A Step Towards Minimizing Damage from Natural Disasters

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1. Introduction

According to the IPCC Fourth Assessment Report, typhoons are growing in size and the amount of rainfall is rising, hence the increase of disasters caused by torrential rains has become a greater concern. Couple this with changes in meteorological and social conditions, such as the risk of epicentral earthquake generation in the metropolitan Tokyo area and/or Tokai, Tonankai and Nankai areas, plus increasing signs of volcanic activity, and further, depression of local area disaster prevention schemes due to the progression of low birth rates, increased longevity and consequent depopulation, the risk of natural disasters is increasing as never before. We must acknowledge that this tendency for increased risk will continue.

There are two central measures to prevent and control natural disasters: preliminary measures and response measures. Preliminary measures are for preventing and mitigating damages which could be caused by foreseeable disaster events, and response measures are for minimizing damages and preventing their outspread, and for achieving prompt rehabilitation and reconstruction activity in the disaster-stricken locations. Preliminary measures can also be classified as "preliminary disaster prevention and maintenance of disaster-prevention facilities" and "the establishment of prediction and precautionary systems." Response measures can be classified as "rapid assessment of damages," and "emergency and temporary response immediately following disasters," and "rehabilitation and reconstruction measures." Here, I would like to review the occurrence of natural disasters of recent years and introduce the survey studies by the Research Center for Disaster Management concerning preliminary and response measures.

2. Frequent occurrence of major disasters

When we consider the occurrence of natural disasters during the years 2011 and 2012, we find the frequent occurrence of serious and varied types of disasters. On January 26, 2011, Shin-moe-dake of the Kirishima mountains in Kyushu began its eruption activity after approximately three hundred years of silence. On March 11 of the same year, a 9.0 magnitude earthquake occurred off the Pacific coast of Tohoku and a large tsunami struck the Pacific coast of Tohoku and Kanto areas, seriously damaging both areas. Also in September of the same year,Typhoon No. 12 hit Kii Peninsula and caused severe landslides in 72 locations with natural damming (from landslides) in 17 locations. An urgent survey was implemented, based on the Act on Sediment Disaster Countermeasures for Sediment Disaster Prone Areas, in 5 locations of the natural damming sites that were assessed as "especially high-risk." On March 7, 2012, a landslide caused by melting snow occurred in Itakuraku-kokugawa, Joetsu City, Niigata Pref. and it completely destroyed four houses where people were living. This landslide was very peculiar in that a sliding soil mass had traveled approximately 250 meters. On May 6 of the same year, an F3 Fujita scale tornado generated in Tsukuba City, Ibaraki Prefecture inflicted damage on many buildings. Further, beginning on July 11 of the same year, a prolonged rain front unleashed a downpour on northern Kyushu causing flooding and a sediment-related disaster that covered a widespread area. Around Mt. Aso, severe slope failures and flowing debris occurred. 23 people died or were missing due to sediment-related disasters caused by heavy rainfall. The occurrence of various disasters such as heavy rainfall, volcanic eruption, earthquakes, tsunamis, melting snow and tornados illustrate the reason our country is called "a country of natural disaster."

3. Research Center for Disaster Management is making progress

Let me explain some of our efforts to prevent/mitigate damage from frequent occurrence of natural disasters.

(1) To prepare for natural disasters

In order to prevent/mitigate damage caused by natural disasters, it is necessary, on top of promoting disaster prevention measures such as maintenance of disaster-prevention facilities, to strengthen national land surveillance activity, more accurately predict the probabilities of disaster occurrences, provide sensitive information service to the municipalities and concerned residents, and support appropriate evacuation activities. Currently, in order to mitigate flooding/inundation damage caused by intense rainfall, we are conducting a study on " monitoring and forecasting systems for flood damage in integral river-basins, both inundation inside the levee and inundation by river water. In concrete terms, it is for prediction and surveillance of floodwater exposure in wide areas enabled by combining the installation of real-time surveillance equipment for

monitoring inundation depth, river water level, forecast generation utilizing a distributed rainfall-runoff model. It also provides rainfall surveillance via radar rain gauges. In the future, by utilizing existing fiber-optic networks, we plan to implement "wide area monitoring systems through fiber-optic networks" which will be able to report the status of conditions, such as the inundation level in urban areas, on a real-time basis.

The sediment-related disaster alerting information system was implemented on a nation-wide basis in March, 2008. In the event of an earthquake above level 5.0 on the Japanese scale, future issued criteria will be lowered temporarily. In light of the lessons learned from the 2011 Tohoku earthquake disaster, a study concerning the lowered ratio and a reasonable establishment method of the applicable period for quantitatively assessing the loosening of ground, is under way. There are natural disasters on a scale far outside the scope of our past experience or conventional assumptions, and multiple disasters in which earthquakes, tsunamis, flooding and/or sediment-related disasters occur at the same time. In order to cope with those disasters, studies have been made on damage and its influence on structures, formulation methods of disaster occurrence scenarios, and risk effect/assessment analysis of damage. We are currently conducting research for improvement of maintenance and control of disaster-prevention measures for infrastructure located in the midst of multiple natural disasters (with a focus on crisis management under excess external force).

(2) A step towards rapid assessment of damage

When a natural disaster of extreme severity arises, it is necessary to quickly assess its severity in order to minimize damage and prevent its outspread. However, there are times when smooth disaster-prevention support is difficult from lack of manpower or experience. Upon the request of the Regional Development Bureau and local governments, collaborative effort between the National Institute for Land and Infrastructure Management and the Public Works Research Institute will ensure experts are dispatched to disaster sites who can comprehend damage status, provide advice for the prevention of outspread damage or secondary damage, review safety of search activities conducted by the fire defense, maintain surveillance systems, and offer advice on emergency and/or tentative measures.

For massive earthquakes generated in wide areas, a study was conducted to support: quick initial response, an estimating method for seismic movement distribution based on strong motion seismograms (seismic intensity, acceleration, spectrum intensity, etc.), and from above seismic movement distribution, a method to estimate and judge the damage status of road and river facilities under our own control, and also to estimate and judge the degree of collapse-risk of slope faces. As an assessment method for determining passable roads after an earthquake, development of an evaluation method utilizing CCTV images and information from sensors installed on highway structures is underway.

A study of the method for acquiring damage information by utilizing satellite and aircraft remote sensing technology during the outbreak of wide area disasters is also underway. It is primarily aimed at improving the method for acquiring information regarding large scale landslides and/or flooded areas, by utilizing synthetic aperture radar (SAR) images which are observable even at night or in bad weather. Furthermore, with a goal of quickly acquiring deformation information of post-disaster levees, research and development of mobile-mapping utilizing an in-car, high precision/high density laser scanner is underway.

4. Conclusion

In the Fukui Earthquake of 1948 and Typhoon Vera in 1958, a single earthquake and typhoon incident each took thousands of victims. Since those incidents, laws such as the Basic Act on Disaster Control Measures, improvements of fundamental disaster-prevention facilities, provisions of disaster-preventing information and consolidations of alerting and evacuation systems have been implemented. However, in the cases of the Southern Hyogo Prefecture Earthquake and The 2011 off the Pacific coast of Tohoku Earthquake the amount of damage was massive, with thousands to tens of thousands of victims.

For disaster-prone countries, disaster prevention and control measures must form the basis of all protective activity. With "Protecting people's lives" as our mission, we must quickly and deliberately deal with the issues which will construct a strong national land infrastructure, strengthen national land surveillance functions, improve crisis management capability, enhance regional disaster-prevention power, and more. We would like to move ahead with research aimed at upgrading disaster prevention and control measures to minimize damage and prompt rehabilitation and construction of "a resilient society" which will reduce the negative impact of disaster on society as a whole.

[Reference]

(1) White Paper on Disaster Management 2012: Cabinet Office, Government of Japan