Toward the Establishment of a Regional Society that is Safe and Secure against Disasters

by

Tsuneyoshi Mochizuki[1], Kiyoshi Minami[2], Koichi Yamashita[3], Keiichi Tamura[4], Koh-ichi Fujita[5] and Katsuya Oda[6]

ABSTRACT

Japan has suffered and recovered from numerous and varied disasters in the past, and has made constant efforts to ensure safety in a range of areas towards to a safer society. These efforts ensure the basic requirements for every aspect of living. However, the country still suffers much human and property damage every year, and sees the emergence of additional detrimental or restricting factors in ensuring greater safety and security. This paper proposes, in the form of ten challenges, guidelines for establishing a regional society that is safe and secure against disasters under the current conditions.

KEYWORDS: Disaster, Regional Society, Safety, Security

1. INTRODUCTION

Japan has suffered and recovered from numerous and varied disasters in the past, and has made constant efforts to ensure safety in a range of areas towards to a safer society. These efforts ensure the basic requirements for every aspect of living.

However, the country still suffers much human and property damage every year, and sees the emergence of additional detrimental or restricting factors in ensuring greater safety and security. In this context, the country needs dramatic technological advances along with their application and operation in local communities in close collaboration with the human and social sciences. This will help to bring an enhanced social resistance to risk events and build a safer and more secure society, thereby providing the infrastructure for a decent quality of life.

In the United States, the Subcommittee on Disaster Reduction, which was established within the National Science and Technology Council's Committee on Environment and Natural Resources, published a report called the *Grand Challenges for Disaster Reduction* in June 2005 [1]. This report identified a set of hazard-mitigating measures and policies known as the Grand Challenges to develop a ten-year strategy for disaster reduction through science and technology. The Subcommittee also plans to develop a hazard-mitigating strategy on 15 priorities identified and an implementation schedule for it in Phase II of the Grand Challenges program in around June of 2006.

In Japan, the Working Group on Science and Technology Policy for a Safe and Secure Society, which was established by the Ministry of Education, Culture, Sports, Science and Technology, developed a set of priorities for a safe and secure society in April 2004. The Council for Science and Technology Policy, established by the Government, specified the implications of the development of safety science and technology and clarified the guiding principles and implementation of its steps. The council also proposed that the achievements of science and technology which contribute to security should be shared through a range of applications to achieve the policy objective (Goal 6), "The world's safest country – making Japan the world's safest country" under Concept 3, "Protect nation's health and security – to become a nation that secures safety and quality

[1] Director-General, National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure and Transport, Tsukuba-shi, Ibaraki-ken 305-0804 Japan

[2] Research Coordinator for Evaluation, ditto

[3] Research Coordinator for Codes and Standards, ditto

[4] Research Coordinator for Earthquake Disaster Prevention, ditto

[5] Head, River Environment Division, ditto

[6] Head, Coastal Disaster Prevention Division, ditto

of life" set out in the Third Science and Technology Basic Plan.

With these points in mind, this paper proposes Japanese efforts to provide guidelines addressing the perceived needs for the development of a comprehensive policy towards a society resilient to natural disasters. We hope that this proposal will help develop a shared key understanding that allows all concerned to address the issues in a concerted manner.

2. WHAT IS A SAFE AND SECURE COMMUNITY?

The Working Group on Science and Technology Policy for a Safe and Secure Society, which was established by the Ministry of Education, Culture, Sports, Science and Technology, defined a safe and secure community in an April 2004 report as having the following qualities:

1) A community to minimize risk and withstand actualized risks

Continuous efforts should be made to reduce risk to a socially acceptable level in order to ensure safety, and an appropriate risk management system should be developed to maintain risk at the lowest level. At the same time, in the event that a risk does materialize, the community should be able to limit its consequences and maintain normal function.

2) A community for flexible response and international cooperation

Anticipating that safety may be threatened at any time in ways that are unpredictable, the community should develop a dynamic system to ensure flexible and timely response to any emerging threat, and should participate in international cooperation towards safety.

3) A community whose members have an increased level of safety-consciousness

Organizations should be responsible for building a safer community, and individuals should have a knowledge and awareness of safety and be able to fulfill appropriate roles in community's efforts towards safety.

4) A community that reassures individuals through confidence

A socially acceptable level of safety should be continuously maintained, and mutual confidence should be increased among organizations involved in security and individuals through coordinated activities, thus enhancing the feeling of safety.

5) A community with the capacity to consider the positive and negative aspects of policies for a safer and more secure community and to make rational decisions

The community should be able to closely consider the positive and negative aspects of policies for a safer and more secure community, and should be able to make rational decisions about the level of safety and security to be achieved through these policies.

It should be noted that the term *safety* refers to any objectively verifiable absence of injury or damage, either tangible or otherwise, to humans, organizations and public domains.

The term *security* refers to a belief that no events significantly different from predictions based on knowledge and experience will occur, and that the resulting conditions can be accepted even if such events do occur.

3. PRESENT ISSUES IN CREATING A SAFE AND SECURE SOCIETY

The disaster environment of Japan and its surrounding countries has recently undergone significant changes. To ensure a safe and secure lifestyle, the contemporary issues arising from these changes should be carefully considered and appropriately handled. The issues are outlined as follows:

1) Emergence of new critical phenomena

Recent advances in research into the generation mechanisms of dangerous phenomena such as earthquakes, volcanic eruptions and tsunami

have clarified previously unknown phenomenon generation patterns, and new measures for these patterns should be now considered. In addition, the frequent occurrence of large-scale disasters around the world has created the need to consider measures to address the effects of new disasters. New emergency issues also need to be handled, such as chemicals whose harmful effects have only recently been discovered and newly detected infectious diseases.

2) Increased harmfulness of some dangerous phenomena

As an example, abnormal local weather phenomena such as concentrated heavy rains are found in relation to global warming.

3) Reduction of regional resistance to disasters

There are indications that disaster resistance in each region decreases explicitly according to inhabitant ageing, depopulation, changes in the regional community, the deterioration of social systems such as flood prevention teams, the scattering or loss of experimental knowledge saved in each region and the popularization of urban lifestyle.

4) Increased vulnerability due to the enlargement, deepening and complexifying of urban systems

Our society may have gradually evolved a vulnerability to dangerous phenomena in the consistent flow of enlargement, deepening and complexifying of urban systems. In particular, such vulnerability may be actualized as unstable actions in and damage to systems caused by unexpected external factors, or as a chain reaction and amplification of simultaneously caused damage.

5) Delays in the supply of scientific diagnosis and technical solutions to handle new issues

A number of issues threatening the safety and security of our society have been pointed out. For example, can disaster prevention equipment developed in the past also function effectively today? Do the devastation of forests and the abandonment of plowlands increase the risk of landslides and floods? Could watershed degeneration from human activities have destroyed the continuation of near shore water ecosystems? Can the effects of chemical pollution on humans and ecosystems be ignored? It is necessary to properly diagnose these risks and propose solutions to prevent unnecessary alarm over a range of disputed problems whose risk is not sufficiently clear.

6) Occurrence of restrictions on assuring safety and security

It can be considered that the capacity for investing in disaster prevention systems may decrease in the long term, and the number of function-deteriorated disaster prevention facilities may increase. In this light, there is an increasing worry that enhancements to disaster prevention facilities may remain insufficient for possible external forces. It is becoming clearer that disaster prevention measures depending solely on disaster prevention facilities are dangerous.

4. WHAT CONSTITUTES A REGIONAL SOCIETY THAT IS SAFE AND SECURE AGAINST DISASTERS?

Referring to the US's *Grand Challenges for Disaster Reduction* activities outlined above and the report issued by the Working Group on Science and Technology Policy for a Safe and Secure Society, we propose the following three basic recognitions to consider Japan's disaster prevention measures:

- Checking the requirements of safety and security in regional society.
- Comprehensively arranging the issues to be resolved.
- Viewing these measures as a process in which a common awareness is developed between all the related parties, leading to evolution based on the present conditions and a steady increase in cooperation.

Based on these recognitions, we first clarify the issue of what constitutes a regional society that is safe and secure against disasters. Then we

show how all the parties can create and maintain a regional society that satisfies the following three requirements:

1) The capability to safeguard human life to the maximum
2) The capability for resistance to danger (above a certain level)
3) The capability for speedy recovery from disasters

The conditions to be achieved (or maintained) for a safe and secure regional society will be outlined according to the above three requirements: 1) safeguarding life, 2) increasing resistance, and 3) increasing recovery capacity. These conditions must also be established and maintained in line with the following three factors:

a) A continued grasp and understanding of the necessary information and knowledge
b) Maintaining the means and environment necessary for fulfillment
c) Keeping a sense of belonging between the parties concerned

Table 1 lists these conditions in detail.

5. INTERIM APPROACHES (DRAFT PROPOSAL) – TEN CHALLENGES –

The draft proposal of approaches towards realization of the content in Table 1 is suggested in the form of ten challenges.

As described in the basic acknowledgement above, this draft evolves constantly in response to current status by considering how to widen the coalition circle while developing a common view among the parties involved across a range of fields. For this purpose, the Ministry of Land, Infrastructure and Transport should encourage the parties to collaborate with each other. This draft also shows the nature of such encouragement and the direction of the approaches undertaken by the Regional Development Bureau. By reviewing this information, it is considered possible to identify areas that have not yet been studied or researched by research institutes such as the National Institute for Land and Infrastructure Management. Examples of research and development issues to be addressed in the future are also provided.

– Ten challenges –

Classification	Ten challenges
1. Knowledge	1-1 Learning from disasters 1-2 Supporting communications that lead to risk-preventive behavior 1-3 Knowing the effects on the economy and business activities in disaster-stricken region
2. Cooperation	2-1 Sharing information and knowledge with regional communities even under normal circumstances 2-2 Promoting the creation of communities capable of disaster prevention through self- and co-support
3. Real-time information	3-1 Providing information in real time 3-2 Utilizing emergency earthquake information
4. Recovery	4-1 Improving the resistance and recovery power of basic infrastructures as a whole 4-2 Developing innovative technologies to improve the resistance of facilities 4-3 Preparing for recovery

1. Knowledge

1-1 Learning from disasters

- ○ Encouraging local governments to share information on successful (or failed) case examples of disaster control to accumulate technical knowledge.
- • Accumulating technical knowledge which cannot be stylized.
- • Accumulating information on actual action taken in response to disasters, such as whether proper evacuation was carried out or proper information given.

Table 1 Conditions to be achieved for a safe and secure regional society

Conditions to be achieved / Requirements of safe and secure regional society	a) A continued grasp and understanding of the necessary information and knowledge	b) Maintaining the means and environment necessary for fulfillment	c) Keeping a sense of belonging between the parties concerned.
1) The capability to safeguard life	1. People are aware in advance of the nature of each danger (i.e., the present state of resistance, future prospects and degree of threat), proactive measures and action to be taken when necessary. 2. People have a continued grasp of the present state of danger and can understand the level of threat.	3. People execute proactive measures including seismic inspection and retrofit of houses. Safe evacuation zones, routes, procedures and emergency measures are established.	4. People trust the information and action of disaster prevention agencies and can take appropriate action in response to instructions given by them. 5. People are able to lend assistance to others.
2) The capability for continued efforts to increase resistance	1. Disaster prevention agencies know the mechanism and level of threat for each danger, and are aware of the present situation of resistance and any resistance-related issues of the facilities in their jurisdictional area. 2. Disaster prevention agencies know the degree of people's knowledge, the proactive measures they are capable of, their level of trust in the agencies, and their co-support awareness. 3. Disaster prevention agencies know the nature and degree of effect that each danger will have on the private sector and industries, and have strategies such as BCPs (Business Continuity Plans) to minimize these effects. 4. Disaster prevention agencies know the process of the mutual effects of infrastructure damage.	5. Disaster prevention agencies can acquire measurement data on each dangerous phenomenon and the status of resistance using an appropriate observation system. Agencies can save such data for use as needed and are able to analyze it. 6. Disaster prevention agencies have means such as visualization techniques to obtain a visceral understanding of disaster information, and can utilize these means for internal and external notification. 7. Disaster prevention agencies have a standard analytical method for actual disasters, and can accumulate experience by utilizing this method. 8. Disaster prevention agencies have the technical knowledge to develop co-support awareness, and can support regional societies by using this knowledge. 9. Disaster prevention agencies can use innovative techniques for increasing resistance. Examples may include minimization of the disaster area or network creation of a physical distribution infrastructure to secure overall function. 10. Disaster prevention agencies can make and execute plans for increasing resistance that are appropriate to the level of threat, the degree of effect and the current state of resistance and any issues related to it. Such plans include prevention measures against the mutual effects of infrastructure disaster and measures by land induction.	11. Disaster prevention agencies can share information and act as a unit.
3) The capability to acquire ideas for increasing recovery power	1. The private sector and industries know the nature of each danger (i.e., the present state of resistance, future prospects and degree of threat).	2. The private sector and industries have strategies such as BCPs (Business Continuity Plans) to minimize the effects of danger in collaboration with the parties concerned, and can update such plans as necessary. 3. The private sector and industries have plans in conjunction with disaster prevention agencies for effective measures to recover from disaster. The private sector and industries can also update such plans as necessary and can reserve the executive organizations and materials required. 4. Disaster prevention agencies have recovery plans that determine the priority of infrastructure recovery, and can reserve the executive organizations and materials required. 5. Disaster prevention agencies can make and execute new plans for easy recovery as necessary in addition to the above plans for increasing resistance.	6. The private sector, industries, disaster prevention agencies and inhabitants share necessary information.

Interim approaches (draft)

RDB, etc.	• Collecting successful (or failed) case examples of disaster control, diffusing successful examples • Conducting field surveys on evacuation and the supply of information
NILIM	• Analyzing the successful (or failed) case examples collected • Studying how to interpret or quantify the information accumulated

RDB: Regional Development Bureau, Ministry of Land, Infrastructure and Transport
NILIM: National Institute for Land and Infrastructure Management

1-2 Supporting communication that leads to risk-wise behavior

○ Encouraging local governments to engage a common view on the importance of information services that lead to risk-wise behavior, and collecting and utilizing successful examples while reflecting on failed examples.
○ Upgrading visual indication technologies to promote awareness of dangerous phenomena among people, and conducting research into methods of supplying such information by considering types of human bias in collaboration with the fields of arts and social sciences.

Interim approaches (draft)

RDB, etc.	• Conducting survey on actual conditions (i.e., case examples) of the relationship between risk-wise behavior and information
NILIM	• Analyzing case examples collected • Studying methods of upgrading visual indication technologies • Conducting research into methods of supplying information by considering types of human bias, in collaboration with the fields of arts and social sciences

1-3 Knowing the effects on the economy and on business activities in a disaster-stricken region

○ Encouraging local governments (at a prefectural level), the private sector and economic communities to have a common awareness to grasp the effects of disasters on the local economy as a whole and on business activities, and clarifying the procedures for this purpose.
• Preparing a macro analysis method for the whole region utilizing an economic model, applying the model to a disaster area and establishing a quantification method.
• Preparing a research method to determine the spreading process of direct/indirect disaster impact (e.g., questionnaire research involving the representative private sector and industries), applying the method to a disaster area and establishing a method of understanding the effects.

Interim approaches (draft)

RDB, etc	• Using a macro-analysis method in a disaster area • Developing and utilizing a micro-analysis method (such as questionnaires) according to regional characteristics
NILIM	• Developing a macro-analysis method and analyzing the application results • Developing a micro-analysis method and analyzing the application results

2. Collaboration

2-1 Sharing information and knowledge with regional communities even under normal circumstances

○ Encouraging inhabitants, local governments and the private sector to share information and knowledge related to disasters, as well as information on the level of damage to be expected from each type of disaster and the actual status of facilities.
• Knowing the depth of inhabitants' current awareness and understanding of hazard maps and so forth, and taking measures to improve the level of awareness.
• Knowing the actual status of and issues related to regional governments' disaster measures, and presenting methods to enhance regional resistance such as information collection/analysis abilities.
• Knowing the current status of and issues related to each private sector's Business Continuity Plan (BCP), and supplying basic information to enable the private sector to make their BCP consistent with others.

- Providing a progress indicator for realization of the desired community through these activities, and reflecting this into new technological development and academic activities.

Interim approaches (draft)

RDB, etc.	• Continuously enhancing the information-sharing ability of inhabitants, local governments and the private sector through daily activities (e.g., disaster drills, disaster prevention meetings, facility inspections, various events etc.) • Continuously measuring the indicator provided to show progress towards a desirable society
NILIM	• Researching methods of developing, analyzing and improving the indicator to show progress towards a desirable society • Researching the new technology necessary to provide the information and knowledge required by the parties concerned

2-2 Promoting the creation of a disaster-preventive community through self- and co-support

○ Encouraging inhabitants to have a common awareness of the importance of creating a disaster-preventive community through self- and co-support, raising awareness of disaster prevention through regional activities, and supporting the development of a disaster-preventive community.
- Analyzing the relationship between community changes and co-support awareness, and presenting measures to improve co-support awareness (preventing decreases in awareness).
- Collecting and diffusing good case examples of activities linked with daily regional activities.

Interim approaches (draft)

RDB, etc.	• Collecting and familiarizing the good case examples of creating a disaster-preventive community by self- and co-support • Surveying the relationship between community alteration and co-support awareness • Supporting the creation of disaster-preventive communities linked with daily regional activities
NILIM	• Collecting and analyzing the good case examples of a disaster-preventive community by self- and co-support • Analyzing the relationship between community alteration and co-support awareness, and studying about measures to improve co-support awareness (reduction prevention)

3. Real-time information

3-1 Providing information in real time

○ Encouraging inhabitants, local governments and the private sector to have a common awareness of the importance of real-time disaster information for all including the unspecified majority who are not constituent members of the regional society, and building a mechanism for providing/ receiving such information.
- Pinpointing areas for improvement in existing methods of transferring disaster information to a wide range of people, indicating how to use it under normal conditions and developing a new media method of utilization.
- Developing a system to provide information to the unspecified majority such as users of cars or public transportation, seaside visitors, and so on at facilities in the jurisdictional area, and encouraging the relevant authorities to take appropriate measures in places with a high number of visitors such as downtown areas.

Interim approaches (draft)

RDB, etc.	• Pinpointing areas for improvement in existing methods and indicating how to utilize information under normal circumstances in accordance with current regional conditions • Executing social testing of new information media • Solving the issues of how to provide information to the unspecified majority at facilities in the jurisdictional area
NILIM	• Analyzing/presenting areas for improvement in existing methods and how to utilize information under normal conditions • Developing an application of new information media • Studying how to provide information to the unspecified majority at facilities in the jurisdictional area

3-2 Utilizing emergency earthquake information

○ Encouraging facility managers to have a common awareness of the importance of utilizing emergency earthquake information, and conducting research and development into new methods of applying this information to the field of ITS etc.

Interim approaches (draft)

RDB, etc.	• Exploring the possibility of using emergency earthquake information for facility management
NILIM	• Researching a method of using emergency earthquake information for facility management

4. Recovery

4-1 Improving the resistance and recovery capacity of the basic infrastructure as a whole

○ Encouraging each infrastructure manager to have a common awareness of the mutually dependent relationships between infrastructures, analyzing this mutual dependence and presenting a method of damage reduction (i.e., a proactive program).
○ Presenting a framework of broad-based collaboration across a range of fields to prepare a method for the temporary storage, transportation and disposal of waste and debris caused by a disaster.

Interim approaches (draft)

RDB, etc.	• Surveying/analyzing the mutual dependent relationship between key infrastructures in the area • Studying the current conditions and issues related to the temporary storage, transportation, and disposal methods of waste and debris from a disaster area
NILIM	• Developing a method of analyzing the mutually dependent relationships between key infrastructures and presenting a method of damage reduction • Presenting a framework of broad-based collaboration across a range of fields for the temporary storage, transportation and disposal of waste and debris from a disaster area

4-2 Developing innovative technologies to improve the resistance of facilities

○ Encouraging the private sector and facility managers to understand the needs and seeds of innovative technologies to improve the resistance of facilities, and collaborating in the development of such technologies.

(Examples)
- Development of structures using high-strength steel with nanotechnology.
- Performance improvements in seismic isolation technologies and reductions in their cost.
- Large-scale emergency recovery work from the air for breached dykes.
- Minimization of flooded areas using existing structures such as roads etc.
- Collective use of facilities with functions for local revitalization and environmental conservation, with the aim of preventing or reducing disasters.

Interim approaches (draft)

RDB, etc.	• Grasping the needs of innovative technologies to improve the resistance of facilities • Grasping the needs for multiple methods
NILIM	• Grasping the needs and seeds of innovative technologies to improve the resistance of facilities, and conducting technology development • Grasping the needs for multiple methods, and researching the necessary technologies

4-3 Preparing for recovery

○ Encouraging local governments to have a common awareness of the importance of creating highly disaster-preventive towns based on changes in the social environment, and beginning research by clarifying the topics, methods and period of discussions to prepare a recovery plan.

Interim approaches (draft)

RDB, etc.	• Surveying the awareness of local governments of the preparations necessary for recovery
NILIM	• Researching a range of issues to prepare a recovery plan in advance

6. CONCLUSION

This paper proposes, in the form of ten challenges, guidelines for establishing a regional society that is safe and secure against disasters under current Japanese conditions. The following actions are planned:

1) Establishing the content of each challenge more specifically.
2) Encouraging inhabitants, regional societies, local governments, infrastructure managers, the private sector and economic communities to execute these challenges jointly with the parties concerned. This should be done in accordance with general instructions from the Regional Development Bureau or other organizations of the Ministry of Land, Infrastructure and Transport.

7. REFERENCE

1. Subcommittee on Disaster Reduction, Committee on Environment and Natural Resources, National Science and Technology Council: *Grand Challenges for Disaster Reduction*, 2005.