

**COORDINATION PROBLEM IN EMERGENCY PLANNING**

by

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## **ABSTRACT**

Local governments have primary roles and major responsibilities during the response to disasters in British Columbia. Their limited public resources can be increased by requesting support from the province and by developing networks of local and regional agencies. In that respect, coordination among many agencies is required for effective response. Inadequate coordination creates a disorganized and incremental response endangering lifelines, response personnel as well as victims, and slowing down recovery.

The study explains the importance of multi-agency coordination, specifies a plausible disaster scenario and reviews common coordination models. A model of coordination is specified permitting the use of functional network analysis of quantitative and qualitative data collected from agencies with disaster response functions in the City of Coquitlam, British Columbia. The results indicate areas of weaknesses and breakdowns in communication to be expected should a major disaster response be required at this time.

The conclusions of this study identify the negative aspects of incrementalism in contemporary emergency management practice, and propose a new methodology for the evaluation and improvement of inter-agency communication planning and preparedness. Specific networking efforts and modifications to the organizational structures of agencies with disaster response functions are suggested to alleviate coordination problems and improve response operations at the local, regional and provincial levels.

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## **GLOSSARY**

Command	The direction of response resources and operations with authority
Communication	Transmission of information (giving and receiving) through technical or personal means
Control	The exercise of authority in the field
CSAR	Coquitlam Search and Rescue. Local volunteer agency.
CSARES	Coquitlam Senior Amateur Radio Emergency Services. Local volunteer agency
EOC	Emergency Operations Center. The location where agencies are directing their emergency operations
EOCG	Emergency Operations Center Group. A group of personnel from primary agencies directing operations in the ESM model
ESM	Emergency Site Management. An emergency management model based on two layers of command and control (one located in the EOC and one located at the site of the incident)
ESS	Emergency Social Services. Services and resources concerned with mass care
GIS	Geographical Information System. A system designed to provide accurate information on topography, geology, and risk assessment when applied to the seismicity of areas (liquefaction for example). The information is produced on maps
GVRD	Greater Vancouver Regional District boundaries
HEROS	Home Emergency Response Organization System. Local volunteer agency
ICS	Incident Command System. An emergency management model based on a pyramidal organization
RCMP	Royal Canadian Mounted Police. Police force under Federal jurisdiction operating in Coquitlam

PEP	Provincial Emergency Program. Provincial authority, under the Ministry of Attorney General, designed to manage emergency situations in British Columbia
PESSOC	Provincial Emergency Social Services Operations Center. An EOC activated with the PFRC (with an adjacent location) and designed to manage emergency social services at the Provincial level
PFRC	Provincial Field Response Center. The Provincial EOC activated in a disaster area (in Vancouver if an earthquake strikes the GVRD) and designed to manage the provincial effort in support of local governments. The PFRC is activated by authorities in Victoria
SFHU	Simon Fraser Health Unit. The local medical agency designated by Coquitlam to provide medical advice and management
TMP	Trans Mountain Pipeline. The corporation responsible for the transportation of oil from Alberta to British Columbia, with operations in the GVRD

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# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 INTRODUCTION TO THE STUDY**

#### **1.1.1 PREOCCUPATION WITH SAFETY**

The preoccupation of society with disasters can be traced to the beginning of recorded history. More recently, the fear of disasters evolved to include concerns such as armed conflicts, technological catastrophes, and crises affecting social and economical networks. Natural disasters, with their broad and sinister implications on all aspects of human life, are placed high on the list of concerns, particularly now, in an age of global military detente between major powers.

Humanity's ever-present concerns with survival and the prevalence of disasters throughout history, have encouraged significant disaster preparedness and response activities (Kuban, 1993(2), p.1).

But humans are basically the instrument of their own destruction because they have chosen to live where natural disasters occur. They have brought on disaster by altering the environment and creating technological hazards.

### 1.1.2 MISSING RESEARCH IN THE FIELD OF DISASTER PREPAREDNESS

Disaster mitigation, preparedness, response and recovery are now responsibilities of our governments. However, the state of research has been limited in scope.

Even though a large body of research on disasters has emerged over the past two decades, some contend that much of the research has been conducted with limited conceptualization; and even where concepts and theories are presented, little effort has been made to explain links between them (Anderson, 1990).

Gillespie contends that:

surprisingly little research has been conducted on the interorganizational structure most directly related to response effectiveness: the interorganizational preparedness network. In large part this reflects the evolution of research on organizations (Gillespie, 1993).

Kartez explains that there have been fewer direct prescriptions for strategies that will overcome obstacles caused by organizational rather than individual behavior in emergency response. The recent disasters in California have provided research material on disaster management. However,

the information which would embarrass the Department Heads would be suppressed. There is also a problem of research fragmentation as different academic departments and professions work on isolated studies (La Casse, 1992, p.94).

Articles examining the interrelations among the various responding organizations are rare. This is unfortunate, since coordination among agencies involved in a disaster is almost always a problem. For decades, researchers have pointed out that most communities contain rich resources bases that can be used when disasters strike. Except in the most unusual circumstances:

the required equipment, personnel are present somewhere nearby. The problem is access and organization, not existence (Drabek, 1990, p.73).

The study of disasters has been incomplete and has not yet moved into a phase of systematic testing of organizational problems. This fact is disquieting. Still more disquieting is the following finding:

what is puzzling is that after years of disaster research on organizational behavior in major emergencies, local governments continue to be surprised when their standard operating procedures in their lengthy, detailed response plans are found irrelevant in the disaster event (La Valla and Stoffel, 1991).

In the fall of 1985, the Disaster Research Center at the University of Delaware began work on a five year project, the ultimate purpose being to improve understanding of community response to a major disaster when it overwhelms local capabilities. The goal was to identify those dimensions that influence effectiveness of response activities. They found six elements of importance: (1) a good information system, (2) a fully staffed Emergency Operation Center (EOC), (3) adequate human and material resources, (4) coordination of labor from various agencies, (5) a legitimated authority structure and (6) coordinated relationships. Data gathered from the case studies indicated that the areas of most difficulty included communication, task assignment and coordination.

The elements of interorganizational linkages play a decisive role in disaster planning according to research. Their importance has been identified and recognized, but research is still missing in these areas. Organizations, typically, experience a large number of coordination problems following a disaster. Three major problems have been noted in social science research:

lack of consensus among organizations concerning the meaning of coordination; secondly, strained coordination between organizations working on common but new disaster related tasks; finally, difficulties in achieving overall coordination in a community disaster of any magnitude (Quarantelli, 1988, p.382).

In spite of all evidence, the problem persists.

### 1.1.3 DIFFICULTIES WITH TERMS

It is unusual to find any organization which does not agree that coordination is needed following a disaster. The problem is to define the term.

At one extreme, some organizations view coordination, at best, as informing other groups of what they will be doing in the disaster. At the other extreme, some organizational officials see coordination as the centralization of decision-making in a particular agency, thus confusing control and coordination (Quarantelli, 1988, p.382).

An understanding of what coordination means in operational terms has to be developed if crisis management is to proceed.

### 1.1.4 A DISASTER IS UNLIKE A DAY-TO-DAY INCIDENT

Disasters, by their very nature, present unusual and unique demands on the entire community.

Most disasters create demands which exceed the normal capacity of day-to-day emergency response agencies in a short period of time and the community must be modified to fit situations that did not previously exist (La Valla and Stoffel, 1991).

As a result, management approaches used for day-to-day public bureaucracies and private firms are not sufficient to handle emergency disaster circumstances. Disaster response demands that decisions be made quickly, often in a vacuum of meaningful information. Communication and transportation can be disrupted.

Organizations are at a disadvantage in a disaster. Victims can look around, see what has to be done, and do it. Communication and transportation problems do not allow organizations to do the same (La Casse, 1992, p.44).

Timing is often pivotal and a critical factor in disasters, yet is rarely an integral part of disaster planning. When an incident occurs, often many agencies respond and each normally performs a different task. The division of responsibilities results from those involved knowing their roles through training and experience. There is another complication in disaster: the total resources of emergency agencies may be insufficient and require the establishment of priorities, or require help from agencies normally never contacted before. Complexity increases.

The response efforts must eventually reach a level of complexity much greater than that required in day-to-day operations, requiring the resources, experience, and capabilities provided by organizations through organized response (Kuban, 1993(2), p.55).

Implicitly, a disaster demands a total, integrated, and coordinated response.

#### 1.1.5 DISASTERS INDUCE CHANGING CONDITIONS

Disasters may put demands on organizations,

requiring them to make internal changes in structure and delegation of responsibilities ... requiring them to share tasks and resources with other organizations that use unfamiliar procedures (Auf Der Heide, 1989, p.53).

Disasters may attract the participation of organizations and volunteers who usually do not respond to emergencies, or create new tasks for which no organization has traditional responsibility. They may also render unusable the normal tools and facilities used during emergency response.



Within organizations,

decision-making becomes centralized, informal rules and improvisation become the modus operandi, bureaucratic politics flourish, the speed and volume of communication increases dramatically, decision makers prefer to rely on trusted sources, and problems emerge regarding the control of the flow of information (Kuban, 1993(2), p.61).

Certain activities such as information collection, control, and coordination become less obvious and are often neglected. This further aggravates the situation. Response activities therefore take place in a different environment where parameters and to some extent rules have changed.

#### 1.1.6 COORDINATION AS A CORNERSTONE OF EFFECTIVE RESPONSE

Complexity is present at all levels following a disaster. What does it take to manage that complexity ? Coordination, relationships between agencies and communication are often mentioned in research.

The major issues are: effective coordination at all levels, good relationships established in advance through training, communication links (Home Office Emergency Planning College, 1993).

It was found that immediately following Hurricane Hugo on the south-east coast of the United States,

response agencies' abilities to coordinate activities were hampered by organizational and communications problems (United States General Accounting Office, 1991).

Following the Loma Prieta earthquake in San Francisco in 1989, research indicated that

many inefficiencies were noted. These inefficiencies resulted from staffing and coordination difficulties at all levels (United States General Accounting Office, 1991, p.44).

A system perspective during disaster response requires inter-organizational planning.

Some of the most critical difficulties in disaster response are due to a lack of inter-organizational coordination. Yet, many organizations plan for disaster as if they were to function in isolation. Their disaster plans are conceived with a focus on trees rather than forests (Auf Der Heide, 1989, p.39).

Poor coordination among response agencies result in misunderstandings, delays and duplication of effort. Crisis managers having been involved with disasters indicate that disasters always require a multi-organizational response and noted that to be effective, this response must be coordinated. The opposite of coordination is anarchy, where each agency pursues its objectives irrespective of others, necessary resources are wasted and where unnecessary resources hinder response operations. Following a mid-air collision over San Diego in 1978, research found that a communication foul-up flooded the 727 crash site with ambulances, almost none of which were actually needed.

Emergency managers never seem to learn from past mistakes. Case studies and research interviews have shown time after time coordination problems about communications, responsibilities, services to be provided and resources capabilities. These problems cannot be denied anymore or hope to be resolved in the stressful period following a disaster.

## **1.2 PURPOSE OF THE STUDY**

### **1.2.1 PROBLEM STATEMENT**

The importance of coordination during response to a disaster is acknowledged. Therefore, a certain level of coordination between agencies will affect response operations. It will be important to define properly the meaning of coordination and to determine which elements have a direct impact on coordination. A case study will then be employed where the level of coordination between agencies will be measured. These measurements will be used finally to propose practical methods to improve coordination. The study will show a lack of multi-agency coordination in the Greater Vancouver Regional District (GVRD) and indicate a methodology and suggestions improving the situation.

Understanding the complexities of coordination necessitated by the multiorganizational responses is the best route planning and managing can take. The question is not who is in charge but how is coordination to be maximized ? (Wenger et al, 1990).

### **1.2.2 RESEARCH QUESTIONS**

The following research questions apply to this study: how significant is a disaster context for response agencies ? What does coordination mean ? What are the important elements of multi-agency coordination ? How is it possible to measure our elements of coordination ? How can the structure of emergency management in the GVRD affect the

level of coordination ? By following measurements of coordination levels, strengths and weaknesses, how can these levels be improved ?

### **1.2.3 STUDY CLIENTS**

The research will address problems of relevance for the emergency agencies of the City of Coquitlam and other agencies involved in this study. By its scope, the study contains lessons applicable to government and non government agencies at the local, regional and provincial levels. It is hoped that such study can show the importance of multi-agency coordination and provide practical instruments to facilitate improvement.

## **1.3 SIGNIFICANCE OF THE STUDY**

### **1.3.1 COMPLEXITY OF RESPONSE FOLLOWING A DISASTER**

The complexity of disaster environment taxes present knowledge and methods of management. A lack of standardization among a myriad of agencies representing various levels of government and private agencies complicates coordination of disaster response.

Many organizations continue to act independently in disasters, focusing on their own organizational tasks, and sometimes failing to see or find out how their role fits into the overall response effort (Auf Der Heide, 1989, p.57).

Even within government itself, the dispersal of responsibility among dozens of agencies, offices, departments and councils makes it difficult to handle disasters effectively. This interaction of multiple agencies with their own procedures, values, and

resources in a chaotic environment makes response a difficult task. Organizational differences are compounded by cultural diversities and a complex web of jurisdictions, some overlapping, each other having the potential to generate conflict and counter the effectiveness and collaboration required by the situation. A disaster produces unfamiliar tasks and procedures in interaction with unfamiliar faces. Roads may be blocked or jammed, facilities may be damaged, radio frequencies may be overloaded. These facts strongly argue for coordination among the groups involved during response operations.

The need to coordinate efforts is more significant. Limited time and the risk to life and limb dictate that things be done right the first time. This requires that the various response efforts be coordinated so as not to create dangerous operational gaps, or working at cross purposes (Kuban, 1993(1)).

### 1.3.2 TECHNOLOGICAL HAZARDS AND OTHER FACTORS

The rate of disaster occurrence is actually not increasing but the potential for disaster is. Increased vulnerability is due to three factors: increased population concentrations and densities, populations moving to hazard-prone areas such as GVRD, and reliance of societies on technology including toxic products.

As the number of people, structures and technologies increase, the likelihood of natural hazards or technological failures becoming catastrophic events in these environments escalates rapidly (Comfort, 1988, p.4).

How could it be different ? People live in floodplains, on slopes subject to mudslides and landslides, next to water dams and other places vulnerable to natural disasters. Therefore, disasters have the potential to affect larger populations, becoming more complex and involving the close proximity of diverse interests. Hazardous and toxic materials are moved by road, rail and pipeline through heavily populated areas. Oil

refineries are located nearby. All these developments underscore the increasing importance of preparedness and coordination during response operations.

### **1.3.3 THE PUBLIC EXPECTATIONS**

Both the media and the public are becoming more aware of government's role in reducing the consequences of natural disasters and are expecting government to fulfill that role responsibly.

Not so long ago, disasters and their effects were considered Acts of God and governments were protected by the so-called sovereign immunity. Times have changed and it is now quite possible that a local government be liable in the situation of a disaster (La Valla and Stoffel, 1991).

In all cases, governments have moved forward financially to help areas stricken by disasters, in Canada, United States and elsewhere. Legally, they are mandated to provide an emergency management organization and plans at the local level. The liability question is not far away. Local governments would gain advantages to open up the emergency management process and collaborate with local non-government agencies to promote coordination, cooperation and increase total response resources.

## **1.4 ASSUMPTIONS**

The following assumptions are required to frame the coordination problem and to link the preparedness and response phases in emergency management.

#### 1.4.1 PREPAREDNESS INDUCES A BETTER RESPONSE

It is easy to assume that if there has been preparedness, there will be a successful response. Research has shown that it is not entirely true. In order to be effective, preparedness must be of quality, linked to the operational response and follow the principles of disaster management.

Poor planning can only encourage poor management activities. Research has shown that successful disaster management results from emergency organizations coping well with the communication process and information flow, the exercise of authority and decision-making, the development of coordination and loosening the command structure (Quarantelli, 1988).

Moreover, the better we prepare, more routine the response period should be.

Preparedness and response are connected because response represents the policy implementation stage. Rapid mobilization of resources requires training, shared commitment and common understanding of the tasks involved. These elements have to be developed during preparedness, not during the chaotic response. Even then, planning has been shown to be effective, although establishing and maintaining preparedness is difficult.

#### 1.4.2 COORDINATION IMPROVES PREPAREDNESS AND RESPONSE

The multi-organizational and multi-jurisdictional nature of disaster demands cooperation among response agencies and coordination of their activities during both phases. If a disaster can be handled effectively, coordination has to be the vital element of effectiveness.

Coordination reduces fragmentation by linking specific organizations in the overall community and increases access to resources (Gillespie, 1993, p.5).

#### 1.4.3 COORDINATION CAN BE MEASURED DURING PREPAREDNESS

Based on research, preparedness can be measured during normal periods.

Preparedness is similar to the readiness dimension of effectiveness. The concept of preparedness applies widely to the various roles and functions that must be fulfilled to respond effectively when disaster strikes. Studies of disaster preparedness can be conducted during periods of normal community functioning (Gillespie, 1993, p.97).

Coordination is present both in the preparedness and the response phases and therefore can also be measured as one element of preparedness. Disaster requires a response from the entire system and that system is dependent upon its linkages for effectiveness. This will become essential during the research and methodology chapter.

Our research contributes to planning interorganizational coordination of resources and responsibilities under disaster conditions. The measure of preparedness facilitates the monitoring of community readiness for disaster response (Gillespie, 1993).

Measurement of multi-agency coordination offers interesting practical avenues for the evaluation of agencies involved and the emergency management structure itself.

#### 1.4.4 COORDINATION IS AN UNIVERSAL TOOL

Research indicates that disasters have a similar disruptive effect upon the local systems regardless of geography, size of community, culture, seasons. Crisis management principles and practices have broad general similarities which transcend the socio-economic and cultural backgrounds. It can be assumed that the principles of coordination



are also universally valid. Therefore, coordination experiences from other locations are applicable to the study.

#### **1.4.5 THE DISASTER WILL AFFECT THE GVRD ENTIRELY**

The hypothetical disaster will affect all municipalities and agencies within the GVRD to different degrees. The province, faced with a catastrophic situation, will declare a State of Emergency (assume all powers as detailed in the Provincial Emergency Act). All municipalities within the GVRD will ask for and be given powers under the State of Local Emergency within their own jurisdictions.

### **1.5 THE STUDY BOUNDARIES**

#### **1.5.1 A CASE STUDY: THE CITY OF COQUITLAM**

The study is delimited by the boundaries of the City of Coquitlam (see Appendix 1, Map 1.5.1) and all major agencies potentially involved during the response operations within the limits of the City.

#### **1.5.2 THE RESPONSE PHASE**

The study will measure the level of coordination between agencies involved during the response phase. As seen previously, data can be measured during the preparedness phase.

### 1.5.3 WHY THE CITY OF COQUITLAM IS A GOOD CASE STUDY ?

The City of Coquitlam is a suburb city in the GVRD. The population is approximately 85,000 people and the tax base is mainly residential and growing. As a bedroom community, the proportion of land occupied by industry is small but not insignificant. However, Coquitlam's strategic location provides other interesting problems.

All major utilities, transportation routes and lifelines on which depend the region of Vancouver west of Coquitlam cross the city boundaries at some point. The Greater Vancouver Water District Coquitlam Lake supplies water to Surrey, New Westminster and the remainder of the GVRD and passes through a landslide area and liquefiable soil on route to crossings of the Fraser River. There are six major water reservoirs, one of which belongs to the Greater Vancouver Water District, located in Coquitlam. There are ten major water pumping stations and 32,000 water service connections in Coquitlam alone. The Greater Vancouver sewerage and drainage trunk sewer crosses Coquitlam in liquefiable soil areas. Coquitlam has 46 sewer pumping stations and 25,000 sewer connections. There are two B.C. Hydro sub-stations and three major transmission lines crossing Coquitlam, some in liquefiable soil areas. Various B.C. Gas pipelines, essential to the metropolitan area, and the main gas compressor station for Vancouver Island are located in Coquitlam. Some of these pipelines are located in liquefiable soil areas and one line crosses the Fraser River. Trans Mountain Pipeline has a 24 inch oil and refined product pipeline crossing the Fraser River in liquefiable soil areas. There are 65 kilometers

of City arterial roads. The Trans Canada Highway and Lougheed Highway with three major interchanges pass through Coquitlam and are major components of the Provincial Highway system. The Port Mann bridge terminates in Coquitlam in an area of liquefiable soil. C.P. Rail and their inter modal yard in the Mayfair Industrial Park are located in liquefiable soil areas. Coquitlam is clearly a strategic location for the region.

It is also important to consider potential induced hazards. Flooding from a collapsed or damaged Coquitlam dam would cover most of the low areas of the city where are located strategic utilities, transportation routes and lifelines. A collapse at any point along the five kilometers of dykes along the Fraser and Pitt Rivers would cause the same problems. The dykes are located in liquefiable soil areas. There are up to 15,000 vehicles per hour in peak travel time on routes which cross the areas of greatest hazards. Collapsed overpasses, derailed trains and vehicle accidents could cause gridlock which would seriously impair response agencies and present major coordination problems. To complete the picture, a psychiatric unit is located on liquefiable soil in areas subjected to the greatest hazards.

Coquitlam is actively engaged in preparedness activities. A new disaster plan has just been completed. The city is establishing a strategic plan to improve emergency preparedness throughout the community. This broad plan focuses on citizen preparedness and contact with other local agencies. A computer network linking intra-municipal agencies will improve access to information and coordination. The Geographic

Information System (GIS) is being introduced to help manage hazards. An utility control center, designed to monitor and control utilities on a 24 hour basis is being established. Mitigation activities are also being conducted. The city is expanding its fleet of emergency generators and adapting them to multiple uses. The city is conducting regular emergency exercises to test its capabilities, procedures and readiness. Finally, a sub-regional emergency organization is contemplated of which Coquitlam is the leading municipality.

The strategic location of Coquitlam, the number of regional lifelines crossing its boundaries and the quality of its preparedness make the city an appropriate case study in the GVRD.

## **1.6 DEFINITIONS**

### **1.6.1 RESPONSE PHASE**

The response phase represents activities which individuals and organizations undertake to minimize the negative impact of a disaster, or reduce the potential for further damage after the event. It is often called the post-impact phase. The response phase represents activities that immediately follow the occurrence of a disaster, activities that will save lives and property. It also represent a duration starting at the first hours to a few weeks following a disaster.

### 1.6.2 PREPAREDNESS

Preparedness represents

arrangements to ensure that, should a disaster occur, all those resources and services which are needed to cope with the effects can be efficiently mobilised (Natural Disasters Organization, 1992).

The preparedness concept is a pre-planned activity to reduce loss of life, injury, and property damage, and to restore everyday routine in the aftermath of a disaster. It suggests organizing a response prior to an event, planning how to respond, and working to increase local resources and their abilities to respond effectively.

### 1.6.3 COORDINATION

Coordination has been defined as:

the cooperation of independent units for the purpose of eliminating fragmentation, and duplication of services. It is vitally important during all four phases of emergency management: mitigation, preparedness, response and recovery (Kuban, 1993, p.71).

Environment Canada identifies coordination as the essential process building together with functional arrangements in order to provide an effective response. Coordination relates primarily to resources (human and material), and to a process involving information and activities from multiple agencies. That definition provides the basic elements of coordination for the study.

#### **1.6.4 RECOVERY**

The recovery is the final phase of the emergency management cycle. It continues until all community systems and services return to normal, or near normal. The border between response and recovery is overlapped. The last phase of response represents the initial phase of recovery. However, recovery is not concerned with life saving activities.

#### **1.6.5 DIRECTION AND CONTROL**

Direction is concerned with the overall conduct of operations for a massive disaster response effort. La Valla and Stoffel (1991) define control as the tracking and allocation of existing and needed resources. Direction represents command at a strategic level while control is more tactical and locational.

### **1.7 STUDY OUTLINE**

The study intends to define the disaster context, the term and elements of coordination and analyze existing coordination models. A methodology for data collection and analysis will be presented. Data will be analyzed from a local perspective. Suggestions will be submitted to improve local preparedness, and question the structural elements of the existing emergency management structure at the local, regional, and provincial levels.

## **CHAPTER 2**

### **THE DISASTER CONTEXT**

Disasters are events of such magnitude that the response to them is beyond the realm of a single organization.

An occurrence of a severity and a magnitude that normally results in deaths, injuries, and property damage and that cannot be managed through the routine procedures and resources of government. It usually develops suddenly and unexpectedly and requires immediate, coordinated, and effective response by multiple government and private sector organizations to meet human needs and speed recovery (Auf Der Heide, 1989, p. 51).

#### **2.1 THE EARTHQUAKE : AN ENCOMPASSING DISASTER**

##### **2.1.1 THE ALL HAZARDS APPROACH**

The study does not analyze agent-specific disasters such as toxic spills because they refer only to a few elements of the response, and are usually well documented, well defined and well rehearsed by the proper authorities. They seldom involve a total response. Research has found advantages to an all-hazard approach in emergency planning. This approach can reduce a multitude of plans to a manageable level and put emphasis on problems common to all disasters, mainly coordination and communication.

There is also no conceptual reason for treating technical or natural hazards differently. The advantages of the all-hazard approach over agent-specific plans are as follows:

the management needs and problems are similar. The approach avoids duplication of efforts and resources. Research into civil defense programmes in the 1960s and 1970s found that appeals made to local coordinators on the basis of an all-hazard approach were more likely to be acted upon than others (La Casse, 1992, p.25).

The type and size of disasters are not mentioned in these studies.

## 2.1.2 THE EARTHQUAKE AND ITS TRIGGERING EFFECTS

Research shows that preparation for the worst case scenario, for example an earthquake of extreme magnitude, creates several problems when planning for disasters:

such scenarios amplify apathy. Preparedness for moderately sized disasters may be more realistic and achieve greater acceptance by those who must pay for and carry out the preparations (Auf Der Heide, 1989, p.24).

Focus on moderate disasters involves procedures more likely to be used and therefore learned. The skills, training, procedures and supplies developed for moderate disasters are a logical step towards preparedness for larger events. The earthquake is a good type of disaster of moderate size to practice an all-hazard approach over a large geographical area. It allows a certain number of planning assumptions to be made in the context of a total response:

an earthquake is an event or series of events that will result in large number of deaths and injuries, destruction of a large percentage of facilities that provide and sustain human needs and may occur without warning. Access to and from the damaged areas may be severely restricted. Communications and life support systems will be severely disrupted or destroyed and resulting aftershocks may trigger secondary events such as fires, tsunamis, liquefaction, landslides, flooding and release/spread of hazardous materials (Federal Emergency Management Agency, 1985, p.10).



Local resources are likely inadequate to respond to the effects of a damaging earthquake. These assumptions will tax to the limit the response efforts of all agencies and their coordination mechanisms. The earthquake is also known to trigger a series of other events with a cascade of hazards (see Appendix 1, Figure 2.1.2).

An earthquake has a variety of primary effects such as damaged buildings, facilities, and disrupted transportation and other systems. A secondary effect would be when the earthquake causes structural failure in a dam, causing flooding (La Valla and Stoffel, 1991).

To reduce the impact of such events, authorities must be able to coordinate emergency systems capable of dealing with these effects. How realistic is it to prepare for such events in the GVRD ? What is the scientific basis on which we can support our planning assumptions ?

## **2.2 AN EARTHQUAKE : A POSSIBILITY IN THE GVRD**

### **2.2.1 GEOLOGICAL EVIDENCE**

The most intense region of seismicity in Canada is located on the West Coast (see Appendix 1, Map 2.2.11). The Cascadia subduction zone is an oceanic-continental boundary located off the West Coast of Canada and the United States. The zone extends northwards from the San Andreas fault to the Queen Charlotte fault and 500 kilometers of that zone is in Canada. On the Cascadia subduction zone, three plates (Juan de Fuca, Explorer and Gorda) are moving in a northeast direction and are subducted beneath the North American plate (see Appendix 1, Map 2.2.12). Although earthquakes are frequent

within the plates along the Cascadia subduction zone, there has been no significant earthquake activity known to have occurred along the interface where the Juan de Fuca, Explorer and Gorda plates descend. Explanations could be that

the descending plates are subducting smoothly without any resistance or that the subduction plates are slowing down as a result of strain build up which in turn may lead to a great earthquake (Scovill, 1993, p.4).

The latter theory may explain the accumulation of crustal strain on Central Vancouver Island and across the Juan De Fuca Strait. Crustal deformations in other earthquake-prone regions indicate that these changes could be precursors to future, large magnitude events. As well, southwest British Columbia has an history of past earthquakes, although they were not characteristic of major subduction earthquakes. In 1946, an earthquake of magnitude 7.3 on the Richter Scale occurred along the Nootka fault on Vancouver Island. In 1965, Vancouver felt an earthquake of magnitude 6.5 centered below the City of Seattle. Each year, more than 200 earthquakes are recorded in the Fraser Lowland and on Vancouver Island. In 1990, there was a series of shallow earthquakes in Washington State, just south of Abbotsford, which went on for two months, the largest of a magnitude of 5 on the Richter Scale. Basically, the region is at risk from three types of damaging earthquakes: shallow earthquakes near Vancouver with numerous possible aftershocks; a large subduction earthquake farther than 100 kilometers away; lower intra plate quakes nearer Vancouver with no or few aftershocks. Whatever the scenario, geology and historic evidence show that the next quake is a certainty. The only remaining question is when will it occur ? The Munich Reinsurance Company, Canada Mortgage and Housing Corporation, and B.C. Hydro have all made studies and

chosen scenarios applicable to their different spheres of interest for planning. The scenario for the large subcrustal quake can be said to be contained within the parameters of the scenario for the subduction quake. For that reason,

if the subduction event is used as a planning scenario, then the large subcrustal event can be said to have been planned for as well (Hightower et al., 1993, p.32).

What does that mean ? An earthquake with four minutes of ground shaking, no significant uplift in the Vancouver area, liquefaction in susceptible areas (see Appendix 1, Map 2.2.13), a small residual wave in the order of one foot in height and observed intensities varying from 6 to 7 on the Modified Mercalli Scale within the Greater Vancouver Regional District, except Delta and Richmond (up to 8). We must remember that the Mexico quake of 1985 was a subduction event and had his epicentre more than 400 kilometers away. The epicentre could be much nearer in our case. The Kobe quake of 1995, although details are still unknown, had an intensity of only 6.8 on the Richter Scale.

One important theory applied to earthquake prediction is the theory of seismic gaps.

Scientists hypothesize that, after a large earthquake eases strain along one part of a fault, the probability of more large quakes along that part of the fault is low at first. But, as strain again increases from the movement of the earthcrust, the potential for a future earthquake is greater along segments of active faults that have a lengthy gap since the large event (Whitehead and Sadkowski, 1989).

The last great subduction event has taken place over 300 years ago and it has been calculated, based on geological evidence, that

the last 13 subduction events have been preserved, and on this basis a return period of 590 years, plus or minus 170 years, can be estimated (Hightower et al., 1993, p.29).

However, reliable earthquake prediction is still a distant goal.

## 2.2.2 EFFECTS ON THE GVRD

What would be the effects of a major earthquake on the GVRD lifelines and most importantly the effects on response teams and organizations responsible to save lives ? The following section provides some answers to that question, based on previous earthquake experiences of disaster in Japan and United States. The sum of data has been provided following the earthquakes in California over the last eight years (Los Angeles 1987, San Francisco 1989, Los Angeles 1994) and Japan. Specialists in the geo-technical field agree about the possibility of a large earthquake occurring nearby the GVRD, with a magnitude perhaps even greater than 7.5 on the Richter Scale. An event of this size could have domino-type effects causing catastrophic damage and much loss of life. Liquefaction causing ground subsidence could occur in many parts of the Fraser River Delta.

Buildings and other structures in these areas will, in addition to damage from shaking, be subject to uneven ground settlement since differences in soil susceptibility to liquefaction occur on a microscale. This will cause parts of the buildings to slump, dig, sag or collapse while other portions remain intact (Anderson et al., 1990(2), p.6).

Liquefaction was also a factor in damage to highways and industry in the Courtenay earthquake of 1946. As in Nigata in 1964, differential settlement of the ground in the Fraser River Delta may cause large cracks in the dykes which would allow serious flooding. Appendix 1, Map 2.2.21, indicates areas where liquefaction is possible in Coquitlam. These areas are crossed by major transportation and utility lines. Lateral

spreading of soil fills on which bridge abutments are placed may disrupt bridge access as happened in Nigata, where ground subsidence due to liquefaction caused a bridge approach to sink several feet below the bridge. On the North Shore mountains, including large areas in Coquitlam,

slope failures could trigger rock or snow avalanches, flooding, debris torrents, and debris flows. Landslides throughout the Lower Mainland may cause earth slumps, flooding, debris flows, mud flows and other types of hazards. Disruptions to major transportation routes will likely occur. Human life and safety will be in serious jeopardy, and severe property damage could occur (Anderson et al., 1990, p.7).

Older brick buildings anywhere may collapse or be severely damaged as happened to stores and banks in Campbell River and Courtenay during the 1946 quake, and during the quakes in California. Even when a building is structurally safe, internal objects such as ceiling tiles, fluorescent lights, overhead pipes, electrical wiring and internal beams may loosen and collapse on persons below. This hazard could have tragic consequences in schools and hospitals. During the Whittier Narrows earthquake in 1987, enormous damages were encountered inside buildings, although the exterior of new structures were left intact. Throughout the region, light to moderate damage will probably occur to lifelines (water, sewer, gas, electrical, fuel and telephone lines). Fires may start as a result of broken mains and downed electrical wires. Access and ability to contain fires will be curtailed and a conflagration is possible.

The Kobe experience seems to confirm this statement. The earthquake can trigger human induced hazards potentially serious to the population. Toxic accidents and spills can trigger explosions, pollution of lifelines, fires and force evacuation of whole areas.

Communication failure for an undetermined period of time is a real possibility. Of all these hazards, earthquake-induced fires are considered the most dangerous.

The most recent research on post earthquake fires stresses that fire remain one of the most serious threats associated with earthquakes in heavily populated areas. This is especially true in cities having a large wood building stock. For obvious reasons, additional hazards also exist with regard to industrial facilities, such as oil refineries and chemical plants, located in densely populated areas (Hightower et al., 1993, p. 82).

During the Northridge earthquake of Los Angeles in 1994, the entire City of Los Angeles was without power following the earthquake. No one thought it was possible. The police department was able to operate out of their parking lot for the first 24 hours. Only half of the electricity customers had power within 24 hours. Electrical substations were considerably damaged and it is estimated it will take three to four years to restore all facilities. Over half the population had no water after the quake: pipes were broken, pumps were not functioning and the distribution system was badly damaged. It took four to six days to restore water to the western part of the city, and another two to three days before the water was potable. Decisions to demolish the collapsed Santa Monica Freeway (well publicized) was reached within only 24 hours, although Los Angeles is crossed by a multitude of large arterial roads. The number of housing units lost was estimated at 60,000 to 70,000 units. Initially, there was a program of food distribution via food stamps for those affected, but this was poorly managed and considerable fraud took place. Two months following the disaster, statistics were issued by the Federal Emergency Management Agency (FEMA):

368,000 disaster housing applications received, 320,125 home inspections completed. The American Red Cross served 2,401,218 meals to date. Rental assistance has provided 5,548 daily and 5,249 monthly rental units (Interviews, 1994, p.36).

More than 35,000 people were left homeless. Quick action moved these people out of the shelters and into vacant dwellings, hotels and other accommodation within three and a half weeks. A 12% vacancy rate in the area at the time helped to relocate these people. Many single family homes suffered damage from chimney failure. An estimated 70% of the homes in the earthquake zone lost their chimneys and another 75,000 also experienced hot water tank failures as the tanks toppled and broke. In a number of neighbourhoods, new ghost towns appeared, due to the destruction of multi-family dwellings, damages to commercial buildings and lack of customers. It is interesting to note that Los Angeles is, by our standards, very well prepared. They have a flexible emergency management structure, response resources and public awareness, like in Japan.

The numbers shown above are staggering. Are these effects also possible in the GVRD ? Certainly and to some degrees they could be worse.

Transportation is one important regional concern following a major earthquake. Not only is access to sites important during the assessment and rescue phases, but usable transportation routes are essential in order to provide emergency resources, both personnel and materials, and to enable people to return to their homes or shelter. Traffic congestion is already a major issue in the Lower Mainland and following an earthquake, one could expect the problems to become horrific (Hightower et al., 1993, p.36).

The number of bridges which connect all municipalities within the region poses unique problems. As well, the number and location of bridges and highways which connect the region with the rest of Canada and the United States are also a concern (see Appendix 1, Map 2.2.22). Other concerns relate to airports and port activities. The capability of the

region to receive bulk supplies for repair and recovery could rely entirely on the road network, with some of the main arteries passing through Coquitlam.

There is a great deal of uncertainty about the degree of damage which would occur to the existing telephone network, as communications are essential to assess damage and determine the number of people to be rescued.

There are suggestions that the conservative approach to engineering design and construction of B.C. Telephone facilities might not result in major damage (Hightower et al., 1993, p.60).

A 1990 CMHC report estimates that following a major earthquake, from 50% to 100% of all unreinforced masonry buildings would collapse, in the older areas of the region, creating a Search and Rescue (SAR) issue.

Past experience (the Niconhai-Chubu earthquake, 1983) has shown water systems to be susceptible to severe damage during earthquakes, particularly due to liquefaction. Potable water for drinking and water for fire fighting could potentially become in short supply in the GVRD. Damages to the gas distribution system could also become problematic.

Munich (1992) suggests that the complex gas distribution system in the Lower Mainland would be heavily impacted and that a lengthy downtime could be expected (Hightower et al., 1993, p.88).

Previously, leaks have caused several fires and customers reaction to shut off their gas supply for safety reasons have overloaded the gas companies response capacity. The recent Kobe earthquake in Japan seems to indicate that no distribution system so far is immune to damage.



The inability to obtain and disseminate useful, accurate and timely information on casualties, damage, and resources required has been identified as a major problem.

Experience suggests that casualties numbering in the thousands, with fatalities probably in the hundreds are to be expected. Hospitals, which might or might not survive, would be swamped. At a more local level, the following observations complete the picture:

responding mutual aid units will require guides and maps. Water will be contaminated and unsafe for drinking. Tankers will be needed for carrying drinking water. Electric power will be interrupted. Phone service will be erratic. Fuel will not be available because there will be no electricity to run the pumps. Portable toilets will be in demand. Streets will be impassable in some areas. Many fire hydrants will be inaccessible or inoperable. Generators will run out of fuel. Critical facilities will have to be self-sufficient: gas, lights, water and sewage may be out for days. Handicapped and disabled persons will probably die unless personal family and friends can care for them. Emergency equipment will not be able to reach some locations because of traffic jams. Parked or abandoned vehicles will block streets (Blackston, 1986, p.26).

This is not a scenario for doom. An earthquake is not an incident but a total event.

Comments from two smaller Canadian disasters are interesting for comparison: The 1990 Hagersville tire fire and the 1987 Edmonton tornado.

They were both complicated events. Both situations involved several emergency operation agencies and hundreds of volunteers were on site. This created many problems coordinating communication. They presented a strain on resources. Several levels of government were also involved in both incidents. Disasters can also create problems when there are conflicting priorities ... the need for quick decisions (Scanlon, 1992(1), p.3,4,6).

The unique environment of a disaster involves a multi-organizational and multi-jurisdictional effort. This demands cooperation among agencies and the coordination of their activities.

Failure to achieve these two key requirements-coordination and cooperation-typically results in breakdown of communications, failure to effectively allocate

scarce resources, disjointed operational tasking, and the inability of these agencies to meet their respective response objectives (Hightower et al., 1993).

Coordination is a difficult goal to achieve because agencies have the habit of working independently on a day-to-day basis. This will not work in a disaster context.

### **2.3 MYTHS TO BE DISPELLED IN A DISASTER CONTEXT**

What are the effects of a disaster on people, who, in the final analysis respond first to any disaster ? A myth is that disasters bring out the worst in people. Experiences present a completely different view of human interaction.

Victims of disaster often respond with actions of altruism. Looting is also rare during the impact period of disaster, and is often conducted by outsiders. Panic is also rare during disasters (Kuban, 1993(2), p.59).

Not only panic is an uncommon response to disasters, but it is difficult to get people to leave when disasters threaten. This is a lesson to learn for cases where an evacuation is necessary.

A similar hesitancy to flee in the face of impending disaster has been documented in dozens of disasters of all sorts. In some of these cases, even the threat of force and coercive measures were not enough to assure evacuation (Auf Der Heide, 1989, p.198).

Disasters generally do not render people stunned and unable to act. They will take what they perceive to be appropriate actions even without direction of leadership from authorities. In fact, official directives that are not considered relevant or appropriate may be ignored altogether. Residents of affected areas respond actively and do not wait for

community officials to tell them what to do. This is another reason to involve them fully in emergency management activities.

Communities mobilize rapidly to meet emergency demands even under severe circumstances. Timely coordination is more important than control. Coordination is essential and should be maintained under local authority (Drabek, 1991, p.35).

One important element is information. It should not be withheld because of fear that people will panic. They will not. Another element is morale. Experience showed that morale overcomes the chaos caused by a disaster. Post event morale is not necessarily low despite the negative experience of many individuals. In fact, the heightened sense of mutual need and support help to enhance morale. What about the responders sense of duty within their agencies ? Again, research provides interesting results specifically applied to the earthquake case:

it should be noted in the instance of the subsample of the earthquake, the most efficient test of the role conflict hypothesis, there was no abandonment of occupational role responsibilities, nor any delay in reporting, regardless of location (Dynes, 1990, p.20).

Myths become dangerous when organizations act on them, particularly when coordination of all resources and cooperation are necessary.

Fearing panic, radio stations hold back warnings. To prevent looting, police devote their resources to security. On the assumption that victims cannot cope, impact areas are evacuated. Imagining the victims to be helpless, outsiders rush to help, causing congestion (Drabek, 1991, p.89).

If individuals react relatively well, what about organizations ? They do not adapt as quickly as individuals. They have to cope with a changing environment and a realization that day-to-day methods are not relevant anymore.

Many of the problems occur because agencies assume that they can operate with the same degree of management control that they use in smaller emergencies. Major events have impacts on many different segments of society, each with their

own pre-existing patterns of authority and the simultaneous and autonomous actions they take make it impossible to create a centralized authority system in disasters (Kartez and Lindell, 1987).

In conclusion, the earthquake scenario provides a context applicable to all agencies in the case study, with effects demanding a different response than their day-to-day operations.

## **CHAPTER 3**

### **MULTI-AGENCY COORDINATION**

Research shows that most problems encountered during the response phase were associated with agencies. This chapter will further define the word coordination and the elements supporting coordination between these agencies.

#### **3.1 OVERVIEW OF COORDINATION**

Disasters are characterized by great uncertainty. Initial actions are undertaken based on vague and often inaccurate information. Disasters are also fluid in nature, with needs changing constantly. Following the Californian experience, the most serious problems related to all jurisdictions centered on a lack of interorganizational coordination at the operational level. Who is responsible for coordination ? By law, local governments must produce emergency plans but the term coordination, particularly between many jurisdictions, is not defined.

Laws determining who has overall coordinating responsibility and authority when jurisdictions are crossed are often unfamiliar to the participants, or are vague, confusing, or non-existent (Auf Der Heide, 1989, p.59).

The Emergency Act in British Columbia does not define the term coordination. This is unfortunate since

disaster response organizations which are typically restricted by limited resources should concentrate on information gathering, interagency coordination, and systems control (Kuban, 1993(2), p.100).

### 3.1.1 A DEFINITION OF COORDINATION

Coordination is often defined as a framework to accomplish a task specifying task assignments, organizational responsibilities, chains of command, and resource provisions. Coordination is closely related to the response, the implementation phase of a plan. In a disaster context, it refers to the immediate response phase, when time is essential to save lives. Flexibility is necessary. Coordination is not just an administrative arrangement. It must have an operational purpose and be accepted by the agencies involved. Coordination channels resources into a common direction for the overall benefit of a community, and suggests the creation of response networks for particular functions, a concept presented in the following chapter. A simple definition is provided as follows:

coordination is the cooperation of independent units for the purpose of eliminating fragmentation, gaps in service delivery, and unnecessary duplication of services (Drabek, 1991).

### 3.1.2 COMMAND AND CONTROL OF RESOURCES

Command and control refers to a rigidly structured operation in which authority flows from the top down, as in military planning. There are limitations however, even in the military, with such a model, because it does not accurately capture what really goes on during a disaster. In fact, a command and control model would probably not be viable even if attempted. The model is based on several invalid premises such as weakness of the victims and fragility of the social systems. Research suggests a very loose command

structure at the beginning (the response phase) becoming more centralized with the increased amount of resources deployed to fix problems (response-recovery interface), a tactically decentralized system followed by a centralized strategic structure. This is logical since communication and information flow always represent a problem in the post-impact phase restricting any centralized command and control of resources.

Sometimes, the problems are so threatening that consultation between the first responders and their superiors is not possible. Decisions are taken on the scene. A double layer approach supports such actions and is discussed in chapter 4.4. The situation also shows the importance of communication to provide a constant flow of information and to support command and control.

This blueprint is applicable to the GVRD and does not negate a need for command and control. Control implies the ability to contain a situation and is essential to avoid problems such as mass convergence and duplication of efforts. The argument concerns how command and control are applied in the field.

### 3.1.3 COOPERATION BETWEEN AGENCIES

The response phase involves situations where roles and lines of authority are ambiguous, with new agencies on site including volunteers and private agencies. In these cases, effective coordination hinges on effective cooperation.

It is critical for emergency management systems to encourage and facilitate inter-agency cooperation. Moreover, this cooperation should exist from the start of pre-disaster planning through the end of post-disaster response and recovery (Kuban, 1994, p.5).

Cooperation is difficult to establish, particularly before a disaster, but planning for common tasks and functions may help. Increased cooperation in problem solving and decision-making can be enhanced by improving information gathering, interpretation and exchange of information. Direct contacts between agencies with similar responsibilities can also enhance cooperation beforehand, and help to secure the required personnel, resources and information when needed. Some research goes further:

cooperation between the private sector and the public sector on a daily basis is required before a profound impact on effective disaster response is realized (Auf Der Heide, 1989, p.vii).

#### 3.1.4 THE AGENCIES AND THEIR ROLES

Understanding of the community systems is essential to establish and maintain coordination. These systems are common to all communities and are described in general terms. These represent activities associated with the response phase and accomplished by a large number of agencies. In this section, each system is described and their activities defined. For each system, a list of agencies potentially involved during the response phase in the City of Coquitlam is provided.

3.1.4.1        Emergency Medical Care. The emergency medical system includes a wide variety of services and resources, from first aid offered in the field to basic



life support provided in hospitals. Disasters place extensive and often unexpected demands upon the medical system.

There may be large number of patients, a shortage of trained staff, and damage to medical facilities and equipment. Mass convergence is likely. Telephone are often inoperative or overloaded and the public demand for information is high (Drabek, 1991, p.67).

The situation demands preparedness (an inventory of equipment and personnel) and management of the victims flow during the response. The agencies involved in Coquitlam are: the City Emergency Operation Center (City EOC), the Simon Fraser Health Unit (SFHU), the Royal Columbian and Eagle Ridge hospitals, the Greater Vancouver Hospital District, the Ministry of Health and B.C. Ambulance.

3.1.4.2        Emergency Social Services. These services include the provision of food, clothing, mass shelters, first aid, and counselling. Special efforts are required to coordinate services to elderly residents, handicapped residents, children and non-English speaking residents. Planning has to include community and social networks already in place, the inevitable emergent networks of altruistic groups, and the designated authorities and professionals. The agencies involved may include: the private sector, the City EOC, the School District number 43, churches, the Salvation Army, the Greater Vancouver Housing District, the Red Cross, the St John's Ambulance and the Ministry of Social Services.

3.1.4.3        Public Agencies. These agencies are central to the initial response at the local level and provide such services as police and law maintenance,

firefighting, Search and Rescue, maintenance of water lines, sewer lines, roads, debris clearance and reaction to hazardous material incidents. The diversity of these tasks and their potential magnitude require an approach based on a total coordinated response from all agencies. The agencies involved include: the City EOC, the private sector, volunteer groups, the Greater Vancouver Water and Sewerage Districts, the Ministries of Attorney General, Environment, Forests, Transportation and Highways, and the Regional Fire Commissioner.

3.1.4.4      Private Sector. It includes the construction industry, the chemical industry, merchants, volunteer groups and supporting agencies such as hotel accommodation to support social services. Volunteers can help established organizations increase their effectiveness. Local control, widespread involvement and flexibility are essential to a quick and effective mobilization of volunteer resources. The agencies include: the private sector, and volunteer agencies such as the Home Emergency Response Organization System (HEROS), the Coquitlam Senior Amateur Radio Emergency Service (CSARES), and the Coquitlam Search and Rescue (CSAR).

3.1.4.5      Regulated Sector. It includes agencies regulated by government such as power, utility, telephone and public transportation corporations. These agencies are essential to any emergency response, yet are not coordinated neither at the local, regional nor the provincial level.

Because power sources are critical to saving lives and protecting property, coordination between power companies and government agencies takes precedence over all other activities (Drabek, 1991, p.71).

Research concludes that

minimal cost is involved in developing inventories of equipment, identifying experienced personnel, establishing mutual aid agreements and maintaining interorganizational and interjurisdictional disaster planning. The expense involved in taking these precautions compares favorably with the high cost of replacing equipment (Drabek, 1991, p.74).

A very interesting statement. These agencies include: the Fraser River Port

Authority, B.C. Hydro, B.C. Gas, B.C. Telephone, C.P. Rail, Trans Mountain

Pipeline, B.C. Ferries and B.C. Transit.

3.1.4.6      Media. They provide the public with hazard warnings, safety instructions, official announcements, evacuation procedures, directions on getting to medical and mass care facilities, status reports on the condition of lifelines, and damage assessment information. Agencies involved in the study represent only a sample of potential media: the City EOC, radio stations such as CKNW, television stations such as CBC. Newspapers, faced with potential distribution problems, are less important during the response phase.

Federal agencies are not covered in this study, as they become involved mainly through provincial ministries. At the provincial level, the Provincial Emergency Program (PEP), under the Ministry of Attorney General, has the responsibility to prepare for and respond to disasters within the province. Under PEP, roles and responsibilities of

municipalities are to prepare for and respond to emergencies when they occur within their boundaries. A regional agency such as the GVRD has no legal mandate or authority to act as coordinating body over its municipalities during emergencies. The range of agencies mentioned above represents a wide cultural and organizational spectrum compounding coordination problems. Finally, Emergency Preparedness Canada supports the primary role of municipalities following a disaster.

When these services and resources are offered, they are typically provided in support of municipal efforts. In other words, the involvement of provincial or federal resources does not automatically mean a shift of overall jurisdiction away from the municipality's elected officials (Kuban, 1994, p.6).

### 3.1.5 RESOURCES TO BE COORDINATED

Five resources are coordinated during all phases of emergency management but specifically during the preparedness and response phases. These resources are: information, personnel, equipment, physical space and money. Of these resources, information is the most important:

in predisaster phases, the sharing of information builds a capacity to respond effectively during the postdisaster stages and guides action. An effective response to disaster requires the accurate and timely transfer of information and one of the most serious problems in disasters is disruption of the flow of information (Drabek, 1991, p.63).

The coordination of personnel is also essential. These contacts are better established during the preparedness phase rather than following the event, for obvious reasons of time, stress and urgency. Equipment is critical to save lives and restore lifelines during the response. Resources potentially available can be determined at low cost during the

preparedness phase. This includes communication equipment. Field equipment is identified and inventoried during predisaster phases to build resource capacity. Physical space, land and building, is also required, as shelter or as a location to deploy equipment and bulk resources. Buildings house most emergency management activities. Money is the last element to be coordinated and is not covered in this study.

### 3.1.6 THE INFORMATION FLOW

Information is necessary to know what happened, what is happening and what is likely to happen.

Impact and immediate post-impact phase needs ... tend to be focused on surveillance, tactical and logistical requirements for directing and coordinating immediate action, relying upon rapid, accurate and orderly information exchange and management (Anderson, 1990(1), p.18).

Information is required for individual and collective action. The flow of information within and between participating organizations is required to determine the existence and the nature of a problem. The ability to gather, process and disseminate information quickly and accurately through a multi-jurisdictional structure reduces uncertainty and increases effectiveness of the whole system during the response. Many problems exist however. The first one relates to the compatibility of communication networks. This problem will be studied in section 3.3.5. The second one relates to the content of information. Personnel like to be informed about the situation and the tasks ahead. A lack of information has a detrimental effect on the response teams.

One of the surest ways to destroy an effective crisis team and undermine the effectiveness of your organization's crisis response is to withhold information from the team. (Kuban, 1993(2), p.107).

Secrecy is not a good strategy. Another problem is the relevance of information. The obtention of relevant information from previously unknown agencies can become problematic, in practice. Information must flow between a multitude of agencies in a two-way direction and a certain degree of preparedness is required to ensure an efficient flow of information between them.

The accomplishment of these tasks involves far more than one-way information flow among participating organizations. Rather, there are multiple two-way and chain communications between different kinds of multi-layered groups. In a medical system, there may be several first aid stations or triage points, ambulances or transportation units, primary and secondary hospitals and segments of different authorities operating within diverse jurisdictions (Quarantelli, 1988, p.378).

The last problem concerns the amount of information to be processed. It takes training to prioritize quickly the incoming information. As research indicates:

although the information flow within an organizational system is difficult during non-stressful periods it can, and often does, become quite problematic during a disaster (Quarantelli, 1988, p.378).

## **3.2 COORDINATION PHASES AND AREAS**

### **3.2.1 PREPAREDNESS AND COORDINATION**

Emergency preparedness makes an important contribution if a disaster takes place. Actions have to be improvised according to the situation. However, even a modest level of

preparedness clearly makes a difference and enhances any necessary improvisation. Pre-planning the coordination effort is vital for operational effectiveness.

Disaster officials can recount many stories of well-meaning volunteer groups who just dived in without coordinating with local officials. Too often, they are ineffective, less effective than they could have been, or even counter productive to the disaster response mission. Pre-planning coordination, with specific roles assigned, will usually overcome such potential problems (Kuban, 1993(2), p.109).

Coordination encouraged during the preparedness phase has a positive impact on the response and accelerates recovery operations. Therefore, coordination plays a major role in almost all phases of emergency planning.

### 3.2.2 THE RESPONSE : A GENERIC APPROACH

In section 2.1.1, the benefits of planning for an all-hazard approach were mentioned. That approach supports well the choice of response generated demands over agent generated demands. Research mentions a need to plan for response generated demands and gives us the advantages of doing so:

whatever the agent, the same general activities have to be undertaken, whether the task be warning, evacuation, sheltering, feeding, search and rescue, disposition of the dead, mobilization of resources, communication flow, interorganizational coordination, or public information, and whether the tasks involve individuals or groups (Colloquium, 1990, p.98).

Because the same tasks are required in different hazards, each task can be planned and coordinated in advance with the other agencies involved, whatever the location of the task lying ahead. Apart from theoretical reasons to choose a generic approach (or a response function concept), there are practical reasons to do so:

the generic is (a) cost efficient in terms of time, effort, money, and other resources; (b) politically better because it mobilizes a wider range of groups, thereby creating a more powerful constituency for the process; (c) a good way to prevent duplication, conflict, overlaps, and gaps in preparedness and response efforts; and (d) a way to increase the effectiveness of organized efforts (Colloquium, 1990, p.105).

The response function concept, based on a generic approach, intends to create networks of agencies around the same operational roles and missions.

### 3.2.3 THE RESPONSE FUNCTIONS

In section 3.1.4, six systems were mentioned, encompassing agencies potentially involved in the case study. In this section, fifteen response functions are defined. They represent the functions used for planning in the British Columbia Provincial Emergency Program and the United States Federal Emergency Management Agency (FEMA). The differences are explained as required.

3.2.3.1        Communication. It establishes communication links throughout the disaster area between the response agencies. Public information is excluded from that task.

3.2.3.2        Search and Rescue. It involves the removal of trapped and injured persons from landslides, mudslides, building failures and other structural collapses. FEMA does not differentiate between heavy and light search and rescue but PEP does. In this study, the task will encompass both heavy and light search and rescue.



3.2.3.3        Medical-Public Health. It involves the provision of coordinated emergency medical care and public health services.

3.2.3.4        Shelter and Mass Care. It involves emergency housing, feeding, first aid care for victims and emergency services personnel such as registration, inquiry and counselling.

3.2.3.5        Coroner Services. It identifies dead personnel, certifies the cause of death and manages the temporary storage of fatalities.

3.2.3.6        Public Information. It includes continuous communication with the public through media in order to provide hazard warnings, official instructions and announcements (boiling water order for example), status of critical lifelines (water, power, gas lines), emergency services (reception centers), and damage assessment information. It includes the operation of an emergency information center as part of the City EOC as well as the provision of basic services to the press and public inquiries at the local level.

3.2.3.7        Law and Order. It involves the provision of law enforcement resources to protect lives and property and to establish control procedures in and around emergency areas (following a toxic spill for example).

3.2.3.8      Firefighting. It involves the mobilization of firefighters and equipment to respond to fires. Both FEMA and PEP include hazardous material management as a supplementary task, although that task corresponds to different networks of agencies. In this study, hazardous material management is a separate response function.

3.2.3.9      Hazardous Material Management. It involves the management of hazardous materials release incidents such as chemical and other toxic spills, and hazardous conditions caused by utility lines leakages such as sewer, B.C. Gas and Trans Mountain Pipeline fuel lines.

3.2.3.10     Damage Assessment. It includes early reconnaissance of impacted areas to determine the nature, severity and extent of damage, the submission of timely situation reports, and the subsequent assessment and reporting of sustained damage.

3.2.3.11     Utilities and Lifelines. It includes the temporary repair of electrical power, gas, fuel, water, sewer and telephone distribution systems in order to minimize the impact upon critical services and the general public.

3.2.3.12      Transportation. It involves the coordination of available transportation resources, the designation of evacuation and supply routes, and above all the quick assessment and repair of essential transportation routes (including air, sea, land routes, bridges and tunnels). The task involves traffic control. The task also includes road and bridge repair, a specific function for FEMA and the engineering and construction aspects related to transportation for PEP. The reason to include these tasks within one function is as follows: the repair of transportation routes demands bulk material and construction expertise shared between all of them, within a single network.

3.2.3.13      Debris Clearance. It involves the removal and disposal of rubble, landslides, wreckage and other material blocking other emergency response functions.

3.2.3.14      Logistical Support. It includes the procurement, allocation and distribution of essential resources and specialized services in support of local emergency response operations. It consists of medical supplies, food, water, energy such as fuel, and consumables to emergency reception centers or other critical facilities.

3.2.3.15      Inspection, Condemnation and Demolition. It includes the inspection of buildings and other structures to determine safety for usage.

### **3.3 COORDINATION ELEMENTS**

In this section, the coordination elements are defined and explained. They form the core of the subsequent network analysis between agencies in each response function.

#### **3.3.1 INTERDEPENDENCE**

The allocation of disaster resources during the response depends on the priorities established and the information received. The task allocated is rarely accomplished in isolation by one agency. For example, B.C. Gas repair teams will require the help of the Engineering department to clear the rubble blocking streets and gain access to a specific area. The firefighters need heavy equipment assistance to clear entrapping rubble and free injured people during search and rescue operations. These tasks are sequentially interdependent. The ability of one organization to complete its assigned task is dependent on other organization's accomplishment of a prior task. In these cases, coordination is essential between agencies. Four elements sustaining coordination are mentioned throughout research: the mission or the task itself, agreements between agencies for the coordination of resources, the element of trust, and communication. The study looks at them separately.

### 3.3.2 THE MISSION

A common mission has the effect of bringing together agencies usually not talking to each other. In this study, these agencies will be determined for each response function.

The organizations identified are those anticipated to be called upon to perform in the event of an earthquake. These organizations are identified by generic agency titles for application. The assignments are made in the form of specific actions to be carried out by designated organizations in support of the overall response function (Federal Emergency Management Agency, 1985, p.4,5).

Another advantage of the mission as a coordinating element is its direct relationship to daily tasks. It facilitates the correct identification of agencies during the preparedness and the response phases.

### 3.3.3 AGREEMENTS BETWEEN AGENCIES

In order to coordinate their activities, agencies can use mutual agreements usually established during the preparedness phase. Research identifies six forms of agreement: common data bank, mutual aid agreement, board memberships, cooperative councils, joint planning and programs, and informal agreement of cooperation.

3.3.3.1 Informal Agreement of Cooperation. This agreement identifies a need for coordination without formally specifying any details related to operations. It could be the starting point of a stronger agreement in the future. The informal agreement is usually a verbal exchange between agencies.

3.3.3.2        Common Data Bank. Sharing data banks is a natural extension of hazard vulnerability and capability assessments. Inventories collected contain the following information: incidence of particular hazards in a particular area and their severity, geographical, economical and cultural information, types and locations of resources available.

Sharing data helps to promote coordination agreements. Maintaining, updating, and sharing resource inventories increases a community's capacity for effective response (Drabek, 1991, p.76).

3.3.3.3        Mutual Aid Agreement. They are mandated in legislation or negotiated as legal contracts. There are two kinds: agencies may draw up agreements for reciprocal assistance, under certain conditions, or may establish contingent acquisition agreements between providers, vendors and contractors.

3.3.3.4        Board Memberships. Depending on the tasks allocated to the board members, they can provide a useful way to promote coordination at the operational level.

Boards represent the most important focal points for promoting coordination when they control the organization's principal resources and hold high status in the community (Drabek, 1991, p.76,77).

3.3.3.5        Cooperative Councils. They are valuable forums for information exchange and promotion duties within a community. They generally focus broadly on community-level goals and criteria for measuring progress. They can help to promote disaster preparedness across organizational and political boundaries.

3.3.3.6 Joint Planning and Programs. They represent the most advanced and difficult form of coordination to promote because they address emergency problems during all phases of emergency planning and oblige agencies to clarify their objectives, costs and benefits.

### 3.3.4 TRUST BETWEEN AGENCIES

Research specifies that:

when organizations have interacted and coordinated with each other beforehand, they have had fewer problems doing so in a disaster. At the basis of these relationships is the issue of trust. The factor of trust was crucial for action at each level of disaster operations (Kuban, 1993(2), p.78).

Trust must be gained between agencies to create an operational network and achieve coordination. The importance of trust cannot be over-emphasized enough. The building of trust begins with professional competence and includes knowledge of other agencies roles, responsibilities, methods of operation and effectiveness. It is largely built through informal and frequent contacts, and through confidence in others.

One had to gain the trust and confidence of fellow responders and disaster network colleagues before one could be allowed a partnership role in disaster operations (Kuban, 1993(2), p.253).

### 3.3.5 COMMUNICATION

Earthquakes cause a failure of communications disrupting contacts between individuals and agencies. This produce delays in the assignment and the use of available

resources, and in the accurate and timely transmittal of public information. Resources may be dispatched to low priority and non-life threatening situations while high priority and life threatening situations remain unattended. There are many potential problems associated with communication.

Coordination activities were also hindered by communication systems that became defective or inoperable after the Hurricane (Hugo). Damage to electrical and telephone systems impeded communication between agencies and hampered the ability of state and local personnel to respond effectively, according to FEMA officials (United States General Accounting Office, 1991, p.44).

Agencies are confronted by two major problems: how to communicate among them and between them ? In the GVRD, the following weaknesses are identified: reliance on one communication means only, incompatibility of radio communication systems, receiver intermodulation problems and lack of training. There is a vast array of resources available throughout the region. However, many agencies rely on the telephone system exclusively, including cellular phones, to accomplish their tasks. In these cases, a failure of that system will disrupt entirely their operations. When the system is operable, saturation by both outside and local parties can cause the same problem. It is argued that line load (priority) capability alleviates the problem but it is not entirely true. Many eligible lines are not so designated and databases are difficult to keep up to date.

In California, disaster planners do not recommend dependence upon telephone service for at least 72 hours. A more realistic estimate could be five days after a significant earthquake (La Valla and Stoffel, 1991, p.252).

Radio is the second-most-employed communication mean in the GVRD and incompatibility of radio systems represents the biggest obstacle to coordination.



Radio communication compatibility problems exist, in part, because of the desire of each lead agency to have its own communication flow uninterrupted by other agencies during operations and because of the regulation of communication frequencies to separate users in order to avoid interference problems. This has created a Tower of Babel effect (Anderson, 1993).

In the GVRD, only two radio networks have a regional function: the inter-Municipal and the Provincial Emergency Program networks. Different agencies working on the same task, but physically separated in the field, have to transmit necessary information through their own central networks, and then through a third party to contact each other. Even if it is feasible technically, an inter-agency communication network utilizing compatible radio frequencies would not resolve all problems.

It would be an oversimplification to suggest that the mere development of a mutual, multi-disciplinary, multi-agency communication frequency will solve inter-organizational disaster communication problems. In fact, the undisciplined use of such a frequency could quickly jam it with excessive traffic, rendering it useless (Auf Der Heide, 1989, p.96).

The elements of training and radio discipline need to be mentioned. Another point to consider is the use of such network for strategic planning only.

Physically, the Californian experiences estimate that most microwave systems will be 30% effective or less. Studies suggest that remote satellite terminals relying upon telephone or microwave circuits would be 40% to 50% effective. La Valla and Stoffel (1991) estimated that communication systems used to support computers would be 40% effective. Local commercial broadcasters stations (for public information) generally become inoperable because of control circuit, facility, equipment or power failures.

Newspapers would also become inoperable due to electrical power outages, damages to sensitive equipment and distribution problems.

How can communication between agencies be improved ? There are technical solutions such as frequency sharing agreements, mostly between local and outside agencies involved in the same network, the establishment of a dedicated radio frequency for control and coordination of resources only, installation of back-up power systems in strategic locations, and there are non-technical, more pragmatic solutions such as the development of a "hub system" based on trust and familiarity between agencies. In such a hub, expedient solutions to communication problems can be found.

Inter-organizational communication is fostered by those factors which promote trust in other organizations and familiarity with how they function. These include: Informal contacts, joint planning and training, preplanned agreements (Auf Der Heide, 1989, p.79).

### **3.4 COORDINATION OBSTACLES**

Interest in disaster preparedness is proportional to the recency and magnitude of the last disaster. Apathy and lack of interest are the first obstacles to coordination. If nobody cares, it is difficult to sell and establish networks. Fortunately, there is an interest in the GVRD, activated by the recent disasters in California and Japan. Coordination is also hindered by an increased emphasis on command and control elements.

Emphasis on command and control as part of the coordination process may also produce unintended negative effects such as ambiguity of roles and the disruption of communication (Comfort, 1988).

The same negative results are expected from an increased emphasis on centralization. Many obstacles remain organizational: differences in management methods (hierarchical versus non-hierarchical), disagreement on the type and amount of resources required, on costs, on rights to withhold information, differences in technology, procedures and resources, fear about the loss of organizational identity, and hesitancy to depend on other agencies are frequently mentioned. These obstacles can be the result of political or jurisdictional boundaries. Other obstacles are simply personal: concern about implied liability and about who will get the credit or blame if the effort is successful or fails; personality conflicts between the organization's staff or bad experience with past coordination efforts. Finally, professionals may not want to work with paraprofessionals such as volunteers and want to protect their own authority. There is also a question of legality. Some agencies will refuse extensive coordination with outside agencies on the ground that they do not have a mandate to do so. There are no regulations on that subject in British Columbia. There are operational consequences following a lack of multi-agency coordination: the problem of official convergence (caused by government) or non official convergence of persons, information or material towards a disaster site. Research notes that

convergence is a function of lack of information and it can be controlled only with carefully collected, shared, accurate information - something the very nature of a disaster makes difficult to achieve (Scanlon, 1992(3)).

Despite the altruism, convergence can create more problems (congestion, traffic control, the creation of services vacuums somewhere else) than it solves. They need to be anticipated, not simply reacted to.

### **3.5 COORDINATION INCENTIVES**

Coordination can increase preparedness and operational response effectiveness following a disaster, but also can be employed to increase the visibility of agencies in the community and provide indirect publicity.

Success in building coordinated systems is worth an effort. Coordination can increase the financial stability, staff creativity, public support, geographical representation, and prestige of the organizations involved, while decreasing fragmentation and duplication of services (Drabek, 1991, p.77).

The result becomes a multiplier effect where an agency wields informal power in the community. There are benefits to be gained from that position; for example, an increased ability to protect agencies against liabilities following a disaster, particularly in the case of local agencies.

Recent court decisions indicate that local governments and officials may be financially liable for certain consequences of a disaster if the community was not prepared or did not respond properly (Auf Der Heide, 1989, p.28).

## **CHAPTER 4**

### **COORDINATION MODELS**

Emergency planning during the preparedness phase should be directed towards mechanisms, techniques promoting interorganizational coordination. This demands a planning process, not only the production of a document or plan.

A number of researchers have observed that pre-disaster contacts among the representatives of emergency organizations result in smoother operations in subsequent disasters. Organizations are more likely to interface if the contact is not with total strangers (Auf Der Heide, 1989, p.44).

This chapter discusses the principles of coordination and provides a critical look at the coordination models in existence.

#### **4.1 COORDINATION AND DISASTER PLANNING THEORY**

##### **4.1.1 IMPORTANCE OF THE PLANNING PROCESS**

A team work approach is required between agencies to decide how operations are to be coordinated. This approach must include all agencies in the planning process.

Municipalities do have the resources to significantly increase the effectiveness of a disaster response, the major exception being local government's inability to tap into the private sector for goods, services, and manpower prior to a disaster. Process planning may be the only means to rectify this failing (La Casse, 1992, p.98).

This statement can be applied to all agencies, including volunteer organizations and regulated corporations outside government control.

#### 4.1.2 A MORE FLEXIBLE MODEL

Disaster planning literature has so far provided only concepts to create an emergency response plan within one organization (or a political entity) rather than a process to improve response capabilities between agencies. This trend is changing. A strict military model (with confidential information, a command structure based on a hierarchy system, and isolation of the system itself) is not the best instrument to involve civilian and volunteer agencies. Some flexibility is required. This does not restrict the use of a military model within some organizations (for example Firefighting and Police agencies), but implies the need for a flexible network including supporting agencies.

Effective emergency management should not be based on a command and control model but on what might be called an emergency resource coordination model (Drabek, 1991, p.45).

One planning approach called the problem solving model, with coordination and cooperation characteristics, deserves attention. The problem solving model provides us with a set of consequences for planning: utilization of existing structures and agencies, coordination, emphasis on response generated demands, emphasis on improvisation and preparedness, utilization of a wide variety of organization forms including volunteers, and emphasis on maintaining a flexible and open system.

The problem solving model, then, suggests that planning should be directed toward developing an effective response by concentrating on structures which facilitate coordination of a multiorganizational response (Dynes, 1990).

Research finds major differences between organizations performing well in changing environments, such as disasters, and those performing well in stable

environments. Agencies performing well in a disaster environment are identified as “organic”, in contrast to “mechanistic agencies”. Organically structured organizations tend to have the following characteristics:

job assignments that are not rigidly defined in advance and that allow for readjustment to the emerging situation, a network or matrix communication structure and an emphasis on maximizing the flow of communications, an emphasis on consultation and coordination and limited preoccupation with adhering to the chain of command (Comfort, 1988, p.174).

#### 4.1.3 PRINCIPLES FOR COORDINATION

Because of the unique context of disasters, our disaster management model must be designed to meet certain principles essential to multi-agency coordination.

Flexibility and adaptability, cooperation across organizations and jurisdictions, supremacy of elected officials, provincial and federal governments in support, enhancement of the flow and distribution of information, disaster site management through team effort (Kuban, 1993(1)).

These principles suggest a clear division of authority between our levels of government and emphasize elements already studied such as cooperation, flexibility and a good flow of information.

## **4.2 THE EMERGENCY OPERATIONS CENTER (EOC) CONCEPT**

### **4.2.1 THE EOC STRUCTURE**

The United States FEMA defines EOCs as crucial to emergency responses. They are the central direction, control and coordination point for emergency operations. The Canadian Emergency Preparedness College (Arnprior, Ontario), stresses the use of EOCs in all their training programs. The Home Office in the United Kingdom requires municipalities to establish, equip and maintain emergency centres. The EOC is required to perform the following functions: coordinate the overall response at the local level, make policy decisions, allocate personnel, equipment and facilities, gather and validate information, disperse information to the public, and finally host visitors. It requires the presence of those with decision-making authority. Unfortunately, those assigned to the EOC often represent middle management levels of their respective agencies. This creates problems when urgent, high-level policy decisions are needed.

Top management representation is needed at the EOC. They have the authority and experience necessary to facilitate the type of innovative decision-making required (Auf Der Heide, 1989, p.128).

What organizations should be represented at the EOC ? Most local key organizations, private utility companies, volunteer organizations, and non local groups of importance such as media, even if only on a temporary basis. The need varies according to the situation and demands flexibility from local authorities. Research on EOCs, despite problems identified (command problems, control of entrance, overcrowding, movement of



EOC, limited information, faulty communications) confirms the validity of the EOC concept.

An EOC is an effective way to achieve coordination among agencies responding to a disaster. The absence of an EOC seems to encourage the opposite (Scanlon, 1992(2), p.19).

The EOC is and will remain the basic instrument for coordination employed by local authorities following a disaster. In the GVRD, there is no regional EOC assuming the same function presently. The province intends to deploy resources in a regional context and create a Provincial Field Response Center (PFRC) in the GVRD to coordinate efforts in support of municipalities. The strengths and weaknesses of that approach are studied in section 4.7.1.

#### 4.2.2 DETAILS RELATED TO THE EOC

Training of personnel assigned to local EOCs is essential to operations because they do not normally work together in that building.

Their files and resources will not be at hand; their means of communication will be foreign. In day-to-day operations, police and fire/rescue rely on their own trained dispatchers and communications people (Burton, 1990, p.29).

This comment is applicable to all agencies represented in the EOC. Research also indicates a problem with the number of separate EOCs appearing at the local level following a disaster: Police EOC, Fire EOC, Engineering EOC, each dealing with a limited range of problems. In such cases, there may be delays or deficiencies in information exchange among key officials located at different EOCs.

It is probably best in most cases to encourage the development of a single EOC, if maximal inter-organizational coordination is to result (Auf Der Heide, 1989, p.127).

In most municipalities, these local agencies are not located under the same roof.

Therefore, a good information flow and a local communication network are required for operational effectiveness.

### **4.3 THE INCIDENT COMMAND SYSTEM (ICS)**

#### **4.3.1 ORIGIN AND CONCEPT OF THE ICS**

In the fall of 1970, a series of devastating wildfires in Southern California burned over 600,000 acres, killing 16 people in 13 days. This was a truly multi-jurisdictional event involving the federal, county and city jurisdictions. The response to this disaster made clear that serious response problems existed: lack of a common organization (with over 100 agencies participating) with common terminology; poor on-scene and inter-agency communications (agency dispatch centers could not communicate with each other); inadequate joint planning (each agency planning in a different direction); lack of valid and timely intelligence (no one had a clear and complete picture and no central agency was required to collect all information and disseminate it according to specific needs); finally, inadequate resource management, as a consequence of all previous weaknesses. Design criteria were developed to address these problems and create a new

system, based on specific requirements. They are interesting because they favour a very flexible model, in theory.

It must provide for effective operations at three levels of incident: 1) single jurisdiction and/or single agency 3) multi-jurisdictional and/or multi-agency support. It must be able to expand from the organizational requirements up to the needs of a major emergency; it must have basic common elements in organization, terminology, and procedures; implementation of the system should have the least possible disruption to existing agency procedures; it must be simple enough to assure rapid proficiency of new users (Auf Der Heide, 1989, p.137).

A set of concepts was developed from these requirements. They included: agency autonomy, management by objectives, unit integrity and functional clarity. The Unified Command concept was designed to encourage the close working relationship of diverse agencies while, at the same time, preventing power plays or take overs by larger or more assertive members. The ICS was designed to bring together the necessary resources from various agencies and jurisdictions under one umbrella and coordinate their diverse activities to resolve common problems.

#### 4.3.2 CHARACTERISTICS OF THE ICS

The ICS organizational structure develops in a modular fashion based upon the type and size of the incident. It can expand and shrink according to the situation (see Appendix 1, Figure 4.3.2). Communications at the incident site are managed through the dual use of a common-communication plan and an incident-based communication center established for the use of tactical and support resources. The ICS is designed for effective span-of-control of supervisors over subordinates (a ratio of five-seven to one). Common

terminology is included for organizational positions, resource elements and facilities.

Finally, comprehensive resource management procedures are designed to avoid the problems of mismanaged response forces. The ICS is built as an efficient vehicle for operations and coordination of resources.

#### 4.3.3 THE UNIFIED COMMAND CONCEPT

The concept of unified command, included in the ICS, simply means that all agencies having a jurisdictional responsibility at a multi-jurisdictional incident contribute to the process of determining overall incident objectives and global strategy, ensuring that planning for activities and integrated operations is conducted and maximizing the use of all resources involved. As in a single command structure, the Operations Chief has the responsibility to implement the plan.

The determination of which agency the Operations Chief represents must be made by mutual agreement of the Unified Command. It may be done on the basis of greatest jurisdictional involvement, number of resources involved, by existing statutory authority, cooperative agreements, or by mutual knowledge of the individual's qualification (La Valla and Stoffel, 1991, p.282).

This is theory. In practice, the most frequent and experienced responders (firefighters and police) take over that role quite naturally.

#### 4.3.4 THE LIMITATIONS OF THE ICS

The ICS has originated in fire departments. Because the system effectively melded many different fire agencies and jurisdictions, it has been suggested that the ICS can serve as a universal model. The ICS advocates classic elements of a military command and control model: tasks and responsibilities are neatly defined, decision-making authority resides within one position, terminology is common. However, there is little place in the ICS for inter-agency coordination, because the ICS is an intra-organizational system. This is a structural flaw in the model.

While particularly effective for the needs of fire departments, the ICS and its various derivatives are inadequate for the needs of community disaster response structures. The key weaknesses of the ICS are in its rigid organizational structure, functional roles, terminology, and approach. It demands all agencies to adhere to the same protocol (Kuban, 1994, p.9).

The ICS does not acknowledge the role of the municipal EOC. The ICS is operated as if the "local fire department" was in command. It neglects the needs of the rest of the community. It does not permit for the shift of control from fire departments to other response agencies. It does not account for the involvement of agencies from other levels of government, regional or provincial.

These expectations of the ICS system are not realistic in situations which involve varied organizational cultures with often conflicting jurisdictions (Kuban, 1994, p.9).

The lack of coordination is particularly acute between local and external agencies. Because the ICS has appealed mostly for organizations which normally act with considerable independence or have come to rely on vertical support (for fire agencies,

support from external fire agencies), not horizontal support (resources from external and different agencies), it is not an ideal instrument for coordination, unless responding agencies of all types have been involved in developing the ICS, including its implementation aspects. The system is not recommended neither at the local nor at the regional or provincial levels.

#### **4.4 THE EMERGENCY SITE MANAGEMENT SYSTEM (ESM)**

##### **4.4.1 CONCEPT AND CHARACTERISTICS OF THE ESM SYSTEM**

The ICS, whatever its shortfalls, still provides a conceptual basis for the development of the ESM, taught for the past ten years at the Emergency Preparedness College at Arnprior. The ESM is based on the expectation that municipalities undertake on-going planning efforts involving all key players.

This on-going planning process is important. It helps maintain preparedness and momentum. It assists in the revision of existing procedures, contact lists, and resource allocations. It helps maintain direct contact among those who will be involved in the community's disaster response effort. In essence, these people and their organizations form a disaster response network the value of which is fully realized during disaster response (Kuban, 1994, p.10).

The ESM model is inclusive, not exclusive. It emphasizes coordination rather than simply the command of disaster operations. Typically, the municipal EOC (the EOC Group or EOCG) is activated when it appears that public resources are insufficient to respond to the disaster. The primary role of the EOCG is to support the response efforts of the site team. The secondary role is to funnel the necessary resources from external agencies. A third

role is to manage the strategic response, contact other jurisdictions, and receive the necessary supplies and services (see Appendix 1, Figure 4.4.1). At the other end, the members of the site team must share information and pool resources and experiences. Neither the members of the EOCG nor the site manager are expected to replace the existing command or organizational structure and communication of the other response agencies.

The ESM structure offers the framework to coordinate the flow of information and resources between sites and the agencies supporting the response. The ESM model possesses interesting characteristics. The EOCG inner circle is an operational group only, not an executive one. It is comprised of the EOC manager, the municipal director of disaster services, the heads of municipal departments, a public information officer and personnel from industry or other orders of government. Elected officials, as key players, are close to the EOC but outside the operations room, because of their unique public relation or political role. They receive briefings but are advised to allow the response to be managed by personnel trained to do so. The second circle represents municipal response agencies and other agencies within the municipality. The third circle represents a wide variety of non-municipal organizations, services and resources. These may include mutual aid partners, contractors, volunteer groups and the media.

The site team inner circle includes the site manager and the most senior members of each agency responding to the site. The second circle includes supporting agencies at

the site. These may include volunteer agencies such as the Red Cross, the Salvation Army, and local contractors. The third circle represents available agencies off site. In that concept, the site manager is appointed by the EOCG to manage the overall operation at the site, and to coordinate the agencies involved. Communication is the key principle of the ESM model. It occurs through a web of networks. A team approach is also required from the site manager to direct all his resources.

#### 4.4.2 DIFFERENCES BETWEEN THE ICS AND THE ESM MODELS

The ESM model addresses both strategical and tactical needs following the disaster. It relies on a more complex network of communication between the EOC and the sites and permits a better information flow, as each agency involved uses its own network.

The ESM process,

allows each organization to employ the system which best fits its needs, while still maintaining operational coordination at site and EOC levels. The Incident Command System, for example, can be used by fire personnel to control their operations. The use of the ICS does not detract from the ESM process (Kuban, 1994, p.14).

The ESM model reaches out horizontally external agencies in an effort to increase potential resources. It creates a network of operational resources, and a coordinating apparatus, the EOCG, to deploy them in specific areas. For these reasons, the ICS is seen as a sub-element of the ESM model. The constant flow of information between agencies, and liaison at both the EOCG and the site, are the most important advantages of the ESM model over the ICS model. Finally, the ESM is more adaptable to community needs in a



Canadian context, and it meets the needs of the various jurisdictions responding to disasters.

## **4.5 NETWORKING AND COORDINATION**

### **4.5.1 A NECESSITY FOR LOCAL AUTHORITIES**

Networking is not a coordination model but its main ingredient. According to research,

two key elements exist in effective disaster response: the presence of response networks and planning. Disaster networks help bridge organizational boundaries, enhance cooperation, and facilitate resource acquisition. These networks need time to be developed and should be part of the disaster planning process (Kuban, 1994, p.15).

Networking multiplies the potential resources available to the community during the preparedness and response phases.

### **4.5.2 CHARACTERISTICS OF NETWORKING**

Networking focuses primarily on communication, but does not exclude the exchange of information on other resources such as equipment, facilities and personnel. It is defined by Webster's dictionary as the exchange of information or services among individuals, groups and organizations. It is therefore a mobilization instrument.

Networking establishes confidence between agencies and affects the passage and acceptance of information positively.

An organization directly linked to many other organizations can pass on information through a minimum number of steps. Communication is fast and efficient. Increasing organization links to actors in the network should result in more rapid communications through the fewest intermediate links, as long as the organization is able to contact all others in the network within the time required for an adequate response (Gillespie, 1993, p.16).

Networking is represented as a medium where multi-agency coordination occurs, is maintained and developed.

#### 4.5.3 A NETWORK : CENTRAL AND PERIPHERAL AGENCIES

Research in the field of network analysis in a disaster context has linked preparedness and response.

An overall preparedness strategy might be to arrange a problem solving session for representatives of all the organizations in a network with the goal of increasing direct contacts with the most central organizations and integrating peripheral organizations into the network. This is why many community-based disaster exercises actually lead to better response when disaster occurs (Gillespie, 1993, p.16).

Agencies in a central position within a network have access to a variety of resources from different locations. They have more options for obtaining these resources and are less dependent on any one actor for meeting their needs because they have linkages with so many other agencies. This includes the access to the information flow, essential to a coordinated action. Isolated and peripheral agencies with few linkages with other organizations within the network,

can be expected to miss important information, to continue to carry out activities in ways that are no longer effective, and to fail to coordinate with other organizations (Gillespie, 1993, p.16).

A central agency has more power than a peripheral agency and more potential for an effective response. Research also shows that each network is different. For example, the medical network differs from the utility network because their functions, tasks, number of agencies and jurisdictions differ.

Many types of networks exist. One particular type, called a star network, is interesting. In the star network, one central organization is connected directly to all others, and communications or exchanges are sent directly from the center to other organizations. Conversely, the central agency is receiving information from all sources, like the EOC model or the EOCG in the ESM model. The central agency is the coordination point in the network. In such a network, the central agency can also be called a "hub" or "linking pin". In a star network, the linking pin agency functions to pass on communication, to transfer resources, to direct actors in the network.

Centrality has been used to characterize organizations that have many links to other organizations in the network. Any particular organization can be rated as more or less central than any other. Organizations with the lowest ratings on any particular measure of centrality are the most peripheral (Gillespie, 1993, p.17).

It is useful, within each network, to determine the central and the peripheral agencies.

Which agency, if any, is central ? Is that agency supposed to play a coordinating role ?

Which ones are completely isolated ? These questions will be addressed in chapter 6.

The concept of centrality is relevant to disaster preparedness and response networks. An organization that has more direct contacts with others will be able to play an active leadership role and will be in a good position to pass on plans and information directly to the rest of the network (Gillespie, 1993, p.17).

An agency with a coordination role should necessarily occupy a central position in the network. If, in practice, the coordinating body is not in a central position, it will have difficulties to accomplish its tasks. The same theory is applied to communication, information flow, and exchange of resources. Concerning communication in the GVRD,

efforts are underway to develop new umbrella networks which provide common operating frequencies between agencies. In many cases where no networks exist or existing ones fail during a disaster, it is assumed by most levels of government that amateur radio will fill the void (Anderson, 1993).

The study of each network will determine the position of agencies and the linkages between them.

#### **4.6 PUBLIC PARTICIPATION AND COORDINATION**

Effective emergency preparedness and response require planning and public support.

Local plans often emphasize law enforcement techniques instead of strategies for collaborating with citizen volunteers and neighborhoods in a major disaster, even though experience shows that such cooperation is needed (Kartez and Lindell, 1987).

This is not the case in Coquitlam, where a number of volunteer agencies such as HEROS, CSAR, and CSARES are being developed under the umbrella of the city departments.

#### 4.6.1 ROLES FOR THE COMMUNITY

There are more resources in our communities than within the responding agencies alone. The private sector, for example, can be integrated in the process and increase potential resources during the response period. Other community involvement can range from,

informational/educational exchanges (e.g. compliance with warnings/evacuations), participation in selected operational duties (emergency social services teams, amateur radio operators), to independent citizen cadres (neighborhood disaster response team) (La Casse, 1992, p.41).

Citizen are required for the operation of emergency shelters (feeding, clothing, lodging) or first aid duties. The unemployed work force with specific skills may be employed on specific tasks such as debris clearance, logistic or liaison duties. These resources cannot be mobilized rapidly and in a coordinated way in the chaos following the disaster. The networks must be established and maintained during the preparedness phase. Without the cooperative and coordinated efforts of all stakeholders, it is unlikely that the neighborhood-level approach could attain any real depth of mastery without the necessary training and education.

#### 4.6.2 GETTING THE COMMUNITY INVOLVED

This is a difficult but not impossible task. Research was conducted on the subject and this study intends to expose only the most important elements. Communities are often inadequately prepared for disasters because they have no sense of need. Disasters are

uncommon and preparedness is rarely a priority among local officials, politicians or the public. The only way to overcome that reluctance to plan ahead is for someone in the community to take the initiative, a person with authority. Such a person can show leadership in various ways: by ensuring action within the municipal structure (emergency plans and training), by obtaining the support of the community (volunteer groups for example), by analyzing the potential hazards and the resources required to respond, and finally by creating networks between the response agencies.

It is important to know more than that such groups exist or how to reach them. It is important to understand how the community perceives hazards and what the residents consider an appropriate response (Drabek, 1991, p.81).

This task cannot be accomplished by the emergency coordinator alone. All government staff must be involved in that process, each in their own area of responsibility. Networks are created slowly through a process started within the existing planning structure.

A city manager suggests that disaster preparedness and planning be made part of their normal job descriptions, requiring an annual assessment and evaluation. Department managers should also require the same of their subordinates. Experience demonstrates that such an approach works (Drabek, 1991, p.81).

When the planning process starts within the structure, it is time to involve community groups, volunteers and the private sector in the newly created networks. One option is to break down the planning process into tasks assigned to different groups. These groups will eventually have to work together because their resources alone will be insufficient for their tasks (for example, the medical network will have to regroup resources from the local health units, hospitals, firefighters, B.C. Ambulance and possibly B.C. Transit for

transportation purpose). The work accomplished within these networks will serve to evaluate community resources before the need to use them arises.

Only when a tornado hit the mining area of Sudbury in Northern Ontario (1985) was it discovered that many residents had either basic or advanced first-aid training (Drabek, 1991).

Communication problems will be discussed. Confidence will increase between agencies, each one discovering what the other agency can do. The network approach is therefore a strong continuum for coordination. As research indicates:

the use of neighborhood volunteers may work best when organized neighborhood groups already exist and agency staff have experience in working with those groups (Kartez, 1984).

#### **4.7 STRATEGIC COORDINATION MODELS**

Coordination models applicable mainly to municipalities have been studied until now. The case study also involves agencies at the regional and provincial levels and it is important to show the strategic application of existing coordination models. Two models will be studied: The PEP model in British Columbia and the regional model in the Province of Quebec.

##### **4.7.1 THE PEP MODEL**

Following a disaster encompassing the municipalities in the GVRD, a Provincial Field Response Centre (PFRC) may be established in the Vancouver area by provincial

authorities after the declaration of a state of emergency. Its task is to direct and coordinate provincial government response in support of the municipalities on a regional basis (see Appendix 1, Figure 4.7.11). This approach is needed to compensate for the absence of a formalized regional emergency management system in British Columbia.

Coordination is defined as:

the provision of policy guidance and leadership to a number of disparate organizations in such a way that their skills and resources can be used in an effective manner (Provincial Emergency Program, 1993, p.1).

The PFRC is activated when it is necessary to coordinate the emergency response of provincial ministries or agencies. It can also include:

arrangements for the provision of resources and other support to local governments, for the provision of emergency services to local governments by provincial government ministries and agencies and the facilitation of impromptu mutual aid among local governments (Provincial Emergency Program, 1993, p.3).

The PFRC is a coordinating instrument for the provincial response in support of local governments, not a coordinating body encompassing provincial, regional, local and non-governmental agencies. The PFRC in effect does not compensate for a "missing" regional organization coordinating all elements at a strategic level. It was not designed to do so, excepted in unorganized and more rural areas where the province would assume the total responsibility for the response. This is not the case in the GVRD.

The structure of the PFRC (see Appendix 1, Figure 4.7.12) breaks down the total responsibilities of the PFRC into manageable groups (then assigned to branches or a staff like in the ICS model), is well structured with defined tasks assigned to all of its



components, and is more related to an intra-organizational model than a coordinating body in contact with external agencies. The executive branch, where the PFRC operations are managed, comprises a "local government coordinator" with the following tasks:

provision of information summaries. Negotiations for the use or continuing use of local government resources in response operations. Explanations of prioritization approach taken by the Commander. The position should be filled by the Ministry of Municipal Affairs, Recreation and Housing (Provincial Emergency Program, 1993, p.18).

This "coordinator" is not expected to receive specific requests for assistance from municipalities. These requests are received within all other branches, without any central collection point in the structure at the operational level. The PFRC is based on the ICS model but without its main strength, the centralization of the flow of information necessary to take a strategic decision at the regional level. Other weaknesses have been identified from documents at the provincial level.

A first weakness is the fact that personnel earmarked to man positions in the various branches of the PFRC have no detailed knowledge of local hazards, organizations, resources or specific problems. In these conditions, it is difficult to evaluate their effectiveness to support local agencies.

A second weakness is a complete lack of liaison with external agencies at the executive level within the PFRC. Why are high ranking local officials not represented within the PFRC, if the PFRC is a coordinating body ?

A third weakness is the fact that nobody coordinates the utility function in the PFRC.

No single provincial ministry has responsibility to coordinate utilities response. B.C. Hydro has also agreed to coordinate planning amongst the above agencies and to be the first contact for representation to the management structure. The coordination of resource assistance to local government utilities functions (water, sewage, etc), if necessary, will be done by the Logistics Management component of the PFRC (Provincial Emergency Program, 1992, p.91).

Utility functions include all lifelines, an essential component of any response operations.

A fourth weakness concerns the rigidity of the PFRC structure regarding external agencies. They do not exist within the PFRC, neither at the operational nor at the executive levels. It is worthwhile to remember that the PFRC is created to "support" local authorities.

Finally, the training exercises provided so far (exercises Thunderbird 1 and CANATEX 2) to practice local, regional, provincial and federal emergency management procedures have focused their attention more on the federal-provincial linkages than provincial-local linkages. Communication gaps appeared between local authorities and the PFRC, negatively affecting the information flow, the damage assessment, and the response operations. The PFRC model is not the efficient coordinating instrument required by the GVRD in response to a disaster.

#### 4.7.2 THE CIVIL SECURITY MODEL IN QUEBEC

Quebec also had its share of disasters, whether caused by natural phenomenon, technical failure or human action, in recent years: The fire in the PCB storage site in St-Basile-le-Grand (1988), the earthquake in the Saguenay region with a magnitude of 6 on the Richter Scale (1988), the Oka crisis (1990) and the tornado at Maskinonge (1991). It is interesting to study the coordination structure and the response mechanisms in place.

The Civil Security Branch of the Ministry of Public Security is responsible, since 1988, for the implementation of two provincial acts: the Fire Prevention Act and the Act respecting the Protection of Persons and Property in the event of a disaster. Earlier these roles were played by the Ministry of Supply and Services and the Ministry of Justice. The Civil Security Branch exercises leadership, offers expertise and coordinates activities or responses,

developing and reviewing programs, coordinating government action, training of responders, distribution of information and support for various agencies (municipalities, businesses, institutions, government departments) (Deputy Minister, 1994, p.11).

Civil Security is based on two entities: the Quebec Government and the municipality, and is activated on three levels: municipal, regional and provincial (see Appendix 1, Figure 4.7.21). Each municipal council is responsible for civil security on its territory. At the regional level, the Regional Civil Security Directorate corresponding to an administrative region has the mandate to provide civil security planning and take action during a disaster on its territory. Following a disaster, if the disaster affects only one

region, the Directorate forms an organization, a civil security organization at the regional level, to coordinate the supporting resources and actions during the disaster. Disaster response planning is defined as the process which makes possible to specify and organize the resources required and measures to be taken.

The process is based on measures to fill the gap between the desired ability to react and the real ability to react (see Appendix 1, Figure 4.7.22). The establishment of decision centres, the coordination centre and the operations centre, makes it possible to ensure adequate coordination of responses. The coordination centre is a place where the disaster response is managed, where the main stakeholders consult and where all major strategic decisions are made. It is usually located outside the risk area. The operations centre located near the disaster site like the PFRC is the centre where all actions related to the disaster are coordinated and where all information from and for stakeholders comes together. Flexibility is required. The stakeholders present in the operations centre may include the regional branches of other ministries, the municipalities, volunteer organizations, the private sector, and the utilities. The focus of the response is clearly established at the municipal and regional levels. A third element of coordination, the command post, is located near the site where the actions of each service or public, private or volunteer agency taking part are coordinated. The command post is established to coordinate the response for a specific incident, for example traffic control in a flooded area.

The Quebec model employs the same response function concept as PEP in British Columbia. Multi-agency coordination is stated as a primary objective at all levels in the structure. Another interesting element is the fact that the regional structure permits and encourages the development of networks between local stakeholders and the regional government almost on a day-to-day basis during the preparedness phase. Regional and local personnel know each other.

If there is a disaster requiring participation of several key players within a region, not only will they already know their role and the resources available, but they will have already profited from having worked together. The process of coordination encourages camaraderie and cooperation among the various representatives, and is a determining factor in the effectiveness of emergency measures (Ayotte, 1991, p.3).

Also, this response model allows municipal authorities to deal with a single organization. This is a great advantage for municipalities requiring a variety of government services in support of their operations. Although the PFRC is a single organization, the municipalities have to contact multiple ministries when requesting support. Decentralization of the emergency management structure is a reality in Quebec, where the model has been successfully tested, and can be compared to the county emergency management structure in United States.

## **CHAPTER 5**

### **RESEARCH AND METHODOLOGY**

At this point, the unanswered research question of this study concerns the methodology employed to measure multi-agency coordination achieved as a factor of preparedness, and potential response. What is the quality of networks between agencies potentially involved ? This chapter provides the elements of design and methodology employed for data collection and analysis.

#### **5.1 RESEARCH OBJECTIVES AND CONSTRAINTS**

The research's objective is to measure four coordination elements between agencies: mission, agreement, trust and communication. Each element demands a specific treatment tailored to its particularity. The study is limited by one constraint: location. The study encompasses agencies intervening within the Coquitlam boundaries and including local, regional, provincial government agencies, volunteer organizations, major utility and transportation corporations.

## **5.2 DESIGN**

### **5.2.1 THE RESPONSE FUNCTION NETWORKS**

In chapter 3, fifteen response functions were identified. Of these functions, thirteen are studied in this research. The damage assessment function is an initial and on-going responsibility of each agency. The passage of information related to damage assessment is closely linked to the passage of information and other elements of coordination achieved within all networks where the agencies are involved. In this case, the damage assessment network becomes redundant and is not included in this study. The logistic function is also related to all agencies individually, as an integral part of their responsibilities to sustain activities and operations. In these conditions, the network would become far too complex for the scope of this study. Finally, the communication function examines only the communication element between agencies. The use of the response function concept to organize and analyze the data permits the description of the networks and the identification of their weaknesses.

### **5.2.2 COORDINATION ELEMENTS WITHIN THESE NETWORKS**

The elements studied are not independent from one another. However, all of them influence preparedness and response. Preparedness represents the intervening variable influenced by the four coordination elements. Response is a dependent variable of

preparedness. We therefore have a causal model (see Appendix 1, Figure 5.2.2) where measurement of the coordination elements gives a level of coordination, preparedness and potential response to a disaster (potential because non measurable during research).

The mission is defined in operational terms and relates to common training, execution of day-to-day tasks, planning of tasks or information purpose. The type of agreement, if one exists between two agencies, relates to a common data bank, a working relationship, a mutual aid agreement, a board membership or a joint program. The agreement identifies which agency controls the resources in the field. The element of trust refers to reliability and confidence between two agencies and includes the frequency and formality of contacts. A working relationship between agencies strongly supports the element of trust. The research addresses the personal aspect of communication such as trust as a separate element. Therefore, communication between two agencies relates to three technical fields defined as follows: on-line communication (telephone, cellular, fax, computer messages), off-line communication (radio and telecommunication) and liaison.

### 5.2.3 DETERMINATION OF SAMPLE SIZE

The final sample size, forty two agencies, is determined by the number of agencies potentially involved as primary agencies during the response phase (see Appendix 1, Figure 5.2.3). No federal agencies are included in that list, because they represent resources activated by provincial authorities.



#### 5.2.4 THE COMPOSITION OF NETWORKS

Appendix 1, Table 5.2.4, represents the networks created between the forty two agencies and the thirteen response functions. Each function is studied independently.

### 5.3 METHODOLOGY

Multi-agency coordination is a complex subject and data collection has to be performed with flexible tools. The methodology employed faces two necessities: firstly, explain and discuss the study context, define the terms, understand the role of the agency, its structure and operational mechanism; secondly, collect data to measure coordination. The best solution is to employ an hybrid method. An interview is conducted with one knowledgeable person in each agency to discuss the disaster context, the agency's role, structure, and specific problems forecasted in a disaster context. The interview leads to a specific and short questionnaire to assess coordination between that agency and any other involved in that function, even if the linkage is not specifically related to emergency preparedness. The resulting information provides a comprehensive picture, for each function, of the existing network. Cross examination of results permits to assess the validity of data.

#### **5.4 SAMPLING PROCEDURES**

The research employs a non-probability sampling technique known as quota sample. The respondent is selected on the basis of meeting certain criteria. If the criteria are adhered to, the quota of one selected respondent is provided by each agency as the elite sample for that agency. The criteria are as follow: The emergency coordinator of each agency is selected (or one person occupying a position with comparable authority and responsibilities); the candidate has extensive knowledge of the agency, experience and authority in the field of emergency planning. For the study, thirty eight candidates are identified. No candidates were chosen for the churches and the private sector because too many agencies exist. Candidates from the Royal Columbian Hospital and C.P. Rail were unavailable for interviews. Data involving these agencies is indirectly provided by other agencies in the same network but without the benefit of cross examination.

#### **5.5 ISSUES OF RELIABILITY AND VALIDITY**

The study represents a picture of multi-agency coordination at the present time in a particular context. The interview is best suited to present a complex subject and collect data.

The interview is considered to be a more valid technique than the questionnaire, because it allows the analyst to assist the respondent in grasping the intended meaning of the questions and to probe or inquire about the meaning of the respondent's answers (Mayer and Greenwood, 1980, p.230).

The validity of results refers to a particular locational context.

Reliability is described as the extent to which, on repeated measures, an indicator will give similar readings. As such, the questionnaire permits to compare measures according to the same standards.

The questionnaire can be considered more reliable than the interview, because it eliminates interaction between the observer and the observed, a source of variation in procedure (Mayer and Greenwood, 1980, p.230).

The elite interview on a quota sample complemented by questionnaires represents a sound compromise for validity and reliability in the present context. It also eliminates the need for tests of significance. Conversely, it is expected to encounter non random errors during data collection. Agencies will have a natural tendency to promote their organizations. Cross examination of results can alleviate the problem, as each linkage between two agencies is encountered twice, permitting to average final results.

## **5.6 THE ELITE INTERVIEW**

A personal interview has the advantage of allowing an interviewer to probe in depth, deal with difficult issues and establish a reciprocal relationship with the respondent. The interview is conducted as a dialogue, without limiting the subject to a set of pre-determined questions after initial presentation of the subject, using a technique called interview guide.

So called because it specifies a set of topics without indicating how the interview is to be conducted. Such a guide permits flexibility (Mayer and Greenwood, 1980, p.223).

Non-threatening questions are asked to the interviewee, treated as separate from the subject debated as far as possible in order to minimize potential errors. Highly threatening questions have also a high response biases. Topics discussed during the interview include but are not limited to: the agency's role and responsibilities during the response phase, potential problems, relationships with other agencies for particular response functions, the ideal structure and mechanisms to confront coordination problems and the role of PEP. The confidentiality of the interview is ensured.

## **5.7 THE QUESTIONNAIRE**

The questionnaire is administered verbally to the respondent towards the end of the interview. As with the interview, the objective is to ask non-threatening questions about the agency to minimize the possibility of biases. The questions are as specific as possible and use words that virtually all respondents will understand. If in doubt, the respondent is provided with instant explanation. Questions asked are close-ended questions, easier to analyze and less subject to variance. Due to the small sample size, questions are not precoded. Appendix 1, Figure 5.7, provides a questionnaire sample. Question 1 relates to the precision of the networks studied. Question 2 establishes the existence or absence of linkage with another agency for that function. Questions 3,4 and 5 relate to the element of trust. Questions 6 and 7 relate to the mission underlying coordination. Questions 8 and 9 relate to the agreement element. Question 10 relates to communication. Questions 11,12,13 and 14 provide supplementary information about the

importance of coordination, particularly question 14 ranking coordination elements by order of importance.

## **5.8 ADMINISTRATION**

A first contact with each potential respondent is established over the phone. The objective is to present the researcher, the subject, the information required, and to arrange a time for the interview. If more information is requested prior the interview, an introductory letter with a one page synopsis of the research is faxed to the respondent (see Appendix 1, Figure 5.8). Finally, the interview and questionnaires provide the data for analysis.

## **5.9 DATA ANALYSIS**

### **5.9.1 QUANTITATIVE DATA FROM THE QUESTIONNAIRE**

Each element of coordination is weighted equally in the questionnaire, for a maximum score of ten points. Appendix 1, Figure 5.9.11, describes how questions are weighted in relation to each other. The combined results to question 14 determine the weight of each element of coordination and provide a multiplicator to apply to the score of each element of the questionnaire, for a potential maximum score of 100 points. Each questionnaire represents the level of coordination achieved actually between two agencies.

The same methodology is applied to all questionnaires answered in every response function and provide comparable levels of multi-agency coordination within each function. The results also provide a tool to represent graphically each functional network (see Appendix 1, Figure 9, for the symbolism attached to the graphic presentation). A liaison between agencies and the location of that liaison are considered important. Linkages are defined as strong or weak (see Appendix 1, Figure 5.9.12).

Literature review in chapter 4 indicated how important was the concept of centrality within a network. With the above system of marking and analysis, it is possible to determine where each agency is located in the network, the existence of linkages with other agencies, and the level of these linkages. The analysis intends to determine these elements. The score of each linkage between two agencies represents the average obtained from the results of both questionnaires, in that function (for example the Red Cross linkage with ESS and ESS linkage with Red Cross within the shelter function). A table is produced for each function with the score of each linkage and the total score of all linkages for each agency. Following this table, a graphic representation of the network is produced, involving all agencies of that function. Analysis of that information is provided in conjunction with qualitative data.

### 5.9.2 QUALITATIVE DATA FROM THE INTERVIEW

The most important aspect of the analysis involves the study of quantitative data in relation to data provided informally during the interview. Because the municipalities have primary responsibilities in a disaster context as first responders, the analysis will approach the problems from a municipal or local perspective and focus its attention on the centrality of local agencies in each network. Is there any central agency at the local level for that function ? If not, at which level of government is the central agency located ? What is the communication network with peripheral agencies ? What are the strengths and weaknesses of that network, and where are they ? Answers to these questions will provide material for the final part of the study: proposals and recommendations.

To conclude this chapter, data collected during elite interviews including questionnaires is analyzed according to each function or network. The analysis presents a table representing linkages between agencies, a graph of the network and an assessment of the network from a local perspective.

## **CHAPTER 6**

### **DATA ANALYSIS**

#### **6.1 COMMUNICATION NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.1. The communication network is a disjointed structure with few direct linkages between agencies. Agencies view the communication structure as a weak link not sufficiently addressed and would support a radio network encompassing all major response agencies in the GVRD. The agencies in the network possess their own internal radio network. Local agencies are linked within the City EOC. A certain number of provincial ministries and utility corporations (not all) are integrated within the PFRC under PEP. However, there is no direct linkage between the City EOC and other agencies. At the local level, only CSARES can access these individual networks and is therefore represented as the local central agency, with a more complete technical capability and flexibility than the City EOC itself. From that perspective, Coquitlam could rely on CSARES for operational contacts (agency to agency) and could integrate the agency personnel and equipment within its communication plan in a larger than supporting role only. Ideally, CSARES could become an element of the City EOC, like any other city department, with specific responsibilities, and have to dispatch trained personnel in predetermined locations. These elements of preparedness would test the ability of CSARES to deploy mobile resources and the feasibility of such a plan.



Provincially, the communication problem is recognized and deserves further study. A network linking ministries, utility and transportation corporations, regional and medical agencies, and municipal EOCs could be envisioned. This network could provide a frequency for groups of response functions, accessed by agencies for operational reasons only. Without radio contacts, coordination becomes a difficult enterprise. The existing system, exercised during two major training sessions (Thunderbird 1 and CANATEX 2), has failed local, regional and provincial expectations.

## **6.2 SEARCH AND RESCUE NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.2. This network is interesting for two reasons: firstly, the main activities associated with Search and Rescue are integrated at the fire EOC, not the City EOC, and secondly PEP has a direct relationship and control over CSAR. In practice, the fire EOC would retain control over CSAR, with tasks coming from the City EOC, where we find other peripheral agencies (RCMP and Engineering). Requests from the PFRC to CSAR will be channelled through the City EOC. CSAR cannot be regarded therefore as an "independent local agency". The strong linkage between CSAR and the fire department is logical operationally and must be encouraged. From a local perspective, that linkage represents a good example of cooperation between public and volunteer agencies.

What is less certain is how PEP accepts this fact ? During the first critical days of the response, the city can confidently retain control over CSAR, given the extent of disorganization to be expected. Later, CSAR could be used for tasks in the north-east sub-region. With actual linkages between the fire departments of the Cities of Coquitlam, Port-Moody and Port Coquitlam, it is easy to envision. This "sub-regional" task would be logical and would guarantee the continuous use and control of CSAR at the local level. The operational control over CSAR will be discussed in chapter 7.

### **6.3 MEDICAL NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.3. The medical network presents a complex structure. There are loose linkages between major agencies (city, B.C. Ambulance and hospitals) and no radio network between them although B.C. Ambulance possesses its own radio network. B.C. Ambulance requires transportation status from the city but has to rely on the telephone only. Communication and the coordination of transportation resources for injured personnel and disabled personnel represent a problem. The planning of tasks (who to send where and how) for the triage and transportation sub-functions will be problematic. Individually, agencies agree with the creation of a strong network but efforts so far have been directed towards agency preparedness, not inter-agency linkages. Neither local nor regional or provincial agencies have been working on a strategic plan to assemble all available medical resources. Following a disaster, the medical function is one of the most important in order to save

lives. Time is a critical factor. Integration of major players into an operational network is rather essential and coordination of resources has to take place at the adequate location for rapid exchange of information, planning and decision-making.

The network central agency is B.C. Ambulance in the case study. B.C. Ambulance is a first responder equipped with an internal communication network and loosely linked to provincial, regional and local agencies. At the local level, the medical EOC is in fact provided by SFHU personnel attached to the City EOC, and relying on the city communication net. The functions of SFHU liaison personnel are to identify and assess situations hazardous for public health and recommend a course of action to the city. SFHU itself has weak linkages with hospitals, B.C. Ambulance and the Ministry of Health. Weak linkages also exist between other local agencies, hospitals and B.C. Ambulance. The Hospitals have no radio system with external agencies.

In these conditions, two weaknesses are visible: firstly, a lack of direct communication between agencies in the field and secondly, a lack of a coordinating body. It is not logical to have B.C. Ambulance at the center of the network. That agency is supposed to act following the direction from authorities. At the local level, the City EOC can provide essential information and direction (number and type of injured personnel, danger areas, road conditions) and is the ideal local medical agency. Strong linkages are encouraged at the tactical level between the City EOC, B.C. Ambulance and hospitals, for the triage, transportation and treatment of personnel. It also appears that strategic

coordination can be better achieved at the regional level, because the major agencies (hospitals and B.C. Ambulance) have regional responsibilities. A regional structure could eliminate inter-municipal conflicts over roles, resources, and operational areas.

#### **6.4 SHELTER AND MASS CARE NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.4. The network is well defined. Local agencies are organized around the city ESS. On the provincial side, agencies are organized with specific roles and responsibilities within PESSOC (Provincial Emergency Social Services Operations Center), adjacent to the PFRC. This network is therefore centralized in two locations. The Red Cross, Salvation Army and St John's Ambulance will respond locally only when requested by local authorities, through PEP. Linkages between the city and these agencies directly range from weak to inexistent. PEP and PESSOC have a coordinating and prioritizing task for requests submitted by local authorities and the provision of specific services to local reception centers.

Locally, weak linkages and definition of roles between the city ESS and the School District on one side, and between the city ESS and HEROS on the other (both for the manning of reception centers, actually on a voluntary basis), do not ensure a proper response based on local resources. The resources provided by the Ministry of Social Services at the local level cannot fill the gap. Direct radio communication between agencies is less important in this function because a duration is built in any sustained

action. From a local perspective, further preparedness could enhance operations and take two forms: firstly, a rough estimate of resources required could be provided beforehand to PEP and the agencies within PESSOC in order to indicate the magnitude of the task ahead. This estimate could be quickly revisited following a disaster. This task would give an "information edge" to the city and help to develop direct contacts between local and external agencies. Secondly, the city ESS could work to obtain predetermined resources at the local level. For example, inquire why school teachers are not mandated to fill emergency duties on a prolonged basis, as other public employees, particularly if schools are used as reception centers ? Reliance on volunteer groups is good but probably not sufficient to sustain adequate services to displaced personnel.

## **6.5 CORONER NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.5. The function is not well developed and exists only through weak linkages between specific agencies at the local and provincial levels. The main agencies involved are the Coroner office in the Ministry of Attorney General and the RCMP at local level. B.C. Ambulance could get involved if requested but is usually not involved in that function. The main problem related to that function is the proper disposal of dead bodies, among other and more urgent priorities. This function has the potential, if mismanaged, to provoke rapidly a public relation crisis.

The bulk of the work is usually performed by the private sector. The City EOC or the RCMP have no real linkages with the private sector. It is assumed at the local level that the provincial government has the necessary resources to handle the function and can provide material such as body bags and a list of locations to freeze corpses. This is not the case and therefore the municipalities will have to get involved. Preparedness of local authorities is a safeguard against liabilities. Many questions can be answered at the local level: how many corpses and under which conditions can the private agencies handle ? Do they require any external support ? Do they have special procedures to manage a catastrophic event ?

## **6.6 PUBLIC INFORMATION NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.6. The network is practically inexistent in the case study. Local, regional and provincial agencies have all affirmed the importance of public information for successful response operations but the coordination of these agencies has not happened so far.

Public media do not have direct linkages with municipalities, and therefore none are established with the City EOC. The EOC location is unknown, as are the local procedures for public information. Weak linkages exist between the media and PEP, and the media consulted had not participated to the recent provincial exercises. The media have no coordinated plans between themselves and individually lack the resources to

provide information services to all municipalities and the PFRC simultaneously. These resources at the moment would be directed following requests from local authorities, without a predetermined plan, in an improvised manner. These resources would also depend upon communication and transportation means available, another area where coordination between the city and the media would be helpful. Finally, there is no channel dedicated to public information on the existing communication networks.

In these conditions, it is difficult to see how essential information will be directed quickly to the public in the first critical days. Municipalities can take three steps to correct the situation: firstly, determine the desirability of direct linkages between some media and the city, and provide local procedures to these agencies. Any kind of agreement securing media resources for the city would be welcome; secondly, develop linkages with PEP as a secondary resource for that function; finally, address the problem of trust between the media and the first responders, where the media are often regarded with suspicion. The City of Coquitlam public information plan establishes the roles of the various local players including local politicians and exercises the plan regularly. Liaison takes place in the City EOC.

## **6.7 LAW AND ORDER NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.7. One local agency, the RCMP, has complete responsibility over that function. Recently, the RCMP

forces, dispatched to local authorities by the RCMP E Division, a federal body, have been moving closer to municipalities by virtue of community policing. This will create stronger linkages between police forces and volunteer agencies such as HEROS (having liaison with the RCMP in the RCMP EOC), which can be used on other duties than the Shelter and Mass Care function, for example on sealing duties around dangerous areas. The RCMP is not under complete command and control of the City EOC. In practice, both have a strong working relationship. Linkages between RCMP units from surrounding municipalities are established and developed, following the ICS model.

The RCMP is expected, as a first responder, to play roles in many response functions. Although they possess mobile resources with an internal radio communication network, they cannot directly communicate over the radio with other first responders except on the city command net. This does not represent a problem if personnel from the agency is clearly identified as site commander to take control over other agencies and rely on their communication nets for coordination. If this is not the case, authority and communication problems may develop.

Because the city does not control entirely the police forces within its boundaries, a good relationship with the Ministry of Attorney General, E Division, is essential to explain the role of the RCMP in the community and avoid these forces being deployed elsewhere following a disaster. A good information flow about the local situation between PEP and the city can alleviate this problem.



## **6.8     FIREFIGHTING NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.8. The network is clearly defined, although so many agencies are potentially involved. Nobody questions the role played by local firefighters. The interesting element is the centrality or the periphery of agencies at the regional and provincial levels, indicating strong linkages at the wrong place.

The network is well defined at the local level. At the regional and provincial levels, the Ministry of Forests play a central role, because of the following elements: firefighting experience outside urban areas (urban interface in Coquitlam), experience in mobilizing resources, a good regional and inter-regional radio network, and other mobile resources. The ministry has been given the responsibility, within the PFRC, to coordinate the movement of resources in support of response operations. In that capacity, the ministry has potentially more coordination powers than the Regional Fire Commissioner. The network indicates weak linkages between local fire forces and the Regional Fire Commissioner. There is an authority problem above the local level. The movement of resources following a disaster could become a tug-of-war between the City EOC, PEP, the Regional Fire Commissioner and the Ministry of Forests. Direct communication between these agencies is only possible through the City EOC and PEP, agencies not normally directly involved in that function.

From a local perspective, a stronger linkage between the firefighters and the Regional Fire Commissioner would alleviate the problem mentioned above. Otherwise, the integration of the Fire department in the city structure is good, the firefighters supporting volunteer agencies such as CSAR, and having developed mutual aid agreements with surrounding municipalities on the ICS model. It is doubtful, based on experiences in California and more recently in Kobe (Japan), whether the Fire department has the resources and proper communication linkages to accomplish their tasks. The department must rely on external agencies for the utility function (water, through the Engineering department) and the transportation function (for road clearance). The need for external support is perceived, although local exercises have shown a difficulty, for firefighters, to place themselves under control of other agencies when requested.

## **6.9 HAZARDOUS MATERIAL NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.9. The network complexity still indicates the location of central and peripheral agencies. The most important aspect of the network is the weakness of linkages developed between almost all agencies.

At the local level, hazardous material incidents are the responsibility of the Engineering department, supported and assisted by the Fire department and the RCMP. Medical agencies are accessed through the City EOC and SFHU personnel dispatched

there. As discussed in chapter 6.3, the local medical network is particularly weak. The GVRD is involved only if the water system is in danger of being contaminated. At the provincial level, PEP considers the spiller (utility, transportation corporation or other private company) responsible for the incident. During normal conditions, the Ministry of Environment and PEP closely monitors the response operations of the spiller (required by law to produce emergency plans for such eventualities) and will continue to do so in a disaster context.

Following a disaster, the spiller will require the complete support of local authorities for information, decision-making and execution (what is the situation, who is in danger, how resources can be moved, which roads are blocked, and who is in charge at the incident site?). Decisions will refer to many functions (transportation, medical, and public information networks). In these conditions, the response becomes primarily a local operation, controlled from the site itself and supported from the City EOC, the only agency capable of coordinating all local resources and informing external agencies. Communication is essential and the site commander must be clearly defined between a representative of the spiller, or any city responder. This function is a good case study for the development of the ESM model at the local level because it involves a double layer coordination structure (City EOC and the site itself). Another important element is quick access to other essential networks (the transportation network is responsible for road blocks, traffic control and sealing duties; the medical network for emergency treatment and evacuation; the public information network for dissemination of information).

Preparedness with major potential spillers could improve the response and therefore stronger linkages with TMP, B.C. Gas, C.P. Rail and chemical companies are encouraged.

## **6.10 UTILITY NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.10. The network is interesting for three reasons: firstly, most agencies have direct working relationships between them; secondly, these linkages are weak and usually happening at lower levels of the agencies structures; finally, at the provincial level, the network is not clearly represented within the PFRC structure. In theory, all major agencies should be represented but in practice, the multiplicity of agencies (particularly in the telecommunication sector) makes this project a difficult enterprise. Some utility corporations think that the PFRC is able to play a coordination role while others think that coordination of the response ought to be decentralized at the regional level. In most cases, interference from the PFRC into their technical areas (as seen during CANATEX 2) is neither welcomed, nor encouraged. Finally, most agencies recognize inter-agency communication problems at the regional level.

At the local level, the Engineering department will be pressured to respond not only to water and sewer problems but also to emergency demands for fuel, gas and power in the city. Utility agencies also need assistance from the city for roads clearance, technical support and transportation information. The importance of lifelines could

become the city's first priority in order to support hospitals, reception centers, and the general public. In that context, coordination has to take place with the participation of local authorities for operational effectiveness (within the City EOC or a regional body). Strategic decision-making (like the prioritization of major repair) will also involve the full participation of the municipalities, preferably in a regional context.

Communication and a structure permitting quick-decision making are essential because utility problems can rapidly degenerate in life threatening situations. Strong linkages between local departments and utility agencies could also speed up municipal plans leading to recovery.

## **6.11 TRANSPORTATION NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.11. The network is the only one where provincial authorities, through the Ministry of Transportation and Highways and PEP, play a coordination role as central players with peripheral agencies in support. Both agencies could therefore support local agencies strategically at the regional level. Local and provincial authorities have to rely on the private sector for response tasks, although linkages between them could be improved.

From a local perspective, only resources within the city boundaries are readily accessible. The city has limited resources for tasks that could become limitless. Locally, it

is important to encourage a strong and direct linkage with the regional office of the Ministry of Transportation and Highways for two reasons: firstly, both the ministry and the municipalities depend upon support from the same private resources and agreements are required beforehand, particularly because these resources are deployed for a long period of time; secondly, municipalities are interested to know the ministry probable strategic plans for transportation and access to specific areas, as these decisions will affect the local transportation plans. That linkage could include discussions about the lack of local resources, location for bulk construction material and traffic control problems expected throughout the city.

#### **6.12 DEBRIS CLEARANCE NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.12. This network is closely related to agencies involved in the transportation function. Linkages are weak presently. The advantages of a strong linkage between the city and the Ministry of Transportation and Highways in the transportation function are applicable here. Better preparedness is encouraged. It is interesting to note the communication efforts undertaken by the ministry to contact specific private agencies over the radio, and agreements for direct support established to take effect following a disaster. Another element is the non reliance on volunteers neither at the provincial nor the local levels for assistance on relatively simple debris clearance tasks. This aspect is not mentioned in local or provincial documents.

## **6.13 INSPECTION, CONDEMNATION AND DEMOLITION NETWORK**

The network data is presented in Appendix 1, Table and Graph 6.13. The network is not developed at any level. Experiences in California show the enormity of the task and its importance to citizen. At the local level, personnel from the Engineering department have the task to inspect primarily public buildings used as reception centers. A local exercise conducted within the CANATEX 2 scenario has shown a shortage of local resources to perform this task. For other tasks, the city has to rely on resources from the private sector (architects and engineering firms), or external support. Actual linkages with the private sector are weak. At the regional level, the Greater Vancouver Housing District relies on private inspectors to determine the suitability of newly built public housing and maintains a list of suitable firms for this task. Whether or not this could be of any assistance to the city is uncertain. This function is clearly a local responsibility and demands a tremendous coordination effort to increase preparedness, due to the large number of agencies involved.

## **CHAPTER 7**

### **FINDINGS**

This chapter is divided in two sections: the first section addresses findings related to each function and their perceived impact on the operational effectiveness during the response phase. That section emphasizes the importance of preparedness within each function from a local perspective and the desirability of strong networking with the external and supporting agencies. The second section presents a general assessment of the findings and suggestions addressing structural coordination problems.

#### **7.1 FUNCTIONAL FINDINGS**

##### **7.1.1 GENERAL CONSIDERATIONS**

The elements contained here apply to many response functions, for example the evacuation case where the transportation, medical and public information functions are involved. An improved linkage in one function could apply to another (for example the city-TMP linkage has a positive effect on both the utility and hazardous material functions). Inter-agency agreements are often mentioned, and they would take effect following a declaration of a local State of Emergency. Often, a sub-regional structure is mentioned. These sub-regions could include the following geographical areas: the City of Vancouver, the north (West Vancouver, North Vancouver and North Vancouver District),



the south (Richmond and Delta), the center (Burnaby and New Westminster), the south-east (Surrey) and the north-east (Coquitlam, Port-Moody, Port Coquitlam, Belcarra and Anmore). A regional structure could represent the GVRD geographical boundaries.

Structural changes should not compromise the political integrity of each municipality but complement local preparedness efforts. In this chapter, boundaries mismatch problems are not addressed.

#### 7.1.2 SEARCH AND RESCUE FUNCTION

CSAR is politically controlled by the city but administratively controlled by PEP.

CSAR is also the only sub-regional resource in support of the firefighter and police forces for light Search and Rescue. The linkages developed with local agencies, particularly with firefighters, are important and must be encouraged. The function presently has no resources for heavy Search and Rescue (such as trained operators and mobile heavy equipment). Contacts and agreements with the private sector are inexistent at the local level. Responsibility for the function is rightly placed with the firefighters as the primary local agency, but preparedness activities deserve further attention with the private sector and possibly volunteers. The province is supporting the creation of local agencies such as CSAR, but has not resolved the problems associated with the duplication of services (for light and heavy activities) and the lack of resources for the latter. Military trained personnel (possibly militia units) could provide support resources for the function although it is not planned presently.

In summary, the linkage developed between CSAR and the Fire department, and CSAR location at the sub-regional level, presume a larger than purely local role for the agency. A total Search and Rescue function demands further resources and preparedness at the local level.

### 7.1.3 MEDICAL FUNCTION

At the local level, the importance of providing communication between the city, B.C. Ambulance and the hospitals is a priority to establish a network. With SFHU providing personnel to man the City EOC, SFHU becomes the primary agency to establish linkages in the network. Parts of the network are already in place and the city can provide supplementary resources (perhaps mobile communication equipment). Major agencies of the network are outside local boundaries (hospitals and B.C. Ambulance) and demand some form of regional coordination, inexistent presently. B.C. Ambulance is centrally located in the network because of numerous but weak linkages with almost every other agency. Inter-agency communication is a recognized problem and has operational consequences for strategic planning between municipalities, hospitals, and transporters on tasks such as closure of hospitals, relocation of personnel, transportation, and the location of field hospitals. These problems are compounded by the weak role played by provincial ministries.

In summary, inadequate inter-agency communication, lack of a central agency dedicated to coordination, and the necessity to rely on external resources for local agencies demand major changes in order to improve the network.

#### 7.1.4 SHELTER AND MASS CARE FUNCTION

The city ESS has local responsibility over that function. Linkages and communication between ESS and potential reception centers (municipal buildings or schools) are weak. ESS could investigate the possibility of mandatory involvement of public service employees in schools used as reception centers, and increase preparedness at the local level with the support of HEROS and other potential volunteers. An element rarely mentioned concerns the provision of resources to sustain reception centers, and the requirement (passed to the province) for planning with agencies under the provincial umbrella in PESSOC. Another area of interest concerns the inclusion of the private sector during the preparedness phase for the provision of food, beverages and other commodities. Strategic coordination of a function involving so many disparate agencies requires the involvement of all levels of authorities. The provincial organization for the function works well, if adequately supported by a communication network. The PFRC can play a coordinating and a supporting role at the regional level by prioritizing requests for support received from the municipalities. Presently, no criteria for prioritization are prepared.

In summary, a proper communication system between municipalities and the provincial supporting agencies and prioritization procedures for assisting municipalities could improve the network.

#### 7.1.5 CORONER FUNCTION

The city RCMP has local responsibility for the function. Local preparedness efforts concern the provision of adequate resources from the private sector to support the function. The province has positioned itself to play a supporting role only. Coordination of activities becomes a local responsibility. Like in other areas, communication represents a weak link for the function.

In summary, local preparedness is required with the PFRC providing support mainly as a central information point.

#### 7.1.6 PUBLIC INFORMATION FUNCTION

The information network is inexistent at the local level but improvements would only require minimum efforts from the city staff: establish a list of media agencies with a potential to inform quickly the population (radio stations), and a direct contact with these agencies by exchanging operational information. At the provincial level, contacts with media are treated on an incremental basis, without any responsibilities assigned to each

major media agency. A communication network dedicated to public information is also inexistent. Media have a regional and provincial roles and cannot be treated as a local or regional resource only.

In summary, lack of communication and lack of planning about the resources in a regional context represent two problems to be addressed probably at the provincial level. The PFRC is best located to coordinate the regional public information requirements.

#### 7.1.7 LAW AND ORDER FUNCTION

The RCMP has local responsibility over that function. The network is working adequately and relies on mutual aid agreements between municipalities in a sub-regional context presently. Police forces are involved locally in many response functions and as such are extremely important to a municipality. They also have developed strong linkages locally (with HEROS).

#### 7.1.8 FIREFIGHTING FUNCTION

The function is under the responsibility of the local Fire department. The network works adequately and relies on mutual aid agreements between municipalities in a sub-regional context. The department is integrated within the city structure and support other local agencies. The role of the Regional Fire Commissioner, as a coordinator of resources

at the regional level, is difficult to explain without a regional structure and without strong linkages with municipalities. The Regional Fire Commissioner is not playing any central role and is not integrated in the PFRC structure. Communication linkages are weak between major agencies and could impair the support requested from local authorities.

In summary, a lack of communication and unclear definition of roles for some agencies present a challenge to operational effectiveness in a regional context.

#### 7.1.9 HAZARDOUS MATERIAL FUNCTION

The function is a responsibility of the local Engineering department. For reasons expressed in the previous chapter, the coordination of operations is better conducted at the local and inter-municipal levels. The choice of an incident commander at the scene and communication from and to the site are essential. Preparedness could be improved with stronger linkages between the city and possible spillers (TMP, B.C. Gas, C.P. Rail and the Greater Vancouver Sewerage District) and the preparation of response plans for vulnerable areas. Communication is a weak link in the network at the operational level. The provincial agencies operating from the PFRC have a supporting role as technical advisor but cannot replace local agencies in a coordination role.

In summary, inadequate communication between major agencies can reduce the response effectiveness, particularly when decisions involving many municipalities are required. There is no regional structure to resolve these conflicts presently.

#### 7.1.10 UTILITY FUNCTION

The function is a responsibility of the local Engineering department. The network shows loose linkages and communication problems between all agencies. Liaison and preparedness (plans, procedures, potential resources, and location of vulnerable areas) are required by the city to increase the response effectiveness. Utility agencies could be tempted to send liaison personnel in a regional EOC, supported with a communication network, to coordinate their strategic activities. Utility agencies have limited resources and some prioritization of work is necessary at the regional level. The PFRC does not play a strategic coordination role in that function because few agencies are represented at the PFRC and the communication network is presently inadequate.

In summary, inadequate communication and inexistence of a regional structure for strategic coordination could impair operations in that crucial function.

#### 7.1.11 TRANSPORTATION FUNCTION

The function is a responsibility of the local Engineering department. A lack of public resources obliges the city to produce agreements with the private sector and provide the Ministry of Transportation and Highways with an assessment of the situation (expected problems, existing resources, existing agreements). Coquitlam is a strategic location in the regional transportation grid and as such, decisions of a strategic nature and potential traffic control problems can be resolved with a strong linkage between both agencies. That linkage can be important locally because the ministry controls a web of external resources eventually useful to the city. As for other functions, communication represents a problem. The ministry is well placed to assume a regional coordination role at the strategic level, in cooperation with municipalities.

In summary, the regional office of the Ministry of Transportation and Highways can assume a coordination role at the regional level if adequately supported by a communication network.

#### 7.1.12 DEBRIS CLEARANCE FUNCTION

The function is a responsibility of the local Engineering department. The city requires support from the private sector in order to accomplish its task. A strong linkage is also desirable with the Ministry of Transportation and Highways to determine the priority



of tasks having an effect on the local situation. The ministry is well located to play a coordination role at the regional level but again, a weak communication network could impair the response.

#### 7.1.13 INSPECTION, CONDEMNATION AND DEMOLITION FUNCTION

A final responsibility for the local Engineering department (permits and licenses personnel). It demands a local coordination of activities, with support from provincial agencies. Linkages with the private sector, including agreements and exchange of information, are inexistent presently. The PFRC can play a supporting role only. The task is demanding, necessitates preparedness and is an important issue of public safety. The function has not received significant attention neither at the local nor provincial levels.

#### 7.1.14 COMMUNICATION FUNCTION

Findings from most networks confirm a generalized communication problem between agencies. Locally, the city could integrate CSARES in the emergency management structure, and use its mobile resources to fill communication gaps with major external agencies in the important response functions: CSAR, B.C. Ambulance, hospitals, radio stations, B.C. Hydro, B.C. Tel., B.C. Gas, TMP, C.P. Rail, the Ministry of Transportation and Highways and major private contractors and firms. Regionally, a single communication system is necessary (see Appendix 1, Figure 7.1.14) to encompass the

major responders in each important response function. Each region could have its own network with one frequency for inter-regional communication controlled by the province. The province would create and maintain the whole network, but each network would have a regional orientation. The actual system is too fragmented and incremental to work effectively, as demonstrated not only in the communication network but also in all other functions.

## **7.2 STRATEGIC FINDINGS**

The cost of preparedness is minimum, when compared to mitigation efforts. However, it involves the personnel in place, the development of good communication, staff work, agreements, contacts, and training exercises, an effort usually required as a secondary duty for the staff involved. Preparedness can be improved at all levels of government and must be sustained. The City of Coquitlam and PEP are actively pursuing that goal. But in itself, preparedness is not enough.

Findings determined in chapter 7.1 mainly address three problems: the adequate level required for coordination within each function, a lack of a regional coordination mechanism for decision-making, and finally communication.

The first problem concerns the level for coordination between agencies. The analysis of the functional networks shows that some functions should be coordinated at

the provincial level, while some others should be coordinated at the regional level or local level only. Responsibility for coordination has to be at the best level possible for operational effectiveness. One clarification: in all cases, the province plays at least a supporting role. A coordination requirement involves strategic planning, prioritization of tasks, and decision-making for actions involving many agencies and many jurisdictions. The following functions, according to findings, could be best coordinated by provincial authorities from the PFRC: communication, public information, shelter and mass care, and transportation. The following functions could be coordinated by a regional agency: damage assessment, firefighting, Search and Rescue, medical, law and order, utility, and hazardous material. Finally, municipalities could coordinate the coroner and inspection functions. The levels for coordination could change because the tasks are not similar, the agencies involved are different and the complexity of the tasks require coordination at a lower or higher level of authority for operational effectiveness.

The second problem identified shows a missing structural link between local authorities and the PFRC in many response functions. The exercises Thunderbird 1 and CANATEX 2 have shown that the PFRC cannot resolve all coordination problems presented by major agencies and municipalities because its structure does not permit coordination in many cases and communication problems exist. Findings also indicate a series of functions where coordination could be accomplished at a regional level outside the PFRC. The study suggests two structural solutions (sections 7.2.1 and 7.2.2) to address the problem.

Finally, it is impossible to resolve coordination problems without a good communication network at the tactical and strategical levels. Communication is required horizontally at the local level (city command net), regional level (proposed network), and provincial level (PFRC). Communication is also required vertically between focal points (City EOC, regional EOC and PFRC). Section 7.1.14 briefly mentioned how it could be done. All major agencies involved in the response would be connected in the network, including City EOCs, utility and transportation corporations, regional agencies and regional branches of provincial ministries in the PFRC. It would be the responsibility of minor agencies to link with major ones within their network to access the communication network. The PFRC would still have a responsibility for communication with federal and international agencies. The City EOC would still employ its command net. Such system, if used adequately, would provide a communication umbrella over the GVRD or any region in the province.

#### 7.2.1 THE EXPANDED PFRC MODEL

In the preceding section, a need for a regional structure is identified. One suggestion concerns the expansion of the existing PFRC without creating a new structure. An expanded PFRC assembles representatives from the GVRD, municipalities, utility and transportation corporations, and regional agencies within a regional coordination structure. This solution resolves multi-agency information and communication problems

and place local authorities in a location adjacent to their supporting agencies, in a large restructured EOC. Politically, such model would probably have to be imposed on municipalities against their will, and it is difficult to see how so many agencies would agree on task prioritization and decision-making in a location responsible for coordination over all response functions. The size and complexity of such EOC would cause many problems, as the actual PFRC is already oversized and too bureaucratic. One last point: the PFRC is an internal provincial organization based on the ICS model, isolated, self-sufficient, and independent. The expanded model would require a physical and "spiritual" transformation, opening up doors to welcome unrelated and structurally different agencies, and cooperating with them (a very difficult task for a rigid and bureaucratic organization). During interviews, many agencies previously invited to the PFRC during exercises played no role, were not involved in the decision-making process and were not provided with communication means, like discarded players. That attitude is not precursor to an expanded PFRC.

### 7.2.2 A REGIONAL MODEL

A second suggestion concerns the creation of a regional EOC to coordinate some response functions. The regional model establishes an EOC composed of representatives from all municipalities, major utility and transportation corporations, and regional agencies (see Appendix 1, Figure 7.2.2). The ESM system is used as a model, with its double layer function, one at the local level and one for strategic decision-making and coordination

with external agency (in this case the PFRC). The EOC is supported by the communication network suggested in Appendix 1, Figure 7.1.14. The structure itself is flexible, can expand or regress according to the situation. The model becomes a strategic communication center for incidents and decisions requiring multi-agency coordination, where local interests are represented.

Such model has many advantages: it can only be created by and for municipalities (although the province could require municipalities to form regional agencies), with political will to resolve common problems. The model is implemented when the problems are comprehended and defined. Request for external support are coordinated by the regional EOC and sent to the PFRC after prioritization, according to local wishes and in full knowledge of the situation. This model can be compared to the successful county EOC in the United States, where major agencies are assembled under one roof to coordinate response activities in a regional context.

However, this model requires a good comprehension of response problems following a disaster by the political leaders. It also requires money to build the regional EOC (perhaps existing infrastructure could be employed), communication equipment, training for personnel, definition of tasks, roles and procedures for the new model. The regional EOC would only coordinate the functions indicated in the findings as best coordinated at a regional level, with the remaining of the functions still coordinated at the

PFRC. The result would be a convenient operational EOC concerned with efficient response operations in an area populated by 1.8 million people.

Between these two suggestions, the regional EOC on the ESM pattern, as explained in chapter 4, is attractive. Many municipalities have started to increase local resources by contacting similar agencies from other municipalities in a sub-regional context. This trend is slow and can be compared to a first step towards a regional structure. The regional model is based on the principles supporting coordination and has the flexibility required to operate in an urban environment. Finally, the structure is based on a consensus between local authorities and regional agencies at the operational level and does not compromise the local political structure.

## **CHAPTER 8**

### **CONCLUSION**

This study showed the importance of multi-agency coordination in emergency management to enhance preparedness and response activities at the local, regional and provincial levels. The analysis of functional networks showed weaknesses to be addressed in order to improve the agencies individual and collective responses.

The quality of multi-agency coordination in the GVRD is not very high and must be addressed by governments. What can be done at the local level ? Promote preparedness, networking between local agencies and external counterparts engaged in the same response functions; promote sub-regional activities; review the possibility of expanding the City EOC to accommodate external agencies, utility corporations and volunteer groups; promote linkages with volunteer groups, and finally, consolidate networks with the signature of agreements when possible. The City of Coquitlam is actually pursuing these activities to some degree and represents a model for other municipalities in the GVRD. The creation of a sub-regional structure (the case of the north-east sub-region) is an intermediate step towards the creation of a regional EOC and foster a common approach, networking, and pooling of resources under specific circumstances.



Much has to be done at the provincial level: the Emergency Act can be revised and regulations reviewed to indicate a necessity for inter-municipal arrangements or a regional response (perhaps some incentives such as technical support and training could foster local preparedness); a review of operational principles appears necessary to indicate in which areas local authorities can expect a coordinated support from the province and finally a new communication system is essential.

The study findings shows a structural gap in the emergency management structure of the GVRD. The problem must be addressed satisfactorily between the levels of government but not be restricted to the government only, as public resources are clearly insufficient for an efficient response.

The methodology employed in the study is also interesting. The functional network analysis is a new method, relatively simple to employ, applicable at any level of governance (and by any agency), and a useful tool to identify problems and solutions. The data employed in the study is probably changing daily but the method itself appears a reliable instrument with a multitude of practical application for any agency interested to improve preparedness.

- It is suggested that further research in emergency management be directed towards the network analysis method, as it becomes evident that networking is an efficient and cheap method to improve preparedness between different types of agencies.

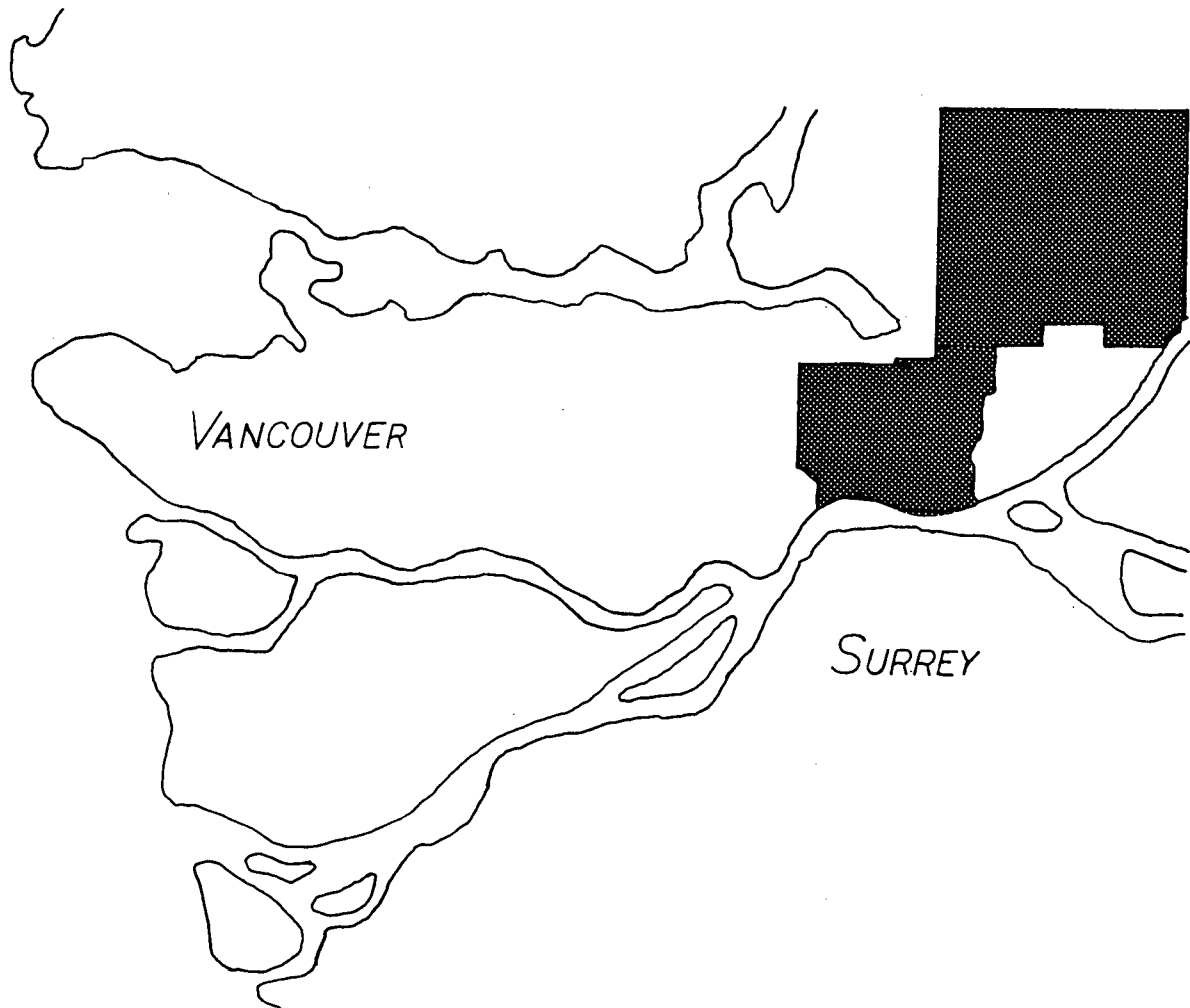
Improving multi-agency coordination is a long term goal, achievable over years (a constant process) and affecting not only agencies but also individuals. Awareness of potential problems are learned through training exercises and information. Emergency coordinators cannot work alone in that process but they can present the key principles of effective emergency management to the public and elected officials. Coordination (as defined in this study), is the most important principle of all. It will be difficult, following a disaster, to justify the resources already spent on mitigation if the responding agencies cannot coordinate their response ultimately. All levels of government and major agencies will answer to the public about these shortfalls.

## **APPENDIX 1**

### **MAPS, FIGURES, TABLES, AND GRAPHS SUPPORTING DOCUMENTATION**

MAP 1.5.1

THE CITY OF COQUITLAM IN THE GVRD CONTEXT

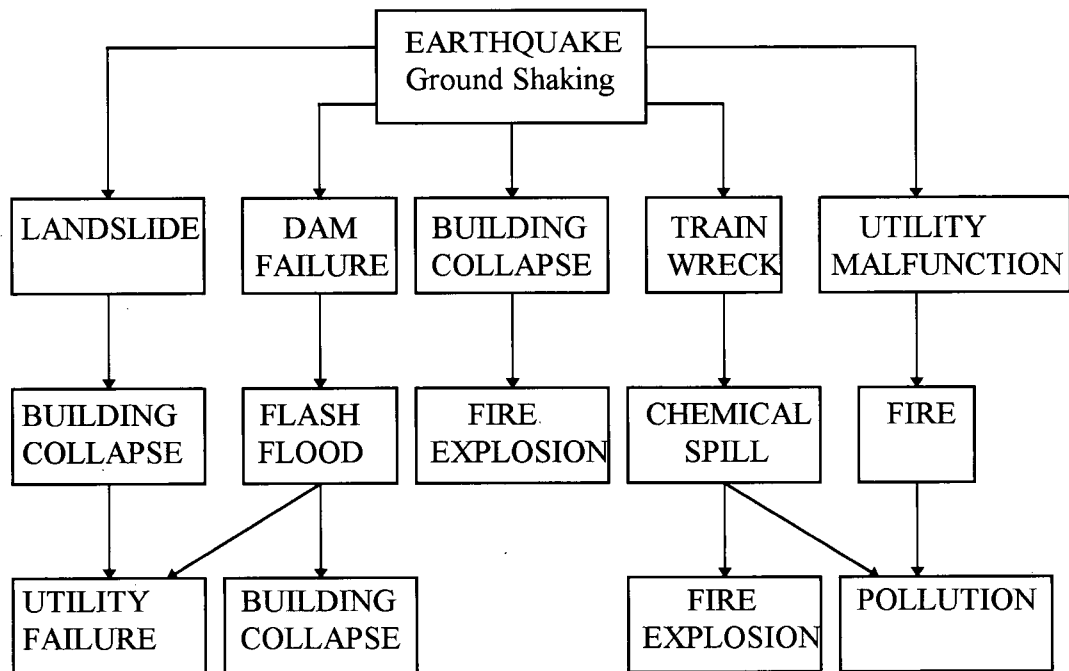


No scale

Source: Author. 1995.

FIGURE 2.1.2

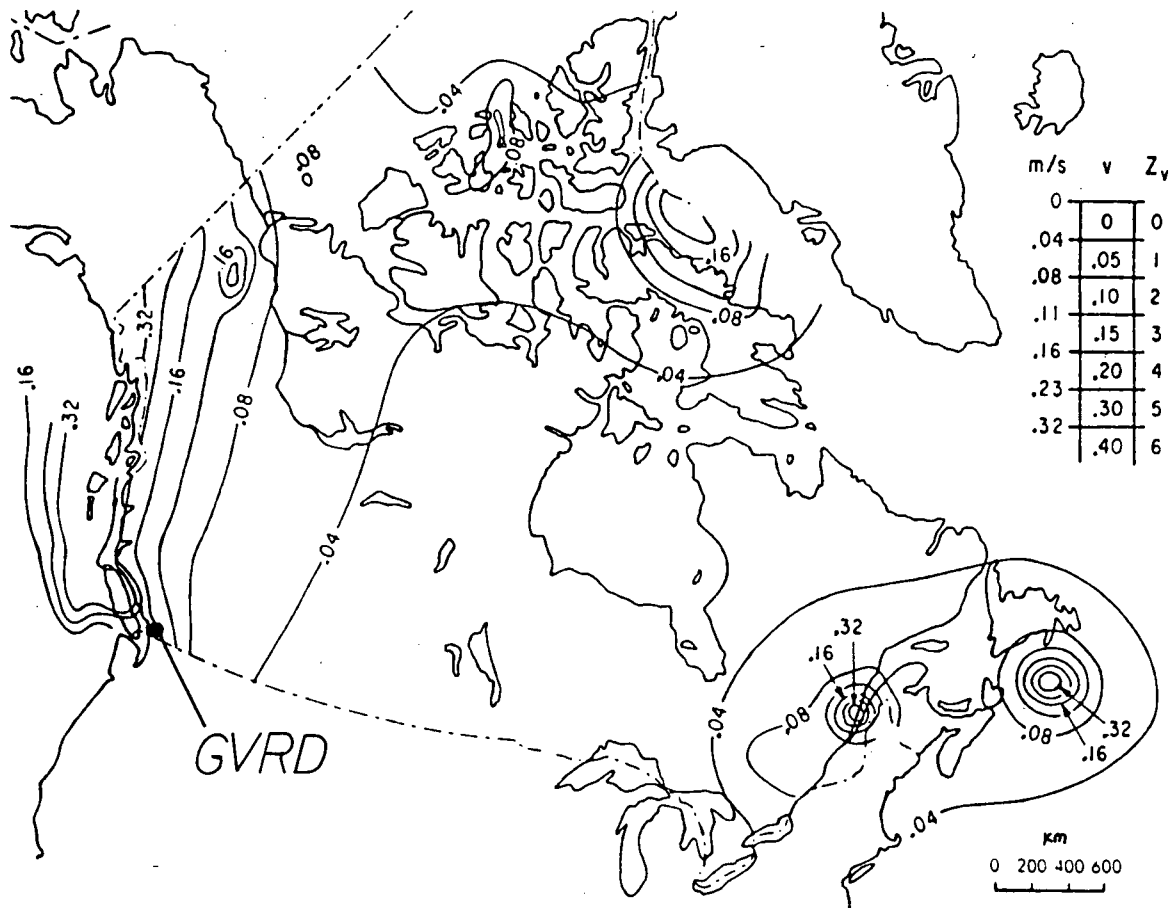
THE EARTHQUAKE : A TRIGGERING EVENT



Source: La Valla, Patrick and Stoffel, Robert. 1991.

# MAP 2.2.11

## THE CANADA SEISMICITY MAP



The map represents the seismic zones for large structures in Canada. The areas indicated, including the GVRD on the West Coast, represent a peak horizontal velocity on firm ground superior at 0.11 meter per second, having a probability of exceedence of 10 % in 50 years.

Source: Hightower, Henry et al. 1993.

## MAP 2.2.12

### THE SUBDUCTION EARTHQUAKE SCENARIO

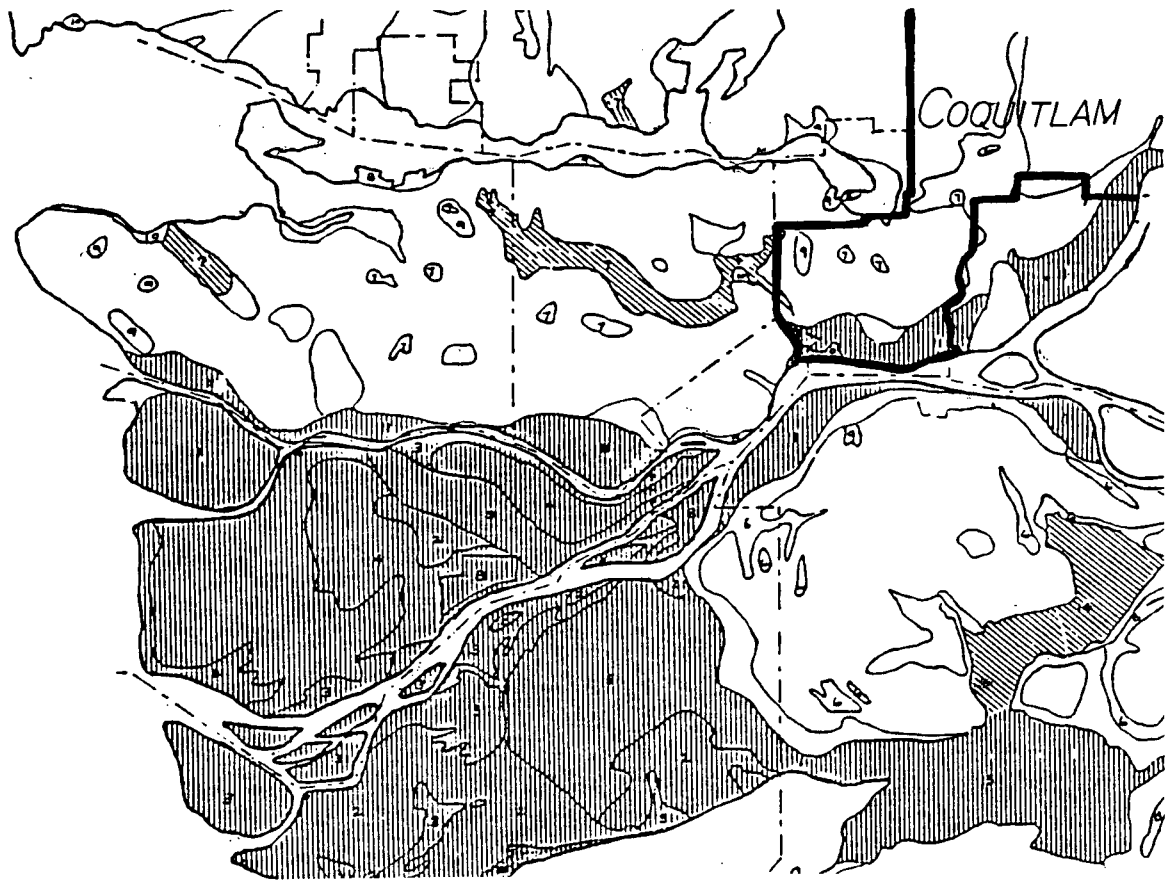
The Pacific Northwest is a subduction earthquake waiting to happen. West of Vancouver Island, an oceanic ridge churns out new crustal material. As part of the Juan de Fuca Plate, the young crust slowly edges eastward, sliding under the North American Plate. Scientific evidence suggests that the plate is not descending smoothly but is stuck, creating strain and buckling the plate. As stress gradually mounts, the plate could snap, releasing vast amount of energy in the form of a large subduction earthquake.



Source: Hightower, Henry et al. 1993.

MAP 2.2.13

THE GVRD LIQUEFACTION MAP



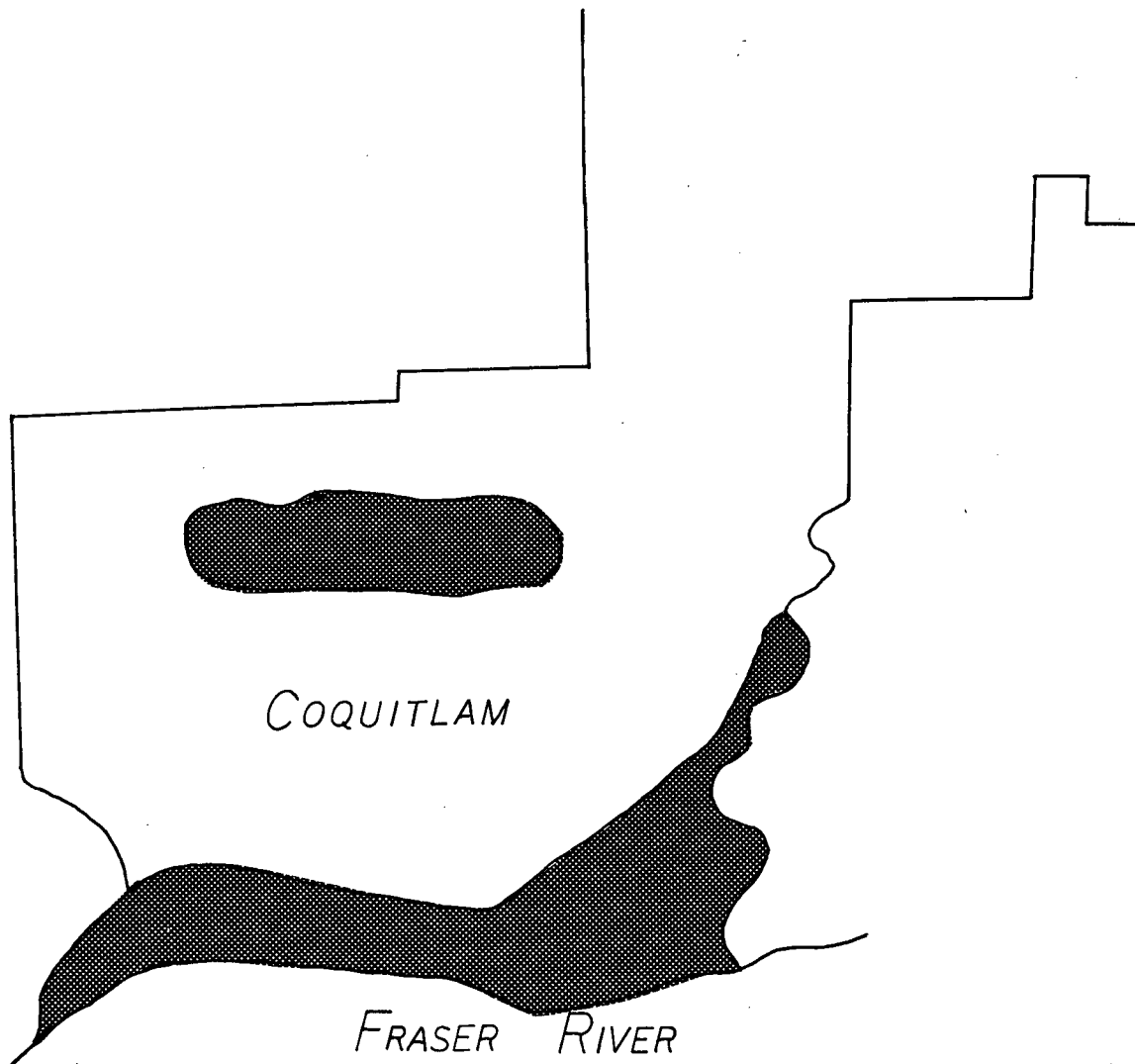
No scale

Source: Hightower, Henry et al. 1993.



MAP 2.2.21

THE CITY OF COQUITLAM LIQUEFACTION MAP

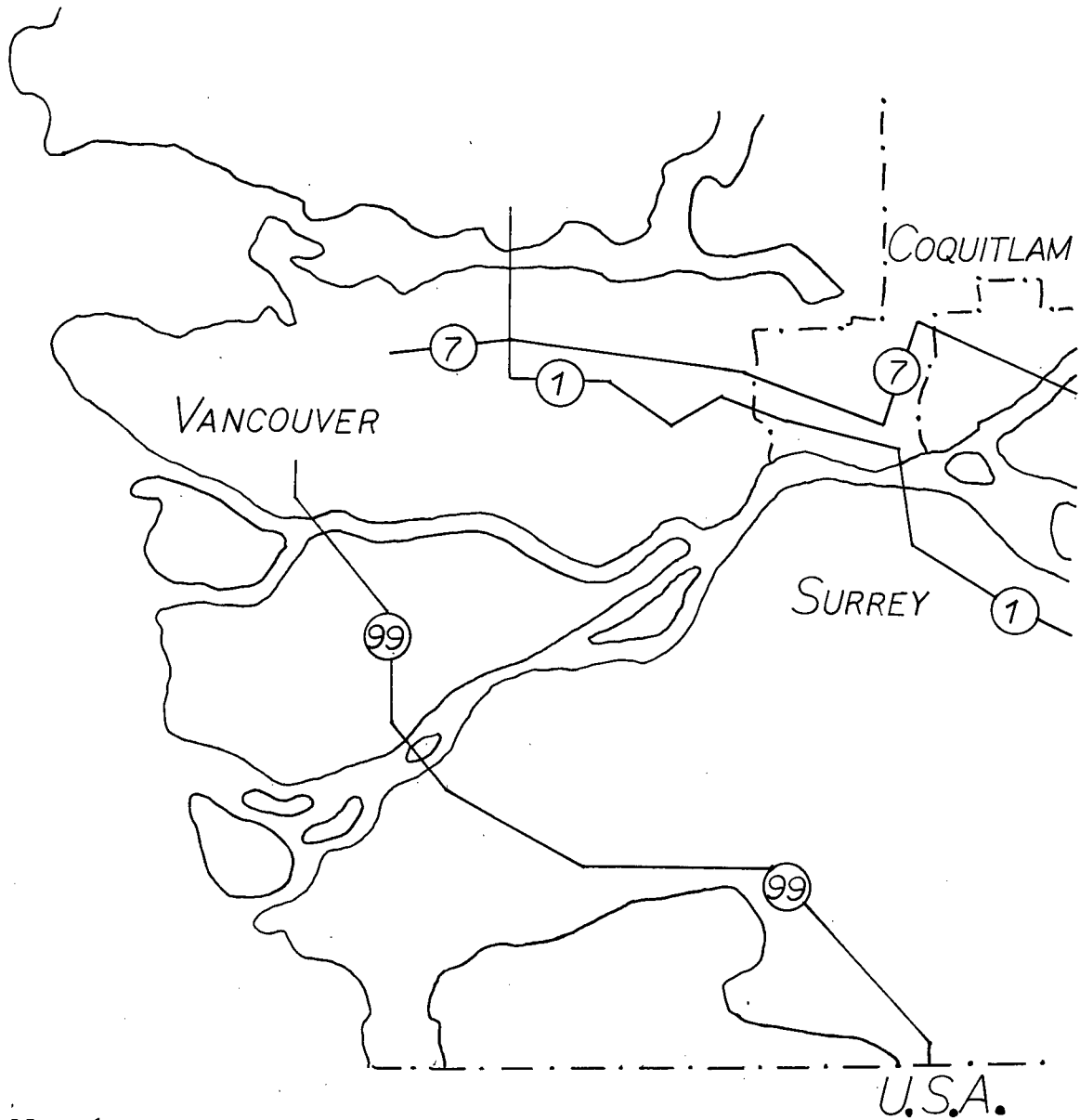


No scale

Source: Author. 1995.

MAP 2.2.22

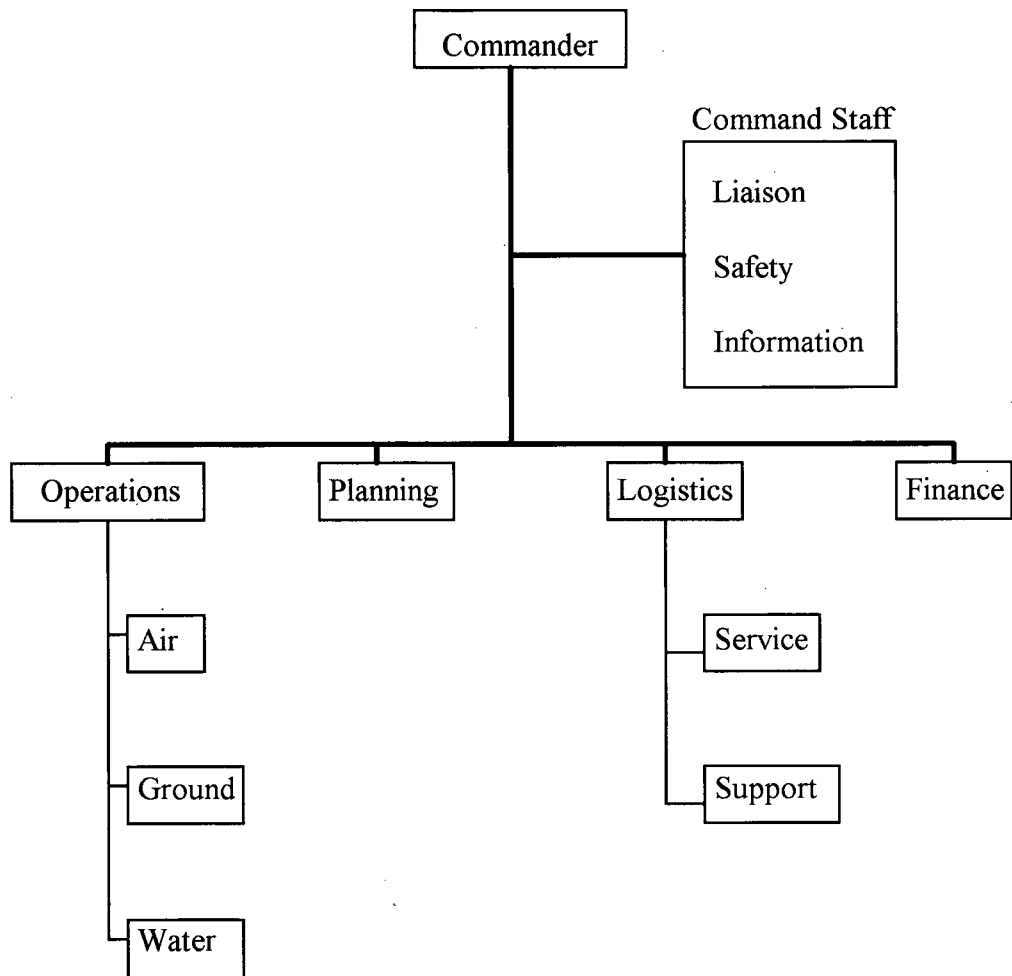
THE GVRD TRANSPORTATION GRID



No scale

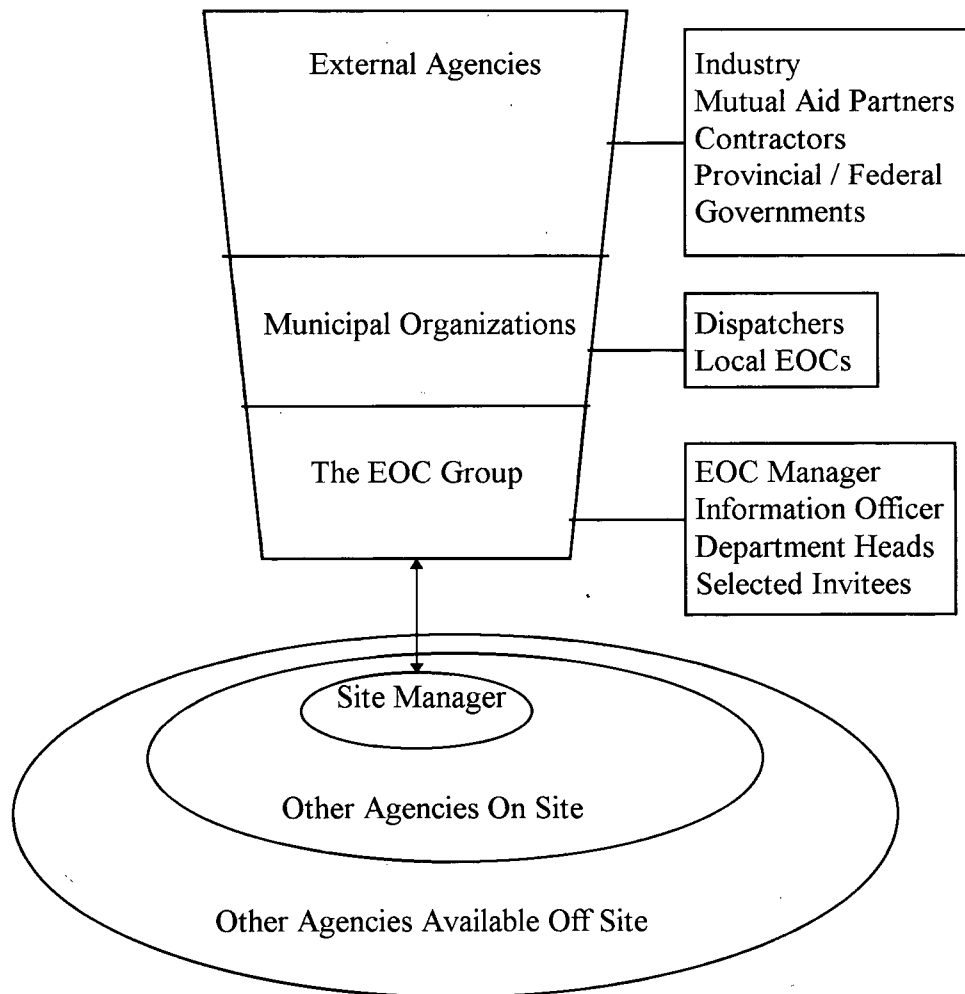
Source: Author. 1995.

FIGURE 4.3.2  
THE ICS MODEL



Source: La Valla, Patrick and Stoffel, Robert. 1991.

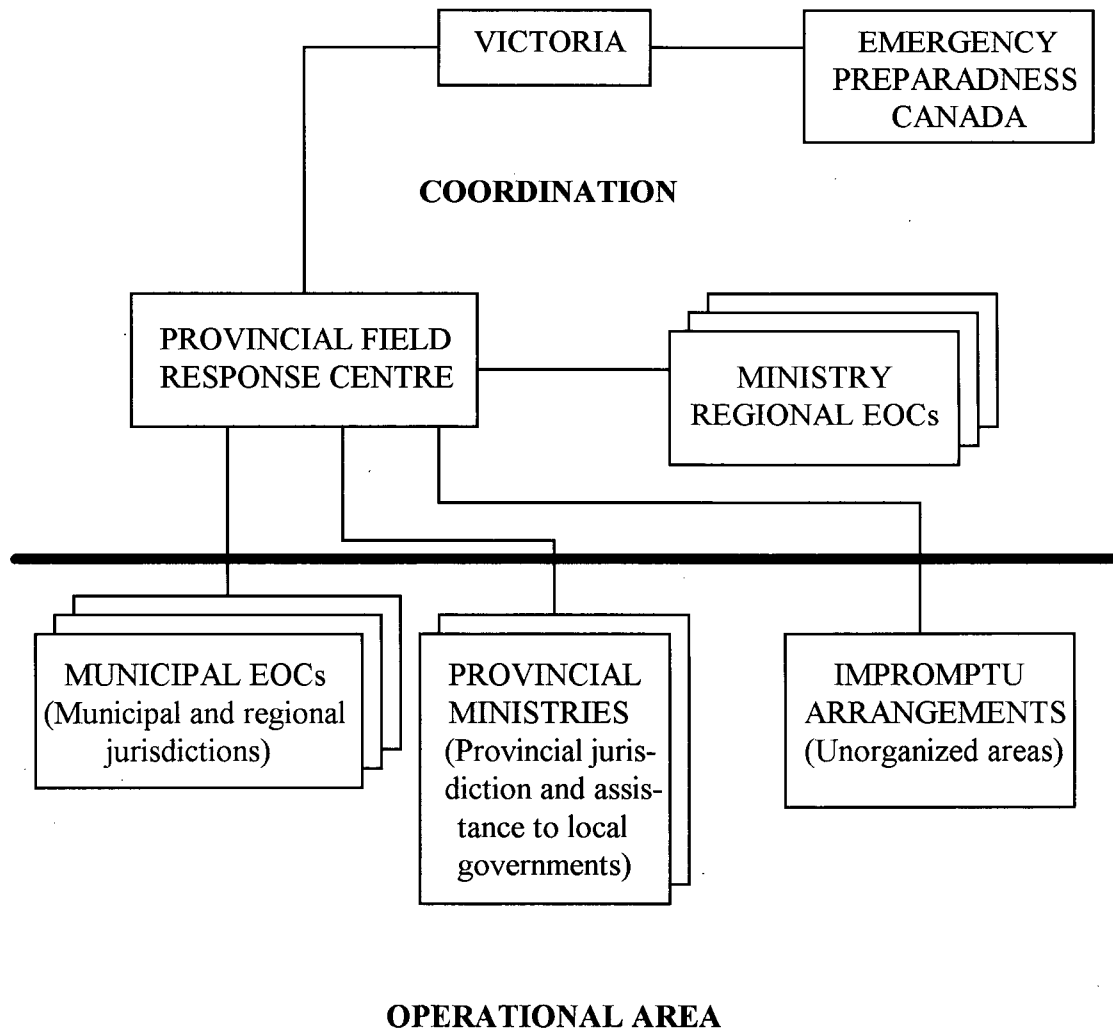
FIGURE 4.4.1  
THE ESM MODEL



Source: Hightower, Henry et al. 1993

FIGURE 4.7.11

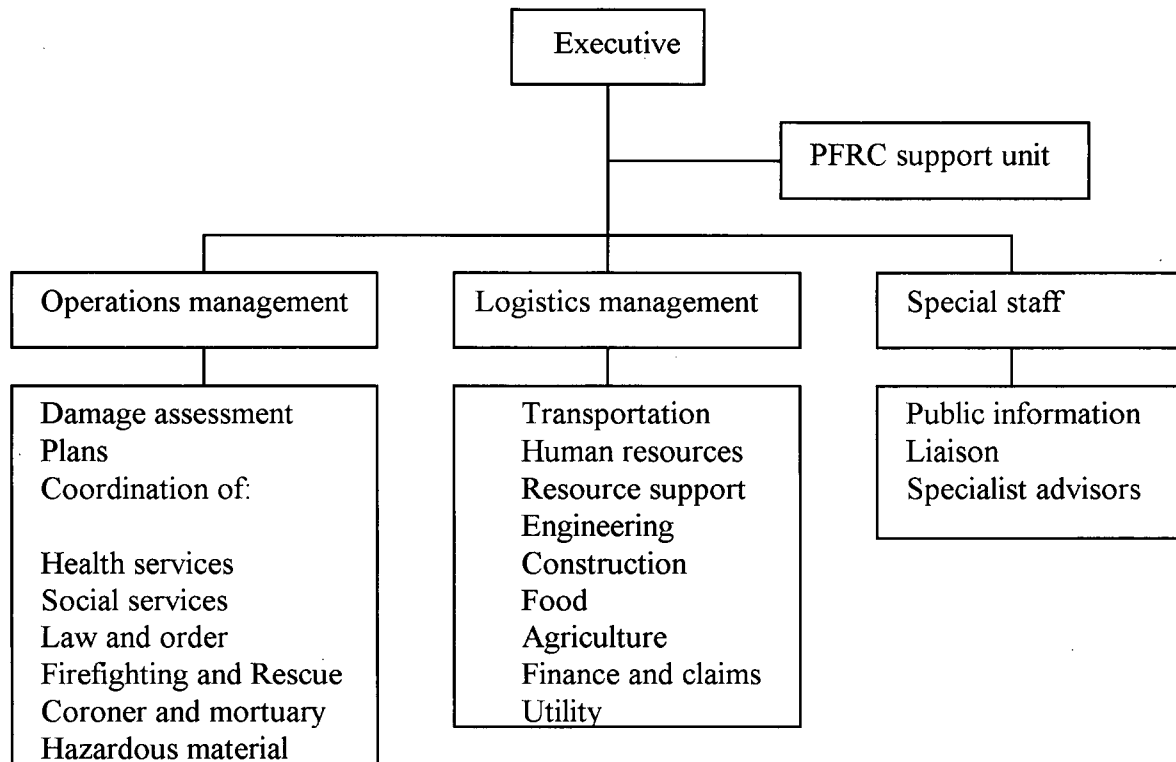
THE PFRC IN A DISASTER CONTEXT



Source: Emergency Preparadness Canada. 1992.

FIGURE 4.7.12

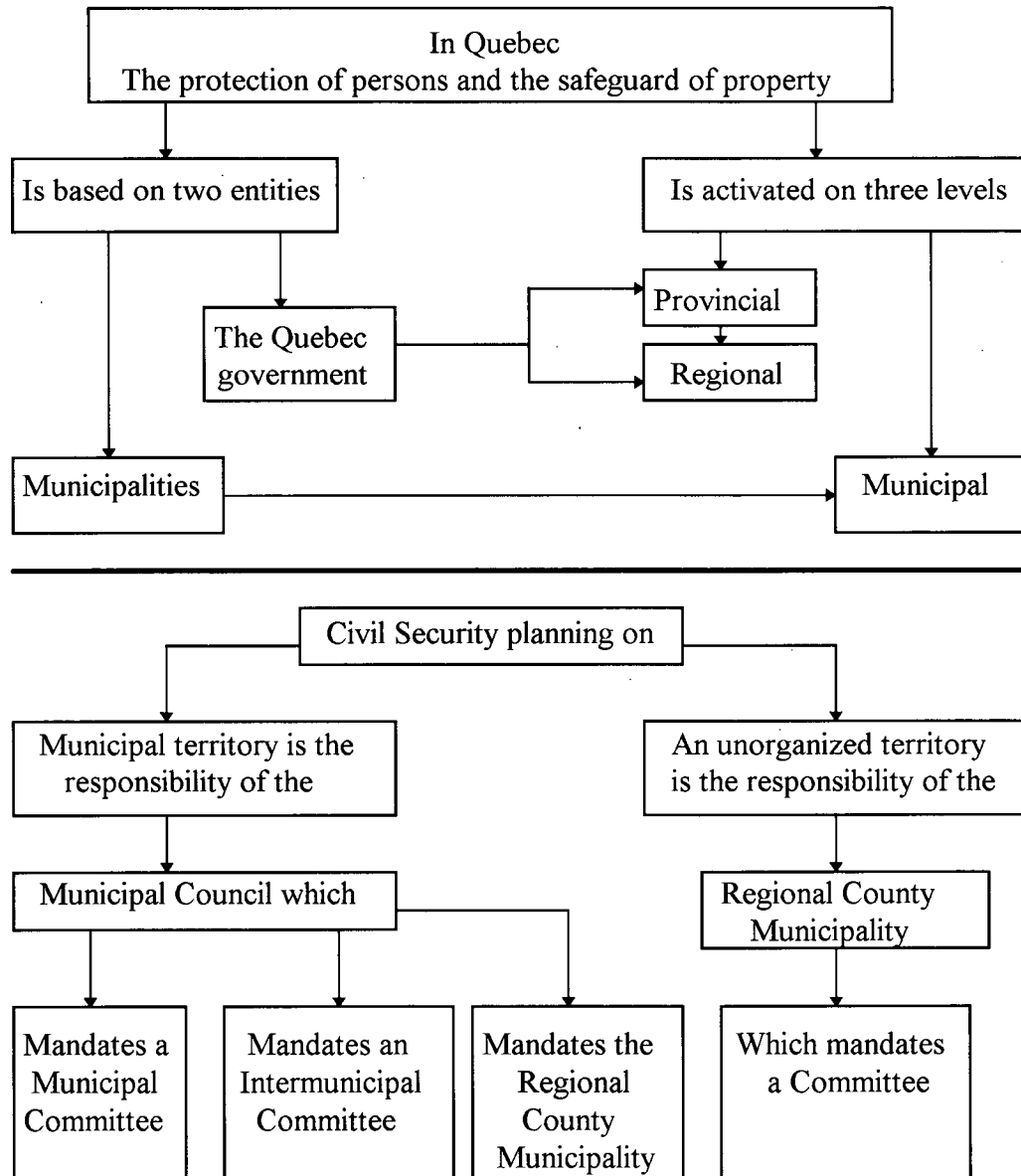
THE PFRC STRUCTURE



Source: Provincial Emergency Program. 1993.

FIGURE 4.7.21

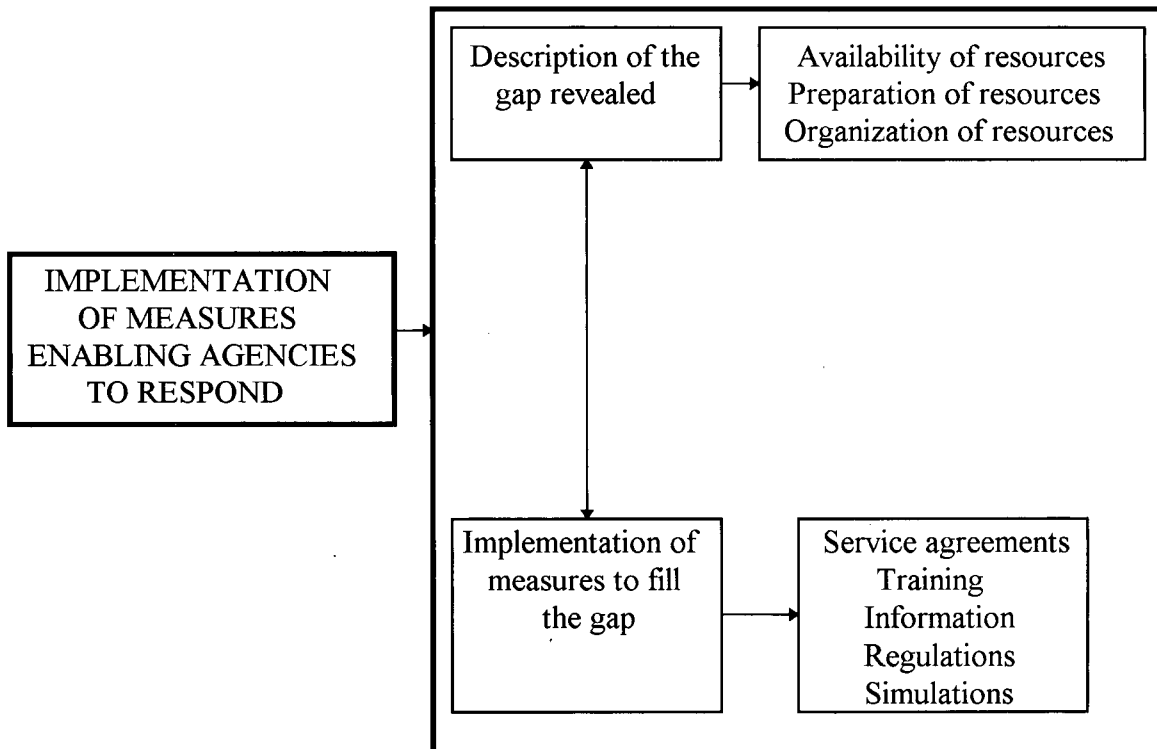
THE CIVIL SECURITY MODEL IN QUEBEC



Source: Deputy Minister Responsible for Civil Security, Government of Quebec. 1994.

FIGURE 4.7.22

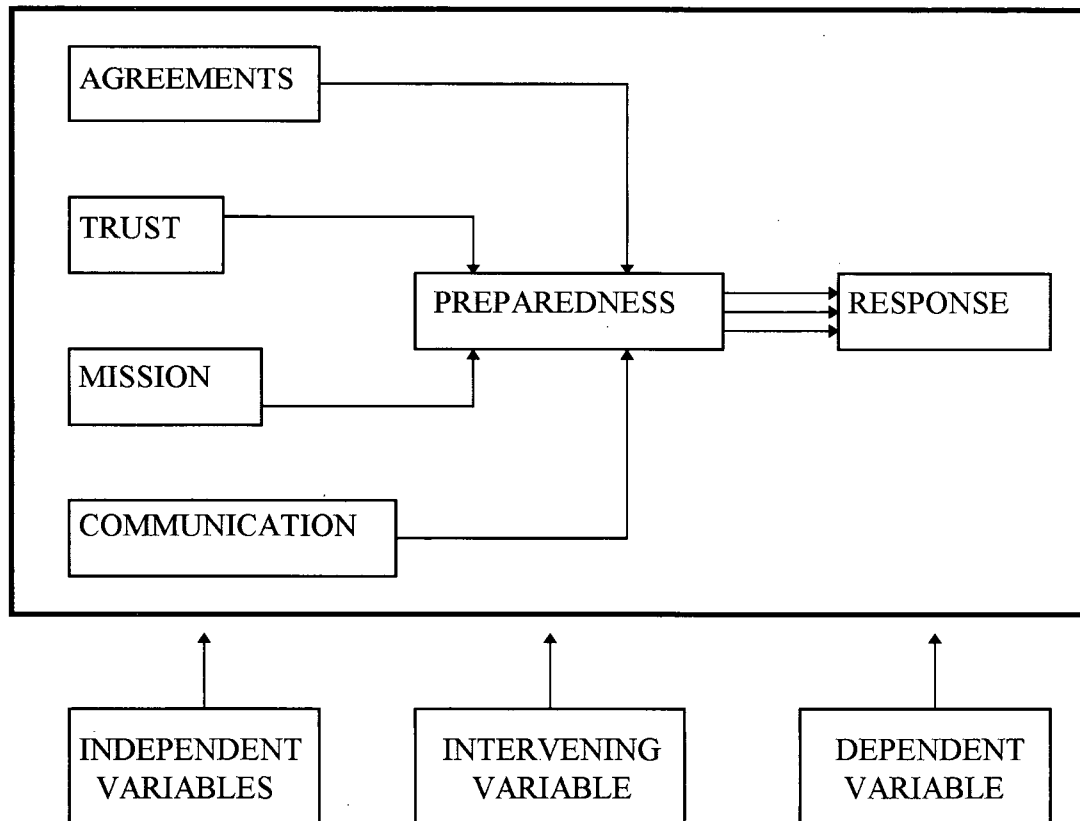
IMPLEMENTATION OF MEASURES ENABLING AGENCIES TO RESPOND:  
THE QUEBEC MODEL



Source: Deputy Minister Responsible for Civil Security, Government of Quebec. 1994.



FIGURE 5.2.2  
A CAUSAL MODEL DIAGRAM



Source: Mayer, Robert R. and Greenwood, Ernest. 1980.

FIGURE 5.2.3

AGENCIES INVOLVED AND SAMPLE SIZE

Agencies involved (abbreviation in brackets)

Local level

1. Coquitlam communication section (Comm)
2. Coquitlam public information section (Info)
3. Coquitlam RCMP (RCMP)
4. Coquitlam Firefighting department (Fire)
5. Coquitlam Engineering department (Engr)
6. Coquitlam Emergency Social Services (ESS)
7. Coquitlam Search and Rescue (CSAR)
8. School District no 43 (School District)
9. Home emergency response organization system (HEROS)
10. Coquitlam Senior Amateur Radio Emergency Services (CSARES)
11. Simon Fraser Health Unit (SFHU)
12. Churches (Churches)

Regional and Provincial levels

- 13-14. Greater Vancouver Water and Sewerage Districts (GVRD)
15. Greater Vancouver Housing District (GV Hous. District)
16. Greater Vancouver Hospital District (GV Hosp. District)
17. Regional Fire Commissioner (Reg. Fire Comm.)
18. Red Cross (Red Cross)
19. St John's Ambulance (St John's Amb.)
20. Salvation Army (Salvation Army)
21. Ministry of Attorney General, Provincial Emergency Program (PEP)
22. Ministry of Attorney General, Coroner office (Coroner office)
23. Ministry of Attorney General, RCMP E Division (RCMP E Div.)
24. Ministry of Social Services (M/ Soc. Svcs.)
25. Ministry of Transportation and Highways (M/ Transport.)
26. Ministry of Environment (M/ Environment)
27. Ministry of Health (M/ Health)
28. Eagle Ridge Hospital (Eagle Ridge Hosp.)
29. Royal Columbian Hospital (R. Columbian Hosp.)
30. Ministry of Forests (M/ Forests)

FIGURE 5.2.3 (Continued)

AGENCIES INVOLVED AND SAMPLE SIZE

Private and regulated sector

31. Private sector (Private sector)
32. Fraser River Port Authority (FRPA)
33. Radio station CKNW (Radio CKNW)
34. TV station CBC (TV CBC)
35. B.C. Hydro (B.C. Hydro)
36. B.C. Gas (B.C. Gas)
37. B.C. Telephone (B.C. Tel)
38. C.P. Rail (C.P. Rail)
39. Trans Mountain Pipeline (TMP)
40. B.C. Ferries (B.C. Ferries)
41. B.C. Ambulance (B.C. Amb)
42. B.C. Transit (B.C. Transit)

Note: Churches and the private sector representatives were not interviewed, as they represent a large amount of disparate agencies. The C.P. Rail representative was not interviewed but information related to that agency was obtained from indirect sources. The same method was used regarding the Ministry of Health and the Royal Columbian Hospital representatives.

Source: Field research by author. 1995.

TABLE 5.2.4 - NETWORKS STUDIED

	Communication	Search and Rescue	Medical	Shelter/Mass Care	Coroner	Information	Law and Order	Firefighting	Hazardous Material	Utility	Transportation	Debris Clearance	Inspection
Comm	X												
Info						X							
RCMP		X	X		X		X	X	X		X		
Fire		X	X					X	X				
Engr		X						X	X	X	X	X	X
ESS				X									
CSAR		X											
School District				X									
HEROS				X									
CSARES	X												
SFHU			X						X				
Churches				X									
GVRD	X								X	X			
GV Hous. District													X
GV Hosp. District			X										
Reg. Fire Comm.								X					
Red Cross				X									
St John's Amb.				X									
Salvation Army				X									
PEP	X	X	X	X		X		X	X	X	X	X	X
Coroner office					X								
RCMP E Div.							X						
M/ Soc. Svcs.				X									
M/ Transport.	X										X	X	
M/ Environment									X				
M/ Health			X										
Eagle Ridge Hosp.			X										
R. Columbian Hosp.			X										
M/ Forests	X		X					X					
Private sector		X		X	X			X	X	X	X	X	X
FRPA											X		
Radio CKNW						X							
TV CBC						X							
B.C. Hydro	X									X			
B.C. Gas	X								X	X			
B.C. Tel	X									X			
C.P. Rail											X		
TMP									X	X			
B.C. Ferries											X		
B.C. Amb.	X		X		X			X					
B.C. Transit	X		X								X		

FIGURE 5.7  
THE QUESTIONNAIRE

Confidential

<u>Questions</u>	<u>Potential answers</u>
1. In a disaster context, during ... response function, research shows that your agency is involved with ... agency. Is this statement correct ?	Yes No
2. Do your agency maintains any contact with that agency ?	Yes. Go to 3. No. End of questions.
3. Is the contact formal or informal ?	Formal Informal
4. Is the contact frequent ?	Often Sometimes Rarely
5. Is the contact related to :	Training Execution of task Planning of task Information
6. Do you consider that contact to be :	Essential Necessary
7. Do you have any coordination mechanism or agreement in place with that agency ?	Joint program Formal agreement Working relationship Common data bank Any other ?

FIGURE 5.7 (Continued)

THE QUESTIONNAIRE

- |     |   |  |
|-----|---|--|
| 8.  | Do you have any agreement related to the command and control of resources in the field with that agency ?   | Yes<br>No                                      |
| 9.  | Do you share any of the following communication network with that agency ?  | Liaison<br>Off line<br>On line only            |
| 10. | Do you rely on the assistance of the Provincial Emergency Program (PEP) to establish and maintain communication with that agency ?  | Yes<br>No                                      |
| 11. | Do your agency intends to rely on the work of volunteers for operational purpose during the response phase ?  | Yes<br>No                                      |
| 12. | Based on your experience, please rank the following four elements in a decreasing order from the most important to the least important to achieve and sustain coordination between agencies ? | Communication<br>Agreement<br>Trust<br>Mission |

Thank you for your cooperation

Source: Author. 1995

## FIGURE 5.8

### INTRODUCTION LETTER AND SYNOPSIS

Michel Coutu  
2818 West 5th Avenue  
Vancouver, B.C.  
V6K 1T6

April 99, 1995

Mr. Abc  
Emergency coordinator  
Xyz Corporation  
99999 West Broadway  
Vancouver, B.C.

Dear Mr. Abc:

As a graduate student of the University of British Columbia (UBC) Planning School, and actual member of the Military Engineering Officer Corps in the Canadian Armed Forces, I am working on a thesis related to the coordination of agencies in response to a disaster in the Greater Vancouver Regional District, specifically within the boundaries of the City of Coquitlam.

My thesis Advisor is Dr. Henry Hightower and my second School reader is Dr. Alan Artibise, both teaching at the School of Community and Regional Planning. Dr. Peter Anderson, from the Communication Faculty at Simon Fraser University, is my external reader.

Attached to this letter is a short synopsis of my project for your perusal prior our interview. If you have any questions, please contact me at home. My telephone number is 999-9999. Thank you again for your cooperation.

Sincerely,

Michel Coutu  
Graduate Student

Attachment - 1

FIGURE 5.8 (Continued)

INTRODUCTION LETTER AND SYNOPSIS

SYNOPSIS OF THE PROJECT

SUBJECT	- MULTI-AGENCY COORDINATION DURING THE RESPONSE TO A REGIONAL DISASTER
LOCATION	- THE BOUNDARIES OF THE CITY OF COQUITLAM
PARAMETERS	- EARTHQUAKE SCENARIO - THE RESPONSE PHASE - MAJOR AGENCIES INVOLVED
THE TERMS	- A DISASTER CONTEXT - THE MEANING OF COORDINATION - COORDINATION ELEMENTS
THE STUDY	- USING THE RESPONSE FUNCTION CONCEPT AND AGENCIES INVOLVED, WHAT IS THE EXISTING LEVEL OF MULTI-AGENCY COORDINATION ? - STRENGTHS AND WEAKNESSES - RECOMMENDATIONS
THE TOOLS	- AN INTERVIEW WITH EACH AGENCY - QUESTIONNAIRE
DURATION	- NO MORE THAN ONE HOUR

Source: Author, 1995.



FIGURE 5.9.11

QUESTIONS WEIGHT FOR DATA ANALYSIS

ELEMENT OF TRUST (weight factor of 2.89)

Question 3.	(3 points)	Formal	3 points
		Informal	1 point
Question 4.	(7 points)	Often	4 points
		Sometimes	2 points
		Rarely	1 point
		Working relationship, add	3 points

MISSION (weight factor of 2.33)

Question 5.	(8 points)	Common training	8 points
		Execution of tasks	6 points
		Planning of tasks	4 points
		Information purpose	2 points
Question 6.	(2 points)	Essential	2 points
		Necessary	1 point

AGREEMENT (weight factor of 1.44)

Question 7.	(7 points)	Joint program	7 points
		Formal agreement	5 points
		Working relationship	3 points
		Common data bank	1 point
Question 8.	(3 points)	Yes	3 points
		No	-

COMMUNICATION (weight factor of 3.34)

Question 9.	(10 points)	Liaison	10 points
		Off line	6 points
		On line only	2 points





Note: Each element is weighted 10 points before using the weight factor for a total of 40 points before and 100 points after multiplication.

Source: Author. 1995.

FIGURE 5.9.12

THE NETWORK SYMBOLISM

The graphic presentation of each network is included in Appendix 1 from Graph 6.1 to Graph 6.13 inclusively and is based on quantitative results from the questionnaire.

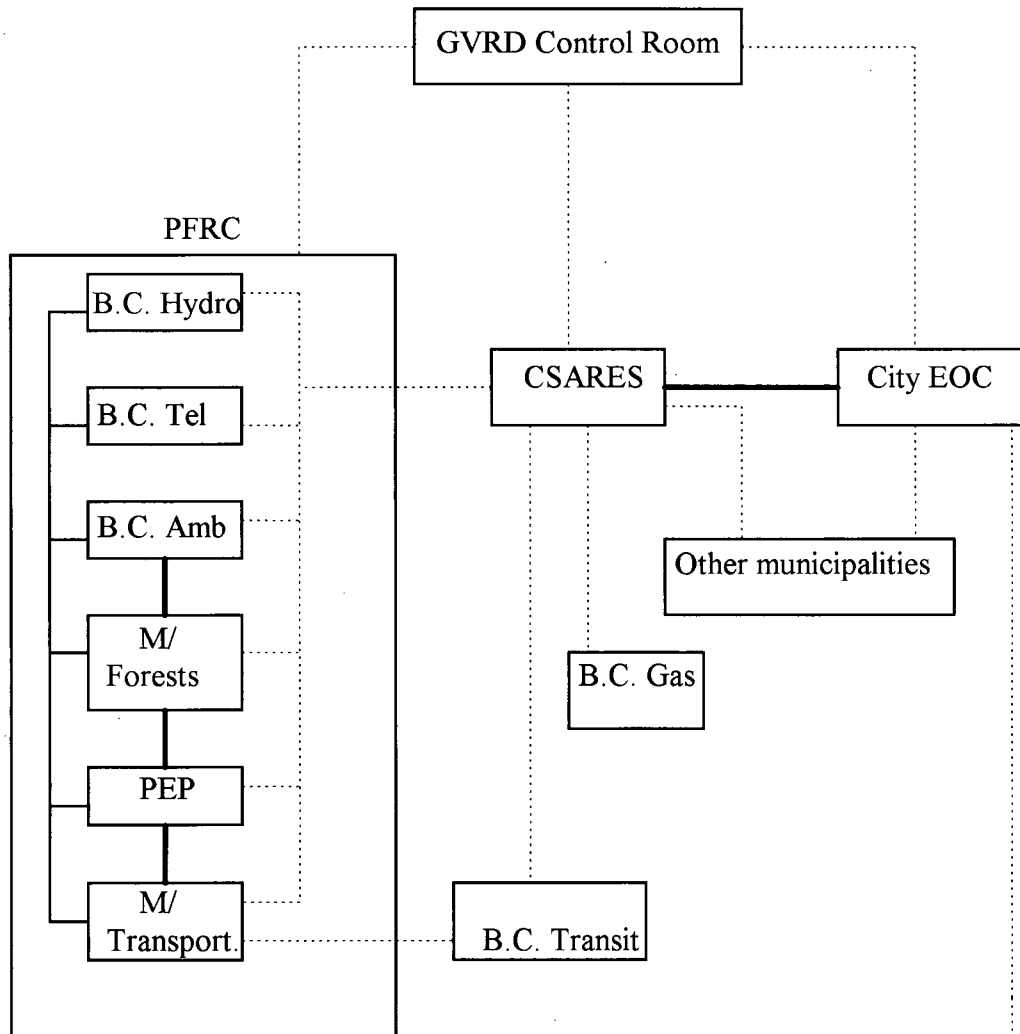
	Represents a liaison between both agencies.
	Represents a strong linkage between both agencies. A strong linkage has a score superior to 57. This high score is achieved when two agencies share the following elements : a working relationship, coordination for the execution of tasks, and radio communication between both agencies.
	Represents a weak linkage between both agencies, with a score inferior to 58.
	Represents a location for coordination between agencies and usually refers to the City EOC, the GVRD Control Room, the PFRC or PESSOC.

Source: Author. 1995.

TABLE 6.1 - COMMUNICATION NETWORK DATA

	City EOC	CSARES	GVRD	PEP	B.C. Hydro	B.C. Gas	B.C. Tel	M/ Transport.	B.C. Amb.	B.C. Transit	M/ Forests
City EOC	-	XL	X	X							
CSARES	XL	-	X	X	X	X	X	X	X	X	X
GVRD	X	X	-	X							
PEP	X	X	X	-	L		L	XL	L		XL
B.C. Hydro				L	-		L	L	L		L
B.C. Gas						-					
B.C. Tel				L	L		-	L	L		L
M/ Transport.				XL	L		L	-	L		L
B.C. Amb.				L	L		L	L	-		L
B.C. Transit				X				X		-	
M/ Forests				XL	L		L	L	XL		-

GRAPH 6.1  
COMMUNICATION NETWORK



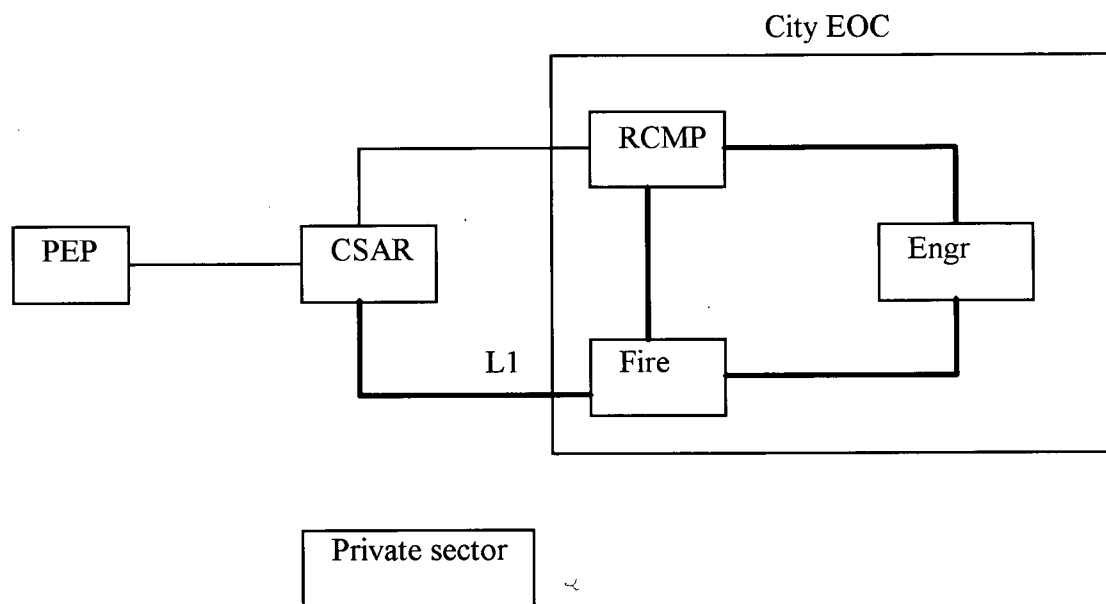
Legend:      ——— In liaison and on radio network with unit  
                  ——— In liaison with unit  
                  ..... On radio network with unit

Source: Field research by author. 1995.

TABLE 6.2 - SEARCH AND RESCUE NETWORK DATA

	RCMP	Fire	Engr	CSAR	PEP	Private sector
RCMP	<b>224</b>	85L	74L	65		
Fire	85L	<b>242</b>	84L	73L		
Engr	74L	84L	<b>158</b>			
CSAR	65	73L		<b>205</b>	67	
PEP				67	<b>67</b>	
Private sector						-

GRAPH 6.2  
SEARCH AND RESCUE NETWORK



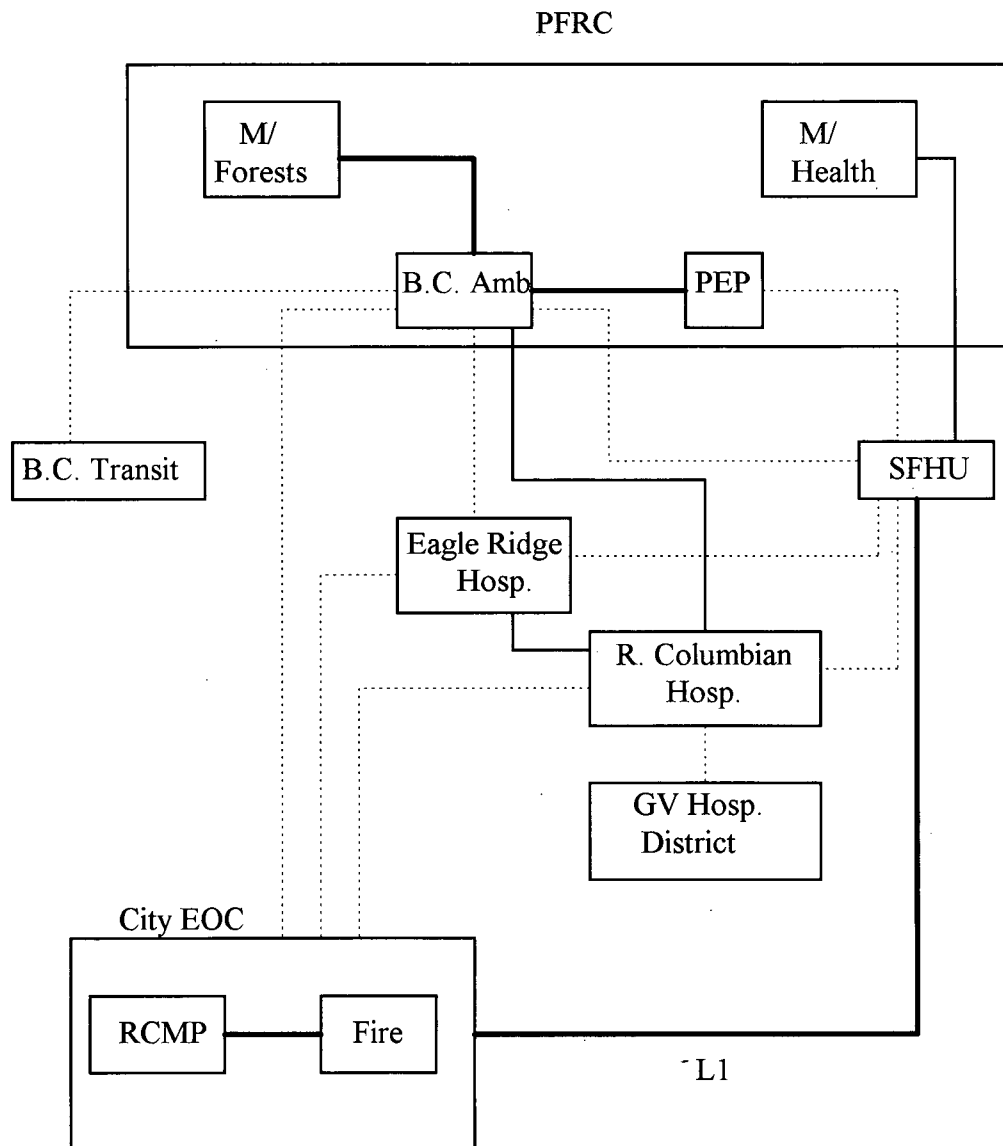
L1 Liaison at Fire EOC

Source: Field research by author. 1995.

TABLE 6.3 - MEDICAL NETWORK DATA

	RCMP	Fire	SFHU	GV Hosp. District	PEP	Eagle Ridge Hosp.	R. Columbian Hosp.	B.C. Amb.	B.C. Transit	M/ Health	M/ Forests
RCMP	<b>166</b>	79L				15	15	57			
Fire	79L	<b>164</b>				15	15	55			
SFHU			<b>281</b>		14	41	53	27		60	
GV Hosp. District				<b>42</b>			42				
PEP			14		<b>53</b>			39L		L	L
Eagle Ridge Hosp.	15	15	41			<b>169</b>	73	25			
R. Columbian Hosp.	15	15	53	42		73	<b>264</b>	66			
B.C. Amb.	57	55	27		39L	25	66	<b>414</b>	57		88L
B.C. Transit								57	<b>57</b>		
M/ Health			60							<b>60</b>	
M/ Forests								88L			<b>88</b>

GRAPH 6.3  
MEDICAL NETWORK



L1 Personnel from SFHU at City EOC

Source: Field research by author. 1995.

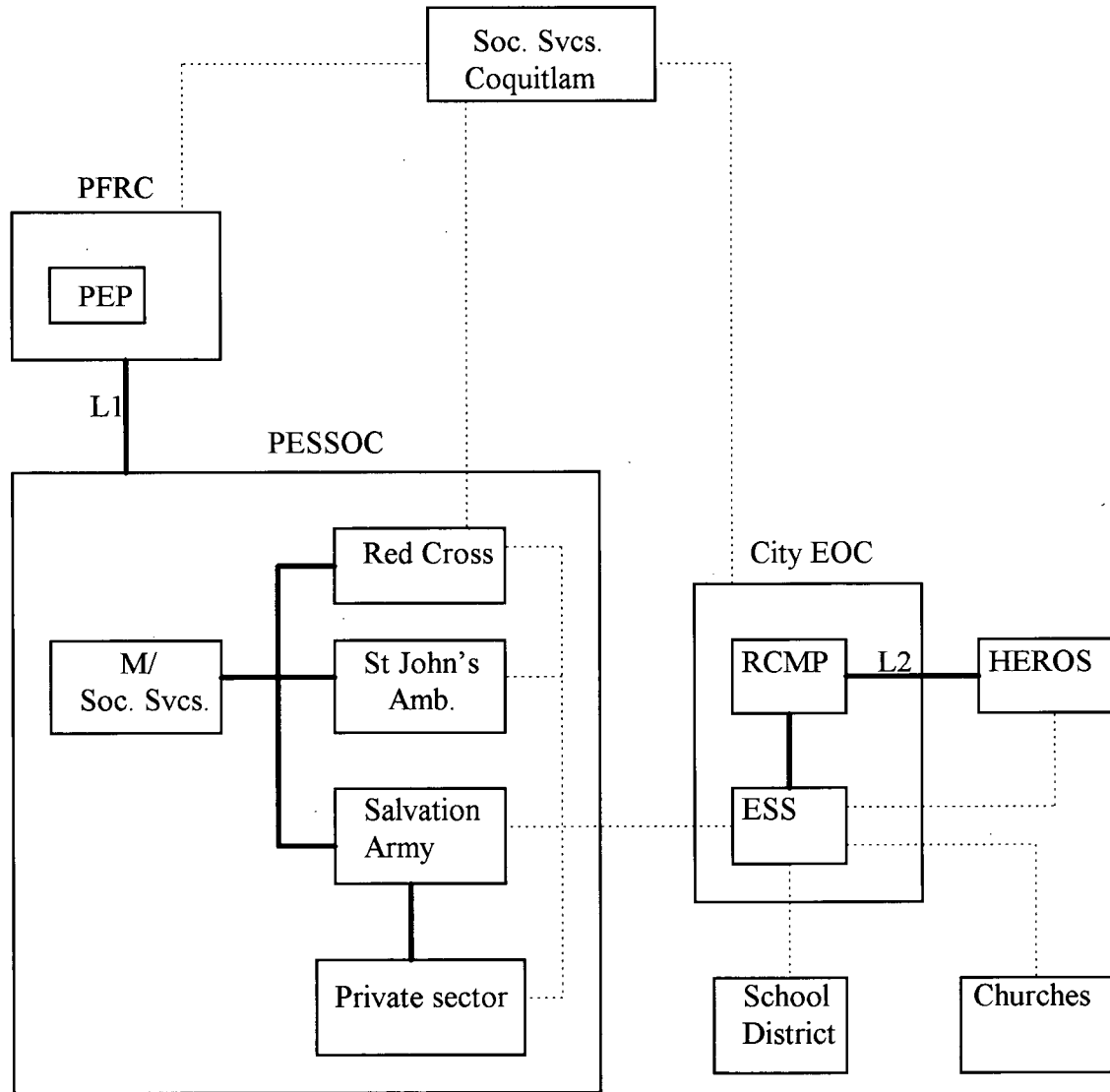


TABLE 6.4 - SHELTER AND MASS CARE NETWORK DATA

	ESS	School District	HEROS	Churches	Red Cross	St John's Amb.	Salvation Army	PEP	M/ Soc. Svcs.	Private sector	RCMP
ESS	194	35	16	24	40	16	22		12	29	L
School District	35	35									
HEROS	16		102								86L
Churches	24			24							
Red Cross	40				265	53L	53L	76L	43L	L	
St John's Amb.	16				53L	207	55L	55L	28L	L	
Salvation Army	22				53L	55L	327	77L	42L	78L	
PEP					76L	55L	77L	266	58L		
M/ Soc. Svcs.	12				43L	28L	42L	58L	183	L	
Private Sector	29				L	L	78L		L	107	
RCMP	L		86L								86

GRAPH 6.4

SHELTER AND MASS CARE NETWORK



L1 ...Liaison at adjacent locations.(PESSOC and PFRC)

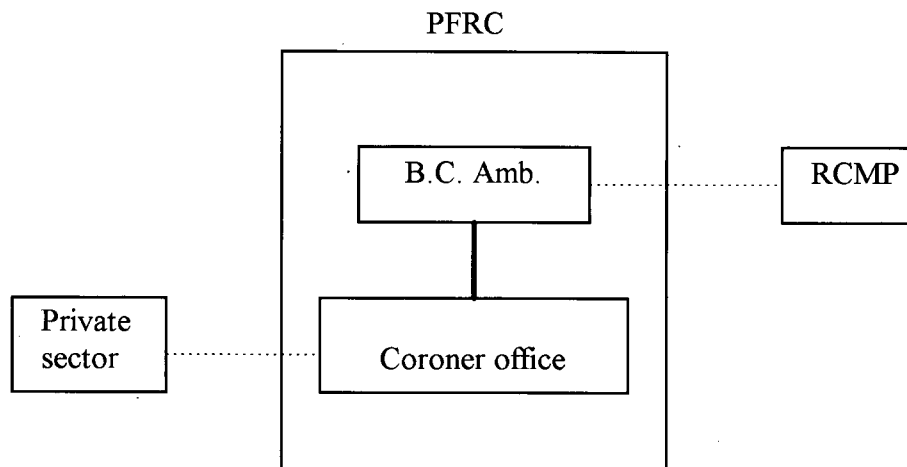
L2 Liaison at the RCMP EOC

Source: Field research by author. 1995.

TABLE 6.5 - CORONER NETWORK DATA

	RCMP	Coroner office	Private sector	B.C. Amb.
RCMP	50	28		22
Coroner office	28	82	54	
Private sector		54	54	
B.C. Amb.	22			22

GRAPH 6.5  
CORONER NETWORK

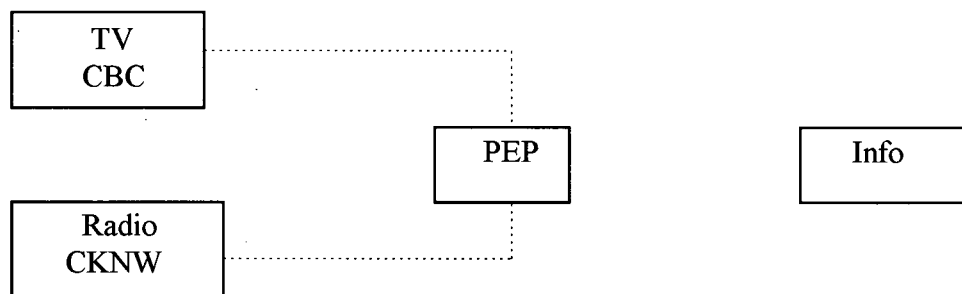


Source: Field research by author. 1995.

TABLE 6.6 - PUBLIC INFORMATION NETWORK DATA

	Info	PEP	Radio CKNW	TV CBC
Info				
PEP		40	20	20
Radio CKNW		20	20	
TV CBC		20		20

GRAPH 6.6  
PUBLIC INFORMATION NETWORK

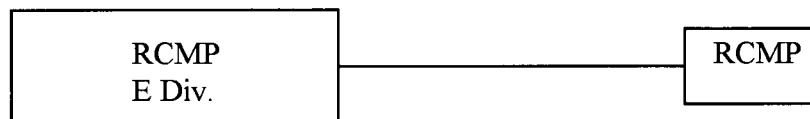


Source: Field research by author. 1995.

TABLE 6.7 - LAW AND ORDER NETWORK DATA

	RCMP	RCMP E Div.
RCMP	87	87
RCMP E Div.	87	87

GRAPH 6.7  
LAW AND ORDER NETWORK



Source: Field research by author, 1995.

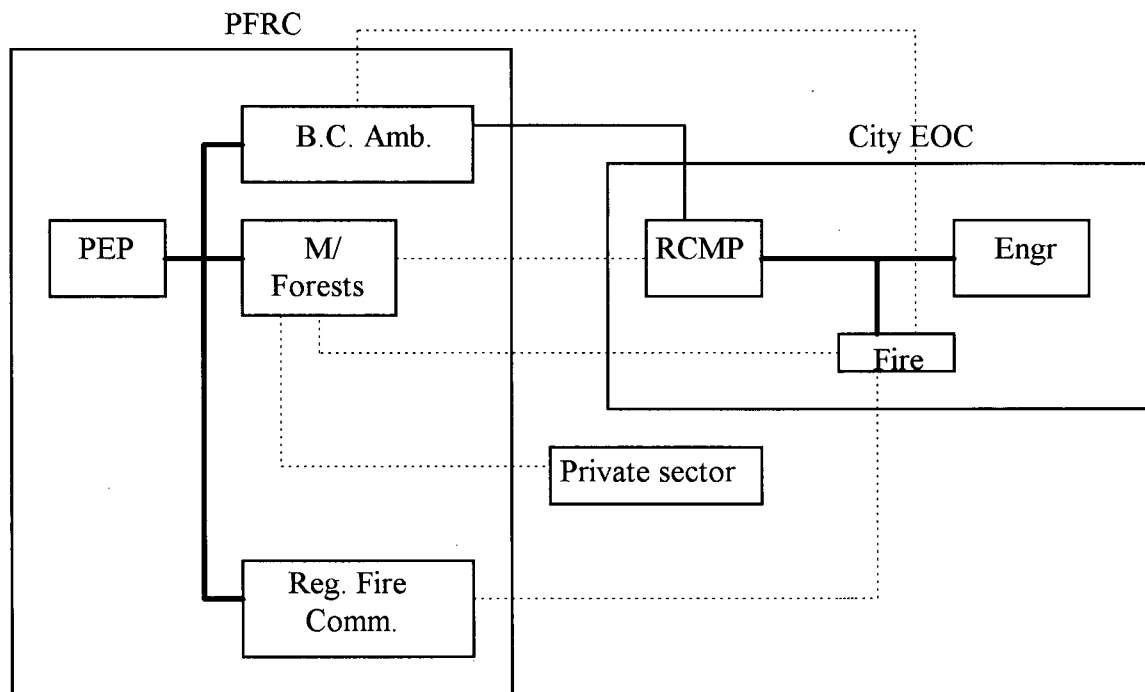


TABLE 6.8 - FIREFIGHTING NETWORK DATA

	RCMP	Fire	Engr	Reg. Fire Comm.	PEP	M/ Forests	Private sector	B.C. Amb.
RCMP	<b>161</b>	79L	L			24		58
Fire	79L	<b>316</b>	86L	38		57		56
Engr	L	86L	<b>86</b>					
Reg. Fire Comm.		38		<b>138</b>	69L	31L		
PEP				69L	<b>199</b>	91L		39L
M/ Forests	24	57		31L	91L	<b>313</b>	36	74L
Private sector						36	<b>36</b>	
B.C. Amb.	58	56			39L	74L		<b>227</b>

GRAPH 6.8

FIREFIGHTING NETWORK



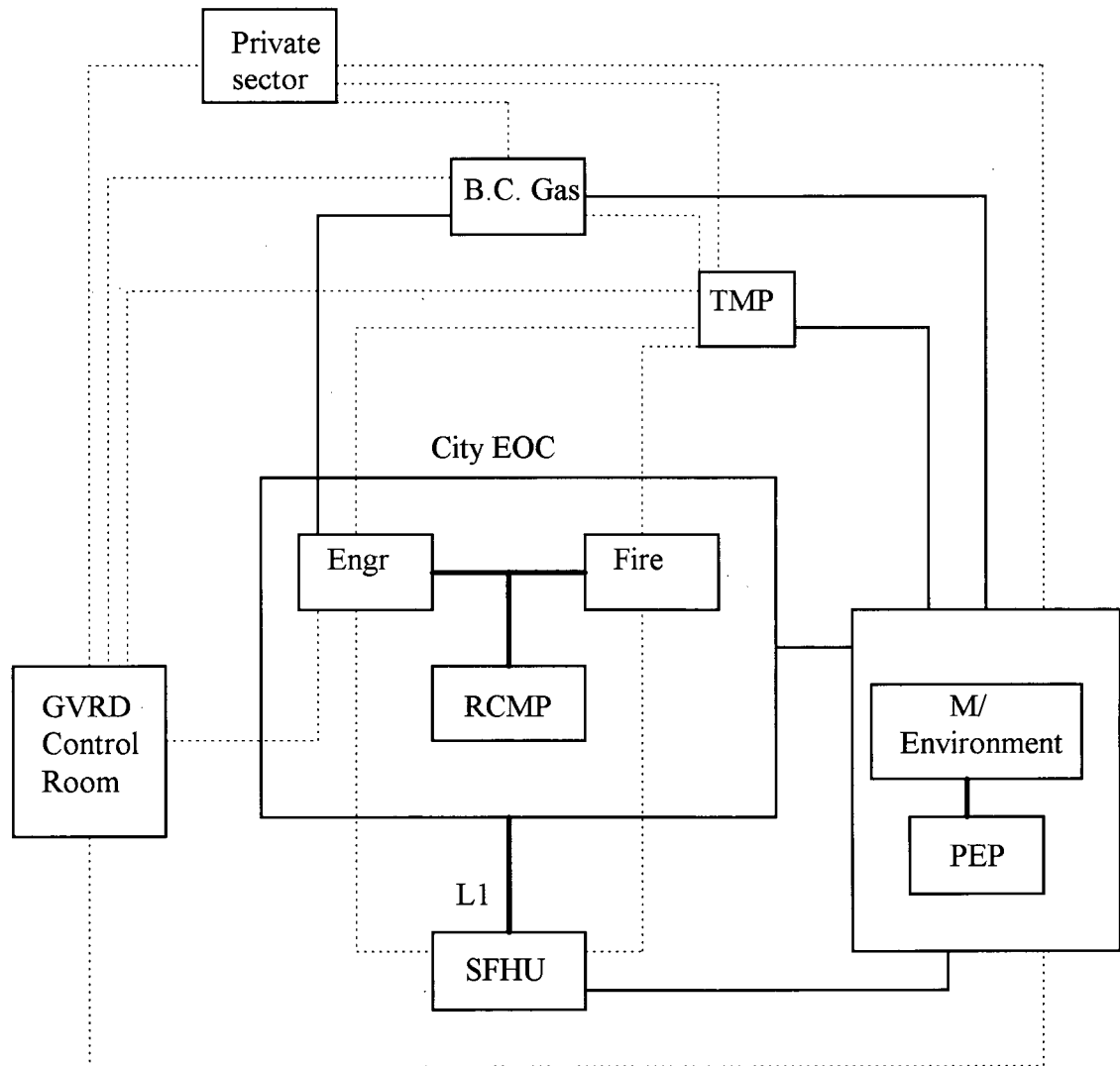
Source: Field research by author. 1995.

TABLE 6.9 - HAZARDOUS MATERIAL NETWORK DATA

	Fire	Engr	SFHU	GVRD	PEP	M/ Environment	Private sector	B.C. Gas	TMP	RCMP
Fire	<b>361</b>	86L	40		59	59			38	79L
Engr	86L	<b>381</b>	40	30	59	59		59	22	L
SFHU	40	40	<b>175</b>	39		56				
GVRD		30	39	<b>201</b>	25	36	23	31	17	
PEP	59	59		25	<b>425</b>	94L	35	63	61	29
M/ Environment	59	59	56	36	94L	<b>475</b>	59	54	29	29
Private sector				23	35	59	<b>218</b>	53	48	
B.C. Gas		59		31	63	54	53	<b>311</b>	25	
TMP	38	22		17	61	29	48	25	<b>240</b>	
RCMP	79L	L			29	29				<b>137</b>

GRAPH 6.9

HAZARDOUS MATERIAL NETWORK



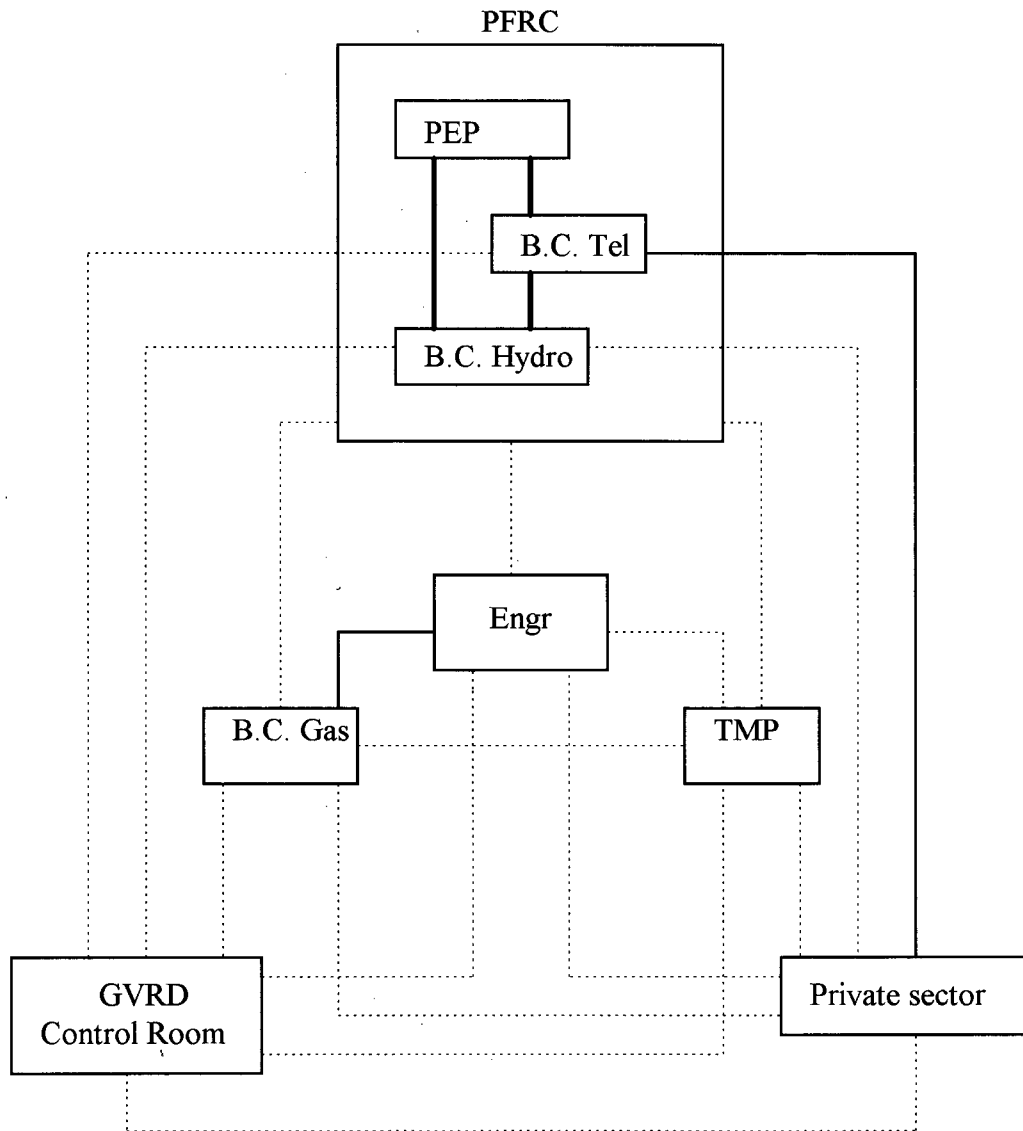
L1 Personnel from SFHU at City EOC

Source: Field research from author. 1995.

TABLE 6.10 - UTILITY NETWORK DATA

	Engr	GVRD	PEP	Private sector	B.C. Hydro	B.C. Gas	B.C. Tel	TMP
Engr	<b>284</b>	30	31	30	59	56	56	22
GVRD	30	<b>150</b>		23	14	31	25	17
PEP	31		<b>312</b>		88L	43	89L	61
Private sector	30	23		<b>283</b>	50	53	79	48
B.C. Hydro	59	14	88L	50	<b>356</b>	37	88L	20
B.C. Gas	56	31	43	53	37	<b>289</b>	44	25
B.C. Tel	56	25	89L	79	88L	44	<b>419</b>	38
TMP	22	17	61	48	20	25	38	<b>231</b>

GRAPH 6.10  
UTILITY NETWORK

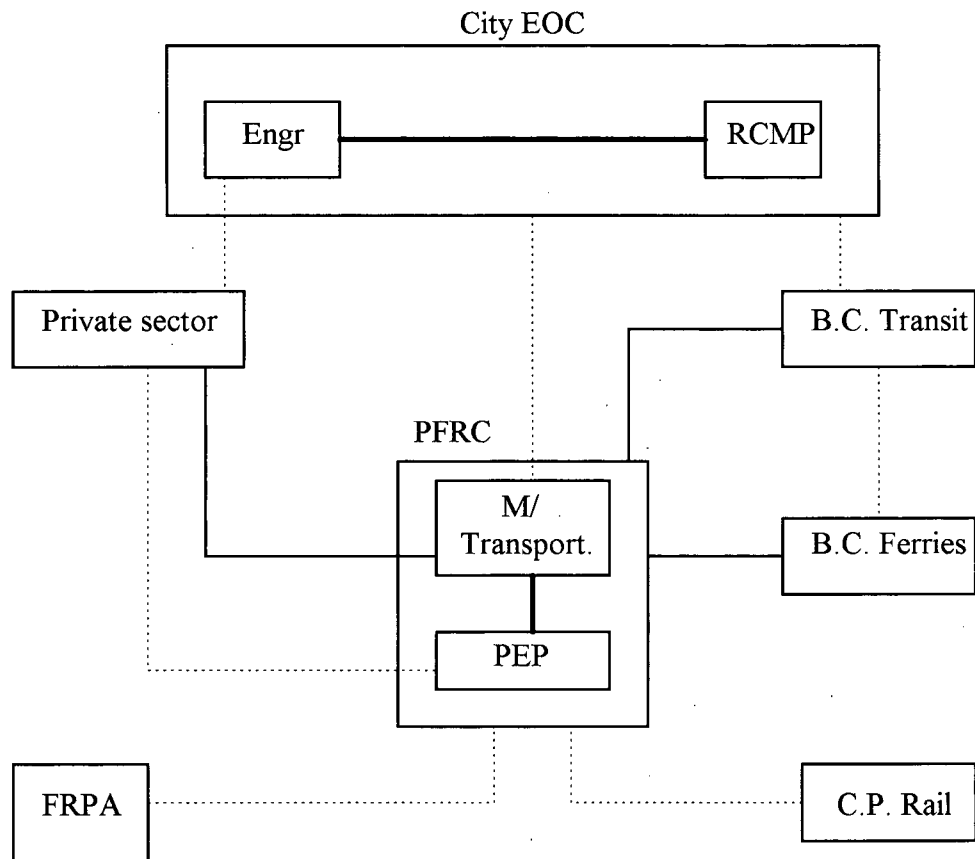


Source: Field research by author. 1995.

TABLE 6.11 - TRANSPORTATION NETWORK DATA

	RCMP	Engr	PEP	M/ Transport.	Private sector	FRPA	C.P. Rail	B.C. Ferries	B.C. Transit
RCMP	<b>163</b>	79L		55					29
Engr	79L	<b>189</b>		51	30				29
PEP			<b>315</b>	89L	49	29	29	60	59
M/ Transport.	55	51	89L	<b>441</b>	72	24	25	63	62
Private sector		30	49	72	<b>214</b>	63			
FRPA			29	24	63	<b>116</b>			
C.P. Rail			29	25			<b>54</b>		
B.C. Ferries			60	63				<b>156</b>	33
B.C. Transit	29	29	59	62				33	<b>212</b>

GRAPH 6.11  
TRANSPORTATION NETWORK



Source: Field research by author. 1995.

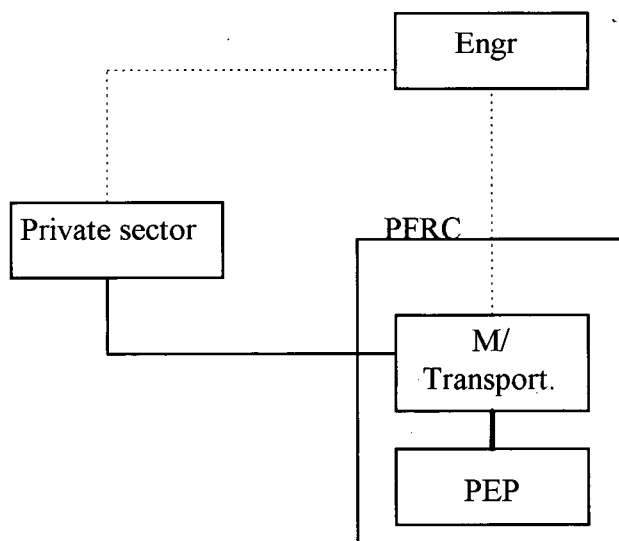


TABLE 6.12 - DEBRIS CLEARANCE NETWORK DATA

	Engr	PEP	M/ Transport.	Private sector
Engr	<b>78</b>		48	30
PEP		<b>86</b>	86L	
M/ Transport.	48	86L	<b>209</b>	75
Private sector	30		75	<b>105</b>

GRAPH 6.12

DEBRIS CLEARANCE NETWORK



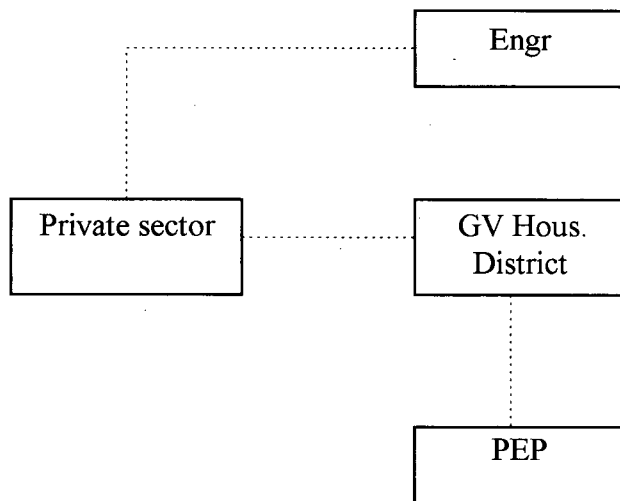
Source: Field research by author. 1995.

TABLE 6.13 - INSPECTION, CONDEMNATION AND DEMOLITION NETWORK DATA

	Engr	GV Hous. District	PEP	Private sector
Engr	30			30
GV Hous. District		51	22	29
PEP		22	22	
Private sector	30	29		59

GRAPH 6.13

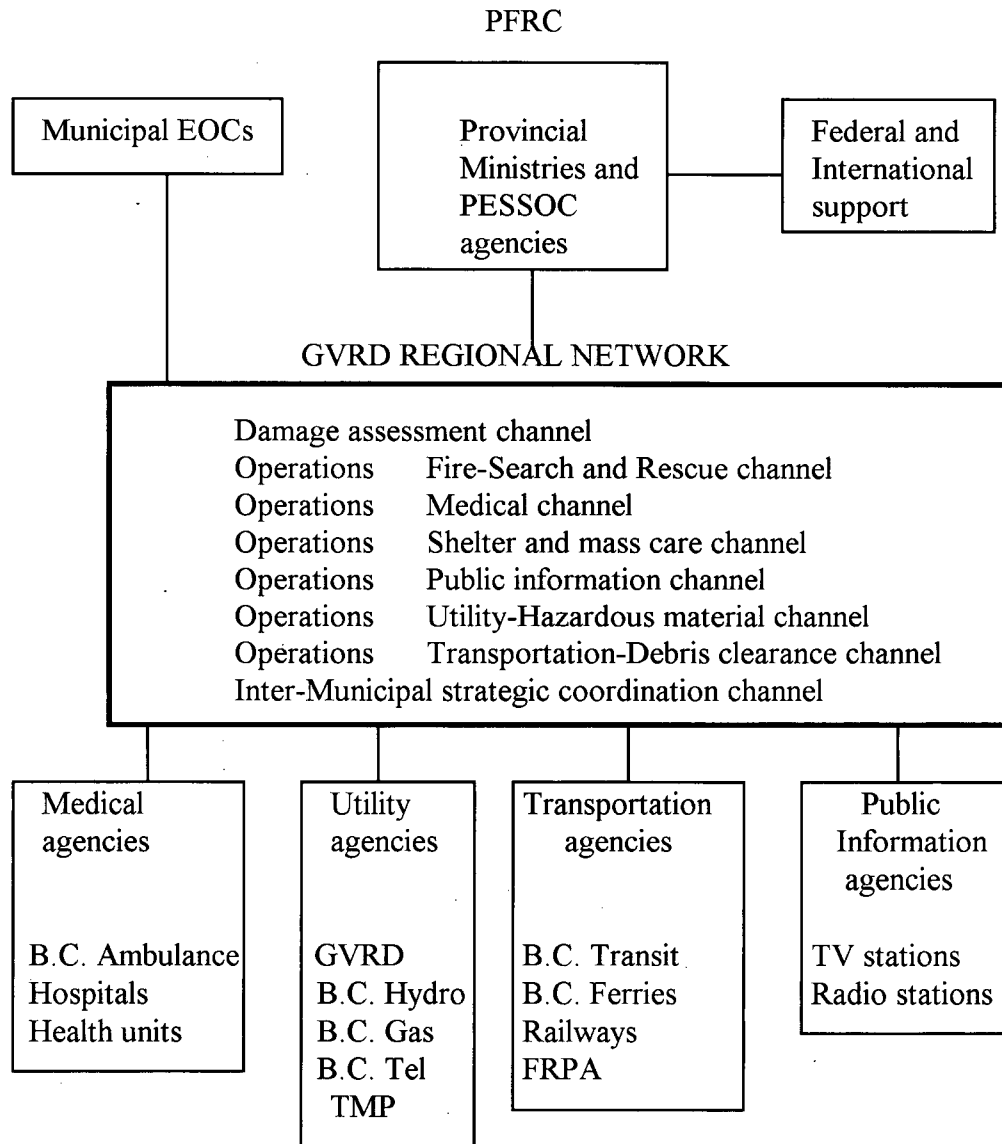
INSPECTION, CONDEMNATION AND DEMOLITION NETWORK



Source: Field research by author. 1995.

FIGURE 7.1.14

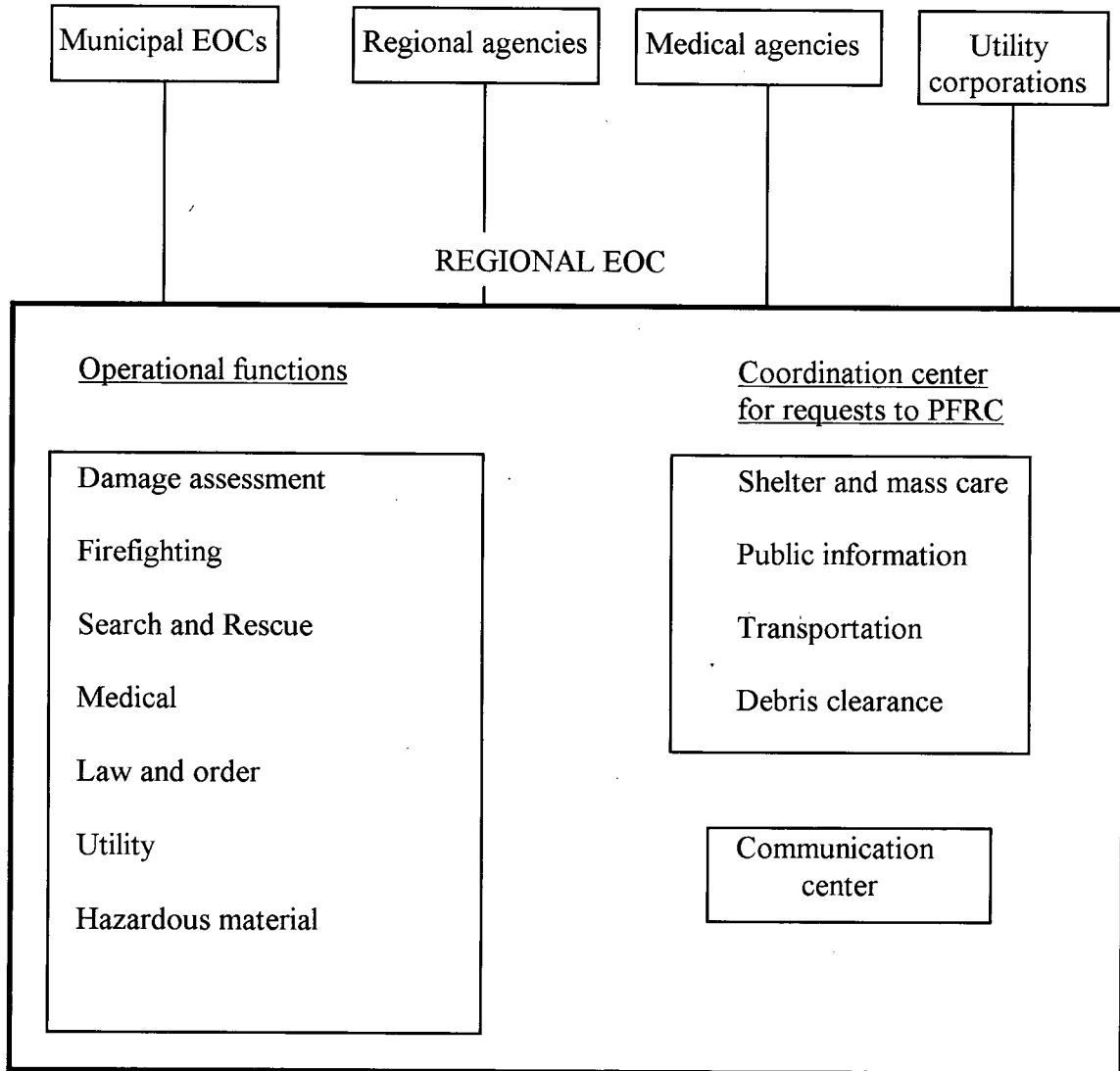
PROPOSED REGIONAL COMMUNICATION SYSTEM



Source: Author. 1995.

FIGURE 7.2.2

PROPOSED GVRD REGIONAL EOC



Source: Author. 1995.

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