such as NFPA 1021 are required for most promotions.	No
Annual performance reviews are required for all employees and senior mangers review the performance reviews of employees.	No
Procedures clearly outline the process for employee counselling and discipline.	Yes, but revisions are needed
Depending on the type and severity of infraction, officers at all levels are involved in the counselling/ disciplinary process.	No
Cross-staffing of suppression and special services	Excellent
After action reports are completed on each incident including written command summary	No
Frequent drills are conducted at high-risk properties	No
Pre-incident surveys completed and up-to-date; information available to all units electronically	No
Fire inspector, investigator and public educator participate in after action review committee	No
Augment FT instructors with adjuncts/ shift personnel	Excellent
Officer rotation program to training division	No
Training division established as enterprise model	No
Use of certified instructors	Yes
Mandatory officer development program	Yes
Regionalized training	No
Documented training plan with goals, objectives, and resource allocations	Yes, but can be improved
Training capacity assessment	No
Smoke alarms are available at every fire hall; firefighters install the alarms and change batteries when requested	No
Pre and post-test fire education knowledge assessment	No

Strategic Planning – At the time of this study the fire department is making plans for a comprehensive strategic planning (SP) exercise. Although the process has not yet been determined, it is expected that representatives from all segments of the department will be

represented. Prior to the exercise it would be beneficial if each manager and representatives of the various programs compile a list of performance metrics and their ideas for 'best practices'. These could then be discussed by the committee and the best ones selected. The selection of these would give a good indication of the data sets that need to be collected.

To help with the SP process, the Center for Public Safety Excellence (CPSE), which is the coordinating body for the accreditation process for fire departments, has developed an excellent "three-year review and development process guide centered on the 10 categories that guide modern fire and emergency service agencies".[6] Specific areas covered by the guide include:

- Governance and Administration
- Assessment and Planning
- Goals and Objectives
- Financial Resources
- Programs
- Physical Resources
- Human Resources
- Training and Competency
- Essential Resources
- External Systems Relationships

We highly recommend this guide as part of the SP process. However, we do not recommend that the fire department attempt accreditation without assessing its cost and merit. Achieving accreditation is an expensive process. Likewise, the process requires excellent data, data which the fire department does not now have. However, using the CPSE guide will be of great benefit for the SP effort even if accreditation is not pursued.

Recommendation 11: Have managers of each function and other individuals involved in the SP process develop possible performance metrics and best practices for their area. From these, select the most appropriate use them to gauge department performance.

Recommendation 12: Use the CPSE guidebook as part of the SP process.

[6] http://publicsafetyexcellence.org/BestPractices/tabid/60/Default.aspx

Interjurisdictional Comparisons

To put a department's performance in perspective, it can be helpful to compare the department with other organizations that share similar characteristics. In doing so, department leaders can identify benchmarks that can be used to assess their own performance. When these comparisons are drastically different, further evaluation is required.

Jurisdictional comparisons can be difficult to interpret as there are many variables. No two jurisdictions are exactly alike in terms of geographic size and features, population dynamics, or governmental organization and services provided. However, many jurisdictions do share some similar qualities that are useful for comparison. While these comparisons are not direct indicators of departmental performance, they do provide a valuable function in assessing a department in relation to the performance of its peers. This direct comparison identifies organizational strengths and suggests areas for improvement.

The jurisdictions chosen for comparison all possess characteristics similar to Vancouver. The data were obtained from websites and direct contact with the departments and from surveys, Statistics Canada 2006, U.S. Census 2006 estimates, and other TriData research. We compared several different attributes, including stations and equipment, staffing and work hours, demand for service, fire loss, and cost per capita of operating budgets. Averages shown in the comparison tables were calculated without Vancouver included.

Stations and Equipment

With 20 fire stations, each station in Vancouver covers 5.7 square kilometres. As shown in Table 5, comparable jurisdictions average 11.0 square kilometres per station. One factor to consider in this assessment is the population density of the jurisdiction. Population density in Vancouver is more than twice that of the average of the other jurisdictions. Accordingly, Vancouver is serving nearly 29,000 residents per station as compared to an average of 20,361 residents. This data is displayed in Table 5.

Table 5: Comparison of Population Served per Stations

Jurisdiction	Population	Area Served (Square Km)	Number of Stations	Density (Pop/ Square Km)	Pop/ Station	Square Km/ Station
San Francisco, CA	744,041	119	42	6,245	17,715	2.8
Oakland, CA	397,067	145	25	2,738	15,883	5.8
Seattle, WA	584,454	215	33	2,719	17,711	6.5
Sacramento, CA	453,781	251	23	1,806	19,730	10.9
Fresno, CA	466,714	269	23	1,735	20,292	11.7

Jurisdiction	Population	Area Served (Square Km)	Number of Stations	Density (Pop/ Square Km)	Pop/ Station	Square Km/ Station
Brampton, ON	433,806	267	13	1,625	33,370	20.5
Portland, OR	537,081	347	30	1,548	17,903	11.6
Denver, CO	566,974	396	33	1,431	17,181	12.0
Winnipeg, MB	633,451	464	27	1,365	23,461	17.2
Calgary, AB	988,193	727	35	1,359	28,234	20.8
Edmonton, AB	730,372	684	24	1,068	30,432	28.5
Average	594,176	353	28	2,149	21,992	13.5
Median	566,974	269	27	1,625	19,730	11.7
Vancouver, BC	578,041	115	20	5,039	28,902	5.7

Each jurisdiction was also asked about the amount of apparatus staffed each day. Table 6 shows the number of engines, trucks, heavy rescues or squads, and quints. The total number of heavy apparatus is related to the population of the jurisdiction in the last column.

Table 6: Comparison of Fire Apparatus

Jurisdiction	Engines/ Quints	Trucks	Rescues/ Squads	Total Heavy Apparatus	Heavy Apparatus/ 10,000 Pop
San Francisco, CA	42	19	2	63	0.85
Oakland, CA	25	7	1	33	0.83
Seattle, WA	33	11	1	45	0.77
Sacramento, CA	23	8	1	45	0.99
Fresno, CA	22	7	1	30	0.64
Brampton, ON	13	1	4	18	0.41
Portland, OR	30	9	3	42	0.78
Denver, CO	27	14	1	42	0.74
Winnipeg, MB	29	5	6	40	0.63
Calgary, AB	33	11	9	53	0.54
Edmonton, AB	24	8	5	37	0.51
Average	28	9	3	41	0.71
Median	27	8	2	42	0.74
Vancouver, BC	23	5	7	35	0.61

Vancouver has fewer fire apparatus than all of the jurisdictions used in the comparison. Table 9 will show, however, that Vancouver responds to fewer incidents than their peers. Fewer apparatus could be explained by the lower demand for service, in part a result of sprinklering. Also, the higher population density of Vancouver makes it more efficient to provide fire protection services.

Staffing

There are several viewpoints from which staffing should be assessed. Total staffing, uniformed staffing, the ratio of uniformed to total staffing, and minimum on-duty staffing per 10,000 residents is depicted in Table 7. Total staffing includes both operational personnel and the support personnel who keep departments running as smoothly as possible, while uniformed staffing is those people whose primary job is staffing fire apparatus.

Vancouver is near the average in all but one category in staffing. In minimum on-duty staffing, and consequently minimum on-duty staffing per 10,000 residents, Vancouver is well below average. This is a function of the fact that, while Vancouver has a near-average figure for uniformed firefighters per 10,000 personnel, Vancouver firefighters work fewer hours per week than the average of the comparable jurisdiction. Work hours are identified in Table 8. Accordingly, as Vancouver has similar numbers of firefighters who work fewer hours than their peers, there are fewer firefighters on-duty.

Table 7: Staffing Comparison

Jurisdiction	Total Staffing	Uniformed FF (Career)	Uniformed FF/ 10,000 Pop	Minimum On-Duty Staffing	Minimum On-Duty Staffing/ 10,000 Pop	Percent of Total Staffing in Uniform
San Francisco, CA	1,616	1,368	18.4	307	4.1	85%
Oakland, CA	596	507	12.8	140	3.5	85%
Seattle, WA	1,109	1,030	17.6	207	3.5	93%
Sacramento, CA	629	550	12.1	156	3.4	87%
Fresno, CA	408	337	7.2	98	2.1	83%
Brampton, ON	401	348	8.0	57	1.3	87%
Portland, OR	723	675	12.6	169	3.1	93%
Denver, CO	955	914	16.1	203	3.6	96%
Winnipeg, MB	1,240	884	14.0	212	3.3	71%
Calgary, AB	1,289	1,126	11.4	215	2.2	87%
Edmonton, AB	982	888	12.2	180	2.5	90%
Average	904	784	12.9	177	3.0	87%
Median	955	884	12.6	180	3.3	87%
Vancouver, BC	819	744	12.9	134	2.3	91%

Table 8: Average Work Hours per Week

Jurisdiction	Work Hours Per Week
San Francisco, CA	48.7
Oakland, CA	52.0
Seattle, WA	42.0
Sacramento, CA	56.0
Fresno, CA	42.0
Brampton, ON	42.0
Portland, OR	53.0
Denver, CO	48.0
Winnipeg, MB	42.0
Calgary, AB	42.0
Edmonton, AB	42.0
Average	46.3
Median	42.0
Vancouver, BC	42.0

Demand for Service

Demand for fire department services is effectively assessed in terms of calls per 10,000 residents. Table 9 shows that Vancouver responded to 746 calls per 10,000 residents in 2007, well below the average of 1,106. Fire calls per 10,000 residents are almost 25 percent of the average of comparable jurisdictions, and calls for EMS are close to half of the average. Several factors could be responsible for these values, including the fact that VFRS does not respond on every medical call as some departments, particularly in U.S. cities sometimes do. Dispatch policy differences between various jurisdictions can also result in skewed results. In the following set, EMS calls per 10,000 population are lowest for three of four Canadian cities shown in the following table. Winnipeg, which provides EMS, is similar to that of other U.S. cities in the comparison set.

Table 9: Calls for Service per 10,000 Residents

Jurisdiction	Total Calls/ 10,000 Pop	Fire Calls/ 10,000 Pop	EMS Calls/ 10,000 Pop	Other Calls/ 10,000 Pop
San Francisco, CA	1,471	366	1,105	N/A
Oakland, CA	1,565	55	1,047	462
Seattle, WA	1,356	254	1,102	N/A
Sacramento, CA	1,561	53	1,273	235
Fresno, CA *2007	760	53	501	206
Brampton, ON	398	9	205	185
Portland, OR *2007	1,216	47	809	360

Jurisdiction	Total Calls/ 10,000 Pop	Fire Calls/ 10,000 Pop	EMS Calls/ 10,000 Pop	Other Calls/ 10,000 Pop
Denver, CO	1,498	41	1,041	417
Winnipeg, MB	1,360	240	1,121	N/A
Calgary, AB	504	25	237	242
Edmonton, AB	480	56	298	126
Average	1,106	109	794	279
Median	1,356	53	1,041	238
Vancouver, BC	746	27	417	303

Fire Impact

One of the primary missions of fire departments is to prevent and minimize property loss. Data was collected to identify the dollar amounts of fire damage reported annually by each jurisdiction. At the time that data was collected few jurisdictions had reportable information for 2008. Values for 2005 through 2007 are displayed in Table 10 in a per capita format. Figures for U.S. jurisdictions were converted to Canadian dollars on the last day of the calendar day for each year.

Table 10: Fire Loss Per Capita

Jurisdiction	2007 Fire Loss Per Capita	2006 Fire Loss Per Capita	2005 Fire Loss Per Capita
Oakland, CA	$21.58	$24.22	$22.88
Seattle, WA	$18.83	$14.88	$25.87
Sacramento, CA	$91.03	$74.93	$39.16
Fresno, CA	$58.47	N/A	N/A
Brampton, ON	$20.06	$20.52	$11.99
Portland, OR	$42.00	N/A	N/A
Denver, CO	$19.58	$33.30	$20.03
Winnipeg, MB	$73.28	$74.21	$64.40
Calgary, AB	$36.43	$33.39	$28.33
Edmonton, AB	$92.28	$48.74	$81.74
Average	$47.35	$40.52	$36.8
Median	$39.21	$33.35	$27.1
Vancouver, BC	$31.31	$39.55	$42.16

In 2007, Vancouver had well below-average fire loss per capita. In 2006 fire loss in Vancouver was very near the average, but in 2005, however, the figure was well above average. It is possible that these values are being skewed by isolated high-dollar loss incidents.

Another means of measuring the impact of fire on a community is fire deaths. Table 11 shows fire deaths per one million residents for the given years.

Table 11: Fire Deaths per 1 Million Residents

Jurisdiction	2008 Fire Deaths Per 1M Pop	2007 Fire Deaths Per 1M Pop	2006 Fire Deaths Per 1M Pop	2005 Fire Deaths Per 1M Pop	Average
Oakland, CA	8	3	15	8	8.5
Seattle, WA	3	2	9	14	7.0
Sacramento, CA	2	15	20	15	13.0
Fresno, CA	0	2	0	0	.5
Brampton, ON	0	0	2	0	.5
Portland, OR	N/A	9	0	0	3.0
Denver, CO	N/A	2	2	9	4.3
Winnipeg, MB	11	11	6	16	11.0
Calgary, AB	4	3	7	4	4.5
Edmonton, AB	1	7	5	15	7.0
Average	3.6	5.4	6.6	8.1	5.9
Median	4	3	6	8	4.9
Vancouver, BC	0	9	12	3	6.0

Over the past several decades Vancouver has made great strides in reducing what was a very high rate of fire death incidents. Legislation mandating the use of sprinkler systems has helped to bring the rates near or below national averages. When compared to similar jurisdictions, however, Vancouver has room for improvement. As Vancouver has no incident of fire fatalities in sprinklered structures, continued efforts in this field and in public education should further reduce the impact of fire on the community.

Cost Per Capita

Cost per capita for fire protection gives a rough indication of efficiency; it does not consider quality of service. Nevertheless, while many factors play into this ratio, it can be useful to compare peer jurisdictions. Table 12 shows comparative costs per capita and indicates that Vancouver, with an operating cost per capita of $137, is well below the average of $179. Providing EMS transport often results in a significantly higher cost per capita for service than is found in jurisdictions that do not provide this service. Four jurisdictions in Table 12 (San Francisco, Seattle, Sacramento, and Winnipeg) provide this service. Table 13 breaks out just those jurisdictions that do not provide EMS transport. Values for U.S. cities were corrected to Canadian dollars using the exchange rate from January 2, 2008.

Table 12: Cost Per Capita

Jurisdiction	Population	Operating Budget	Cost Per Capita, Canadian $	EMS Transport
San Francisco, CA	744,041	$197,000,000	$262	Yes
Oakland, CA	397,067	$108,000,000	$269	No
Seattle, WA	584,454	$152,107,993	$258	Yes
Sacramento, CA	453,781	$63,255,109	$138	Yes
Brampton, ON	433,806	$44,000,000	$101	No
Portland, OR	537,081	$85,409,580	$158	No
Denver, CO	566,974	$77,958,400	$136	No
Winnipeg, MB	633,451	$101,326,695	$160	Yes
Calgary, AB	988,193	$137,000,000	$139	No
Edmonton, AB	730,372	$115,600,000	$158	No
Average	606,922	$108,165,778	$179	-
Median	575,714	$104,663,348	$159	-
Vancouver, BC	578,041	$79,013,266	$137	No

Table 13: Cost Per Capita, No EMS Transport

Jurisdiction	Population	Operating Budget	Cost Per Capita, Canadian $	EMS Transport
Oakland, CA	397,067	$108,000,000	$269	No
Brampton, ON	433,806	$44,000,000	$101	No
Portland, OR	537,081	$85,409,580	$158	No
Denver, CO	566,974	$77,958,400	$136	No
Calgary, AB	988,193	$137,000,000	$139	No
Edmonton, AB	730,372	$115,600,000	$158	No
Average	608,916	$94,661,330	$162	-
Median	552,028	$96,704,790	$152	-
Vancouver, BC	578,041	$79,013,266	$137	No

III. POPULATION GROWTH, RISK AND DEMAND ANALYSIS

In this chapter, the factors that drive the service needs are examined to determine the capabilities necessary to adequately address the current risks and expected risk levels. The assessment of risk is critical to not only the determination of the number and placement of resources, but also to the mitigation measures that may be available to the fire department.

The goal of the risk assessment is to assign risk levels to different parts of the city. For this purpose we used the same 23 planning areas used by the Vancouver Planning Department, and shown in Figure 3. These areas roughly follow neighbourhood boundaries and there is a large amount of data and statistics collected for each of the planning areas.

Figure 3: Vancouver Planning Areas[7]

The analysis conducted using these planning areas considered population growth, demographics, development areas, fire risk, EMS risk, location of special hazard types, target hazards and demand for emergency services. The chapter concludes by summarizing all the risk assessment information by planning areas.

[7] Source: Vancouver Department of Community Services

Population Growth, Demographics and Development

It is anticipated that by the year 2021 Vancouver could have a population of over 645,000. Conversion of industrial areas has added to the city's housing capacity, and rezoning to allow new forms of higher density housing has followed from the City Plan Community Visions Program. Other housing is being created through higher density redevelopment of existing housing, and mixed-use schemes creating housing above commercial property. These are expected to be able to accommodate anticipated growth beyond 2031.[8] This growth also brings with it new challenges for the fire department.

Demographics[9] – Vancouver has been called a "city of neighbourhoods", each with a distinct character and ethnic mix. People of English, Scottish, and Irish origins were historically the largest ethnic groups in the city, and elements of British society and culture are still highly visible in some areas, particularly South Granville and Kerrisdale. Those of Chinese ethnicity are by far the largest representative group in the city, and Vancouver has one of the most diverse Chinese-speaking communities, with several Chinese dialects being represented, including Cantonese and Mandarin. There are also some neighbourhoods with high concentrations of single ethnic groups, such as the Punjabi Market, Little Italy, Greektown, and Japantown. Bilingual street signs can be seen in various neighbourhoods, including Chinatown and the Punjabi Market.

In the 1980s, an influx of immigrants from Hong Kong, in anticipation of the transfer of that former colony's sovereignty from the United Kingdom to China, combined with an increasing number of immigrants from mainland China and previous immigrants from Taiwan to create one of the largest concentrations of ethnic Chinese residents in North America.

This arrival of Asian immigrants continued a tradition of immigration from around the world that had already established Vancouver as the second most popular destination for immigrants in Canada (after Toronto). Other Asian ethnic groups in Vancouver are South Asian (mostly Punjabi, usually referred to as Indo-Canadian), Vietnamese, Filipino, Indonesian, Korean, Cambodian, and Japanese. It has a growing Latin American population, many from Peru, Ecuador and more recently, Mexico.

Since 1971 the profile of Vancouver residents has shifted away from the age extremes. The adolescent age group (0–19 years of age) decreased sharply from 1971 to 1981, but has been slowly increasing since then. But as more middle-aged people move into Vancouver, the

[8] Source: http://vancouver.ca/commsvcs/cityplans/populationhousing/insightsintopopulationhousing.htm
[9] Source: wikipedia article on Vancouver, http://en.wikipedia.org/wiki/vancouver

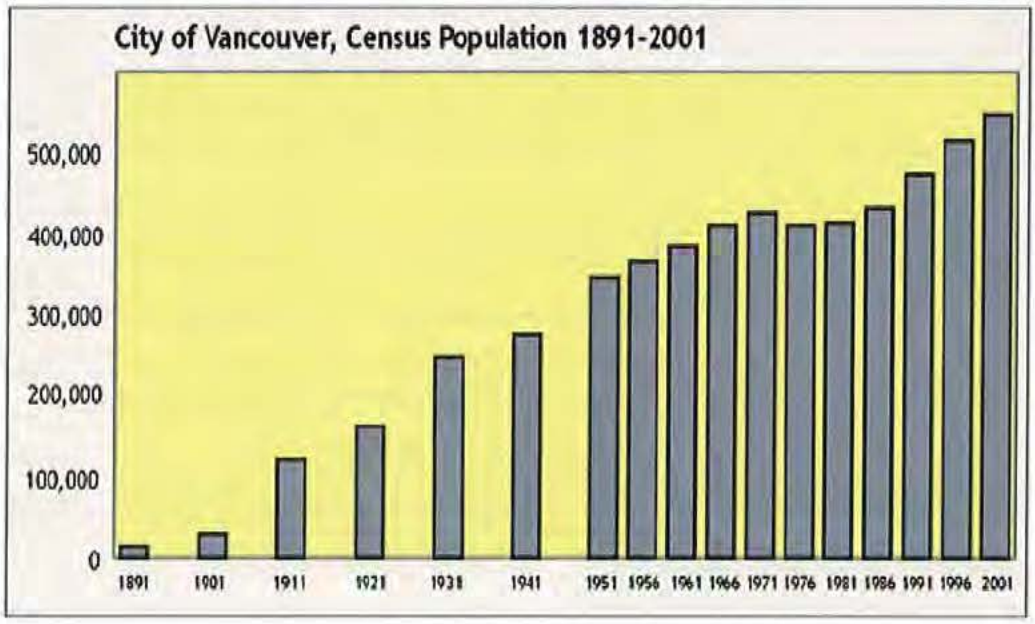
percentage of adolescents has decreased despite increasing population numbers. The elderly population shows the same trend. Despite the number of elderly (age 65 and over) increasing from 57,573 in 1971 to 70,320 in 2001, the percentage of the Vancouver population over the age of 65 has actually decreased from 13.5 percent to 12.9 percent. Although city-wide Vancouver is a relatively middle-aged city, there are planning areas that have very large elderly populations. Aging populations often place a higher burden on EMS services. This is discussed further in the EMS risk evaluation later in this chapter.

Table 14: Young and Old in Vancouver[10]

Year	Aged 0–19		Aged 65+	
1971	116,835	27.4%	57,573	13.5%
1981	88,580	21.4%	63,220	16.3%
1991	92,040	19.5%	66,000	14.0%
2001	101,255	18.6%	70,320	12.9%

Population Growth – In the past 30 years Vancouver's population has been growing steadily, and is now approaching 600,000. Population growth is currently averaging 6,000 more people in the city every year. The following table and graph show the population growth of the City of Vancouver and the metropolitan area using census data from Statistics Canada.

Figure 4: Vancouver Population, 1891–2001[11]



[10] Source: Vancouver Department of Community Services
[11] Source: Vancouver Department of Community Services

Table 15 shows the population growth by individual planning areas.

Table 15: Actual and Projected Population by Planning Areas, 1981–2021

Planning Area	1981	1986	1991	1996	2001	2006	2021
Arbutus Ridge	12,418	12,285	13,058	14,045	14,515	16,145	16,000
Downtown	6,256	5,910	8,880	17,408	27,937	43,415	68,500
Dunbar-Southlands	18,810	19,190	20,354	21,417	21,308	21,450	22,500
Fairview	17,489	20,945	24,321	26,619	28,403	29,295	32,500
Grandview-Woodlands	25,024	25,685	28,055	29,215	29,085	28,205	29,000
Hastings-Sunrise	26,906	27,545	29,771	31,091	33,055	33,130	35,000
Kensington-Cedar Cottage	34,087	35,950	39,944	42,399	44,556	44,665	47,500
Kerrisdale	12,169	12,355	13,093	13,604	14,033	14,615	14,500
Killarney	16,744	20,210	21,389	24,415	25,785	27,180	34,000
Kitsilano	30,273	32,075	34,533	36,578	39,386	40,595	42,000
Marpole	16,651	17,350	19,453	21,728	22,416	23,785	24,500
Mount-Pleasant	20,205	21,000	22,644	23,694	24,539	23,615	38,000
Oakridge	10,018	10,140	10,560	11,370	11,739	12,725	14,500
Renfrew-Collingwood	30,552	31,595	35,204	41,781	44,946	48,885	47,500
Riley Park	18,195	18,410	20,332	21,709	21,998	21,815	24,500
Shaughnessy	9,347	9,200	9,268	9,088	9,012	8,900	9,500
South Cambie	5,900	6,105	6,429	6,740	6,996	7,070	10,500
Strathcona	10,580	10,825	11,423	11,645	11,537	11,920	12,500
Sunset	24,560	25,210	29,214	31,327	33,423	35,230	34,500
Victoria-Fraserview	21,160	21,795	24,149	25,703	27,152	29,200	28,000
West End	36,950	37,050	38,408	40,940	42,154	44,560	46,000
West Point Grey	11,255	11,540	12,732	12,884	12,911	12,990	15,500
Vancouver	415,549	432,370	473,214	515,400	546,886	578,041	647,000

Development – This section explores growth areas of the city. As will be discussed in the EMS risk section of this chapter, population growth is almost directly proportional to the number of EMS incidents. Understanding the expected population changes before they occur help the fire service to prepare for changes in service demand. Furthermore, it is necessary to plan adequate fire service protection for new buildings. New development and growth areas were considered in the evaluation of fire hall and apparatus locations.

Development in the Downtown Core: The major development theme in Vancouver is that the downtown area has had a rapidly increasing residential population since the mid 1970s. Prior to that time, the downtown area was almost entirely commercial with a large daytime worker population, but few permanent residents. In 1981, there were only about 6,000 residents. By the 2006 census, this number had increased to 43,000 and it is estimated that an additional

15,000 population has been added since the last census. It is expected that there will be about 70,000 residents in the downtown area by 2021.

The West End (just west of the Downtown planning area) is also considered part of the Downtown Peninsula, but unlike the downtown planning area has always been a predominantly residential area. The West End had about 37,000 residents in 1981 which has increased to 44,000 in 2006. This growth is very moderate when compared to the Downtown planning area.

The downtown residential explosion began in the mid 1970s when the city council determined that some additional housing would be advantageous in the downtown area (where previously it had not been encouraged outside the West End). Several downtown industrial and semi-industrial areas were rezoned to encourage a mix of uses in parts of the Downtown, opening the door for residential development. These formerly industrial areas have been rapidly developed over the last several decades.

Development in Former Industrial Areas: The City of Vancouver has sought to increase housing opportunities by rezoning industrial land released for housing. Many of these developments have already been completed (or are close to being completed).

- **North False Creek** – This area was originally converted from an industrial area into the location of the 1986 World Expo. Starting in 1991, developers started building residential towers in this area. These residential tower projects account for much of the downtown population growth up to this point.
- **Downtown South** – Downtown South is 88 acres of land (excluding streets) at the south-eastern end of the Downtown Peninsula on the edge of the Central Business District. From 1991-2001, 22 high-rise towers were completed. Since then, at least 17 more buildings and 5 more towers have been completed. It is estimated that this project has already added 20,000 new residents and will add an additional 5,000 residents over the next couple of years.
- **Coal Harbour** – This area has been developed with residential towers to the west and an 8-acre park, marina, and seawall walkway along the waterside. It is estimated that this development project has already increased residential population by 10,000. There are plans for three additional residential towers, one of which is already under construction.

Development in Former Industrial Areas: Two further industrial areas are beginning to be redeveloped: South-East False Creek, by Cambie Bridge, and the former Weyerhaeuser site on the Fraser River near Boundary Road, with capacity for over 10,000 units on 190 acres. The city's remaining industrial areas are intended to stay in industrial use.

It was possible for Vancouver to grow at such a fast rate because of its rezoning of industrial areas. The remaining industrial areas are, however, necessary and in high demand (currently there is only a one percent vacancy rate for remaining industrial areas). Once this last wave of industrial area redevelopment is done, that will be it. Further growth will have to come from rebuilding and infill and is expected to be much slower.

- **Northeast False Creek** – This project centers on the current location of the casino and BC Place. The plan is to rebuild the area with 10 residential towers and either an art gallery or some sort of cultural building. Four of the residential towers will be located at each corner of the football stadium
- **St. Paul Hospital Complex** – Currently, the St. Paul Hospital is located on the downtown peninsula, but there is the possibility of a new St. Paul Hospital complex at the corner of Main Street and Prior Street by the train station. This could potentially bring 4,000 new jobs to that area.
- **Southeast False Creek** – This project will develop the southern portion of False Creek between Cambie Bridge and Main Street with several residential towers. These new residential towers (each approximately 15 stories tall) will house a total of 10,000 new residents. This project will initially be used as the Olympic Village for the 2010 Winter Olympics.
- **East Fraserlands** – This is a former Weyerhaeuser industrial area that is being converted into a large residential complex. There will be a mixture of residential skyscrapers and lower rise (6-8 stories) buildings on the waterfront along Marine Drive. It is expected that this project will bring about 10,000 new residents to the area.
- **False Creek Flats** – Although the area has not been officially rezoned, there are plans underway for redeveloping this area near the western end of the rail yard (by the train station) into commercial space. This project may bring several thousand new jobs to this area, mostly in low-rise commercial buildings.

Other Development: Not all the development in Vancouver is the result of rezoning industrial areas. There are also parts of the city where there is growth as a result of repair and infill. Some of these projects are discussed below.

- **Central Business District** – Located at intersection of Pender Street and Granville Street and spanning approximately four blocks, the central business district is in the process of being rebuilt. It is expected that, through building replacements and infill, enough new commercial space will be created to take on 25,000 new daytime workers.
- **Burrard Street between Drake Street and Davies Street** – It is expected that three or four residential towers be built in this area over the next couple of years. Should the new St. Paul's Hospital complex be built (mentioned earlier); the current hospital (at this location) may also be turned into a residential tower.
- **Foot of the Granville Bridge (downtown side)** – The cloverleaf exit ramps at the foot of this bridge will be removed, making room for four residential towers.
- **Chinatown** – Chinatown is the location of many old heritage buildings. Although there are no plans to redevelop this area, there are plans to provide seismic upgrades to many of the buildings.
- **University of British Colombia** – As a result of several residential projects, it is expected that 25,000 to 30,000 new people will move into the University area.
- **Sky-Train Expansion** – Two of the Sky-Train lines are currently being expanded. The Canada Line is being expanded down Cambie Street and will eventually connect to the airport. Moderate commercial and residential development is expected at some of the new station nodes (Marine Drive, Oakridge, and Broadway Stations). The Millennium Line is being expanded along West Broadway and will extend all the way to UBC. There may also be some commercial and residential intensification along this line.
- **Laneway Housing** – This is not a development project per se, but rather a change in ordinance that will allow people with single-family housing to build residential structures on the alley side of their properties. For the most part, this means people will be converting their garages into residential space. These new residential spaces can be a maximum of 1.5 stories and must be built to new (and often higher) building and fire codes. There also has to be access down the side of the house for the fire department to get water from hydrants to the alley side of the property. Because these

conversions will cost approximately $150,000, it remains to be seen how popular these conversions will actually be.

Impact of Development on Fire Service: Some of the residential projects mentioned above are drastically changing the face of their planning areas. The biggest challenges for the fire department will be meeting the EMS needs of these areas with their larger residential population—the required sprinklering will limit their impact on fire service demand. The fire halls on the downtown peninsula and those covering the area around False Creek are already some of the busiest. The question is: are they adequately staffed and reasonably well located so as to meet the increased emergency services demand?

Fire Halls 1, 2, 3, 4, 6, 7, and 8 will be the most affected by all the development projects mentioned above. Fire Hall 8 will be particularly affected by large population growth. Fire Halls 1 and 3 are closest to the new Southeast False Creek development, but have a fair amount of travel distance to this location. The increase in demand and appropriateness of these fire hall locations will be addressed in later chapters, but it is clear that the fire department will have to make some deployment adjustments, particularly to meet EMS demand, for these new growth areas in the downtown core.

The other growth area is the South Fraserlands project near Fire Hall 5. Although this is a very large project, we will see later in this chapter that there is not currently heavy demand for emergency services in this area. Fire Hall 5 should be able to handle the additional demand placed on it by this project.

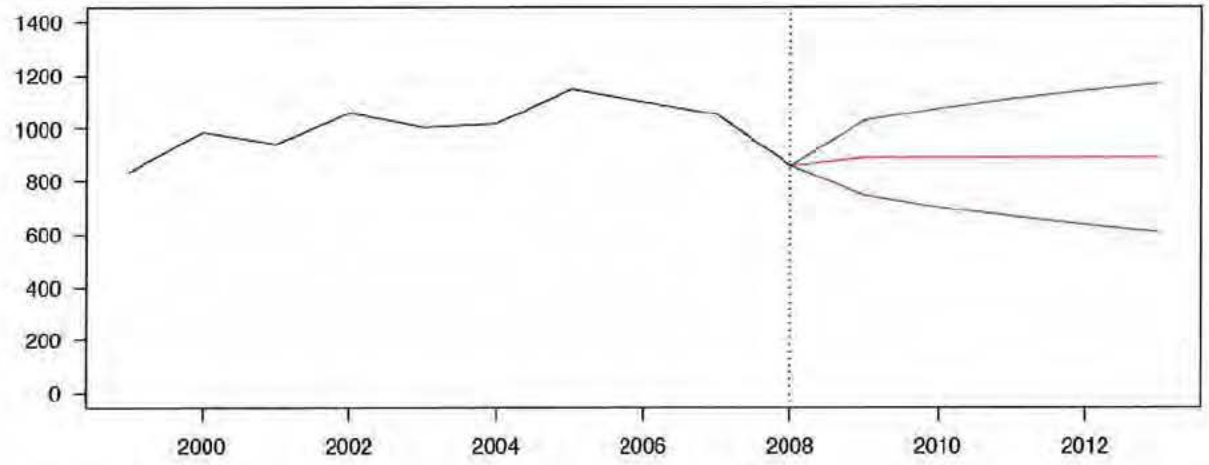
Fire Risk Analysis

Vancouver has had a residential sprinkler ordinance in place for many years now. Also, the building and fire codes are more stringent than typically found in other parts of North America. As a result, the fire risk in Vancouver is relatively low for a metropolitan city. (We use it as a global example of best practices.) That does not, however, mean that all parts of the city have a low fire risk. There are economically depressed parts of the city where there are high numbers of structure fires. There are also parts of the city where the risk of fire might be low (for example, residential high rises with modern sprinkler and alarm systems) but in the case of a fire, the consequences still could be extremely high because even a small fire controlled by a sprinkler could produce sufficient smoke to incapacitate a large number of occupants. The fire risk assessment done in this section evaluates the overall trend in fires, the probability of fires in different planning areas, and the consequence or likely severity of fires in different planning areas. All of these factors were considered for the overall protection needs of each planning area.

Demand for Fire Suppression – From 1999–2005, there was a slight increase in number of fires citywide. Since then, the number of fires has decreased slightly to 1999 levels.

Figure 5 shows actual and forecasted fire incidents from 1999 to 2013. The red line in this graph shows the predicted number of fires using the Holt-Winters statistical prediction methodology. Blue lines above and below the prediction show the 95 percent confidence interval. The black line from 1999 to 2008 shows the actual fire incident counts. These counts reflect only fire incidents with recorded dollar loss (this excludes, for example, a trash can fire that did not result in any property damage).

Figure 5: Actual and Forecasted Fire Incidents, 2004–2013



The analysis predicts that the number of fires with loss will remain fairly level over the next several years. While Vancouver is still growing in population, new developments must adhere to strict fire and building codes. Therefore, it is not expected that new development will lead to any significant increase in major fire incidents.

Location of Fire Incidents – To appropriately place fire apparatus and fire halls, it helps to understand where there are structure fire hotspots within the city.

As depicted below in Figure 6, the area between the downtown and Strathcona is a huge hotspot for structure fires. This area has an extremely high population density and there are sociological issues that can increase fire experience. The Downtown East Side is largely economically depressed and has a history of residents and transients with drug problems. Furthermore, drug growing operations and meth labs are commonly found in this area. All of these factors are likely contributing to the large number of fires in this part of the city.

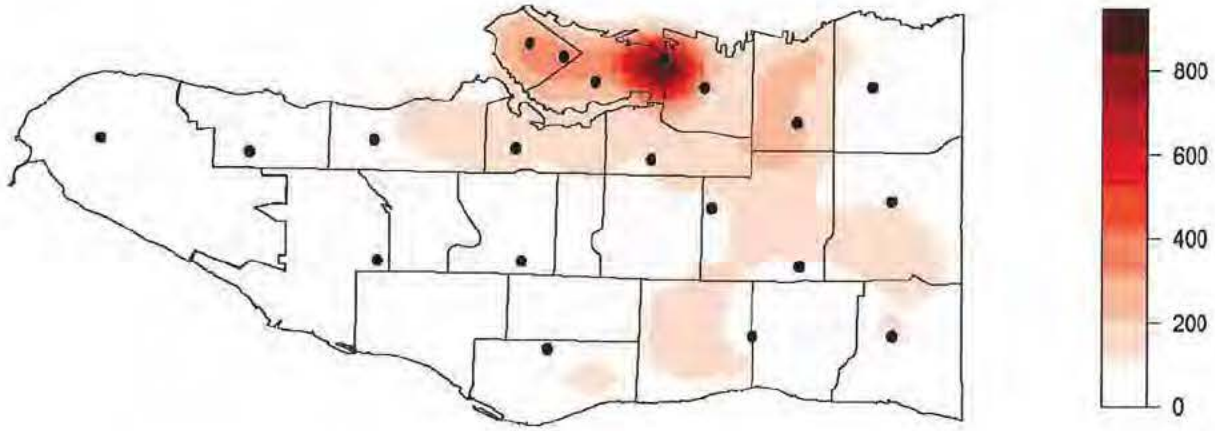
Because of the high population and building density, the rest of the downtown peninsula also has a high number of fires. Although most of the buildings on the downtown peninsula are

sprinklered, the sheer number of buildings and high population density causes this high fire density. Sprinklering does not prevent ignitions, and the fire department must respond whenever sprinkler systems operate; in fact the fire department has a key role in reducing water damage as well as fire damage.

The map also shows the Grandview-Woodlands planning area to be a large high fire density area. Moderate fire density areas are located in Kitsilano, Fairview, Mount Pleasant, Kensington-Cedar Cottage, Sunset and Renfrew-Collingwood. There are also some small fire density areas in Marpole and Killarney.

Fire incident density was analyzed using incident data from 2007 and 2008

Figure 6: Fire Incidents per Square Kilometre, 2007–2008



The table below shows the average annual number of fires in each of the planning areas (again using VFRS RMS incident data from 2007–2008). Also shown is the number of fires that occurred per 100 hectares. Some of the planning areas are larger than others, so it made sense to normalize the numbers to allow a reasonable comparison. Large parks, golf courses, and recreation areas were removed from the planning area land totals because these large open can skew the results of the analysis. [12]

Fire probabilities were classified as low, medium, and high based on which quartile the fires "per 100 hectares" value fell into. The top 25 percent are classified as high fire probability,

[12] During its review of the draft report, personnel rightly commented that an adjustment was necessary to minimize the affect of parks and large open land areas on the risk classifications. The following large open land areas were removed from the planning area land sizes: Vanier Park, Jerico Beach Park, Shaughnessy Golf Course, Point Grey Golf & Country Club, McLeery ana Marine Drive Golf Courses, Vandusen Botanical Gardens, Queen Elizabeth Park, Langara Golf Course, Mountain View Cemetary, Fraserview Golf Course, John Henry Park, Hastings Park, and New Brighton Park.

the middle 50 percent as medium, and the lowest 25 percent as low fire probability. Downtown, Fairview, Grandview-Woodland, Mount Pleasant, Strathcona and West End planning areas have the highest probability of fire.

Table 16: Average Annual Fires by Planning Area, 2007–2008

Planning Area	Total Fires	Per 100 Hectares	Classification[13]
Arbutus Ridge	25	6.8	Low
Downtown	371	98.9	High
Dunbar Southlands	35	5.3	Low
Fairview	105	31.5	High
Grandview-Woodland	217	48.4	High
Hastings-Sunrise	118	15.5	Medium
Kensington-Cedar Cottage	179	26.8	Medium
Kerrisdale	28	5.5	Low
Killarney	100	23.1	Medium
Kitsilano	140	27.1	Medium
Marpole	99	18.1	Medium
Mount Pleasant	122	33.5	High
Oakridge	29	9.1	Low
Renfrew-Collingwood	170	20.7	Medium
Riley Park	60	21.0	Medium
Shaughnessy	20	5.0	Low
South Cambie	19	8.8	Low
Strathcona	215	56.0	High
Sunset	169	27.0	Medium
University Endowment Lands	51	12.7	Medium
Victoria-Fraserview	58	10.9	Medium
West End	169	82.8	High
West Point Grey	52	14.4	Medium

Fire Loss – Table 17 shows financial fire loss and fire injuries by planning areas. Again, these statistics have been normalized by land area (fire loss is given per hectare and fire injuries per 100 hectares). Severity classification was based on both financial fire loss and fire injuries. Planning areas with either financial fire loss or fire injuries in the top 25 percent were classified as high fire loss. Planning areas where both metrics were in the bottom 25 percent were classified as low fire loss. The remaining planning areas were classified as a medium fire loss. Using this classification method, it was determined and that the Downtown, Fairview,

[13] Risk classifications in this table are based on total land area after adjustment for open land areas such as parks.

Grandview-Woodland, Kitsilano, Mount Pleasant, Strathcona, Sunset, the University of British Columbia, West End, and West Point Grey had the most severe fire loss.

Table 17: Average Annual Fire Loss and Injuries by Planning Area, 2007–2008[14]

Planning Area	Fire Loss	Per Hectare	Injuries	Per 100 Hectares	Classification
Arbutus Ridge	909,704	4,725	4	2.17	Medium
Downtown	5,920,610	30,261	14	6.93	High
Dunbar Southlands	443,718	1,287	3	0.76	Low
Fairview	3,791,408	21,822	8	4.50	High
Grandview-Woodland	14,778,976	63,229	20	8.71	High
Hastings-Sunrise	2,275,270	5,731	5	1.31	Medium
Kensington-Cedar Cottage	5,698,197	16,350	21	5.99	Medium
Kerrisdale	726,835	2,721	1	0.20	Low
Killarney	2,344,586	10,402	3	1.16	Medium
Kitsilano	11,282,400	41,827	17	6.19	High
Marpole	2,124,037	7,456	11	3.85	Medium
Mount Pleasant	3,045,615	16,037	11	6.04	Medium
Oakridge	595,904	3,592	0	0.00	Low
Renfrew-Collingwood	3,492,130	8,162	23	5.49	Medium
Riley Park	1,202,270	8,057	2	1.40	Medium
Shaughnessy	395,692	1,887	1	0.25	Low
South Cambie	1,431,657	12,645	0	0.00	Medium
Strathcona	3,282,955	16,386	15	7.55	High
Sunset	4,310,309	13,176	29	8.77	High
University Endowment Lands	25,262,609	120,448	8	3.98	High
Victoria-Fraserview	905,637	3,263	4	1.50	Medium
West End	1,924,171	18,078	11	10.78	High
West Point Grey	893,035	4,728	35	18.51	High

Overall Fire Risk by Planning Areas – Although there are many different ways of measuring risk, the following formula is often used to make risk determinations:

- Probability x Consequence (or Severity) = Risk Level

The previous two sections measured the existing probability of fire and the actual outcome (consequence/severity) for each of the different planning areas. Although we used a fairly simplistic quartile method for classifying the planning areas, it was a quick way of judging probability and consequence of fire in different geographic areas of the city. We use these two inputs to make a final fire risk classification. Generally speaking, a high/high or high/medium

[14] Ibid.

combination was classified as high risk. A low/low combination was classified as low risk. The remaining planning areas were classified as medium risk. The Downtown, Fairview, Grandview-Woodland, Kitsilano, Mount Pleasant, Strathcona, Sunset, UBC, West End, and West Poing Grey planning areas have the highest overall fire risk.

Table 18: Overall Fire Risk Classification by Planning Area

Planning Area	Probability	Severity	Overall Risk
Arbutus Ridge	Low	Medium	Medium
Downtown	High	High	High
Dunbar Southlands	Low	Low	Low
Fairview	High	High	High
Grandview-Woodland	High	High	High
Hastings-Sunrise	Medium	Medium	Medium
Kensington-Cedar Cottage	Medium	Medium	Medium
Kerrisdale	Low	Low	Low
Killarney	Medium	Medium	Medium
Kitsilano	Medium	High	High
Marpole	Medium	Medium	Medium
Mount Pleasant	High	Medium	High
Oakridge	Low	Low	Low
Renfrew-Collingwood	Medium	Medium	Medium
Riley Park	Medium	Medium	Medium
Shaughnessy	Low	Low	Low
South Cambie	Low	Medium	Medium
Strathcona	High	High	High
Sunset	Medium	High	High
University Endowment Lands	Medium	High	High
Victoria-Fraserview	Medium	Medium	Medium
West End	High	High	High
West Point Grey	Medium	High	High

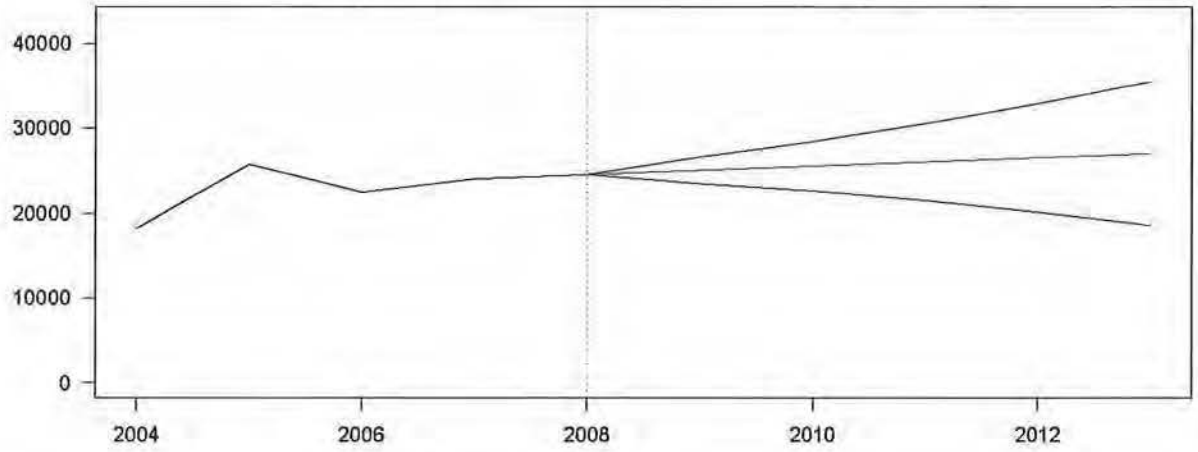
Medical Risk Analysis

VFRS provides medical first response, but does not transport patients. The medical service they provide to citizens of Vancouver is, however, very important when dealing with time sensitive medical emergencies. Take, for instance, a cardiac arrest—if the patient is not defibrillated within six minutes of going into cardiac arrest, there is low chance of survival. Ambulances are often busy and not as well distributed throughout the city as fire apparatus are distributed. By placing fire units on the most serious of medical emergencies, the fire service is able to provide quick (and potentially life-saving) medical interventions.

Demand for emergency medical service varies greatly across the city, but it is fairly easy to predict the areas with the highest EMS demand based on historical EMS incident densities, current population densities and expected population growth noted earlier in the chapter. This section reviews all of those inputs and makes an EMS risk determination for each planning area.

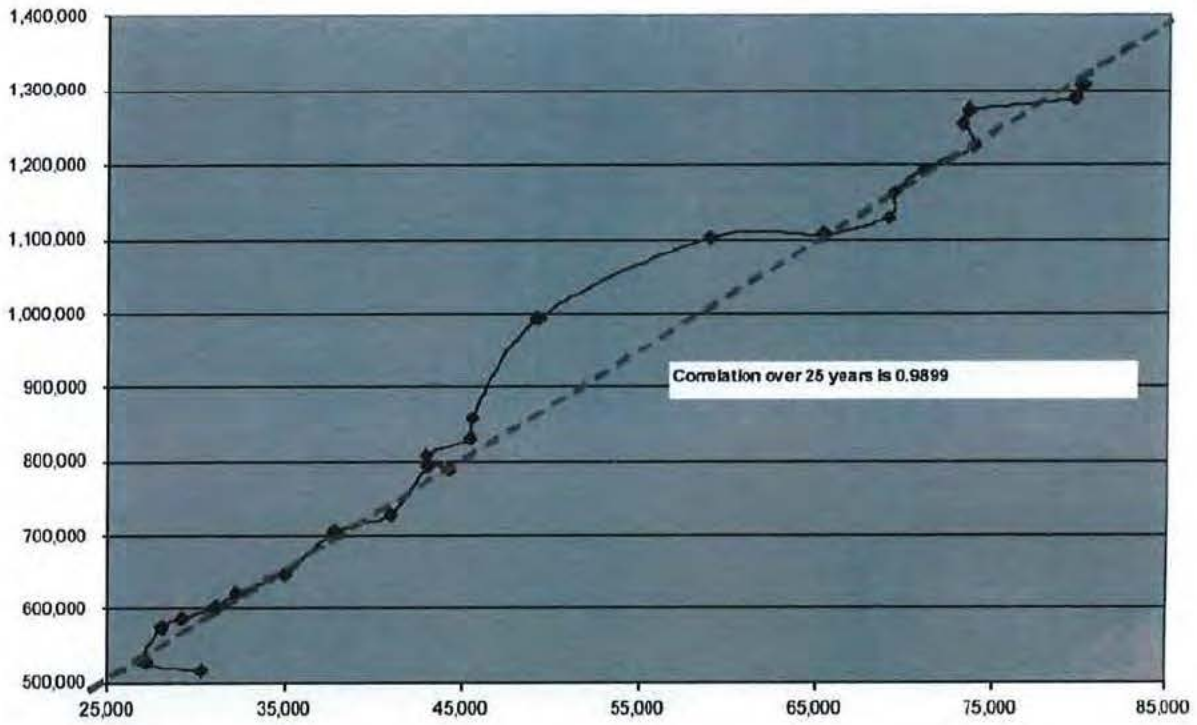
Demand for Emergency Medical Service – Figure 7 shows actual and forecast EMS incidents from 2004 to 2013. (The black line stretching from 2004 to 2008 shows the actual number of EMS incidents; the rest is a projection. The red line represents the predicted number of EMS incidents, and the blue lines represent the 95 percent confidence interval.). The number of EMS first responses is trending upwards. It is predicted that the number of EMS incidents will continue to increase over the next couple of years. Although Vancouver's population growth will probably not contribute substantially to the number of fires, it will lead to an increased number of EMS incidents.

Figure 7: Actual and Forecasted EMS Incidents, 2004–2013



EMS Incident Density – Population density is an excellent predictor of EMS demand. The Center for Accreditation International (CFAI) Standards of Cover manual reports that one West Coast Metropolitan Fire Department found that the correlation between demand for EMS service and the number of people served was 0.9899. A perfect correlation is 1.0, meaning that there is a direct relationship between the two factors. A graph of this correlation, taken from the Standards of Cover manual is shown in Figure 8.

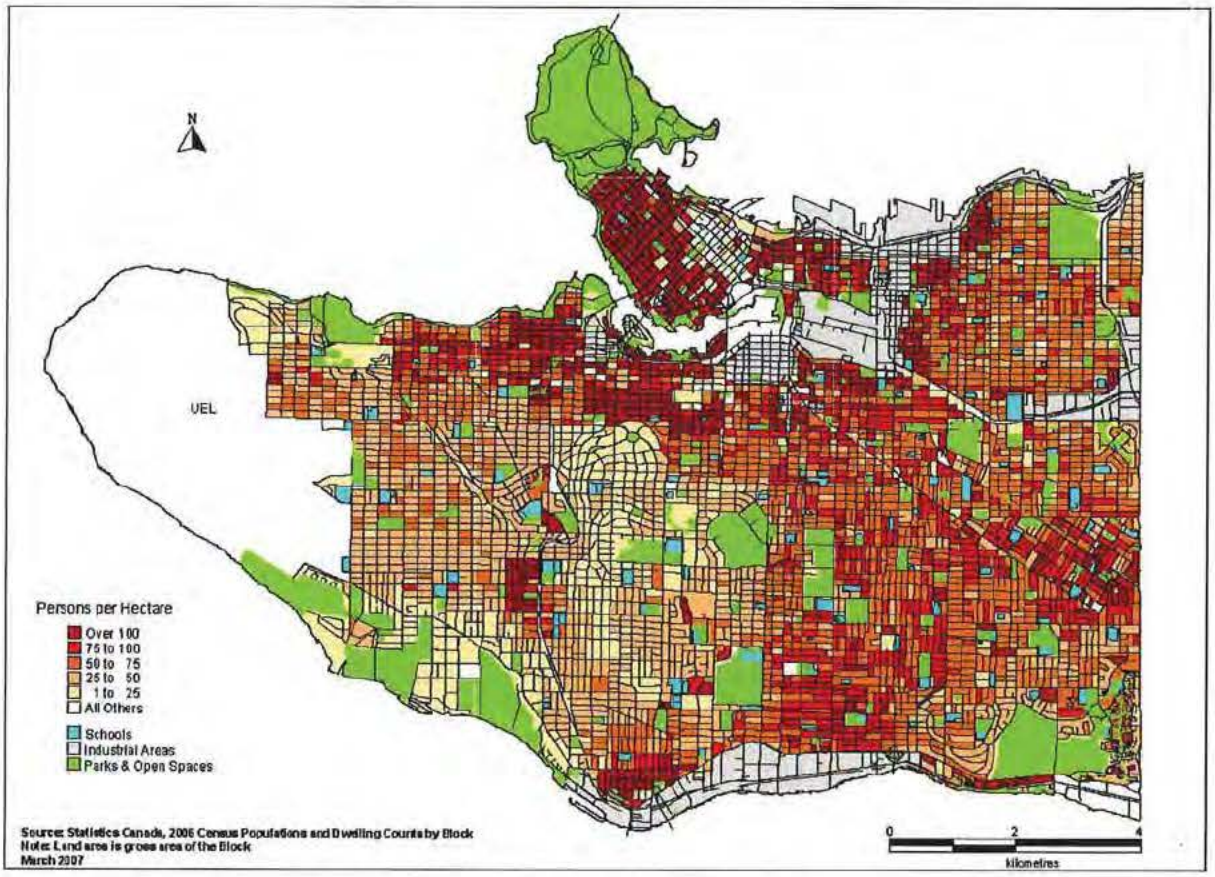
Figure 8: Correlation between Population and EMS Calls for Service Study, 1980–2004[15]



With this correlation established, it is possible to look at a population density map of Vancouver and predict which areas will have the highest EMS demand. The following population density map was compiled by Statistics Canada as part of their 2006 census.

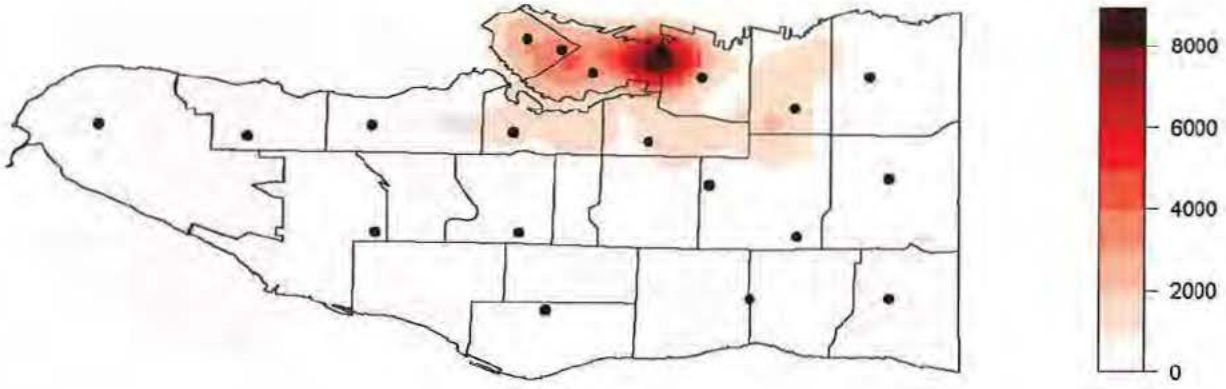
[15] Source: CFAI Standards of Cover Manual, 5th Edition

Figure 9: Vancouver Population Density, 2006



Based on the population density map, we would expect a high number of EMS incidents on the downtown peninsula and around False Creek. We would also expect to see EMS hotspots in the Sunset planning area, the southern portion of the Marpole planning area, and the intersection of the Kerrisdale, Arbutus Ridge, and Shaughnessy planning areas. We see in the EMS incident density map below that, in fact, the downtown peninsula and the areas around False Creek do have the highest number of EMS incidents. However, the hotspots predicted in other areas do not appear on the incident density map. The actual number of EMS incidents by planning area is listed in the next section.

Figure 10: EMS Incidents per Square Kilometre, 2007–2008



EMS Risk Classification – Population density is a good predictor of EMS demand, but other factors also influence EMS demand. Senior citizens, for instance, typically have a higher demand for EMS service than other demographics. In this section we look at population density, average number of EMS incidents over the last two years, and percentage of population over the age of 65 to make our EMS risk classification for each planning area. It would also be beneficial to look at the type breakdown of EMS incidents in each of the planning areas, but this data was difficult to analyze because of the large number of EMS call type classifications used by BCAS. EMS incident type breakdowns would have allowed us to determine in which areas EMS incidents were more severe and would benefit from a quicker response.

Similar to fire experience, sociological issues also impact on EMS demand. The Downtown East Side has some of the highest EMS demand partially the result of the sociological issues discussed earlier. Although sociological issues are difficult to quantify with regard to demand, VFRS should review the EMS risk classifications and, where necessary, adjust the risk classification of particular areas.

Each planning area is assigned an EMS risk classification below. These are based on population density and annual EMS incident counts. The percentage of population over 65 was used to slightly adjust risk up or down. Based on our risk evaluation, it was found that the Downtown, Fairview, Grandview-Woodland, Kensington-Cedar Cottage, Kitsilano, Mount Pleasant, Renfrew-Collingwood, and Victoria Fraserview have the highest EMS risk.

Table 19: EMS Risk Factors and Classification, 2006 Statistics and 2007–2008 Incident Data

Planning Area	Population Density	EMS Incidents	Population Over 65	Risk Classification
Arbutus Ridge	43.75	359	19.7%	Medium
Downtown	115.77	3942	8.5%	High
Dunbar Southlands	24.95	355	13.2%	Low
Fairview	87.97	962	13.4%	High
Grandview-Woodland	62.96	1285	10.4%	High
Hastings-Sunrise	40.80	863	16.2%	Medium
Kensington-Cedar Cottage	61.78	979	13.0%	High
Kerrisdale	23.13	257	14.6%	Low
Killarney	40.15	606	13.8%	Medium
Kitsilano	73.68	813	9.1%	High
Marpole	42.40	504	12.5%	Medium
Mount Pleasant	64.88	945	8.2%	High
Oakridge	31.73	360	19.6%	Low
Renfrew-Collingwood	59.62	989	13.8%	High
Riley Park	44.34	495	12.4%	Medium
Shaughnessy	19.91	217	18.1%	Low
South Cambie	32.58	224	14.4%	Low
Strathcona	31.04	1652	24.0%	Medium
Sunset	56.19	865	13.1%	Medium
University Endowment Lands	54.89	278	17.1%	Low
Victoria-Fraserview	218.43	670	11.4%	High
West End	28.55	1376	14.4%	Medium
West Point Grey	50.41	268	13.1%	Low

Location of Special Hazards

In addition to fires and EMS incidents, there are other hazards that need to be considered as part of a comprehensive risk assessment. Motor vehicle accidents are a common occurrence and often times have a very different geographic distribution than other types of emergencies. Hazmat and technical rescue incidents have a much lower incidence rate, but again it is important to know where these types of incidents are occurring. The following three figures show the location of motor vehicle accidents, hazmat incidents, and technical rescue incidents.

Figure 11: Motor Vehicle Accidents per Square Kilometre, 2007–2008

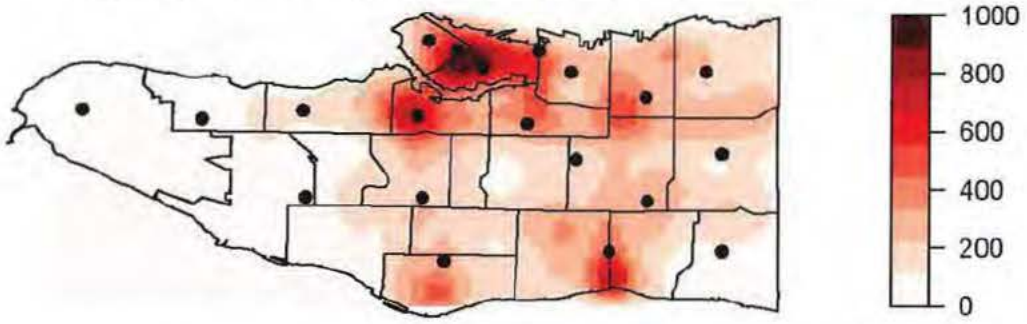


Figure 12: Hazmat Incidents per Square Kilometre, 2007–2008

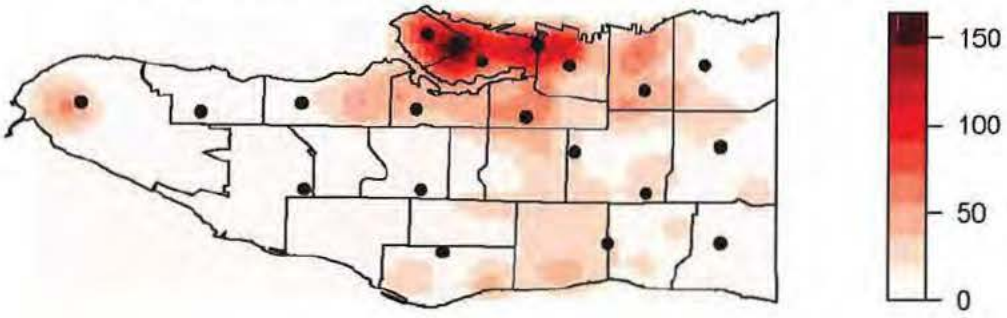
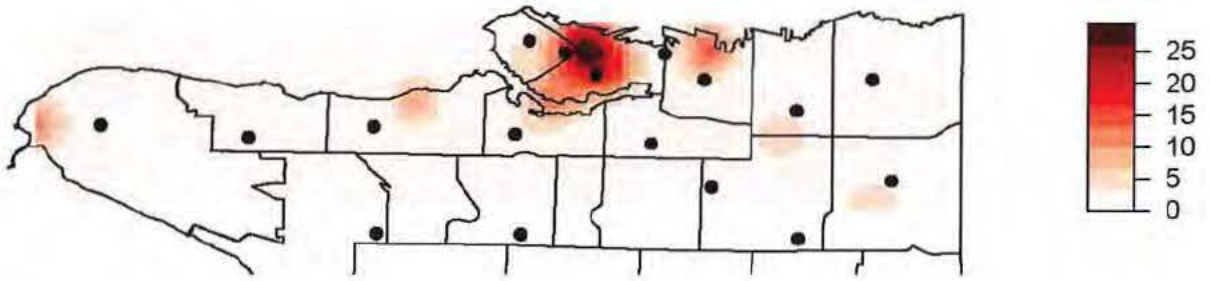


Figure 13: Technical Rescue Incidents per Square Kilometre, 2007–2008

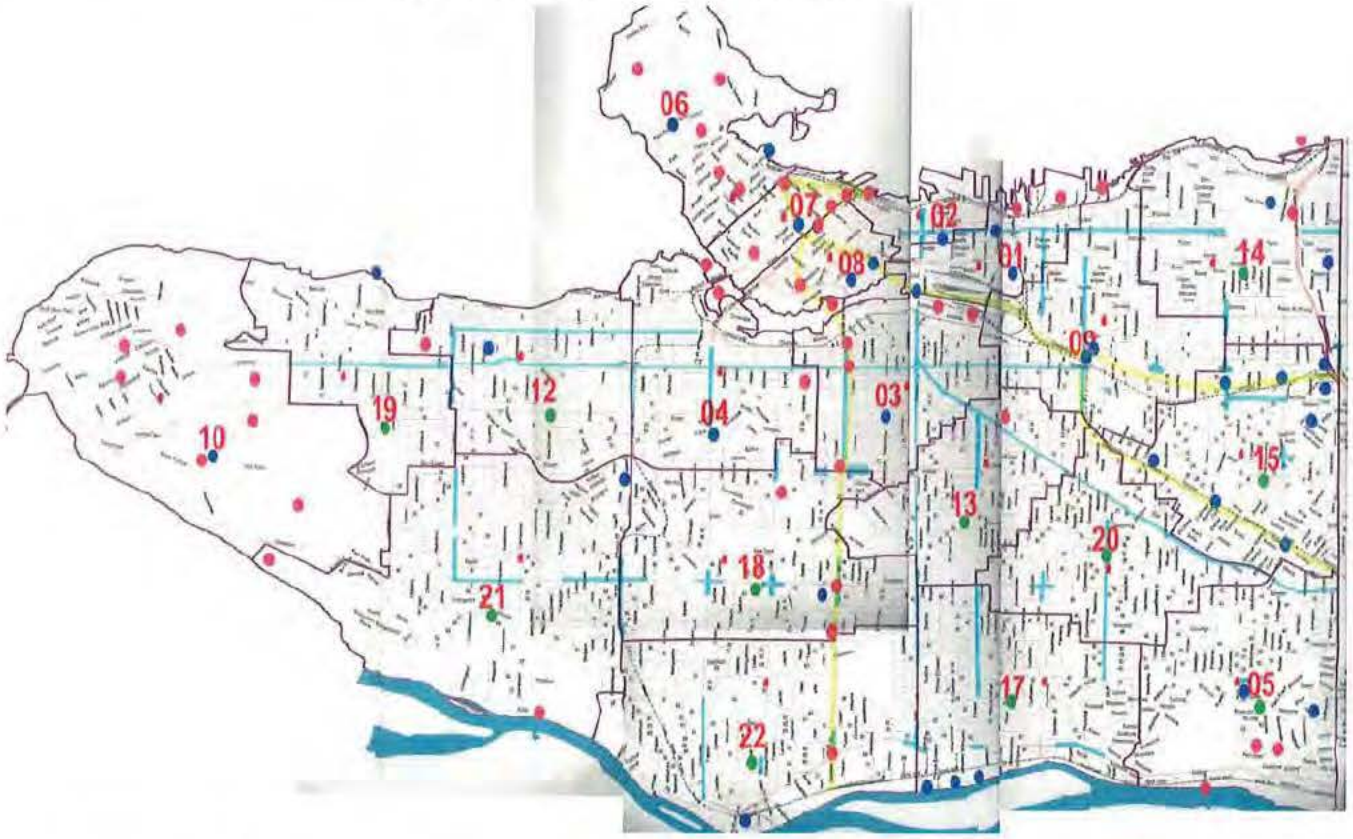


Target Hazards

Several VFRS battalion chiefs were asked to identify target hazards as part of this risk analysis. Risk was assessed based on probability of hazard multiplied by severity. Hazard probability was classified as either high (likely), medium (possible) or low (unlikely). Severity was considered in terms of danger or personal harm (number of people potentially affected), economic impact, environmental impact and social impact. The following coloring scheme was then used to code the target hazards map.

High Risk: Red dot
Medium Risk: Blue dot
Low Risk: Green dot

Figure 14: Target Hazard Locations



The target hazards map identifies several important risks that are discussed below.

- **"Strip Malls" and "Residential over Business" Structures** – These structures are generally unsprinklered and pose a high life safety threat. These structures are marked by blue lines on the map.
- **SkyTrain Routes** – These train routes are mostly above ground and automatically piloted. The Canada Line includes a 10 kilometre tunnel. VFRS Battalion Chiefs categorized the Canadian Line as high risk and the Expo and Millennium Lines as medium risk. The SkyTrain routes are marked by yellow lines on the map.
- **LNG Harbour Transport** – Once a month LNG is transported across the harbour. This event is coded using a red dot in the middle of the harbour.
- **Everett Crowley Park, Pacific Spirit Park, and Stanley Park** – There is a high risk of wildland fires in these parks.
- **University of British Columbia** – The University area is considered high-risk because the area has both research centers working with lethal bio-hazards such as Anthrax and a high probability of severe wildland fires.

- **Marinas** – There are several marinas marked with red dots in the water. These marinas are high risk because of the access and operational difficulties involved with fighting marina fires.
- **Jellico Street LNG Station** – Low probability of an accident, but the potential of extremely severe outcomes.
- **Railroad along Industrial Street** – Rail cars traveling along these tracks contain hazmat materials that are extremely dangerous. Although the risk of an event is not terribly high, the outcomes could be severe.

Demand for Emergency Services

Demand is defined as the number of emergency incidents that required an intervention by VFRS. In the previous sections of this chapter, we analyzed the number of fires and EMS incidents in each planning area. We also looked at incident densities for motor vehicle accidents, hazmat incidents and technical rescue incidents. In a way, we already have a good sense of what kind of demand for emergency services different parts of the city have. In this section we review the counts for all incident types by planning area. Understanding potential demand helps fire department officials make decisions in the following areas:

- **Fire Unit Locations** – Planning areas with high levels of demand show where fire apparatus should be located. Further understanding of the types of incidents in each area helps to determine the type of response equipment is most appropriate.
- **Weight of Response** – The demand analysis shows the number of fires versus the number of fire alarms. A higher weight of response is prudent for planning areas with higher-risk properties.
- **Prevention** – Some areas have such a high demand for emergency service that prevention and education efforts must often be increased.

Figure 15 and Table 20 show demand for emergency services for each of the planning areas. This information was compiled from RMS incident data and EComm coordinates. As a result of EComm transitioning from one computer aided dispatch (CAD) system to another in November 2008, incident coordinates were not available for December 2008. The planning area totals were computed by multiplying the 2007 and 2008 incident totals by .522 to determine the average annual total. The data shows that the downtown planning area has a huge demand for emergency services. In fact, EMS incidents alone account for more demand in the downtown area than any other planning area. The West End, Strathcona, Fairview, Grandview-Woodland also have high demand for emergency service.

Figure 15: Demand for Emergency Services by Planning Areas, 2007–2008 Average

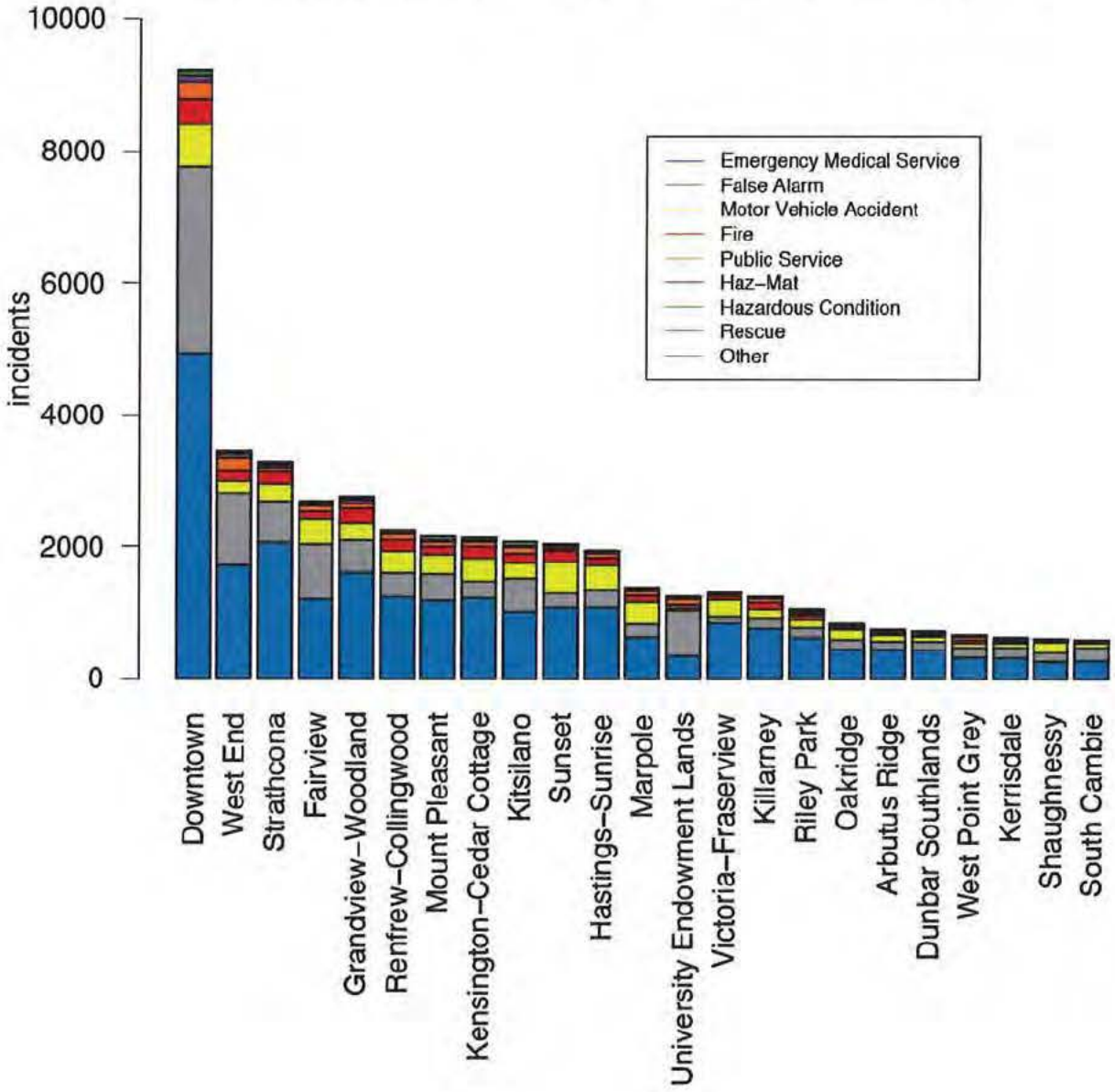


Table 20: Total Emergency Incidents by Planning Areas, 2007–2008 Average

Planning Area	EMS	Alarm	MVA	Fire	Service	Hazmat	Other Hazard	Rescue	Other	Total
Downtown	4,933	2,832	644	371	266	89	67	14	3	9,219
West End	1,722	1,091	183	169	188	54	40	2	2	3,451
Strathcona	2,068	628	249	215	45	49	27	4	1	3,286
Fairview	1,203	836	388	105	93	34	29	1	2	2,691
Grandview-Woodland	1,608	492	268	217	81	59	35	2	2	2,764
Renfrew-Collingwood	1,237	368	332	170	87	30	29	2	2	2,257
Mount Pleasant	1,183	406	297	122	64	37	44	1	2	2,156
Kensington-Cedar Cottage	1,225	250	355	179	66	29	30	1	1	2,136
Kitsilano	1,017	507	241	140	90	34	45	2	2	2,078
Sunset	1,082	215	481	169	42	40	16	0	0	2,045
Hastings-Sunrise	1,081	276	366	118	66	18	20	1	0	1,946
Marpole	631	201	338	99	65	26	22	0	0	1,382
University Endowment Lands	347	693	35	51	88	29	6	3	0	1,252
Victoria-Fraserview	838	116	250	58	37	17	10	0	0	1,326
Killarney	759	163	137	100	60	13	12	0	3	1,247
Riley Park	620	154	130	60	46	26	21	0	0	1057
Oakridge	451	146	155	29	35	13	7	0	1	837
Arbutus Ridge	449	125	95	25	36	4	9	0	0	743
Dunbar Southlands	444	129	70	35	27	7	8	0	1	721
West Point Grey	335	144	64	52	45	9	10	1	0	660
Kerrisdale	322	153	73	28	27	10	11	0	0	624
Shaughnessy	271	131	157	20	17	2	10	0	0	608
South Cambie	280	196	69	19	14	5	7	0	0	590
(all)	24,106	10,252	5,379	2,552	1,585	633	515	30	20	45,072

Summary of Risk Analysis by Planning Areas

This section provides an in-depth description of each planning area and summarizes all the information given about that planning area earlier in the chapter. This information will be a good reference for understanding why certain deployment recommendations are made later in this report.[16]

The planning areas in Vancouver are all unique. Some of the planning areas have residential high-rise buildings with high population densities—others are less populous, but have a large geriatric population—other communities might not have a high fire or EMS risk, but have rail line carrying hazardous materials running right through the middle. Each planning area has unique emergency service needs that have to be considered.

Note: As discussed earlier some planning areas have large open areas such as parks which are mostly undeveloped. Therefore an adjustment was made to eliminate large land areas from the planning areas since parks have few fires. It is believed that by eliminating the open areas a more accurate fire risk assessment is achieved. In the section that follows the adjusted figures for land area and population used in the overall analysis of fire risk are provided (in parenthesis). Only the Oakridge planning area saw its fire risk elevated from low to medium based on the adjusted data.

Arbutus Ridge – Arbutus Ridge is one of 23 neighbourhoods in Vancouver, bordered by 16th Avenue, 41st Avenue, East Boulevard, and Mackenzie Street. Arbutus Ridge is a quiet, mature area of up-scale homes, condos and long-time residents, who enjoy close proximity to downtown Vancouver. It is predominantly a residential area, and several homes remain from the first residential settlement in 1912.

Depending upon their geographic location, residents typically associate themselves with neighbouring Dunbar, Kitsilano, Kerrisdale, or Shaughnessy communities. The upper part of Arbutus Ridge (known as Mackenzie Heights) was settled between the 1910s and the 1930s. The lower part was further developed in the 1940s and 1950s, when more schools, houses, and shops were constructed.

General Statistics
Population: 16,145
Population Over 65: 19.70 percent
Land Area: 369 hectares
Density: 43.75 people per hectare

[16] Some of the descriptive information about the various neighborhoods was obtained from the city's web site.

Fire and EMS Statistics (Average 2007–2008)
Fires: 25
Fire Loss per Capita: $56.35
EMS Incidents: 449

Risk Classification
Fire: Medium
EMS: Medium

Downtown – Downtown Vancouver is located on the southeastern portion of the Vancouver peninsula. The area is also known as the Central Business District, and is situated between Burrard Inlet and False Creek. Within Downtown Vancouver are several smaller communities, including Yaletown, Gastown, Coal Harbour, and the East False Creek. Several of the smaller communities within Downtown are predicting more residential growth, and are in the process of developing a considerable amount of housing, as well commercial and community facilities.

General Statistics
Population: 43,415
Population Over 65: 8.50 percent
Land Area: 375 hectares
Density: 115.77 people per hectare

Fire and EMS Statistics (Average 2007–2008)
Fires: 371
Fire Loss per Capita: $136.37
EMS Incidents: 4,933

Risk Classification
Fire: High
EMS: High

Dunbar-Southlands – This neighbourhood is really two distinct communities, each with its own unique identity; Dunbar is predominantly residential with a number of single-family homes, while the Southlands area is more rural. The neighbourhood is only 15 minutes from downtown Vancouver. Dunbar-Southlands is bordered on the north by West 16th Avenue and on the south by the Fraser River. Dunbar-Southlands became part of the City of Vancouver in 1929. The first noteworthy development in the area occurred in the mid-1920s, and a number of homes built between 1920 and 1922 remain standing today.[17]

[17] The Dunbar-Southlands planning area has a low fire risk classification based on historical demand. However, many of the houses in this planning area are older structures and thus have no sprinkler systems. For this reason the fire department might want to increase the fire risk classification.

General Statistics
Population: 21,480
Population Over 65: 13.20 percent
Land Area: 861 hectares (661)
Density: 24.95 people per hectare (32.5)

Fire and EMS Statistics (Average 2007–2008)
Fires: 35
Fire Loss per Capita: $20.66
EMS Incidents: 444

Risk Classification
Fire: Low
EMS: Low

Fairview – Fairview sits on the shore of False Creek, bordered by 16th Avenue in the south, Burrard Street in the west, and Cambie Street in the east. The area includes the neighbourhoods of False Creek, Fairview Slopes, Burrard Slopes and Fairview Heights. In the late 1880s, the area was home to shipbuilding yards, sawmills, shingle mills, and various woodworking plants, but over the last few decades the area was rezoned and is now primarily residential, rather than industrial. Fairview is home to the Vancouver Hospital and Health Sciences Centre (formerly Vancouver General Hospital).

General Statistics
Population: 29,295
Population Over 65: 13.40 percent
Land Area: 333 hectares
Density: 87.97 people per hectare

Fire and EMS Statistics (Average 2007–2008)
Fires: 105
Fire Loss per Capita: $129.42
EMS Incidents: 1,203

Risk Classification
Fire: High
EMS: High

Grandview-Woodland – Grandview Woodland's first house was built in 1891, and the interurban railway opened in the area that September. Today, this community, located to the east of downtown Vancouver, stretches from Broadway to Burrard Inlet and from Clark Drive to Nanaimo Street. It is a bustling mixture of commercial, industrial, and residential activities, with the popular Commercial Drive is the heart of the community and the area is richly diverse, with an Italian influence that has since broadened into a Latin one.

General Statistics
Population: 28,205
Population Over 65: 10.40 percent
Land Area: 448 hectares
Density: 62.96 people per hectare

Fire and EMS Statistics (Average 2007–2008)
Fires: 217
Fire Loss per Capita: $523.98
EMS Incidents: 1,608

Risk Classification
Fire: High
EMS: High

Hastings-Sunrise – Hastings-Sunrise is located in the north eastern corner of the city of Vancouver. This community is one of Vancouver's oldest neighbourhoods, founded in the late 1860s. Hastings-Sunrise is a predominantly residential, family-oriented community stretching from Boundary Road to Nanaimo Street, and from Broadway to Burrard Inlet.

General Statistics
Population: 33,130
Population Over 65: 16.20 percent
Land Area: 812 hectares (761)
Density: 40.8 people per hectare (43.53)

Fire and EMS Statistics (Average 2007–2008)
Fires: 118
Fire Loss per Capita: $68.68
EMS Incidents: 1,081

Risk Classification
Fire: Medium
EMS: Medium

Kensington-Cedar Cottage – This community was settled during the late 1800s, and is a combination of two historic neighbourhoods, Cedar Cottage, to the south of Trout Lake, and Kensington Heights, to the south of Kingsway. Located in the heart of East Vancouver, Kensington-Cedar Cottage is one of the most ethnically diverse areas in the city. Kensington-Cedar Cottage is younger and more diverse than the rest of the city, and only a third of the community's residents speak English as their native language.

General Statistics
Population: 44,665
Population Over 65: 13.00 percent
Land Area: 723 hectares (668)
Density: 61.78 people per hectare (66.86)

Fire and EMS Statistics (Average 2007–2008)
Fires: 179
Fire Loss per Capita: $127.58
EMS Incidents: 1,225

Risk Classification
Fire: Medium
EMS: High

Kerrisdale – In 1908, Kerrisdale joined the Municipality of Point Grey, which merged with the city of Vancouver in January, 1929. Now, Kerrisdale is a mixed, ethnically diverse neighbourhood, bordered by 41st Avenue, South West Marine Drive, and Granville Street.

General Statistics
Population: 14,615
Population Over 65: 14.60 percent
Land Area: 632 hectares (512)
Density: 23.13 people per hectare (28.54)

Fire and EMS Statistics (Average 2007–2008)
Fires: 28
Fire Loss per Capita: $49.73
EMS Incidents: 322

Risk Classification
Fire: Low
EMS: Low

Killarney – Located in the extreme southeast corner of Vancouver from East 41st Avenue to the Fraser River and from Boundary Road and Vivian Street, Killarney was the last neighbourhood in Vancouver to be developed. This once rural area has experienced significant residential growth that began in the 1950s and continues to this day. In the 1970s, the southern part of the area was transformed into Champlain Heights. Champlain Heights is now fully developed, and a new comprehensive residential project, Fraser Lands, is proceeding along the area's most southerly boundary, the Fraser River.

General Statistics
Population: 27,180
Population Over 65: 13.80 percent
Land Area: 677 hectares (432)
Density: 40.15 people per hectare (62.92)

Fire and EMS Statistics (Average 2007–2008)
Fires: 100
Fire Loss per Capita: $86.26
EMS Incidents: 759

Risk Classification
Fire: Medium
EMS: Medium

Kitsilano – Kitsilano is bordered to the north by two beaches, Kitsilano Beach and Jericho Beach, and extends south to 16th Avenue. It is bordered on the east by Burrard Street and on the west by Alma Street. Kitsilano is home to many young families and students, and is predominantly residential; however, it is home to two distinct commercial strips with shops, restaurants and other services.

General Statistics
Population: 40,595
Population Over 65: 9.10 percent
Land Area: 551 hectares (517)
Density: 73.68 people per hectare (78.52)

Fire and EMS Statistics (Average 2007–2008)
Fires: 140
Fire Loss per Capita: $277.93
EMS Incidents: 1,017

Risk Classification
Fire: High
EMS: High

Marpole – Marpole is another one of the older communities in Vancouver. When the neighbourhood amalgamated with the city of Vancouver in 1929, Marpole was already one of the city's major industrial centres. In the 1960s, the area was rezoned and many of the original homes were replaced with low-rise stucco walk-ups. It is a generally residential neighbourhood, located at the southern most part of the city.

General Statistics
Population: 23,785
Population Over 65: 12.50 percent
Land Area: 561 hectares (546)
Density: 42.4 people per hectare (43.56)

Fire and EMS Statistics (Average 2007–2008)
Fires: 99
Fire Loss per Capita: $89.3
EMS Incidents: 631

Risk Classification
Fire: Medium
EMS: Medium

Mount Pleasant – This community was settled during the early 1900s. Today, Mount Pleasant is one of the most diverse communities in the city. The area, which stretches from Cambie to Clark Drive, and from Great Northern Way and 2nd to 16th and Kingsway, is an eclectic mix of new and old homes, industry, and educational facilities. Mount Pleasant is an up-and-coming neighbourhood, home to young professionals, first-time homeowners, and a growing number of families.

General Statistics
Population: 23,615
Population Over 65: 8.20 percent
Land Area: 364 hectares
Density: 64.88 people per hectare

Fire and EMS Statistics (Average 2007–2008)
Fires: 122
Fire Loss per Capita: $128.97
EMS Incidents: 1,183

Risk Classification
Fire: High
EMS: High

Oakridge – Oakridge is a young community, settled in the 1950s. It is a residential neighbourhood, and is also home to Vancouver's first shopping centre. It is also home to Vancouver's Jewish Community Centre. Approximately 50 percent of the neighbourhood's population list Chinese as their first language. The planning area is named after nearby Oak Street, and sits on the ridge of land that slopes down to the Fraser River. Oakridge is predicted to grow even more due to the construction of the Canada Line; construction is scheduled to be completed by November, 2009.

General Statistics
Population: 12,725
Population Over 65: 19.60 percent
Land Area: 401 hectares (318)
Density: 31.73 people per hectare (40.01)

Fire and EMS Statistics (Average 2007–2008)
Fires: 29
Fire Loss per Capita: $46.83
EMS Incidents: 451

Risk Classification
Fire: Low
EMS: Low

Renfrew-Collingwood – Renfrew-Collingwood is a family-oriented community on the slopes of east Vancouver. The area is bounded by Broadway and the Lougheed Highway on the north, Nanaimo to the west, 41st Avenue and Kingsway on the south and Boundary Road to the east. The community is made up of both a substantial business community and fast-growing residential sectors. The oldest school in Vancouver is located in Renfrew-Collingwood: Carleton Elementary School, which was built in 1896.

General Statistics
Population: 48,885
Population Over 65: 13.80 percent
Land Area: 820 hectares
Density: 59.62 people per hectare

Fire and EMS Statistics (Average 2007–2008)
Fires: 170
Fire Loss per Capita: $71.44
EMS Incidents: 1,237

Risk Classification
Fire: Medium
EMS: High

Riley Park – Riley Park was settled during the late 1800s and early 1900s. This neighbourhood is located at the highest point in Vancouver, and it is bordered by 41st Avenue in the south, 16th Avenue in the north, Cambie Street in the west and Fraser Street in the east.

General Statistics
Population: 21,815
Population Over 65: 12.40 percent
Land Area: 492 hectares (286)
Density: 44.34 people per hectare (76.28)

Fire and EMS Statistics (Average 2007–2008)
Fires: 60
Fire Loss per Capita: $55.11
EMS Incidents: 620

Risk Classification
Fire: Medium
EMS: Medium

Shaughnessy – Shaughnessy is an almost entirely residential neighbourhood, bound by 16th Avenue to the north, 41st Avenue to the south, Oak Street to the east, and Arbutus Street/West Boulevard to the west. Shaughnessy is one of Vancouver's most stable and prosperous communities.

General Statistics
Population: 8,900
Population Over 65: 18.10 percent
Land Area: 447 hectares (402)
Density: 19.91 people per hectare (22.14)

Fire and EMS Statistics (Average 2007–2008)
Fires: 20
Fire Loss per Capita: $44.46
EMS Incidents: 271

Risk Classification
Fire: Low
EMS: Low

South Cambie – South Cambie is considered one of the smallest neighbourhoods in Vancouver. It is located between Queen Elizabeth Park and Shaughnessy Heights. A number of medical facilities are located in the community.

General Statistics
Population: 7,070
Population Over 65: 14.40 percent
Land Area: 217 hectares
Density: 32.58 people per hectare

Fire and EMS Statistics (Average 2007–2008)
Fires: 19
Fire Loss per Capita: $202.5
EMS Incidents: 280

Risk Classification
Fire: Medium
EMS: Low

Strathcona – Strathcona is one of oldest residential neighbourhoods in Vancouver. The community's boundaries stretch from Hastings Street to Great Northern Way and from Main Street to Clark Drive. Originally known as the East End, Strathcona has always been a diverse community where many immigrants lived before moving to different parts of the city. Strathcona has one of the largest concentrations of 19th and early 20th century buildings in Vancouver.

General Statistics
Population: 11,920
Population Over 65: 24.00 percent
Land Area: 384 hectares
Density: 31.04 people per hectare

Fire and EMS Statistics (Average 2007–2008)
Fires: 215
Fire Loss per Capita: $275.42
EMS Incidents: 2,068

Risk Classification
Fire: High
EMS: Medium

Sunset – The appropriately named Sunset is located on Vancouver's sunny southern slope. The neighbourhood is richly diverse, and home to the Punjabi Market. Sunset was once predominantly working class, but the area is becoming more popular with young professionals and families. It is a well-established, single-family oriented community, located between the Fraser River, E 41st Avenue, Ontario St, and Knight St.

General Statistics
Population: 35,230
Population Over 65: 13.10 percent
Land Area: 627 hectares
Density: 56.19 people per hectare

Fire and EMS Statistics (Average 2007–2008)
Fires: 169
Fire Loss per Capita: $122.35
EMS Incidents: 1,082

Risk Classification
Fire: High
EMS: Medium

Victoria-Fraserview – Victoria-Fraserview was one of the earliest areas of settlement in the region. The neighbourhood stretches from 41st Avenue to overlook the North Arm of the Fraser River, and is also bordered by Knight Street and Vivian Street. Many of the existing homes in the area were built during the 1940s. The community has a long history of redevelopment that will continue through the new millennium, as the Fraser River waterfront changes from industrial to residential use.

General Statistics
Population: 29,200
Population Over 65: 17.10 percent
Land Area: 532 hectares
Density: 54.89 people per hectare

Fire and EMS Statistics (Average 2007–2008)
Fires: 58
Fire Loss per Capita: $31.01
EMS Incidents: 838

Risk Classification
Fire: Medium
EMS: High

West End – Like many of Vancouver's neighbourhoods, the West End is densely populated and is home to a mixed population. It is located between Stanley Park, English Bay Beach, and the downtown business district.

General Statistics
Population: 44,560
Population Over 65: 11.40 percent
Land Area: 204 hectares
Density: 218.43 people per hectare

Fire and EMS Statistics (Average 2007–2008)
Fires: 169
Fire Loss per Capita: $43.18
EMS Incidents: 1,722

Risk Classification
Fire: Medium
EMS: Medium

West Point Grey – West Point Grey is an upscale community at the western end of the peninsula. The main commercial strip with shops and restaurants is along West 10th Avenue between Tolmie Street and Discovery Street. It is a primarily residential area, and many residents rent out basement suites in their homes to local students. The community stretches from the

English Bay waterfront to 16th Avenue and from Alma Street to the University Endowment Lands.

General Statistics
Population: 12,990
Population Over 65: 14.40 percent
Land Area: 455 hectares (362)
Density: 28.55 people per hectare (35.88)

Fire and EMS Statistics (Average 2007–2008)
Fires: 52
Fire Loss per Capita: $68.75
EMS Incidents: 335

Risk Classification
Fire: High
EMS: Low

Summary – Table 21 provides a summation of the fire, EMS, and fire loss per capita ($$) for of the city's 23 planning areas.

Table 21: Fire, EMS, and Loss per Capita Summary

Planning Area	Overall EMS Risk	Overall Fire Risk	$$ Loss Per Capita (Rounded)/ Ranking
Arbutus Ridge	Medium	Medium	$56/ 15
Downtown	High	High	$136/ 5
Dunbar Southlands	Low	Low	$21/ 22
Fairview	High	High	$129/ 6
Grandview-Woodland	High	High	$524/ 1
Hastings-Sunrise	Medium	Medium	$69/ 13
Kensington-Cedar Cottage	High	Medium	$128/ 8
Kerrisdale	Low	Low	$50/ 17
Killarney	Medium	Medium	$86/ 10
Kitsilano	High	High	$278/ 2
Marpole	Medium	Medium	$89/ 11
Mount Pleasant	High	High	$129/ 6
Oakridge	Low	Low	$47/ 18
Renfrew-Collingwood	High	Medium	$71/ 12
Riley Park	Medium	Medium	$55/ 16
Shaughnessy	Low	Low	$44/ 19
South Cambie	Low	Medium	$203/ 4
Strathcona	Medium	High	$275/ 3
Sunset	Medium	High	$122/ 9

Planning Area	Overall EMS Risk	Overall Fire Risk	$$ Loss Per Capita (Rounded)/ Ranking
University Endowment Lands	Low	High	NA
Victoria-Fraserview	High	Medium	$31/ 21
West End	Medium	Medium	$43/ 20
West Point Grey	Low	High	$69/ 13

Generally, the table shows that fire risk based on the probability of a fire incident occurring does equate to the ranking for dollar loss per capita. However, this would not always be the case since one or two incidents with high dollar loss occurring in a low risk area with low population density would result in a higher ranking. Still, the table does summarize the current situation, and VFRS should continue to report data using the same or similar method.

IV. RESPONSE TIME, FIRE HALL AND APPARATUS LOCATION ANALYSIS

The analysis of response time and service reliability from the city's 20 fire halls in this chapter shows that coverage is generally good. There are a number of changes in fire hall location and unit deployments that can be made to improve service but these were not found to be critical issues.

VFRS has a unique arrangement with seven two-person rescues located throughout the city. The rescues were implemented to decrease the number of medical calls handled by fire units. In addition to medical responses which rescues handle when they are the closest unit, rescues also respond to structure fires and are integral to the city's fire suppression system. Three of the rescues are also equipped with heavy rescue and extrication tools.

The major steps for a deployment analysis include a risk assessment (discussed in Chapter III), working with the public and local government officials to determine response time goals for the community as a whole or by individual planning areas, and measuring current and potential performance against selected goals. The Center for Public Safety Excellence (CPSE) publishes an excellent reference that can be used by communities to understand the process and determine the choices available to them. Generally referred to as a 'standard of cover' analysis, we used the CPSE methodology extensively in the analysis of Vancouver's fire and rescue system.

Deployment decisions concerning fire hall and apparatus locations should be an iterative process largely based on continual or periodic performance measurement. Because the needs of Vancouver change continually, the recommendations made by this analysis should be considered as one step in a continuing process. To do that the fire department needs to improve the internal process of collecting and analyzing response time data. In another chapter we discuss this problem and we recommended a new planning section to lead the effort.

Strategic Goals

Establishing goals against which to measure response effectiveness rests with VFRS leadership. At the time of this study city officials were developing a city-wide strategic plan and the fire department's leadership team is preparing a department plan. To assist Vancouver fire leaders in their efforts we suggest consideration of the following aspects of setting goals for deployment:

1. **Discuss with community leaders and local government officials the desired performance measures for fire and EMS response times.** Very few citizens and

elected officials understand the concept of response time as it relates to emergency services. Educating them on the available choices and tradeoffs are necessary parts of the planning process. It is useful to note to them that rapid response may prevent a food on the stove fire from becoming a house fire; a cardiac arrest from becoming a fatality; and a gunshot wound from becoming a murder.

2. **Implement a method for tracking unit reliability.** The CPSE Standards of Cover manual places great importance on considering deployment changes when a unit falls below 80 percent performance reliability. Reliability in this case means whether the unit located at the closest fire hall is available to answer the call.

3. **Prepare a monthly response time report and distribute the report department wide.** An example of such a report can be found in Appendix A. TriData could help set up such a report.

4. **Conduct an annual performance review for the entire system and each planning area.** The report should summarize the systems overall performance, note changes to specific planning areas, and recommend deployment modifications, near and long-term.

Response Time Analysis

The initial aspect of our review of VFRS deployment was to collect data and analyze response times. Response time is defined as the total time from an individual calling 911 and emergency service personnel arriving at the scene. Three time segments are considered part of total response time: call processing; turnout or reaction time; and, travel time. Some departments also consider the time segment of when personnel first arrive at the street address until they reach a patient for a medical emergency; usually referred to as 'vertical' response time. This time segment can be important, particularly for high-rise buildings such as are numerous in Vancouver.

Response time is the most common performance measure used by the fire service because it is understood by citizens, easy to compute, and useful in the evaluation of end results. It is one aspect of the quality of service that most citizens care about. Though it does not reflect the outcome of the service, response time is a major factor affecting outcomes. NFPA 1710 provides generally accepted response time standards for career fire departments, though there is no single set of nationally accepted response time standards.

Many communities choose to develop their own response time goals, often in light of what is currently achieved versus what it would take to improve them. There have been attempts to measure the incremental value of a minute faster response time for fires and EMS calls, but there is no definitive study. Faster is better, but is unclear how much better in terms of dollars or lived saved.

Most fire departments use the NFPA 1710 standard as a goal, not as a prescriptive requirement. Also, few departments are currently meeting or exceeding NFPA 1710, especially with respect to travel time (which is the hardest to improve). Vancouver is close to meeting NFPA 1710 with respect to travel times (both by incident type and by planning area). However there are issues with overall response times, mostly related to call processing or poor turnout times. In both cases, data collection is an issue.

Measuring Response Time

To determine overall response time, the clock starts when an individual calls 911 (or alternate emergency number) and stops when the first emergency provider arrives at patient's side or the scene of the incident.

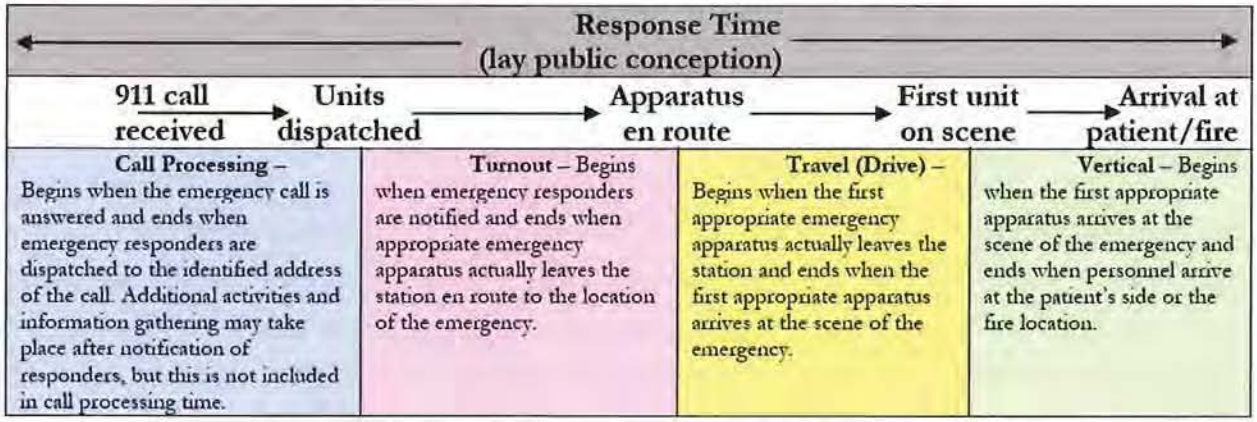
National standards, such as those established by the NFPA provide reasonable means for assessing performance with regard to response times. Different standards have been established for career and volunteer services. Since Vancouver is a career department, NFPA 1710 is the applicable standards. Table 22 summarizes the response time goals established by 1710. Again, NFPA 1710 is a guideline, not a requirement.

Table 22: NFPA 1710 Response Time Goals for Career Departments

Time Segment	Response Time	Percentile
All Calls: Turnout	01:00	90
Fire Suppression		
First Arriving Engine Company	04:00	90
Full First Alarm	08:00	90
EMS		
First Responder	04:00	90
ALS Unit	08:00	90

Response times include the four components illustrated in Figure 16.

Figure 16: Components of Total Response Time



When considering response time, several caveats should be kept in mind.

First, response times are subject to a variety of measurement errors and only measure one aspect of overall system performance. For example, response times are distorted when units report their arrival on scene either early or late. Second, response times are frequently not comparable across fire-rescue systems because of the differing manners in which they are calculated. Not all departments track vertical response times (that is, the time from arrival on scene to patient contact), so their total response times likely would be lower than the total response times of the few departments that do track them.

Many fire/EMS departments report average response times while others report fractile response times. Average response times have been increasingly less used by the emergency service industry because small numbers of very short or long responses—often recorded in error—can distort the results. Also, the public is interested in how fast a system responds to most calls, which is better reflected in fractiles rather than averages. More and more departments are adopting the 90th percentile for reporting response times (mostly due to NFPA 1710's use of this measure).

A fractile response time of x minutes at the 90th percentile means that at least one unit responds in x minutes, 90 percent of the time. The remainder beyond the compliance fractile (10 percent in this case) is the operational tolerance for the system, meaning the system is designed with the understanding that 10 percent of the calls may have response times that exceed the target. Although it is possible to design a system that may ensure rapid response close to 100 percent of the time, it is generally not cost-effective.

Most departments, including VFRS, do not record the vertical response time component. Given the number of high-rise buildings in Vancouver, it would be a good idea to start measuring vertical response time, especially for EMS calls. Vertical response time affects the

realistic expectations for cardiac resuscitation outcomes, and should be considered in response strategy, such as deployment of AEDs, training neighbours in CPR, and deploying more units in high-rise areas. A longer interval of collapse to care time lessens the likelihood of successful resuscitation. Travel times of four minutes to a bedroom community may yield different outcomes than to urban, high-rise communities, as "with patient" times increase the time to care and decreases the probability of successful resuscitation.

Another aspect of "with patient" or "at fire" intervals is better quality oversight. For incident such as cardiac arrest or fire showing, crews could report additional intervals such as "AED placed" or "water flowing," allowing VFRS to measure some aspects of skill quality. For AED placement times, technology and clock synchronization may be used in lieu of extra radio transmissions.

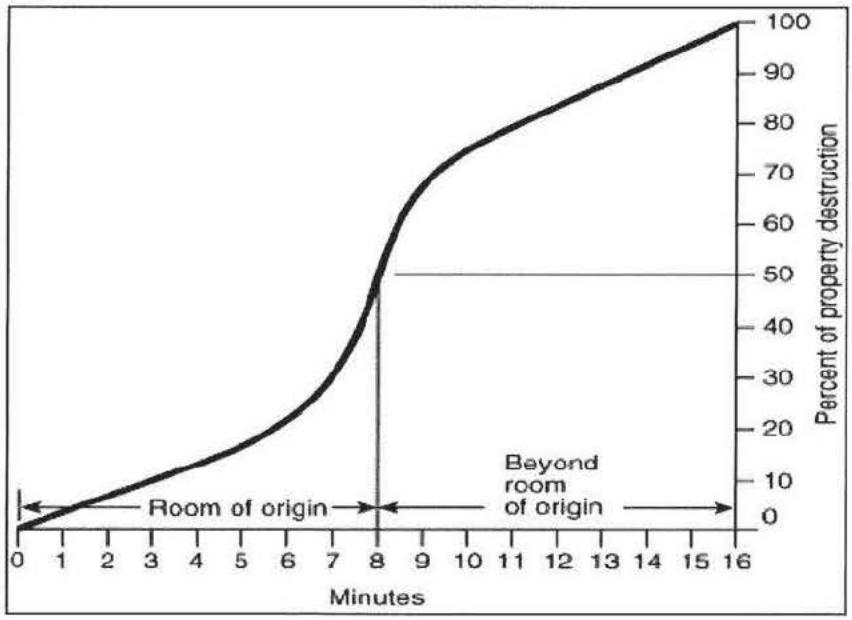
Recommendation 13: Expand the data transmitted and analyzed to include other activities, e.g., primary search complete; ventilation completed; extinguishment started (complete) and begin tracking vertical response time as part of incident data collection, especially for medical calls. Reportedly the fire department is already collecting the time until the application of an automatic external defibrillator (AED). However, the data is not routinely analyzed.

While the speed of response is not directly indicative of service quality, it does affect the number of lives saved and the value of property losses averted when an emergency occurs. This means that while arriving in 3 or 4 minutes every time does not guarantee everyone will live and there will be less damage, more people can be helped or the fire can be put out before the entire building is consumed when emergency personnel arrive in 5 minutes rather than 10 or 20. Fire spreads quickly after ignition and the faster it is found and extinguished, the better the results; similar to someone suffering from life threatening symptoms, the probability of survival increases the quicker the patient is treated.

Despite these general observations, current statistical models cannot realistically assess nor predict the quality of fire services in terms of lives saved and property losses averted. In place of true measures of fire rescue service outcome, response time is often used as a proxy measure.

According to multiple studies, extension of the fire beyond the room of origin begins approximately 6 minutes after ignition, and flashover of the room of origin occurs within 10 minutes of ignition. (Flashover is the simultaneous ignition of all flammable material in an enclosed area.) In some modern rooms with low ceiling and plastics, flashover can occur in two to four minutes, according to studies by the National Institute of Standards and Technology. Figure 17 shows the fire propagation curve, which shows the effect of time and temperature rise of a free-burning fire on the destruction of property.

Figure 17: Fire Propagation Curve



The fire propagation curve above is based on a typical unsprinklered room. Vancouver fire and city officials should keep in mind that the public investment in sprinkler systems may affect what are reasonable response time standards. Building design and sprinkler systems can be used to hold fires in check for longer periods of time. Vancouver has more of its residences sprinklered than any other large city in North America.

When an entire area is sprinklered, response times for fire incidents can be increased. However, unless a whole area is sprinklered, there are still many unsprinklered buildings that need rapid response. In Vancouver, only newly constructed residences have sprinklered systems. The vast majority of single-family houses are still not sprinklered. Later in this chapter, we discuss setting both city-wide response time and planning area response time goals. The percentage of buildings sprinklered should be considered when setting response time goals for fire incidents.

Vancouver Response Time Analysis

The analysis of response times included emergency incidents only. Call processing included the first-dispatched unit from each incident. Turnout, travel, and total response times included only engines, quints, ladders, and rescues. These criteria were applied to keep the analysis in line with the standards against which times are being compared.

For all time segments, 2007 and 2008 CAD data provided by E-COMM were analyzed. We eliminated those time segments that were more than three standard deviations from the median (outliers). Three times the standard deviation was used because assuming that the travel

times had a normal distribution, 99.7 percent of incidents are expected to fall within three standard deviations. Each response time segment is analyzed both by hour of the day and incident type. In the case of the incident type analysis, we matched up the CAD incident number with the actual incident outcome recorded in the RMS system. This means that response time to "fires" only reflects responses to actual fires, not reported fires.

Call Processing – Call processing time includes both call-taking and dispatch. Call-taking is the time to get information from the caller and enter it into the dispatch computer system. This is measured from the time the call is received to the time the call is transferred to a dispatcher. Dispatch time begins when the call is transferred from the call-taker to a dispatcher and continues until units are alerted to respond. The NFPA 1710 Standard recommends a 1:00 minute call processing time 90 percent of the time. However, the one-minute time is believed by some to be an unrealistic goal and 90 seconds is probably more realistic.

The dispatch time analysis was conducted using 2008 data provided by E-COMM. It was determined that call-taking and dispatch times were considerably above that which is recommended, in some cases more than three times the standard. Further analysis by incident type also showed that medical calls received from BCAS took the longest to process. There was also little difference in call-taking and dispatch times by hour of the day, however.

Table 23 shows the total call process and dispatch times for calls responded to by VFRS in 2008.

Table 23: Dispatch Time by Incident Type, 2008

Incident Type	80th Percentile	90th Percentile
Emergency Medical Service	3:42	4:32
False Alarm	2:27	3:16
Fire	2:11	2:50
Hazmat	3:03	3:54
Hazardous Condition	3:01	3:44
Motor Vehicle Accident	2:55	3:40
All	3:24	4:13

Figure 18 shows the call-taking and dispatch times for 2008 by time of day. The red line depicts the call volume by time of day. The line clearly shows the highest volume of calls peaking between 8:00am and 6:00pm, when call volume begins to decrease.