PIARC – C18

RISK MANAGEMENT FOR ROADS

Friday 24 October 2003 (1.30 – 5.00 p.m.)

Session Agenda & Introductory Report

22.18.E

SESSION AGENDA

1. Opening Remarks

Mr. Minoru HIRANO (Chairperson of C18 Committee/JAPAN)

2. Activities of C18 Committee (2000-2003)

Mr. Hiroshi AOKI (English-speaking Secretary of C18 Committee/JAPAN)

3. Presentations on Risk Management

a) Designing Highways to resist Natural Disasters

Mr. John FENWICK (C18 member/AUSTRALIA)

b) Management of Natural and Man-Made Risks

Mr. Michel CLOUTIER (C18 member/CANADA)

c) Managing Man-Made Disasters on Developed Road Networks

Mr. Richard PARSONS (C18 member/UK)

4. Workshops on Risk Management for Roads

a) The Hokkaido Tokachi-oki earthquake in Japan, 26 September 2003

Dr. Michio OKAHARA (Public Works Research Institute/JAPAN)

b) Risk Management for Roads in Tanzania

Prof. N. M. LEMA (University of Dar es Salaam/TANZANIA)

c) Risk Management for Roads in South Africa

Mr. Daniel J.W. WIUM (Africon/SOUTH AFRICA)

5. Future Activities of C18 Committee

Mr. Minoru HIRANO (Chairperson of C18 Committee/JAPAN)

6. Closure

Mr. Minoru HIRANO (Chairperson of C18 Committee/JAPAN)

CONTENTS

EXECUTIVE SUMMARY

At the turn of the century PIARC reformed the former G2 into C18 as one of the permanent Committees. G2 was originally organized in response to the United Nations designation of IDNDR (International Decade for Natural Disaster Reduction) during the last decade of the 20th century.

In 1999, G2 issued "Final Report on Natural Disaster Reduction for Roads" for the 21st World Road Congress, Kuala Lumpur, October in which the following was pointed out.

" A new PIARC committee which will succeed G2 work should be established. This new committee should further organize international seminars and meetings emphasizing the importance of risk management of roads against natural hazards in disaster-prone developing countries".

PIARC Executive Committee took note of the importance of expanding the study area of G2 to man-made risks on roads which might become more and more frequent in the flow of time. Thus C18 was established as a successor of G2.

In the first meeting held in Paris, March, 2000, the following terms of reference was entrusted to C18 by the Theme Coordinator.

- Identification and classification of natural or industrial risks
- Risk exposure plans,
- Risk prevention methods, and
- Crisis management.

After a lengthy discussion among new members, three groups were formulated to undertake the following three activities to respond to the terms of reference.

- International survey on risks to roadways,
- Study on risk prevention methods and crisis management, and
- Seminars for exchange of experience and transfer of technologies.

C18 conducted international surveys in two steps; one in November 2000, and the other in 2001. Risks on roadways can be classified into two major categories:

1) natural risks
2) man-made risks.

Natural risks include

a) earthquakes,
b) floods,
c) landslides,
d) snow avalanche,
e) other risks (volcano eruption, tsunami, forest fire, etc).

On the other hand risks related to man-made and industrial risks depend on variety of social. human and industrial activities, and location of highways and so on.

Examples of man-made risks known through the survey are:

a) explosion and fire in the industrial area close to highway,
b) spill of radioactivity from a nuclear processing facility,
c) spill of toxic materials on the roadway,

d) collision of a train, ship, or airplane to highway structures,
e) fire in a closed space like a tunnel,
f) fallen objects on the roadway,
g) terrorist or strike attacks to the roadway,
h) overloading causing severe damages to the roadway.

In the second survey details of "Laws and Regulations, Codes and Guidelines" "Emergency Manual", "Risk Prevention Methods" "Risk Potential Evaluation Methods", "Evacuation" "Organization Charts of Risk management" "Traffic Management Method", "Man-made Disasters" and "Natural Disasters" were also surveyed from selected countries. The results are introduced in a summarized form in a relevant chapters

C18 also organized two international seminars where regional participants including local experts and C18 experts could have valuable chances of exchanging experiences and information. The first one was held in Temuco, Chile, October 2001 and the second one was in Budapest, Hungary, November 2002. Short summaries of the seminars are introduced in Appendix 4 and other important information collected are compiled in Appendices too.

Results of the study are compiled in Chapters 2 and 3 as "Risk Management Process" and "Crisis Management".

Finally Chapter 4 states C18's conclusion /Outlook,

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1. INTRODUCTION

PIARC C18 started the first term of the committee activity from the year 2000 with 34 expert members, including corresponding members, and conducted two international surveys on risks to roads of both natural and man-made types. Extensive researches were carried out through the surveys, and a lot of valuable information was collected.

The committee exerted best efforts also in organizing the International Technical Seminars on " Risk management on Roads" twice; once in Temuco, Chile, and the next in Budapest, Hungary. In both seminars enthusiastic exchange of opinions and information took place among the regional engineers and C18 experts and thus contributed to impress PIARC's presence to the people and decision making experts in the region. Both the Chilean Road Directorate and the Hungarian Ministry of Economy and Transport rendered hearty assistance and support to our seminars in the years 2001 and 2002.

This report is a compilation of essential findings and valuable information obtained through our studies, seminars and surveys. Risk Management and Emergency Management information for the administrative and organizational framework are provided in chapters 2 and 3 respectively summarizing the world wide practice information, and in references, results of the international surveys and sources of web-site information on road risks are introduced.

C18 hope that this report can be of some help to all the colleagues around the world.

2. RISK MANAGEMENT

All agencies which provide " essential services" should have a process for identifying risks and managing them, by avoidance or reduction. This chapter sets out a generic risk management process, which has been widely adopted. This process can be modified or adapted to meet the specific circumstances of road agencies.

2.1. Establish the context

2.1.1. The Strategic Context –Legislative and Organizational

Road Authorities work with other agencies in a legislative and organizational framework.

In general, governments will have emergency response organizations equipped and trained to deal with natural forces such as cyclones, floods and earthquakes. The protocols for inter-agency cooperation need to be clearly established in the planning phase.

In a crisis situation, access to the devastated area is essential to take in emergency response crews, food, water, shelter and to remove the injured. In most cases, the major access will be by road, so the rapid recovery of the road network is the basis of emergency planning in many cases.

Road Authorities will have design codes which would enable critical elements of the road network (bridges) to resist all but the most extreme natural events, and would cooperate with other authorities (eg police) in keeping the road network open or repaired to service as soon as possible.

Other common risks (e.g. fire, chemical spill) would be dealt with by appropriately trained and equipped specialists.

Strategic responsibilities for road authorities will also include

- The design of the network as a redundant system so that access can be maintained even one or more links are cut.
- The establishment of design and construction standards to provide a "robust" system that is not easily damaged.

Where redundancy is not possible for critical links (bridges, tunnels, etc) then more detailed risk assessments would be required and special design and construction standards may be applied:

- the control of dangerous goods carried by road ? usually in cooperation with specialist fire/chemical response authorities and industry;

- the control of traffic, particularly in high volume or high-speed situations taking into account weather (fog, ice, rain) and adjacent land use (railway, public building, crowds etc.);

- the planning of road networks to avoid areas of high risk from natural causes (eg unstable slopes, flood plains) or man-made risks (chemical factories, explosive storage, nuclear facilities etc) particularly for major high volume routes.

2.1.2. Establish the Risk Management Context Within the Road Authority

Risk management must be done within the road authority consistent with the roles and capability of organizational units, but coordinated to meet the strategic objectives, and to liaise with stakeholders.

2.1.3. Establish the Risk Management Context

Risk, costs, benefits and opportunities must be considered. Risk management structures should include a coordinating group who understand risk management theory and can establish continuity and uniformity across an organization, and each special group in a road authority plus financial and policy branches should be included.

2.1.4. Develop Risk Evaluation Criteria

Determine the criteria for risk evaluation. These may include:

- Operational
- Technical/Engineering
- Financial
- Legal
- Social/Political
- Environmental

2.1.5. Define the Structure of an Authority

For all areas of responsibility, a road authority must define each project or activity in a process form or as a set of elements so there is a logical framework for identification and analysis of all risks.

2.2. Risk Identification

This process should ensure that all risks are identified. The possibility of rare and unusual events and deliberate acts of war or terrorism must be considered.

- What can happen?
- How and why it can happen?

In general, natural environmental risks are easier to identify and to codify into magnitude vs frequency of occurrence. Man-made risks are often harder to identify especially in new transport systems where there is no history to enable estimates of the rare but highly damaging events.

2.3. Risk Analysis

2.3.1. General

Most technical human systems have a high intrinsic risk management content already, based on experience, regulation and statute law. However new complex systems, such as urban road transport networks need regular risk analysis to ensure risks are "balanced". Risks can never be reduced to zero, only to an acceptable level. All risks with the same outcome (financial cost, damage to assets or the environment, injury or loss of life) should have similar levels of occurrence. This will not occur "by accident", only by deliberate planning.

2.3.2. Determine Existing Controls

Identify the existing management technical systems and procedures to control risk and assess their strengths and weakness. Tools and techniques are listed in the report.

2.3.3. Consequences and Likelihood

In most systems the minor but frequent events are statistically analysed to predict the major but rare events. In natural systems it is possible to predict (with acceptable accuracy for design purposes) the rare events with probability of occurrence of 10^{-3} or 10^{-4} per year. In recent man-made complex systems prediction of the major rare events (disasters) is much more difficult, and often depends on a sequence of events (errors or accidents) in a set of subsystems. Only by sharing " accident " data on a large number of similar systems in different countries can sufficient data be assembled to do realistic statistical analysis, and hence make realistic risk assessments for rare but major events in the single systems for which a road authority is responsible.

Sources of information may include the following:

- Past records
- Experience and judgment by experts
- Industry practice and experience
- Relevant published literature
- System models-computer analysis
- Experiments and prototypes.

2.3.4. Types of Analysis

Analysis may be qualitative, semi-quantitative or quantitative, or a combination of these. Often simple qualitative methods are used first and later the most significant risks may be quantitatively analysed.

2.3.5. Sensitivity Analysis

Since some of the estimates made in quantitative analysis are imprecise, a sensitivity analysis should be carried out to test for the effects of changes in the data or assumptions.

2.4. Risk Evaluation

Risk evaluation involves comparing the level of risk found during the analysis process with the previously established risk criteria. Risk analysis and criteria used in an evaluation should be of the same type (qualitative or quantitative, etc). Costs and benefits to all stakeholders and the community should be considered, not just the road organization. If risks are low or "acceptable" they may be accepted with minimal further treatment. If risks are high (unacceptable) there is a range of management options to consider.

2.5. Risk Treatment

2.5.1. Identifying Options for Risk Treatment

Typical options, which are not necessarily mutually exclusive or always appropriate, include the following:

- avoid the risk by deciding not to proceed with the activity or project which generates the risk;
- reduce the likelihood of occurrence through appropriate management and technical systems and procedures;
- reduce the consequences through planning, design, construction standards, disaster management planning, etc.;
- transfer the risk. This is only appropriate for financial losses through insurance. It is not practical to transfer the risk of death and injury;
- retain the risk and plan to manage the consequences if the risk eventuates.

2.5.2. Assessing Risk Treatment Options

Options should be assessed on the basis of any additional benefits or opportunities created. Selecting the appropriate option involves balancing costs of implementing treatment against the benefits derived. Where large reductions in risk may be obtained at low cost, such options should be implemented.

2.5.3. Prepare Treatment Plans

Plans should document how the chosen options will be implemented.

2.6. Monitoring and Review

It is necessary to monitor risks, the effectiveness of the risk treatment plans and the management system which controls the process. Ongoing review is essential to ensure the management plan remains effective.

2.7. Communication and Consultation

Communication and consultation with relevant stakeholders are essential at each stage of the risk management process. For example, the carriage of hazardous goods through tunnels involves the tunnel owner/designer/operator, transport regulators, industry, fire/emergency services and other parties. Each organization must analyse and manage their component of the total risk in an open and cooperative way.

Risk is always easier to manage in relatively closed system where all the costs and benefits fall within a single organization.

Complex urban road networks are multi-stakeholder risk management problems.

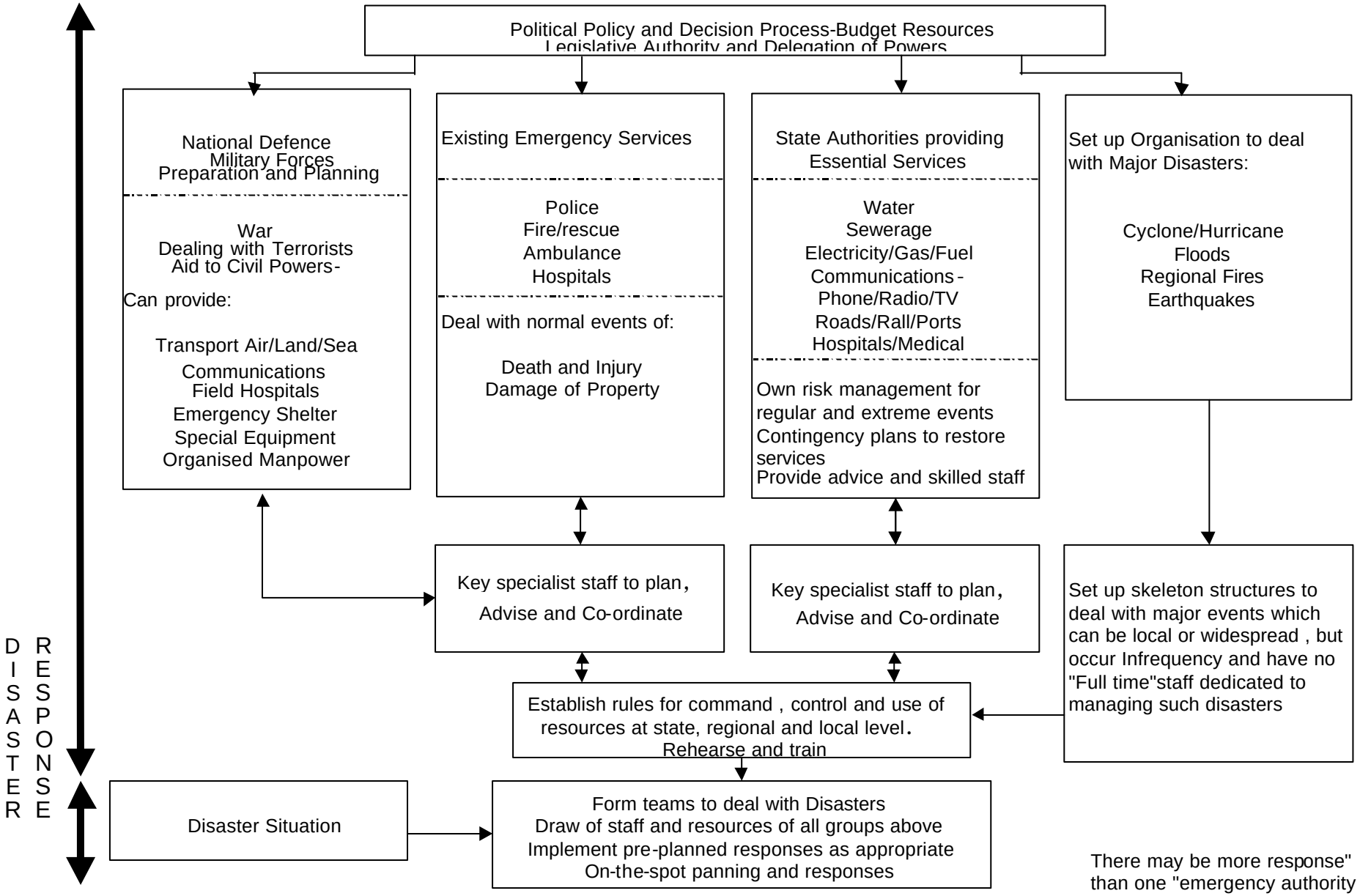


Figure 2-1 STRATEGIC, LEGISLATIVE AND ORGANISATIONAL FRAMEWORK

3. EMERGENCY MANAGEMENT

3.1. General

Emergency Management is a term that is synonymous with other accepted international terminology. Whereas Civil (as distinct from military) Defense was a term used widely in defining preparedness for disasters of all types, the term Civil Defense and Emergency Management (CDEM) is now in more common usage. However, in some countries Emergency Planning is the preferred terminology.

Incident management is generally used to define the principles of planning, providing resources and responding to adverse events when the emergency or incident is at a lower level. However, what may start as an incident can turn into an emergency as the impacts and effects are more widely identified. Incidents range from every day traffic related crashes to more infrequent and severe events. In this chapter, Emergency Management is used as a generic term and there are separate sections on CDEM and Incident Management.

3.1.1. Purpose

This chapter is targeted at providing examples of best practice in the management of emergencies after the event has occurred.

3.1.2. Preliminary Considerations

Emergencies can range from dealing with minor incidents to catastrophic events. Incidents can result from either natural or man-made events.

Natural Events

In terms of natural events, a road way system can be vulnerable to a range of hazards that include as the most common:

- Rainfall
- High winds
- Flood
- Earthquakes
- Volcanic eruptions and thermal activity
- Landslip and landslide
- Avalanches
- Ice and snow.

Man-made Events

Man-made events result from events relating to the built environment such as the operation of vehicles or other events resulting from the actions and activities of people. The range of man-made events that can affect a transport network is very wide. Man-made events include:

- Major accidents involving vehicles
- Truck/train strikes on bridges
- Collapse of bridges due to overload, structural failure, etc.
- Settlement due to excessive dewatering
- Aircraft crashes
- Fire
- Explosions
- Chemical or combustibles spills
- War or insurrection
- Biological issues
- Strikes, lockouts, protest, etc.

Natural events are likely to have a much greater impact on the road network and may result in considerable widespread damage and the inability of the system to function effectively. Man-made events (except war) are likely to have a more concentrated area of impact on a road network than natural events.

An important element of all emergency planning is the establishment of organizations and structures to prepare for adverse events.

3.1.3. Preliminary Consideration of Emergency Management

There are four elements commonly considered in Emergency Management procedures, these being:

- Reduction
- Readiness
- Response
- Recovery.

These “4R’s” are essential functions and any part of that package will not be effective if not considered.

3.1.4. Emergency Planning and Management

Emergency or Incident Management is traditionally based on six principles:

1. Organization
2. Command and control
3. Coordination of support
4. Information management
5. Timely activation
6. Effective emergency plans.

Emergency management during and following an event is an essential function, but the best outcome for road authorities is to ensure the pre event pre-requisites are in places for planning; preparedness and mitigation or prevention.

3.1.5. Road Crisis Situations

During catastrophic events such as hurricanes, earthquakes, floods, fog, bridge collapses, or any number of other emergency situations, managing roadways is of paramount importance. It may be necessary to evaluate, close roadways, and reroute or detour traffic. The most important factor is to save lives on the roadways. The next most important item is to protect the highway or structure (bridges or tunnels). The third item would be to provide temporary roads or detours to move traffic safely.

There is no single reference document providing contingency plans for road crisis management. Rather there are many documents that address various emergency plans for different types of events. In the United States and other countries, all States must have hazardous materials emergency plans. These plans focus on emergency evacuation, road closures, rerouting, and emergency response and treatment of the hazardous materials. This chapter does not address emergency response planning but identifies websites, books, and other reference materials that specifically address road crises management.

3.1.6. Public Policy

Backing all emergency management procedures must be statutory or regulatory powers available to the appropriate parties.

3.2. Civil Defense and Emergency Management

CDEM procedures vary from country to country depending on a range of factors including:

- Government structures (Federal, State, County, City, Local)
- Governmental agency responsibilities, ie direct work functions.
- Role of the private sector in providing services.
- Philosophical issues (communities helping themselves).

The following sections describe some typical CDEM policies and procedures.

3.2.1. United Nations International Strategy for Disaster Reduction

The General Assembly of the United Nations adopted the International Strategy for Disaster reduction(ISDR), a multi-jurisdictional task force that focuses on increasing public awareness, obtaining commitment from public authorities, stimulating interdisciplinary partnership, and improving scientific knowledge of the causes of natural disasters. For more information refer to the following website: www.unisdr.org/unisdr/ResourceCentre.

3.2.2. United States

In the United states there are a number of relevant procedures at Federal, State and local levels for dealing with emergencies. Post 11 September 2001 a substantial review of procedures has been undertaken.

Federal Response Plan

The Federal Response Plan (FRP) outlines how the Federal government implements the Robert T. Stafford Disaster Relief and Emergency Assistance Act.
The FRP can be accessed at the website: www.fema.gov/fema/fed/.htm.

Federal Highway Administration's Emergency Relief Program

Title 23 ? United States Code, Section125 Emergency Relief, provides for an emergency fund for the Secretary of Transportation to use for repair or reconstruction of highways, roads, and trails that the Secretary finds to have suffered serious damage as a result of:

- natural disasters over a wide area, or
- catastrophic failure from any external cause.

3.2.3. Norway

The Directorate for Civil Defense and Emergency Planning (DCDEP) in Norway has produced comprehensive Guidelines for Emergency Planning for use by Ministries and Central Government Agencies. Reference can be made to website: www.dsb.no.

3.2.4. United Kingdom

There are two areas of relevance in Emergency Management in the United Kingdom. These relate to the national Highways Agency responsible for the management of the principle trunk road network in England and the London emergency Services Liaison Panel's major Incident Procedure Manual.

Highways Agency

Although there is no specific guidance for the management of risk for roads, the legal framework is given by the Highways Act 1981 and, to a lesser extent, the Traffic Regulations and General Directions.

3.2.5. Japan

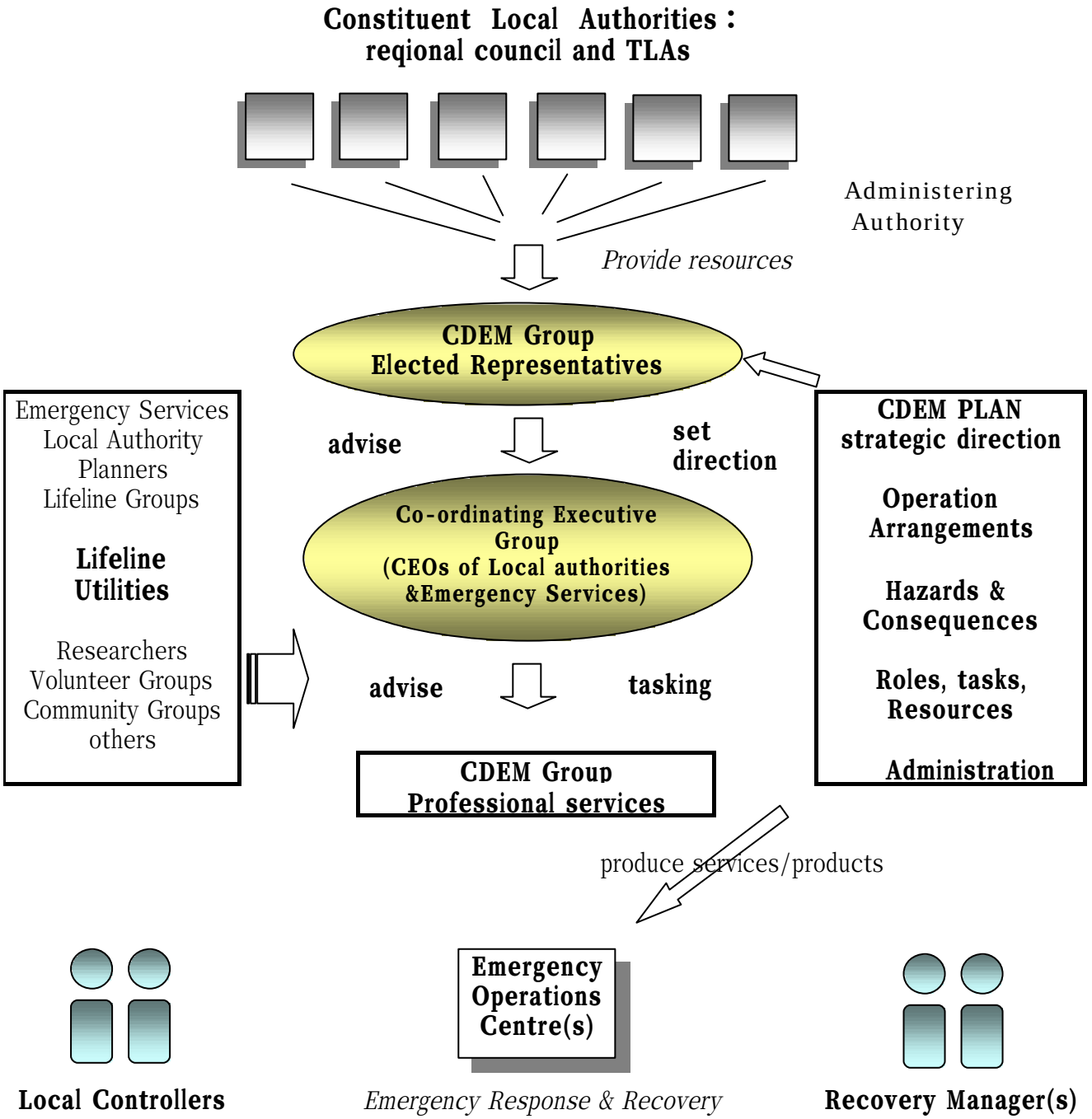
The Basic law on Disaster Countermeasures Provides for a disaster prevention plan, emergency management and post-disaster restoration and rehabilitation of national and regional governments and public sectors.

3.2.6. New Zealand

Civil Defense and Emergency Management Act
New legislation, the Civil Defense and Emergency Management Act, has just been passed by Parliament, is effective from December 2002, and introduces a number of new concepts. The basis of the new Act is to introduce the "Four R's" into emergency management. While the approach is based around community awareness of the hazards and input into planning for risk mitigation, certain utilities are identified as "Lifeline Utilities".

Organizations
The proposed CDEM Group Structure is shown in Figure 1.

Fig 1—Proposed CDEM Group Structure

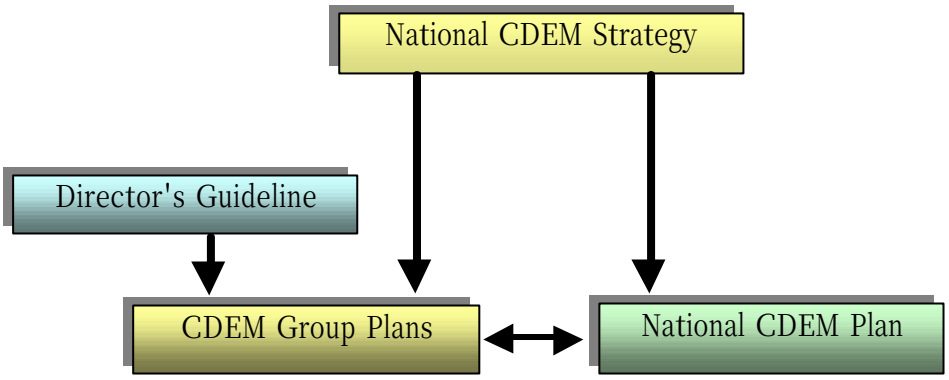


CDEM plans for New Zealand will be at three levels:

- **National CDEM Strategy**
- **National CDEM Plan**
- **Group CDEM Plans**

In addition, the National CDEM Director will provide guidelines for Group Plans and Utility Business Continuity Plans. This is shown in Figure 2.

Fig 2-Planning Hierarchy Under CDEM Act



At Group level the plans will consist of three parts as shown in **Figure 3**.
A Group for CDEM will probably include the Transport Sector given the strategic importance.

Fig 3-Suggested Approach To Structuring CDEM Group Plans

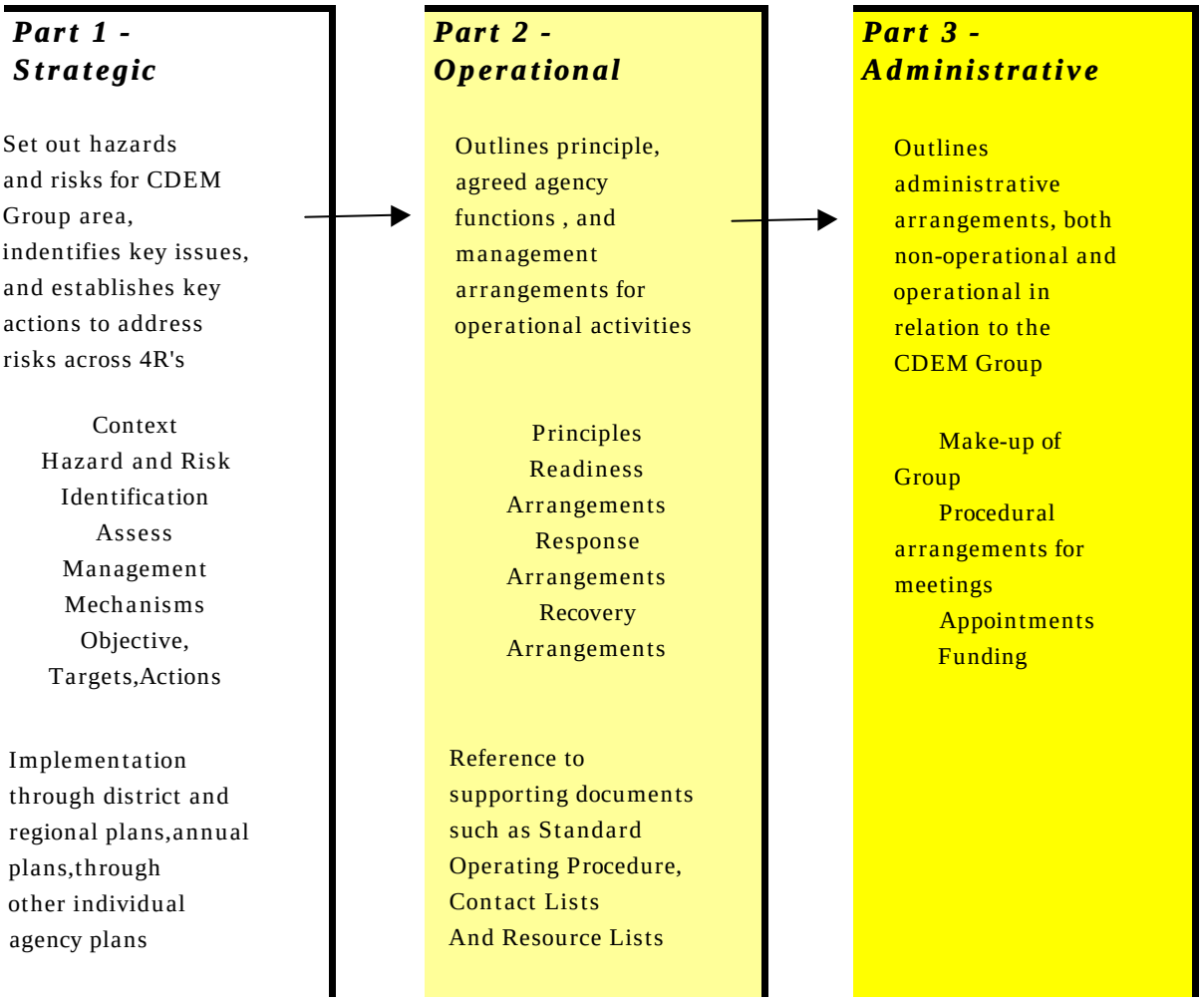


Figure 3 - Suggested Approach To Structuring CDEM Group Plans

Under the Act, Lifeline Utilities must:

- ensure they are able to function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency;
- make available to the Director of CDEM a plan for functioning during and after an emergency, if required;
- participate in the development of the National CDEM Strategy, the National CDEM Plan and CDEM plans developed at the local level;
- provide free of charge any technical advice to any CDEM Group, as long as the request for that advice is reasonable.

3.3. Incident Management

The Incident Management System (IMS) is now being used by organizations throughout the world at large to manage large and small incidents. It incorporates modern management principles and has been modified and adapted for use in the New Zealand context. The system has been used in the USA since 1970's and was introduced into Australia in the 1980's.

3.3.1. United States

The Incident Command System (ICS) was developed in response to fires that consumed large portions of Southern California in 1970.

US Federal Emergency Management Agency

The United States Federal government provides the states with a variety of documents to use as guidelines for emergency situations. The website to access the ICS and training schedule is : www.fema.gov/emi/.

3.3.2. Australia

In the early 1980's the Australian Association of Fire Authorities developed the Australian Inter-service Incident Management System (AIIMS).

3.3.3. New Zealand

Based on international approaches, the Coordinated Incident Management Systems (CIMS), prepared by agencies in New Zealand for pre event planning and post event emergency management is a useful guide.

3.3.4. United Kingdom

In the UK, the London Emergency Services Liaison Panel (LESLP) has a Comprehensive document, "Major Incident Procedure Manual" prepared by the Metropolitan Police Service.

3.3.5. US-Incident Management References

Reference are given to incident management information on both the website and in books.

3.4. Conclusion

The most important factors in road risk management are to save lives and protect property, and to facilitate alternate routes for traffic. In all cases, it is necessary to have a contingency plan. There is no single reference document that provides contingency plans for road crisis management. There are many documents that address various emergency plans for different types of emergencies. The Transportation Research Board does have a lot of papers available via the internet that describe past experiences and lessons learned during severe natural catastrophes occurring in other countries. (http://nationalacademies.org/trb/bookstore)

3.5. Risk and Hazard Prevention

An important issue in emergency planning is to reduce hazards and risks through readiness. This can be achieved in a number of ways.

3.5.1. Risk Prevention Methods

Brief summary of examples are given of the following member countries: Australia, Czech Republic, Hungary, Japan, USA, UK.

3.5.2. Training

An essential part of Readiness and incident management preparedness is training of staff involved in this activity.

Additional Information 1 - Extracts from Norwegian Guidelines for Emergency Planning

Additional Information 2 - Extracts from New Zealand's – Working Together: Lifeline Utilities & Emergency Management

4. CONCLUSIONS AND OUTLOOK

4.1. C18 2000? 2003

PIARC C18 " Risk Management for Roads" was established at the turn of the century as a successor of PIARC G2, which functioned as a forum of the natural disaster experts for roads of PIARC member countries during the UN IDNDR period. C18 was established within the Strategic Theme 3 and new terms of reference were entrusted to C18 by the Coordinator as follows:

- identification and classification of natural or industrial risks
- risk exposure plans
- risk prevention methods, and
- crisis management.

PIARC made a very timely and prudent choice of organizing C18 to tackle the man-made risks on roads in addition to the natural risks. In the new century, natural disasters still occurred from the increasing amplitude of variation in weather conditions. And global instability was increased by the activities of a wide spectrum of bodies from sovereign states to those of terrorist cells.

The terrorist attack of September 11, 2001 on the New York World Trade Center Buildings and subsequent potential threats to the transportation systems of the United States have unveiled an unexpected genre of road disaster of a man-made character. This incident initiated to call for a quite new caution in respect to the risk management for road engineers worldwide. Incident management partnership involving police and other emergency services and agents responsible for managing the road network is desired to be set up in good efficiency. On the contrary to our regret actual performance observed so far can not be considered sufficient enough among almost all the member countries.

C18 conducted two international surveys, "Survey on risks to roadways" circulated to all the member countries and another survey to selected countries. C18 held two international seminars; the first one in Temuco, Chile during October 23-26, 2001, and the next one in Budapest, Hungary during November 6-8, 2002, and also published the introductory report and activity report.

From the two international surveys, it was revealed that there are various types of risks to roadways in both the natural and man-made forms. And they are changeable from place to place.

In summary of our activities including international surveys, seminars, meetings and studies, the following are presented as the C18 conclusions of this 2000 to 2003 term:

- Natural hazards, especially floods and landslides, are the main causes of disturbance to highway networks and transportation systems particularly in developing countries.
- Disturbances caused by dangerous goods transportation occurred most frequently in the category of man-made risks all over the world.
- There are wide varieties in the legal framework among the countries surveyed.
- Selection of appropriate risk management approaches is important. The risk management approaches would be a part of the risk management process of each road agency, which can lead to minimization of the effects of both natural and man-made disasters.

- Exchange of experiences and technical information on risk management practices among the member countries should continue in order to contribute to reduction of catastrophic life loss, property damages and social economic disruption which may result from various types of risks to roadway.
- Risk potential evaluation methods should be sought and studied to minimize probable incidents of both natural and man-made risks.

4.2. Future Activities

Through our Committee members discussion, it was pointed out that C18 has to exert more effort in the following subjects, which could not be studied in depth in the first 4-year term the tools which will enhance road authorities' ability to undertake risk prevention functionally (ITS and others can be applicable).

For the above purpose, measures of risk analysis and evaluation should be searched which are useful in the road risk evaluation.

Probabilistic approach can be one of the easier ways for this purpose.

C18 should function as a showcase of risk management practices of advanced countries.

Risk mapping (Hazard mapping) can be applied not only to natural hazards but also to man-made hazards

Transportation of dangerous goods should be discussed from the viewpoint of overall risk management to roads.

Insurance policies covering various risks

So it is advised that the future C18 Committee establish their work plan in consideration of the above mentioned subjects.

REFERENCES

Reference 1 - International Survey on Risks

The purpose of the international surveys on risks on road ways is to allow the first identification and classification applied in various countries and thereby to summarize risk and crisis management practices in countries that are advanced in these fields.

The surveys were carried out in two steps in the year 2000 and 2001.

R-1 Summary of results of C18 survey

PIARC C18 conducted a survey in November 2000 on risks on roadways to gather information relating to the likely types of risks and damages to road and road transport facilities which may cause major socio-economic problems as a result of human and industrial activities (man-made) as well as natural disasters in PIARC member countries. Information on organizations and manuals were also included in the survey questionnaire. Thirty one (31) countries out of ninety two (92) countries to which the questionnaire was sent responded. They are: Australia, Austria, Belgium, Bulgaria, Canada, Chad, Chile, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Japan, Latvia, Luxemburg, Mexico, Netherlands, New Zealand, Norway, Philippines, Poland, Slovenia, South Africa, Sweden, Turkey, UK, USA and Zimbabwe.

From the survey it was found out that disasters caused by incidents during transportation of dangerous goods are most frequent types of the man-made disasters. Other major risks to or near roads are fires in tunnels, fires near roads, chemical industry accidents, nuclear energy accidents, terrorism and so on.

R.1.1. First Survey
R.1.2. Man-made Disasters
Summary of Major Man-made Disasters.
R.1.3. Natural Disasters
Summary of Major Natural Disasters (see the committee report)
R.1.4. Weight Limits
Table of Weight Limits (see the Committee report)

Summary of major man-made disasters		
Country	**Kind of Disasters**	**Kind of Damages (Casualty, Property Damages)**
Australia	Ship collision to a bridge transport of dangerous goods and accidents	12 dead. 3 span bridge collapsed closing traffic for 34 months.
Austria	Fire in tunnel	12 dead. Tunnel closed for 3 months (Tauern Tunnel)
Belgium		
Bulgaria		
Canada	Civil unrest, chemical release by traffic accidents), fire and explosion caused by traffic accident	
Chile	Oversized (height) loading	
Czech Republic		
Denmark		
Finland	Railway accident, forest fire, transport of dangerous goods	TDG caused fire resulting in the over-bridge collapse
France	Fire in tunnel	40 dead, tunnel closed for two years (Mont-Blanc Tunnel)
Germany		
Greece		
Holland		
Hungary	Taxi drivers' blockade, ammonia spillage, war time explosive	TDG caused several injured.
Italy	Last war bomb, chemical-industrial disaster	
Japan	Nuclear energy plant accident next to roads	Road blockage continued for maximum about 20 hours.
Latvia	Tank lorry overturn under viaduct	Viaduct structure demolished
Luxembourg	Tank lorry accident, airplane crash to roads,explosion	All involved deaths and injured.
Mexico	Derailment, explosion of chemical plant, dam collapse	
New Zealand	Hazardous/toxic spills-tank lorry overturn, over(and oversized) loading, insecure loading, vehicle mechanical faults, aircraft crashes, fires next to roads, terrorism, strikes, outbreaks of disease	
Norway	Explosion in road tunnel under construction	3 dead and 14 injured
Philippines	Civil disturbances, bomb explosion	No infrastructure damages were reported.
Poland	_	
Slovenia	_	
South Africa	Tank lorry carrying LP gas overturn causing fire, trailer overturn causing fire, trailer overturn spilling a road of paint-related products, head-on collision, toxic spills, fire next to roads	
Sweden	_	
Tchad	_	
Turkey	_	
UK	Terrorist bomb, fuel duty protests	Flyover was affected by the bomb.
USA	**Impossible for FHWA to complete Form and with accuracy due to decentralised record-keeping system.	
Zimbabwe	Traffic accidents	3 accidents with a lot of casualties were reported
Note: TDG: Transport of Dangerous Goods During the survey/study period a major disaster occurred in Switzerland: fire in tunnel with 11 dead and tunnel closed for two months (San Gottardo Tunnel)		

Table R.1

R.2. Second Survey

The second step of the survey was targeted to selected countries on the basis of the first survey results. Seven countries replied to the second survey out of 20 selected countries.

R.2.1. Name of Laws, Regulations, Codes, and Guidelines.
Austria, Czech Republic, Italy, Japan, USA, UK.

R.2.2. Emergency Manual
Austria, Hungary, Japan, USA, UK.

R.2.3. Risk Prevention Methods
Austria, Czech Republic, Hungary, Japan, USA, UK.

R.2.4. Risk Potential Evaluation Methods
Austria, USA, UK.

R.2.5. Evacuation
Czech Republic, USA, UK.

R.2.6. Organization Charts of Risk Management
Czech Republic, Japan, UK.

R.2.7. Traffic Management Methods
Austria, Czech Republic, UK.

R.2.8. Man-made Disasters

Austria	Tauern Tunnel fire accident
Czech Republic	Extraordinary accidents
Hungary	No major disasters that people were evacuated
Italy	Mont Blanc Tunnel fire
Japan	Nuclear Plant accident in 1999
USA	Howard street tunnel fire, Baltimore, in 2001
UK	Effects of the fuel crisis in 2000

R.2.9. Natural Disasters
The biggest natural disasters during the last five years were reported.

Austria	Galtür avalanche catastrophe
Hungary	Flood in 2001 of the river Tisza
Japan	Mt.Usu volcanic eruption
USA	Hurricane in 1999 along the East coast from Florida to Maine
UK	Flood in the spring of 2001

R.2.10 Comments

The type of incidents may vary according to the social/economic/ conditions of the country but are generally similar for man-made risks.

Natural risks depend mainly on the location, topography, climates, geological conditions and so on.
Natural disasters become more and more predictable with advanced technologies while man-made incidents often attacked in a surprising way, Like the one on 11th September 2001.
There is considerable variations among countries in the agency's expected functions responsible for handling the incidents.
The state of preparedness for dealing with incidents shows a wide degree of differences from country to country.
The same applies to the legal framework.

R.3. Identification and Classification of Risks

Based on the results of the C18 International survey, the following classification / categorization is suggested.

Incidents related to road and vehicles
- Major roads accidents
- Overloading (weight and height) causing severe damages to the road structures, (damage to bridges)
- Fire / incidents in tunnels
- Fallen objects on the high / roadway
- Bad maintenance of vehicles
- Bad maintenance of road's structures ex.: collapsing of bridges

Incidents related to transport operations (dangerous goods)
- Fuel and oil spillage from accidents
- Hazardous chemical spillage
- Spillage of inert materials
- Danger from nuclear materials

Incidents involving other transport modes
- Plane crashes onto or close to highway
- Train collision and impacts on structure
- Ship / boat impact on structure

Incidents related to property adjacent to high / roadway

- Explosion and fire in an industrial area close to highway
- Spill of radioactivity from a near nuclear processing facility

- Spill of toxic materials near to highway

Incidents resulting from social disruption
- Road blockages by protestors, strikes, demonstrations
- Terrorist activity as active incident or threat
- Vandalism, fun ventures, spraying.

Others
- Wartime remains: mines, bombs, explosives

The study of these types of man-made risks and incidents points out a more complex array of consequential effects and of organizations involved than natural disasters.

Following the first analysis:

a) Consequential effects
- Major traffic delay and disruption
- Direct damage to road and bridge infrastructure
- Indirect delays to other transport modes
- Environmental threat to watercourses
- Danger to people from chemical / nuclear spillages

- Economic impact on local / regional / national economy
- Direct loss of life and serious injuries
- Social disruption / riots
- Political focus on national / local government policies.

b) Organizations involved in incidents
- Police Forces
- Fire and Rescue Services
- Ambulance and Medical Services
- National Government Departments (Transport, Environment, Home affairs)
- Local Highway Authorities
- Emergency Planning Authorities
- Health and Safety Executive
- Road Network Contractors and Consultants
- Coastguard
- Operators of other Transport Modes
- National or Local Advisory Standing Committee (particularly in regard to hazardous chemicals)

c) Issues to consider in incident management
- Initial response and assessment of incident
- Consolidation and recovery of incident
- Logistics and recovery of incident
- Coordination of publicity
- Availability of real time information to public
- Provision of real time information to public
- Availability of alternative road diversions
- Compliance and protocols and procedures
- Temporary and permanent repair to infrastructure.

d) Longer term considerations
- Identification of prevention / management measures
- Development of risk strategies
- Indirect social / industrial / economic implications at a regional / national level
- Accident pathology
- Review of performance by participating organizations
- Education of road users
- Training and simulation exercises

e) Examples of solutions to deal with results of incidents
- Incident Plans prepared by those directly involved in managing the road network
- Emergency plans for wider participating organizations
- Distribution of advice on best practice
- Development of route strategies for major road links
- Provision of real time information to public
- National Traffic Control Centre.

Reference 2 - Examples of Major Disasters

R.2.1. General

This chapter is divided in two parts: the first one presents examples of natural disasters and the other some examples of man-made disasters. Both are written following the managing emergencies process in the Committee report: before, during and after the disaster.

R. 2.2. Natural Disasters

R 2.2.1. The 1999 Turkish Earthquake

In 1999 major earthquakes struck Turkey, resulting in more than 15,000 fatalities and over 30,000 injuries. The first earthquake called the Kocaeli earthquake occurred on 17 August and had a moment magnitude (Mw) of 7,4. It was caused by a right lateral, strike-slip rupture along the main strand of the North Anatolian Fault (NAF) near the town of Golcuk, a province of Kocaeli, which is located 80 km east of Istanbul. The length of the surface fault rupture is estimated at 150 km with an average lateral offset of 3-5 m along most of its length. There were many stations that recorded the Peak Ground Acceleration (PGA) during the earthquake, with results varying from 0,09g in Istanbul to 0,41g in Adapazari.

The second earthquake, the Duzce earthquake, with a moment magnitude of 7.2 occurred on 12 November along the secondary Duzce fault, a branch of the NAF. Its epicenter was centered near the town of Duzce, in Bolu Province, which has a population of 80,000. This is approximately 140 km east of Golcuk, the epicenter of the earlier Kocaeli earthquake.

R. 2.2.2 Volcano Eruption in Japan

The Do-Ou Expressway of Hokkaido is a part of the National Expressway Networks in Japan and goes from north to the south end of the island. The expressway connects main cities of Hokkaido, such as Oshamanbe, Muroran, and Tomakomai, which are the principal cities in South Hokkaido. The International Airport Chitose Airport is accessed by the expressway and thus the expressway is vital for the economy in Hokkaido. The Hokkaido Branch Bureau and the Muroran Operation Office of Japan Highway Public Corporation (JH) received a precaution and emergency message of volcanic eruption on 28 March, 2000. They immediately strengthened their systems for collecting information and contacting related organizations. A vehicle installed with a satellite communication system was positioned at Mt. Usu Rest Area near the volcano. The Branch Bureau and the Office took close contact with disaster prevention offices of other organizations and collected information. JH also warned road users to always listen to highway advisory radio for the information on volcanic activities. On 29 March, 2000, an evacuation advice was announced .The section between Toyoura and Date interchange (26.8KM) was closed. The closure was thereafter expanded to the sections between Oshamanbe and Muroran Interchanges(73.5KM) due to frequent earthquakes. On March 31, at 1:07 PM**,** Mt Usu Volcano erupted. The interchange and various road structures and facilities were destroyed and the expressway was closed for a year and three months.

Photo-R.2.2 - Damage to a Bridge

R. 2.2.3 Floods in Hungary

The flood was the consequence of the immense snow melting and raining that took place on the surrounding watershed area and which is an annually repeating danger. Population living in the area of the upper section of the river Tisza was in immediate life-danger due to the flood in March 2001. The necessity of immediate evacuation and accommodation of a great number of the population arose. Rescue and lifting works of damages were controlled by OKF. Accessibility/inaccessibility of roads was continuously monitored. Economic activity and road traffic were suspended on the flooded areas. The evacuated population was resettled during the reconstruction works.

R.2.3. Man-made Disasters

R. 2.3.1 The Howard street tunnel fire, Baltimore, USA

The Howard Street Tunnel is located directly under the heart of Baltimore City's business and cultural districts and is adjacent to the core of the City's tourist and sports attractions and the Port of Baltimore. The location of the tunnel is also the end point of the surface transport systems leading into Baltimore City. These include interchange 395 and 83, the major north/south interstate routes, and US 40, the major east/west route. These roadways serve passenger traffic, commercial vehicle traffic in transit, and commercial vehicle traffic using the Port of Baltimore. The MARC commuter train service and CSX and the other rail freight carriers use the tunnel. In addition, the Maryland Mass Transit Administration's light rail system runs over the tunnel and the streets above the tunnel are used by MTA's bus service.

At 3:07 PM on Wednesday, 18 July 2001 a 60-car CSX freight train derailed in the Howard Street Tunnel. At 3:15 PM, the engineers discovered that a fire had broken out in the vicinity of the derailed cars. Baltimore City firefighters arrived on scene at 3:35 PM and were given a cargo manifest. It became apparent that the freight train was carrying a number of hazardous materials (including tripropylene and hydrochlonic acid) and that several of the cars carrying these materials were on fire. Emergency response efforts were further complicated when a forty inch water main located on Howard Street also directly above the site of the derailment broke, spilling water into the tunnel and onto the street. The City found itself facing a potentially catastrophic environmental situation at peak demand hours for transportation services.

The role of Incident Commander was assumed by the Baltimore City Fire Department Chief and many other organizations provided response support. There were various immediate transportation impacts for Baltimore City:

- The closing of the major roadways into the City. In the following morning the roadway system was opened to incoming traffic.
- A temporary closing of the METRO subway during tunnel inspection. This continued until a complete damage assessment had been conducted.
- The disruption of light rail service in the vicinity of the water main break and MARC commuter rail.
- The closing of city streets in the vicinity of the tunnel, and the rerouting of passenger, bus, and commercial vehicle traffic.
- The closing of the Inner Harbor to boat traffic by the Coast Guard at 5:00 PM.
- The disruption of rail freight movement.

There were various long term transportation impacts also:

- On 24 July, six days following the incident, nearly all streets were opened to traffic.
- The light rail service disruption, including the use of buses to transfer passengers around the closed-off area lasted for nearly seven weeks until all repairs were completed.
- The intersection of Howard and Lombard Streets was opened to traffic on 4 September, and light rail resumed service on 9 September.
- The East coast's rail network grew increasingly tight with each day that the major north-south artery remained closed.

Smoke billows from the Howard Street Tunnel with the Baltimore City Skyline, Stadiums, and the Inner Harbor as Backdrop

Fig-R.2-3

R.2.3.2 Nuclear accident in Japan

Various nuclear power facilities are located in Tokai-mura which is approximately 100 km north from Tokyo along the Joban Expressway. A criticality accident occurred at 10:35 AM on 30 September 1999, in uranium processing plant in Tokai-mura, Ibaraki Prefecture.

The mayor of Tokai-mura advised people who were within 350 m from the plant to evacuate (39 households). At 10:30 PM, the Governor of Ibaraki prefecture requested people within 10 km from the plant to shelter indoor (staying inside of the building) since there were possibilities of another criticality. A hundred and fifty (150) people were exposed to radioactivity during the accident, including the ambulance crew, nearby residents, and workers of the plant.

The Japan Highway Public Corporation (JH) closed the entrance to the Tokai Parking Area, the nearest rest facilities to the processing plant, at 23:00 on 30 September, which is approximately 700 m from the plant. Since toll collectors working at the two interchanges which were located within 10 km had to be sheltered inside the buildings, vehicles were allowed to pass through the toll gates free.

During this period, traffic regulations were provided by variable message signs, highway advisory radio, post-up signs and all other possible measures. Toll-free passage of vehicle was the first attempt.

The national and prefecture governments have never considered such a small plant as JCO brings about wide area disasters and JH did not assume such an accident either. No prior investigations were carried out against such accidents and it led to confusion among related organizations.

After the accident, the national and Ibaraki Prefecture governments established the "Off-site Center" as a management center for emergency. JH prepared manuals for measures during accidents at nuclear power plants and related facilities.

Road administrators cannot themselves judge the degree of danger nor take appropriate measures. Administrators of highways must quickly acquire correct and useful information from the command offices for radiation emergency, in order to communicate the information to users and workers of the expressways and take appropriate measures. Communication with other organizations must be improved as well as practicing emergency drills, preparing manuals, and constructing software and hardware for collecting and providing information.

R.2.3.3 The fuel crisis in England

For the two decades between the oil crisis of the early 1970's and 1992 fuel costs had remained relatively stable at constant prices as the basic cost had not fluctuated greatly and taxation had only been increased in line with inflation.

Fuel prices in the United Kingdom comprise three elements:

1. the cost of fuel, distribution, and return on capital
2. vehicle excise duty VED
3. value added tax applied to both of the former.

UK fuel costs were in the top quartile of those in Europe but this has been broadly accepted. Two events then combined to cause a change in taxation policy.

Firstly Britain suffered a sharp recession in the late 1980's early 1990's which reduced the taxation base due to unemployment and the taxation returns due to lower company profits etc.

Secondly environmental pressure groups pointed to the continuing use of motor vehicles despite the recession by at least 1% per annum. In response to those pressure the Chancellor of the Exchequer introduced a "Fuel Escalator" in March 1993. The escalator committed the government to increase duties by at lest 3% each year in real terms.

The fuse for the events of Autumn 2000 was lit in 1999 when world fuel prices, which had been as low as USD 10/barrel, started rising steeply to over USD 30/barrel. The retail price of petrol had jumped by one third in 18 months. The fact that fuel was now some 70% above the price obtained in Europe was a further source of resentment.

In the summer of 2000 as fuel prices rose steadily so did public anger. It was pointed out that the overall incidents of VAT was increasing taxation beyond any forward revenue estimates and calls were made for a cut in duty to at least reflect this. Calls for cut in the duty were rejected by the government and the oil companies were accused of increasing their margins and so profiteering. The tax on diesel was somewhat lower than that on petrol until 1998 when a further environmental policy was introduced to make diesel DERV duty slightly higher than that of unleaded petrol in order to encourage drivers to switch to cleaner fuels. This bore heavily on hauliers. The cost of DERV in Europe was generally lower and in some cases markedly so. There are substantial lorry born imports and exports between the UK and Europe and UK hauliers perceived that competition they had always believed was unfair was now grossly so. Between 1990 and 2000 the UK share of cross-channel road haulage reduced from 42% to 32%.

The lobbying organizations of road hauliers pleaded with government to lower tax rates and farmers were also involved in lobbying. Rural motorists expressed concern who did not have the alternative of using public transport.

On Wednesday 5th September 2000 it was announced that fuel prices were to rise again following a further rise in the price of crude oil. The next day the Channel Tunnel was blockaded in protest. On Friday 7th September, lorry drivers , many of whom were individuals owning their own lorries, started picketing the Shell refinery at Stanlow near Manchester. The protests spread very rapidly, encouraged by media coverage and communication by broad band radio between hauliers and mobile telephones. More refineries were blockaded on 8th September and by the 10th September protests had closed Britain's largest inland oil terminal at Kingsbury near Birmingham. Nationwide panic buying had begun on September 9th with huge queues forming at any garages with fuel.

On 11th September Tony Blair, UK Prime Minister, made it clear that it would not change its policy because of blockades and pickets. The crisis deepened by September 12th, protestors had blocked off 6 of Britain's 8 refineries and over half of the country's filling stations were shut. Small tankers to deliver on the basis that fuel taken out was only to be used by emergency services etc were allowed to pass pickets. The Prime Minister held daily emergency meetings at 10 Downing Street calling on oil executives to take steps to get moving.

By 14th September traffic on motorways was down to 39% and 25% on major roads. 14th September was the fulcrum of the crisis, the government actions were now resulting in some tankers leaving the refineries and depots. Organizers stated that they wanted to end the action while they retained public support.

The government also struck more conciliatory tone towards the protestors. Ministers would meet them if they wished and hints were given about taxation changes to help motorists and hauliers.

In calling off the action the protesters made it clear that unless the government made a commitment within 60 days to cut fuel taxes it could be resumed.

The speed with which life returned to normal was similar to that of the disruption taking effect. In 2 weeks the country was back to its usual pattern.

Reference-3 Organizations and Data

R.3.1 Introduction

Risk management (RM) is a complex process that can operate at many levels. This chapter addresses RM at the road network/road authority/government agencies level, and at the road project level-planning design construction and operation of road network.

Government agencies fall into three basic categories:

1. Military- a disciplined group of trained people equipped with transport, communications, logistics and medical capabilities that can all be deployed in a disaster.
2. Civil Emergency Services- police, fire, ambulance, hospitals, which deal with "normal emergencies" and are equipped to deal with larger scale emergencies. Depending on circumstances, there may be other "emergency" organizations often using volunteer staff from the community who are trained and equipped to deal with extreme events-cyclones/hurricanes, floods, earthquakes etc. This chapter contains details of various" civil emergency" organizations.
3. "Essential Services" – authorities, which supply water, power, communications, hospitals roads /rail / port, etc. These all have responsibility for "risk management" of their activities and facilities to mitigate against "extreme events" turning into disasters. Buildings, bridges, power stations, water supplies should be designed to withstand high winds, floods and earthquakes with minimal damage. The process of "risk management" that such authorities would use is now generally defined in codes and manuals and the general approach is described in Chapter 2.

There should be an appropriate government policy and structures to coordinate all these agencies in the "Preparation and Planning" phase (refer to Chapter 2).

R.3.2 International Organizations Releasing General Disaster Information of Various Countries

Those international organizations are releasing not exclusively road-related disasters, but general disasters including all aspects of natural and man-made disasters.

a) United Nations Office for the Coordination of Humanitarian Affairs (OCHA)-New York U.S.A., www.reliefweb.int
b) United Nations Office for the Coordination of Humanitarian Affairs (OCHA)-Geneva, Switzerland, www.reliefweb.int
c) United Nations Office for the Coordination of Humanitarian Affairs (OCHA) -Kobe (Japan), www.reliefweb.int
d) Asia Disaster Reduction Center(ADRC), www.adrc.or.jp
e) Center for Research on the Epidemiology of Disasters (CRED), www.cred.be
f) World Road Association (PIARC), www.piarc.org
g) International Society for soil Mechanics and Geotechnical Engineering (ISSMGE), www.issmge.org
h) TrafficLinq, www.trafficlinq.com or webmaster@trafficlinq.com

R.3.3 National Organizations Providing Road Disaster Information of Respective Countries

This section provides names, home pages, and typical characters of road management organizations and related institutes of various countries.

Australia (AU)
AU-1 Roads and Traffic Authority (RTA), NSW, www.rta.nsw.gov.au
AU-2 Department of Infrastructure, Energy and Resources (DIER), Tasmania, www.dier.tas.gov.au

Canada (CA)
Ministère des Transports, Québec (MTO), Canada, www.mtq.gouv.qc.qc.ca

France (FR)
FR-1 Ministry of Equipment, Transport and Housing, www.equipement.gouv.fr

FR-2 Laboratoire Central des Ponts et Chaussées, www.lcpc.fr**.**

Japan (JP)
JP-1 Road Emergency Management Office, Road Bureau, Ministry of Land, Infrastructure, and Transport (MLIT), www.mlit.go.jp/road/bosai.html (in Japanese)

JP-2 Disaster Management Department of the Prime Ministry, www.bousai.go.jp
Others

New Zealand (NZ)
Transit New Zealand (TNZ), www.transit.govt.nz

Norway (NO)
Norwegian Public Roads Administration, (NPRA or Vegvesen)

Portugal (PT)
PT-1 Direccao Geral de Transportes Terrestres (DGTT), www.dgtt.pt
Pt-2 Laboratorio Nacional de Engenharia

Spain (ES)
ES-1 Ministerio de Fomento Paso de la Castellana (MFOM), www.mfom.es
ES-2 Centro de Estudios y Experimentacion de Obras Publicas (CEDEX), www.cedex.es

Switzerland (CH)
CH-1 Swiss Federal Roads Authority (FEDRO or OFROU), www.astra.admin.ch
CH-2 Research Center on Alpine Environment (CREALP), www.crelap.ch

USA (US)
US-1 Federal Highway Administration (FHWA), www.fhwa.dot.gov
US-2 Transportation Research Board, www.nationalacademies.org/trb

R.3.4 Road Disaster Information depending on Disaster Kinds

Website addresses are listed in groups depending on the following sequences:

a) Floods
b) Landslides
c) Earthquakes
d) Snow Avalanches
e) Other Natural Disasters
f) Man-made

R.3.5 Road Disasters Information depending on Structural Types

Website addresses are listed in groups depending on the types of structures:

a) Pavement (Road Surface)
b) Fills and Slopes
c) Bridges
d) Tunnels

R.3.6 Information on Mannuals of Emergency Responses

Some typical examples of emergency response manuals exclusively prepared for road, management organizations are introduced from four countries.

And in addition to above PIARC G2 reports are also included:

a) Australia
b) Japan
c) New Zealand
d) USA
e) PIARC G2 Reports

R.3.7 Road Hazard Maps

Examples of the Road Hazard Maps are shown. New Zealand, U.S.A., are introduced.

R. 3.8 Quick Reporting Procedures on Road Disasters and Information Items

Examples of immediate reporting procedures on road disasters are introduced. They are from Australia, Japan, USA.

Reference 4 - International Seminars (Temuco and Budapest)

R.4.1 Seminar in Temuco

PIARC C18's first meeting was held jointly by PIARC C18 and the National Road Directorate of Chile in Temuco city, which is located 700 km south from Santiago, the Capital. The period was from 23rd to 26th of October 2001 and about 150 engineers and experts from eighteen countries of the South America and C18 member countries participated. The major objective of this seminar was to exchange technical and administrative information of road risks among experts of the South American countries and C18 Committee on both natural and man-made disasters. Four-day seminar including one-day technical trip was held. Presentations, questions, and discussion covered the following ten sessions.

The sessions proceeded according to the following program.

Tuesday 23
Opening Session
Session 1 - Hazard and Risk Evaluation and Emergencies Prevention Methods during Planning and Design Projects
Session 2 - Hazard and Risk Evaluation and Emergencies Prevention Methods During Construction
Session 3 - Hazard and Risk Evaluation and Emergencies Prevention Methods during Maintenance

Wednesday 24
Session 4 - Management of Road Emergencies: mitigating Actions
Session 5 - Management of Road Emergencies: Evaluation of the Magnitude of Physical and Economical Damage
Session 6 - Latin-American Hazard and Prevention Experiences
Session 7 - Latin-American Crisis Management Experiences

Thursday 25
Technical Visit

Friday 26
Session 8 - Technical Visits Analysis
Session 9 - Need for Risk Prevention Plans Models for Road Emergencies, and their insertion in the Latin-American Road Organizations and in the National Emergency Plan
Session 10 - Chilean National Emergency Plan
Closing Session

Photo R.4.1 - Séminaire tenu à Temuco / Seminar in Temuco

R.4.2. Seminar in Budapest

The second C18 Seminar was held in Budapest, Hungary, from November 6th to 8th in 2003. This was jointly organized by PIARC C18 and the Hungarian Ministry of Economy and Transport to cover the Central Europe area and so called countries in transition in the region.

This part of the world suffered from very severe floods in 2002 and a special report was presented from a Czech Republic Committee member about the record breaking big flood (500 years return period) which struck the republic's Capital, Prague. There were about 60 participants from the Central Europe and others.

The president of PIARC Mr. O. Michaud kindly paid a visit to the seminar and gave a special lecture on the future aspects of roads. He emphasized the importance of the environmental consideration and harmony with the society from the world wide view of the sustainable development

Seminar program is shown underneath.

November 6 - Opening Session
Session 1 - Road Traffic Effects of Natural Disasters Related Risk Management
Session 2 - Road Traffic Effects of Disasters Caused by Man and Related Risk Management
Session 3 - Legal Issues Addressed to the Decreasing of the Effects of Road Traffic disasters

November 7
Session 4 - Duties of Official Enforcement in Road Transport Risk Management related to Transport of Hazardous Materials. Training and Education
Session 5 - Tasks and Experience of the Organizations Involved in Risk Management and Mitigation of Disasters Effects and Road Traffic Accidents
Session 6 - Reconstruction Following the Road Traffic Accidents and the Elimination of the Disaster Co-ordination of Activity of Participants

November 8 - Technical visit