Policy Learning from the Experience of a Neighboring Country: Adaptation of Korean Earthquake Management System after the 1995 Kobe Earthquake[1)]

Keun Namkoong*

Abstract: This article reviews the adaptation of the Korean earthquake management system after the 1995 Kobe earthquake with special reference to the Seoul Metropolitan Government. The Kobe earthquake was a turning point for the earthquake management system in Korea. From a theoretical point of view, social learning and policy diffusion, and adaptation of disaster management system occurred after the Japanese experience of 1995 Kobe earthquake. Section II reviews seismic activities and damages in Korea; Section III discusses reframing governance system for earthquake response in Korea; Section IV covers public policy initiatives for earthquake management in Korea; Section V introduces a preliminary assessment of Seoul Metropolitan Government's earthquake management system from an international standard, and finally Section VII summarizes and makes some recommendations.

INTRODUCTION

Public policy is defined as actions or non-actions by government to alleviate or solve specific public policy problem. Policy problems are products of subjective human judgment, and are possible only when people make judgments about the desirability of correcting a problem situation (Dunn, 1994: 141; Rocherfort & Webb, 1994). Policy problems are therefore socially constructed, maintained, and changed (Berger & Luckmann, 1980). In this context, earthquake threat can be defined as a social problem, rather than a geophysical one (Stallings, 1996). The issue is not whether an earthquake is likely to occur, but what will be its impact on the population. The magnitude of the impact is very much a function of social and political choices. As Stallings convincingly demonstrates using the United States as an example, the earthquake threat is the product of problem definition and domain expansion that take place largely within public policy arenas. In the United States, the earthquake threat has long been a serious policy problem with a well-developed earthquake establishment, composed of engineers, geologists, and seismologists from universities, the private sector, and government, that has framed discussions about policy initiatives needed to reduce earthquake related damages.

In Korea, the earthquake threat has been almost neglected. Until recently, earthquake policies have not been seriously discussed despite earthquakes occurring frequently. However, the Kobe earthquake in January 1995 shocked the Korean public as well as policy makers, stimulating them to regard earthquakes as a serious policy problem. Consequently, a governance system at both state and local government levels was institutionalized, and earthquake mitigation and management related

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* Professor & Dean, Graduate School of Public Policy and Information Technology Seoul National Univ. of Technology (e-mail: keunnk@snut.ac.kr)

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policy initiatives were begun. There are several reasons why the Kobe earthquake is especially disturbing to the Korea. First, the Kobe earthquake occurred in an area previously considered to have low seismic activities, and thus imposed the possibility of a similar disaster striking Korea. Second, unlike Northridge, Gujarat and Turkey, the earthquake struck near the Korean peninsula and reported live in the media. The public was shocked into realizing devastation and huge economic loss could take place in a country with the most advanced earthquake response system in the world.

In short, the Kobe earthquake was a turning point for the earthquake management system in Korea. Earthquakes were now regarded more seriously as a policy problem. From a theoretical point of view, social learning and policy diffusion (Mooney & Lee, 1999) and adaptation of disaster management system (Comfort, 1999) occurred after the Japanese experience of 1995 Kobe earthquake.

This article reviews the adaptation of the Korean earthquake management system after the 1995 Kobe earthquake with special reference to the Seoul Metropolitan Government. Section II reviews seismic activities and damages in Korea; Section III discusses reframing governance system for earthquake response in Korea; Section IV covers public policy initiatives for earthquake management in Korea; Section V introduces a preliminary assessment of Seoul Metropolitan Government's earthquake management system from an international standard, and finally Section VII summarizes and makes some recommendations.

SEISMIC ACTIVITIES AND DAMAGES IN KOREA

According to the plate tectonics, the Korean peninsula is located on the interior of the Eurasian plate and is far away from the boundaries where the Pacific Plate, Philippine Sea Plate, Eurasian Plate and North American plate meet. As a result, seismic activity is lower in Korea than in neighboring countries. However, there are several recorded instances of life and property loss from earthquakes and tsunamis.

According to historical documents, there were about 1800 earthquakes from the first century to 1905.[2] That is an average of about one noticeable earthquake per year. Forty-five earthquakes recorded human casualties and property losses. The figures show that approximately once in every fifty years an earthquake has caused extensive damage. For example, in 779 A.D. the Gyeongju earthquake caused more than one hundred deaths and damage to many houses.

In Korea, regular instrumental earthquake observations began in 1978. In that year, the Korea Meteorological Administration (KMA) opened twelve analog seismograph stations. Between 1978-2001, 512 earthquakes were recorded in and around the Korean peninsula, or about 22 earthquakes per year on average. There were about 9 earthquakes with magnitude 3.0 and greater, with about 7 per year being felt earthquakes. As shown in Figure 1, the number of earthquakes has increased considerably since 1992. Our concern is that the number of earthquakes occurring in Korea has increased rapidly in recent years. Though minor in intensity, 43 quakes hit the Korean peninsula in 2001, the highest number since Korea began monitoring seismic activity 24 years ago.

However, compared to Japan, earthquake activity remains low. As shown in Table 1, nine earthquakes stronger than magnitude 3.0 hit Korea per year, whereas the figure in Japan is 1200, about 133 times more. In Korea, there are 0.2 earthquakes

2) Earthquakes recorded before 1905 when Instrumental earthquakes observation is started are said to be historical earthquakes, and records of these historical earthquakes can be acknowledged through ancient records such as Samguksagi, Koryuhsa, Joseon-Wangjo-Silrok, Ilsung-Rok, Dongguk-Munheon-Bigo, and others.

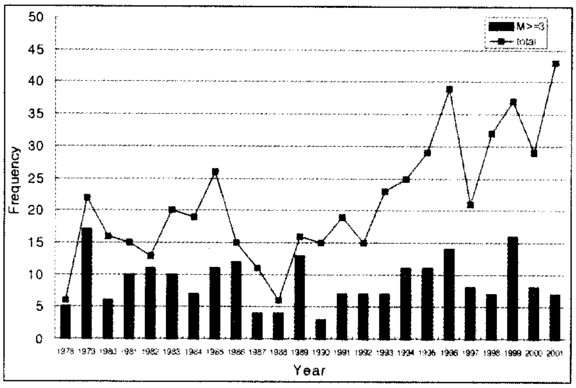

Figure 1. Frequency of Earthquakes by Magnitude.

Table 1. Frequencies of Earthquakes in Korea and Japan per year by Size

Size	Korea	Japan	Worldwide
Greater than 3.0	9.0	1,200	100,000
Greater than 4.0	1.3	400	15,000
Greater than 5.0	0.2	100	3,000
Greater than 6.0	0.0	10	100

over magnitude 5.0 on average annually, but there is an average 100 per year in Japan, or 500 times more than in Korea. The figures show that large-scale earthquakes are more frequent in Japan.

In Korea in recent years, actual life and property loss from earthquakes is relatively small. During the 1978-2001 period, the Hongseong earthquake (magnitude 5.0) at 09:19 AM on October 7, 1978 caused the heaviest damage in recent history. Two people were injured and there was damage to 1,120 buildings. There have been three more earthquakes of about the same magnitude during the same period.

Because earthquake observation in Korea has a relatively short hsitory, and the cycle of earthquake occurrence ranges from several hundred years to several thousand years, this kind of statistical data on earthquake damage has no specific meaning. Seismic researchers claim that the Korean peninsula is no longer safe from earthquake threat. Furthermore, they warn that it would not be entirely surprising if a major quake hit the nation in the near future. Overall, it may be extremely dangerous to think the Korean peninsula safe from future large magnitude earthquakes merely because it has been safe for 200 years.

REFRAMING THE GOVERNANCE SYSTEM FOR EARTHQUAKE MANAGEMENT IN KOREA

As discussed, the Kobe earthquake of 1995 was a turning point for Korean earthquake policies. A systematic earthquake management strategy was established. Before 1995, the Natural Disaster Countermeasures Act did not even list earthquakes as an anticipated natural disaster. The devastating Kobe earthquake spurred the public to demand that the government to formulate systematic countermeasures and disaster prevention program for earthquakes. On December 6, 1995, the National Assembly passed the revised Natural Disaster Countermeasures Act, which added earthquake to the list of natural disasters covered by the Act. The revised Act required national and local governments to formulate comprehensive plans for mitigating earthquake risks, reinforced the regulations for earthquake resistant design of buildings, and required the Korea Meteorological Administration to notify the National Disaster Prevention and Countermeasures Headquarters (NDPCH) when an earthquake occurred.

Since the Kobe earthquake, the Seoul Metropolitan Government has been designing countermeasures for earthquakes combined with plans for deploying faster relief and recovery. In Seoul, there are numerous 30-stories high-rise buildings and many more still under construction. High-rise buildings accommodate tens of thousands of residences, and many connect to underground infrastructures such as the subways. In an earthquake disaster, such a structure risks compound damages. If the subterranean structure damaged, the situation would be difficult to manage, and blackouts could jam the emergency evacuation systems. Consequently it is necessary to frame an effective earthquake governance system in Seoul.

Nevertheless, the earthquake governance system encompasses multi-levels of public, private and non-profit organizations. Partnerships and networking among these organizations is essential and the following section examines these.

Establishment of Public Organizations for Earthquake Management

1) Designation of a Lead Agency for Earthquake Disaster

On January 19, 1995, two days after the Kobe earthquake, the Korean government announced a comprehensive program to prepare for seismic disasters, and presented the plans for legislation. The initial plan was to pass the revised Natural Disaster Countermeasures Act by September in order to add the earthquake countermeasures program, and establish a government command-control system on earthquake prevention, rescue and recovery. Consequently, the Natural Disaster Countermeasures Act was revised on December 6 the same year, and an agency was designated to lead the seismic disaster program.

Nationally, the lead agency for earthquake management is the Disaster Prevention and Preparedness Bureau (DPPB) of the Ministry of Home Affairs, which had previously managed the other natural disasters such as typhoons and floods. In May 1999, as a part of structural adjustments of the national government organizations,[3] the DPPB merged with the Civil Defense and Disaster Management Bureau to form the Civil Defense and Disaster Prevention Bureau (CDDMB). Only 38 staff members in CDDPB manage natural disasters. They work in three key divisions: the Disaster Planning Division, the Disaster Preparedness Division, and the Rehabilitation Division.

At the Seoul Metropolitan Government, the lead agency for earthquake disaster mitigation is the Disaster Prevention & Planning Division within the Fire and Disaster Management Bureau. The division is in charge of preventing and managing man-made disasters.[4] The division is also in charge of mobilizing manpower and resources and preserving materials in case of disasters. The division has only 35 staffs. Among them only one is exclusively responsible for earthquake disaster management. The other staff members work for earthquake disaster management and other human caused disasters management.

In short, although there was a designated lead agency, insufficient staff works on earthquake management at both the national and local government levels. In fact, it is extremely difficult to recruit additional personnel because of cutback management and structural adjustment movements in Korea since 1990s.

2) Creation of the KMA's Earthquake Division

There must be data from observations and analyses of seismic activities in order to establish countermeasures for seismic disasters. At the time of Kobe earthquake, the observation facilities the facilities at Korea Institute of Geo-science And Mineral Resources (the KIGAM) affiliated with the Ministry of Science and Technology (MOST), and twelve pieces of observational equipment at the Korea Meteorological Administration (KMA). The devices at the KMA were simple analog devices

3) The Ministry of Home Affairs (MOHA) merged with the Ministry of Government Administration (MOGA) to form the Ministry of Government Administration and Home Affairs (MOGAHA) in May 1999. This reflected cutback management and structural adjustments in administrative reform movement.

4) It is interesting to note that the Flood Management Division manages other natural disasters such as floods and typoons.

that lacked accuracy. Only three staff members worked on seismic observation. In 1996, one year after the Kobe earthquake, the Earthquake Division increased to 13 staff members and the KMA gave them exclusive authority to observe seismic activities.

In 1997, a digital seismic network expansion plan was established, and in June 2001 a network of 27 seismic stations and 63 strong-motion stations were managed. At present, the KMA Earthquake Division monitors earthquakes and tsunamis. Because it is an ocean peninsula, Korea faces potential damage from tsunamis. In particular, the East Sea (Sea of Japan) between Korea and Japan, is volatile since earthquakes occur frequently in Japan and consequently there is a possibility of tsunamis. In 1983 and 1993, tsunamis caused considerable damage to the eastern coast of Korea. The KMA employs a tsunami monitoring system and exchanges information with the Pacific Tsunami Warning Center (PTWC) and the Japan Meteorological Agency (JMA) for fast and accurate tsunami forecasts. The Planning Division is in charge of the planning and coordination of seismological research, and the Marine Meteorology & Earthquake Research Laboratory of the Meteorological Research Institute carries out seismological research.

Consequently, the KMA's capacity for earthquake data collection and analysis has increased considerably since the 1995 Kobe earthquake. The transmission systems simultaneously report earthquake and tsunami information to about 100 organizations including governmental organizations and broadcasting companies. This simultaneous transmitting system is possible due to the up-to-date observation equipment, and reliable institutional networking made possible by investment in information and communication infrastructure.

3) Establishment of Earthquake Related Research Institutes

Institutes for professional research on seismic activities are crucial parts for preparation of seismic disasters. Before 1995, there were no seismic research centers funded and managed by the government other than the Korea Institute of Geo-science And Mineral Resources (KIGAM) and small university laboratories. After the 1995 Kobe earthquake, it was agreed that a professional research institute was needed. As a result, the central government established the National Institute for Disaster Prevention (NIDP) in 1997[5]. There are three research units in the NIDP. One unit, the Earthquake, Coastal and Structural Disaster Prevention Team, composed of five highly competent researchers, has been conducting research projects related to earthquake prevention and mitigation measures.

Meanwhile in 2001, the Seoul Metropolitan Government provided research funds and facilities to the Earthquake and Disaster Prevention Research Institute, established at the University of Seoul. This Institute has been conducting research projects on disaster countermeasures and programs, with a focus on the particular needs of Seoul.

Public and Private Partnership

The increase of voluntary participation by business and non-profit organizations in the governance system is an international phenomenon and also true of Korea where the number of civil society organizations and non-governmental organizations that participate voluntarily in rescue and recovery operations has increased rapidly as have the number of individual volunteers. For example, many volunteers participated in recovery and rescue activities after typhoon 'Rusa', which hit the peninsula in the late August last year. The

5) www.nipd.go.kr

Table 2. Number of organizations participated in response phase in typhoon 'Rusa', (August 30-Sept. 19, 2002.)

Type of Org.	First Week		Second Week		Third Week		Total	
	No.	%	No.	%	No.	%	No.	%
International	0	0.0	2	2.8	0	0.0	2	1.3
Private	35	68.6	50	69.6	17	68.0	104	70.3
Public: National	4	7.8	5	6.9	0	0.0	9	6.1
Public: Local	6	11.7	12	16.7	1	0.4	19	12.8
Military	6	11.7	3	4.2	7	28.0	16	10.8
Total	51	100.0	72	100.0	25	100.0	148	100.0

typhoon killed nearly 200 people and caused 5 billion dollars in property losses, which made it the worst natural disaster in Korean history. For 21 days following typoon Rusa (August 30-September 19, 2002), a content analysis of news stories reported in Chung- Ang Ilbo press identified a total of 148 organizations engaged in the response phase (see Table 2).

As shown in Table 2, 104 private organizations, or 70.3 % of the 148 participating organizations were involved in response operations. It is interesting to observe that a large number of military organizations (16 or 10.8%) participated in the response phase.

Since the government expects participation of these organizations and individuals in case of a seismic disaster, a system to organize, network and maximize their efficiency is needed. In fact, the 2001 Seoul Comprehensive Earthquake Response Plan contains an action plan for the Seoul Red Cross. Therefore it can be assumed Seoul incorporates public-private partnerships in its local earthquake management plan, yet the program still lacks plans for an efficient networking among various voluntary organizations aside from the Red Cross.

EARTHQUAKE MANAGEMENT POLICY INITIATIVES IN KOREA

With the establishment of the earthquake governance system, it is possible to initiate public policies aimed at prompt, efficient, and effective management of earthquake disasters. These earthquake management policy initiatives can be grouped according to the four management phases: mitigation, preparedness, response, and recovery (Petak, 1985; Clary, 1985, Namkoong, 1995).

a. Pre-disaster Mitigation/Prevention: Policy Initiatives taken to alleviate the impact of or prevent a disastrous event. Examples include land use management, building codes, disaster insurance, risk mapping, safety codes, and tax incentives and disincentives.
b. Pre-disaster Preparedness: Measures adopted in advance of a disaster to aid in its management. Examples are emergency operations plan, warning system, an emergency operating center, emergency communication, emergency public information, mutual aid agreements, resource management plan, training and exercise.
c. Disaster Response: Activities that occur during and immediately after a disaster strikes. Examples are emergency system activation, search and rescue operations, and the provision of food, shelter, and clothing.
d. Post-disaster Recovery: The long-term reconstruction of a community affected by disasters can last up to 10 years. Examples are debris clearance and contamination control.

Among those public policies initiated by the Seoul Metropolitan government and the central government, this article will now examine the most important policy measures such as building code policies, earthquake preparation drills, seismic disaster mapping, an earthquake and fire safety experience center, housing insurance program, and a rapid response plan.

Policy Initiatives on Building Codes

To prevent and reduce the earthquake damages, earthquake-resistant design can never be overemphasized. The effect of earthquake-resistant design was clearly shown in the 1994 LA Northridge earthquake, the 1995 Kobe earthquake, and the 2001 Seattle earthquake. There was a distinctive difference in the damage done to buildings designed in earthquake-resistant structure and to those that were not(Nelson & French, 2002; Olshansky, 2001; Hays & Chaker, 1999).

In Korea, earthquake-resistant design standards for buildings in specific areas have been established according to building codes and the following case-by-case laws: nuclear power plants in 1960, hydroelectric and thermoelectric power plants in 1960, multipurpose dams in 1979, water reservoirs in 1982, and tunnels in 1985. However the 1978 Hongseong earthquake stimulated the obligation of earthquake-resistant design in general buildings in 1988. The Ministry of Construction (MOC) set up standards in the Building Code Enforcement Ordinance and in Building Structure Standards, which required all buildings to be designed to withstand an earthquake of magnitude 7. According to this regulation, every building over six stories or over 100,000 m^2 total area must adopt an earthquake- resistant design. In addition, earthquake-resistant design is required for all hospitals larger than 1,000 m^2, theaters larger than 5,000 m^2, and facilities such as shopping centers larger than 10,000 m^2.

Earthquake-resistant design requires thicker walls, more steel reinforcement and deeper base foundations. The construction cost for earthquake- resistant structures is estimated 10-30% greater than standard construction costs. For this fiscal reason, many apartment construction firms are opposed to the new regulations.[6)]

While one can assume that most buildings constructed after 1988 have and earthquake-resistant design, the real issue is not how the buildings are designed, but how soundly they are actually built. Naturally, a seismic disaster causes more damage to unreliably constructed buildings. It is distressing that many buildings in Korea are shoddily constructed and therefore a guarantee of effective implementation of the regulations is the critical task in earthquake-resistant building. Furthermore, one can assume that high-rise buildings constructed before 1988 are not earthquake-resistant.

Additional earthquake-resistant standards in other specific construction areas have been added since 1988: roads in 1999, bridges in 1992, express railways in 1991, oil storage facilities in 1993, gas storage facilities in 1998, railways in 1999, harbors in 1999, fishing ports in 1999, general dams in 2000, and agricultural production in 2000. Additional design standards for airports, metropolitan railways, floodgates and drainage pumping facilities, water supply facilities, powder storage plants, and sewerage facilities were in consolidation at 2000.

According to the 2001 annual Comprehensive Earthquake Prevention Plan of the Seoul Metropolitan Government, every existing building of any type must be examined for earthquake resistance during 7 years from 1999 to 2005. The results will be analyzed and buildings are to be reinforced by an annual management plan from 2001 if needed. (Seoul Metropolitan Government, 2001)

As seen above, the Korean Government is

6) Chosun Ilbo Press, 1995, 1. 20.

applying earthquake-resistant design standards and checking building conditions. However, whether structures such as nuclear power plants, expressways, and bridges are safe from mid-scale earthquakes is still controversial. For example, an earthquake with a magnitude of 4.3 occurred on July 2, 1997 in Gyeongju, close to the Wolseong, Gori, and Uljin nuclear power plants.[7] This case alarmed the safety management issue of nuclear power plants. To heighten the controversy further, the epicenter of the earthquake is an active fault region. Special modifications or alterations should have already been made to the five plants already constructed in Wolseong and Gori, and the two other plants under construction.

Against this controversy, the government claims that all domestic nuclear power plants were built to withstand earthquakes up to magnitude 7. However, critics assert that even if the structures can endure an earthquake of magnitude 7, in the seismically active areas, the repeated mid-scale earthquakes can cause the critical structural damage. For example, in the Yangsan fault region, 55 small-scale earthquakes were observed during the year 1996 alone, and critics argued that the neighboring nuclear power plants were in danger. But the authorities confirmed the plants' safety, and pointed out that even though the Kobe earthquake ruined the city, the 11 nuclear power plants in the region were completely undamaged and operated normally. Furthermore the magnitude 7.1 earthquake in San Francisco, in October 1989 did no damage to the neighboring Diablo Canyon and Humbolt Bay Nuclear Power Stations. Even as so, the government announced that "all the nuclear power plants including the Wolseong and Gori plants will undergo seismic activity safety inspections and every step will be taken to ensure that they are safe. Their safety is the first priority in nuclear power plants."

However, dispute remains over whether the government complied with its own earthquake-resistant standards. For example, as reported to the National Assembly on September 13, 1999, of the 1936 bridges constructed by the government-owned Korea Highway Corporation, only 71 adopted an earthquake-resistant design.[8] Only 19 of the 353 bridges (5.4%) in the Seoul-Busan Expressway, have an earthquake-resistant design. Most notably, none of the bridges in the Seoul-Inchon Expressway had an earthquake-resistant design. This means that if a strong earthquake struck, it would paralyze the national transportation network within a matter of minutes.

Meanwhile first class earthquake-resistant bridges such as the Mapo, Seongsu, Gayang, Hannam Bridges across the Han River in Seoul have safety risks caused by neglecting the earthquake-resistant design regulations.[9] According to the Inspection Report on Building Construction in Seoul by the Board of Audit and Inspection, 97 of the 322 piers of the four bridges do not comply with the earthquake- resistant regulations. The Construction Management Headquarters of Seoul Metropolitan Government replied, "Since earthquake-resistant structure requires an advanced level of expertise, every design phase was investigated by outside professionals." They also stated, "a bridge cannot be determined unsafe just because the earthquake-resistant design does not match some minor specifications."

As mentioned above, considering the uncertainty of earthquake-resistant design in public facilities, the state of private buildings is even more doubtful. Consequently, how to enforce the building codes and how to insure compliance from policy target groups remains the principle task even after the

7) Donga Ilbo Press, 1997. 7. 4.

8) Chosun Ilbo Press, 1999. 9. 13.

9) Donga Ilbo Press. 2001. 8. 14.

regulations are established and intensified.

Earthquake Preparation Drills

After the Kobe earthquake, the Korean government practiced nation-wide earthquake preparation drills for the first time. Although the government has had monthly civil defense training program since the 1960's, on the civil defense training day in March 1995, it held an earthquake preparation drill. In preparation for communication suspension, local governments, the police, the Korea Electric Power Corporation, and Korea Telecom coordinated blackouts, water shortage, and fire drills. In addition, it gave instruction in evacuation, emergency expedience and order restoring procedures in civil defense member training meetings. Earthquake evacuation instruction were given; for example, a person indoors should take cover in small spaces like the bathroom, or duck under sturdy furniture such as tables and beds. This earthquake preparation drill provided a good lesson to citizens who had thought that Korea was safe from earthquakes.

Afterwards, various organizations have conducted frequent earthquake preparation drills in various forms. For example, the Korea Meteorological Administration conducted the 'tsunami countermeasure simulation drill' on June 11, 2001. The main objective of this drill was to minimize the damage from a tsunami.

The Seoul Metropolitan Government mandated earthquake response action as a compulsory course in the civil defense curriculum, and created and advertising a phase-to-phase course of action in case of earthquake emergencies.

Seismic Disaster Mapping

In June 1997, the Ministry of Construction and Transportation (MOCT) produced a Korean seismic disaster map for reference on earthquake-resistant design standards for various buildings and facilities.[10] The map contains information such as previous earthquake records and hazardous areas accordingly. MOCT set up seismic areas based on this map, and applied stricter safety regulations in the design standards for public buildings and facilities in these areas.

Seoul Metropolitan Government plans a more detailed seismic disaster mapping by the year 2010.

Earthquake & Fire Safety Experience Center

In February 2000, The Seoul Metropolitan Government decided to build a Citizen Safety Experience Center where citizens can experience fire, earthquakes and gas explosions and also receive safety education.[11] The building, consisted of three floors above the ground level, and one floor underground, will be equipped with images and artificial environment for disasters such as earthquakes, floods, building collapses, fires, and gas explosions. After completion of the building in 2003, organized safety education will be given in the center. The center will also be accompanied by physical exercising facilities such as a rock climbing wall, and a park.

Introduction of a Home Insurance Program

The Korean government will introduce a social security type home insurance program in the near future. The program will compensate for housing damage caused by natural disasters.[12] The Ministry of Government Administration and Home Affairs (MOGAHA) compensated residential damages from typhoons, floods, rainfall, snowfall, earthquakes and droughts for up to 25% of the damage cost by government subsidy. However, MOGAHA proposed replacing that system with a home insurance program that shares expenses between the state and homeowners. According to the MOGAHA proposal, residents will pay up to 25%

10) Joongang Ilbo Pres. 1997. 4. 14.
11) Donga Ilbo Press. 2000. 2. 8.
12) Joongang Ilbo Press. 2001. 7. 26.

of the insurance premium based on the charge for benefit principle, and the state will pay the rest.

Accordingly, MOGAHA has asked the Ministry of Planning and Budget to allocate 1.5 billion dollars, which is equal to the average amount of recovery support per year, for the home insurance fund. MOGAHA also proposed a revision in related laws such as the Natural Disaster Countermeasure Act. The insurance premium will apply discriminately by region, graded according to comprehensive data such as damage possibilities. The insurance budget will be determined by the scale of damage, and larger than the current budget. The government plans to test the system in regularly flooded regions, and gradually establish the program nation-wide.

Rapid Response Plan

The Rapid Response Plan is a plan organized for a fast and effective post-earthquake response. The response plan has been significantly improved by trial and error of earthquake management procedures in countries such as the U.S., Japan and Taiwan. Seoul has also recently adopted a rapid response plan (Seoul Metropolitan Government, 2001). A rapid response system, consisting of an accelerometer network, a real-time observation network, an earthquake damage scenario database and a response scenario database, was planned as a part of the Rapid Response Plan. Therefore, the immediate task is to build an accelerometer network by setting up the seismographs in government and public institutions and to network these accelerometers at a minimum cost. Cooperation and understanding is essential for the city of Seoul to utilize the data from seismographs operated by KMA and other institutions.

In order to implement the plan, Seoul Metropolitan Government must soon make a substantial investment on necessary hard and software, and networking devices.

A PRELIMINARY ASSESSMENT OF SEOUL EARTHQUAKE MANAGEMENT SYSTEM

Stimulated by the Kobe earthquake, on December 6, 1995, the Korean government designated an earthquake as a disaster to be managed on the Natural Disaster Countermeasures Act. As previously noted, the Seoul Metropolitan Government initiated earthquake management policies shortly afterwards. However, it is doubtful whether these policies will be sufficiently effective in a real earthquake situations. Therefore, an intermediate assessment of the earthquake management system is needed.

Dimensions and Indicators for Assessment

Louise Comfort (1999) identified three dimensions for assessing disaster response systems: technical structure, organizational flexibility, and cultural openness or cultural values. The indicators representing the technical structure dimension are assessment of seismic risk, building codes, emergency operations center, and identification of vulnerable facilities. Indicators of organizational flexibility are national laws for disaster response, disaster response plan, knowledge base, professional staff, and available trained reserved personnel. Indicators of cultural values are shared values, commitment to goal, acceptance of new information, openness to work with other organizations and jurisdictions, information exchange, and willingness to review actions and search for information.

To assess the capacity of the actual response system following a specific disaster, researchers can assign values of "high", "medium", or "low" for each indicator. The scores for each indicator are totaled to assess the overall performance of the disaster response system. Using these indicators, Comfort attempted to assess the eleven disaster response systems following major earthquakes during 1985-1995. The earthquake response systems assessed are San Salvador, 1986; Armenia, 1988; Ecuador, 1987; Mexico City, 1985; Costa Rica, 1991; Erzincan, 1992; Maharashtra, 1993; Whittier, 1987; Loma Prieta, 1989; Hanshin, 1995, Northridge, 1994. The severity levels of the eleven cases are similar, but the degree of destruction in the affected community markedly differ. There is no clear relationship between the severity of seismic shock and degree of destruction in the affected communities. Comfort argues that different capacities to reduce seismic risk and respond to earthquakes when they do occur, are the determining factors of the scale, scope, number of deaths, and amount of damage resulting from a given earthquake.

It is not appropriate to apply these indicators to assess the capacity of Seoul's earthquake response system, since there were no major earthquakes in recent years, and therefore, it is not possible to observe the actual performance of the earthquake response system. However, Seoul has experienced other kinds of major disasters in recent years. For example, on October 1994, the Seongsu Bridge over the Han River collapsed, and over 30 people drowned. In June 1995, the luxurious Sampoong Department Store in southern Seoul collapsed. The Sampoong collapse, the worst peacetime disaster in Korean history, killed about 500 people and injured 900, so it can be assumed that the performance of the earthquake response system of Seoul is analogous to the system that dealt with the Sampoong collapse.

Assessment of Technical Structure Dimension

The overall rating of Seoul City's response system technical structure might be somewhere between low and medium. As noted above, the Seoul Metropolitan Government gradually applied earthquake-resistant design standards. According to Seoul's annual plan, every existing building is required to be examined on its earthquake-resistant design standards. However, at present, only a small proportion of Seoul's buildings and bridges are earthquake-resistant. Therefore, the score for technical structure dimension is below medium.

Assessment of Organizational Flexibility Dimension

Seoul's response system organizational flexibility might be rated as medium. Since Seoul experienced the collapses of the Seongsu Bridge and the Sampoong Department Store, the organizational dimension of the disaster response system has improved substantially. For example, three weeks after the disastrous collapse of the Sampoong Department Store, the Korean Government passed "The Disaster Control Act" that dealt with man-made or technological disasters. Under the law, the government established an anti-calamity headquarters, which is a relief organization headed by the Minister of Construction and Transportation that is designed to deal with man-made disasters. According to the law, once the government has proclaimed a disaster zone, a wide range of financial support is available for residents and for rescue activities. Although the law is criticized for separating the man-made disaster response system from natural disaster response system covered under the Natural Disaster Countermeasures Act, national laws and corresponding disaster management plans are prepared both at national and local levels.

However, there are insufficient professional staff and trained volunteers at both national and local levels. As mentioned above, the government has been engaged in structural reform and cutbacks during the past decade, and it has not hired enough professional staff and volunteers. As a result, the lead agency is organizationally weak or fragile (Comfort, 2002) for coordinating public and private organizations. Consequently, organizational flexibility dimension is rated as medium.

Assessment of Cultural Values Dimension

The score for cultural value is low. Neither citizens nor the government place a high priority on safety values. The tendency to shunt safety concerns aside for seemingly more pressing goals such as staying within budget and on time, getting something done more quickly and conveniently, still prevails in Korea. It is argued that Korea's rush for development in the 1960s caused the disregard for safety. The rush for development created the "bballi bballi", or "hurry-up syndrome", that results in faulty construction and lax enforcement of safety standards. The twin of "bballi bballi" is "daechung daechung", which means "good enough". The hurry to get things done naturally leads people to settle for what they think is good enough at the time.

Another problem is cultural openness among participating organizations. In case of an actual disaster, there have been frequent conflicts among organizations such as police, fire, public works. Consequently, inter-organizational and inter-jurisdictional actions are not effectively performed during the early stage of rapid response. It is pointed out that there has been confusion over the lead agency, and over coordinating voluntarily participating non-profit organizations and individuals. There is also conflict over decisions on the timing of moving to the recovery phase from response phase. This is very important because the lead organization during these two phases actually differs according to stipulations. The problems are aggravated since separate laws regulate natural and man-made disasters. As a result, MOGAHA has a bureau dealing with natural disasters, and MOCT has a bureau dealing with man-made disasters. It is often argued that Korea should establish a FEMA-like agency at the national level. In that sense, Seoul is moving ahead of the national government in disaster management incorporating both kinds of disasters in the same organizations.

Overall Assessment of the Earthquake management System of Seoul

Comfort grouped the eleven earthquake response systems into four sub-sets reflecting the dominant characteristics of the systems. They are non-adaptive systems, emergent adaptive systems, operative adaptive systems, and auto-adaptive systems. The four subsets provide a useful illustration of the process of transition, and the characteristics that both facilitate and hinder the emergence of self-organizing processes in an earthquake-stricken community. Comfort classified San Salvador, Ecuador, Armenian systems as Non-adaptive; Mexico City, Costa Rica, Erzincan as Emergent Adaptive; Whittier Narrows, Loma Prieta, Maharashtra as Operative adaptive; and Northridge and Hanshin as Auto-adaptive systems.

According to Comfort, emergent adaptive systems are those characterized by low technical structure, medium organizational flexibility, and emerging openness to new cultural meanings of seismic risk in their respective communities.

As such, the current earthquake management system of Seoul may fall into the Emergent Adaptive system category, so earthquake response system needs to be developed through the stage of operative adaptive system to auto-adaptive system. Operative adaptive systems are those in which the technical structure, organizational flexibility and cultural openness are approximately medium. At this stage of development, response systems evolve to enable communities to mobilize a reasonably coherent response to an earthquake. Furthermore, systems that move toward creative new actions are termed auto-adaptive or self-organizing. Such systems are high on technical structure, high on organizational flexibility and high on cultural openness to new information and new methods of action. Consequently the earthquake management system of Seoul needs to be significantly upgraded on technical structure, organizational flexibility, and cultural openness dimensions.

SUMMARY AND RECOMMENDATIONS

This article reviewed the Korean earthquake management system with special reference to the Seoul Metropolitan Government. As discussed above, the public and the policymakers considered earthquake threat as a policy problem only after the 1995 Kobe earthquake. The 1995 Kobe earthquake impelled the government to initiate public policies aimed at reducing and responding to earthquake disasters. Therefore, the 1995 Kobe earthquake served as a triggering event to set up the earthquake management system in Korea.

However, a preliminary assessment of the Korean earthquake management system reveals that the system is not highly developed in technical structure, organizational flexibility, and cultural openness dimensions. At best, the Korean system falls Emergent Adaptive Systems category. Based on this preliminary analysis, I offer five recommendations as first steps toward improving earthquake readiness.

1) It is not yet completely possible for local governments to utilize earthquake information produced by the KMA and research institutes. Consequently it is necessary to enhance the network for sharing information and coordination among the participating organizations. Local governments who actually manage disasters should especially have easy access to relevant information.
2) Lead agencies for earthquake disaster response are seriously understaffed, and it is very difficult to arrange multi-organizational coordination in actual disaster events. It is therefore necessary to immediately increase personnel in order to effectively perform multi-organizational coordination. Furthermore, it is strongly recommended that Korea establish a FEMA-like institution to assist local governments in mitigating and responding to earthquake disasters.
3) In spite of earthquake-resistant standards being gradually set up in the building codes, many buildings constructed before the regulations are not safe even in mid-scale earthquakes. Without a high standard of technical structure, the damage could be devastating in Seoul with its population of more than 10 million and numerous high-rise buildings. All buildings and structures should be inspected and reinforced according to earthquake-resistant standards.
4) It is essential for Koreans to become more safety conscious in real life situation. The "hurry-up syndrome" and "good enough consciousness" must be abolished as Korea advances toward the auto-adaptive system in disaster management. For this, it is necessary to have various kinds of training and education programs related to disaster management and safety values for the entire population.
5) The Government should make a substantial investment in an information infrastructure that will support information sharing and coordination of action among public and private organizations. According to Comfort(1999), the 'auto-adaptive system' requires a continuous exchange of information and resource with its immediate environment to maintain its credibility. A fully developed, advanced information infrastructure is needed to facilitate ease of access, storage and analysis of large amounts of information for disaster management.

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