To reduce damage caused by natural disasters

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(Key words) Natural Disaster, reduce damages, monitoring/warning/forecast, evacuation on warning

1. Frequent natural disasters

Looking back on natural disasters that occurred in 2011, Shin-moe-dake of the Kirishima mountains started full-scale volcanic activity on January 26 for the first time in about 300 years; and on March 11, a gigantic earthquake of magnitude 9.0, the biggest ever observed in Japan, hit the Pacific Ocean side of Tohoku region followed by a huge tsunami causing devastating and enormous human and material damage and seriously affecting social and economic activities in broad areas centered on the Pacific coast. Turning to disasters caused by heavy rain, Typhoon No. 6 in July caused continuous heavy rain amounting to 1,000 mm in the Naharigawa River area in Kochi Prefecture, triggering a debris-flow caused by a deep landslide in Kitagawa village, and caused damage to national roads and power plant facilities. Heavy rain in Niigata and Fukushima prefectures, also in July, recorded continuous rainfall of 600 mm and more, causing more than 250 sediment-related disasters. Furthermore, Typhoon No. 12, which hit Japan in September, brought record rainfall over broad areas centered on mountainous areas from western to northern parts of Japan, especially in the Kii Peninsula, where continuous rainfall exceeding 2,000 mm caused many deep landslides and approximately 200 sediment-related disasters including 17 landslide dams. Judging from aerial and satellite photographs taken after the typhoon, it is estimated that the landslides had a volume of approximately 100 million m^3. The heavy rainfall disaster turned out to be the most serious of all heavy rain disasters since Word War II.

Approximately 70% of the Japanese land is mountainous or hilly. Its topography is mostly steep, with the geological formation being weak; moreover, there are a large number of active volcanoes, and earthquakes frequently occur. Besides, we have explained that Japan has a high risk of natural disasters because it rains heavily beginning with the seasonal rain front and when typhoons approach or make landfall in Japan. Along with the increase of intensive rainfall in a short period of time due to climate change, recently frequent large-scale earthquakes and volcanic activities including the Great East Japan Earthquake and the eruption of Shin-moe-dake of the Kirishima mountains
have occurred At the same time, regional disaster-preventive strength has weakened due to the advance of the aging society and depopulation of mountainous areas, plus natural/social changes including financial restrictions. For these reasons, we can say that 2011 was a year when we strongly felt that the risk of disasters is increasing.

2. Responding to low-frequency but large scale disasters

Based on the Great East Japan Earthquake, the Council for Social Infrastructure Development (Shakai Shihon Seibi Shingi Kai) and the Transportation System Planning Section of the Council for Transportation Policies (Kotsu Seisaku Shingi Kai

Kotsu Taikei Bunka Kai Keikaku Bukai) summarized an urgent proposal "Concept of town development to prevent tsunami disasters" in July 2011. That proposal indicated that relatively frequent tsunami of a certain level and tsunami which occur at an extremely low frequency but cause large scale disasters are to be hypothesized as targets for disaster prevention measures based on structures, and that the concept that "measures to reduce damage caused by disasters (protect human lives and reduce damage as much as possible) are executed to achieve the aim of protecting human lives by all means in whatever disasters, the large scale Tsunami may cause." The proposal also presents the fact that "disasters have no upper limit" as a lesson, and mentions that the most important goal of improving social infrastructure is "to protect the lives and daily life of people" and to consider disasters of all kinds without limiting them to measures against tsunamis; and to execute overall disaster prevention measures by resorting to all possible "hardware" and "soft" measures for reducing damage by low frequency but large scale natural disasters including big earthquakes, storms and flood damages/ sediment-related disasters caused by typhoons, in order to build up a strong foundation for the national land. Besides steadily improving disaster preventive facilities, it is becoming more and more necessary and important to improve capabilities to deal with situations caused by disasters and think of "soft" measures to support the evacuation of residents.

3. For the improvement of risk management organization

The following presents research and development which the Research Center for Disaster Management conducts in the midst of the increasing need for measures on the "soft" side - including the early grasp of the damage situation, and monitoring and warning systems for the purpose of reducing damage caused by natural disasters.

(1) Monitoring and alerting people to wide area and large scale natural disasters

In the event of a wide-area, large-scale natural disaster, it is essential to get the whole picture of the damage situation as soon as possible and to take initial responses in a proper manner. One example is the case of Typhoon No. 12 which hit Japan in September 2011. Concerning landslide dams which were formed in Nara and Wakayama prefectures, the team started investigating the damage situation on September 4, then on September 8, the team informed the affected local governments about predicted sediment-related disaster areas and the time they were expected in the form of sediment-related disaster warning information. Our team checks the formation of landslide dams, measures their shapes and performs flooding simulations in a very short time in order to have local governments issue evacuation warnings and instructions. The initial investigations when a disaster occurs are mainly investigations by helicopters or taking/analyzing photographs by aircrafts; but those investigations face challenges because night investigations are impossible or the investigations are impossible under bad weather conditions. As one method to permit investigations of the extent of damage even under bad conditions, we are developing an investigation technology that uses synthetic aperture radar (SAR), which is capable of observing disaster damage even during the night or under bad weather conditions, to monitor large scale landslides, landslide dams, flooded areas, and areas with concentrated damage to buildings and public infrastructure.

Furthermore, in order to grasp the occurrence of deep landslides as early as possible, we are developing a "Large scale landslide monitoring and warning system (tentative name)" which combines high precision rainfall monitoring by the above mentioned satellite remote sensing technology and X Band MP radar, and seismometers to sense ground vibration that is generated when a landslide occurs, etc.

In addition, to reduce damage caused by flooding in small to medium size rivers caused by local intensive rainfall, consideration is being given to a “Monitoring and forecasting system against flood damage” which combines providing real time monitoring devices for an entire drainage basin, inundation inside the levee and inundation by river water; rainfall monitoring using X Band MP radar; and river water level forecast through a distributed rainfall-runoff model and so forth.

(2) Technology for the immediate estimation of earthquake damage

Inspections will be made of facilities under management immediately after the occurrence of a large scale earthquake, but it is predicted that it should take longer to grasp the whole picture of the damage in a case where an earthquake occurs at night or in a case where the damage is spread over broader areas and where the damage is severe. For example, after the Southern Hyogo Prefecture Earthquake or the Niigata Prefecture Chuetsu earthquake, it took 10 hours or longer to grasp the entire facility damage status, resulting in a period with an information blank. In order to realize quicker initial responses to disasters, we are now developing methods to estimate the distribution of seismic motion from strong motion earthquake records (seismic intensity, acceleration, SI value etc.) received from the network of seismometers immediately after the occurrence of an earthquake, and methods to estimate damages status to facilities under our own control such as river facilities or road facilities from seismic motion distribution.

(3) In preparation for excess external force and complex natural disasters

With the focus on natural disasters including earthquakes, heavy rainfall and volcanic activities, and especially complex natural disasters from excess external force, earthquake, flooding beyond our expectations which have not been well considered, we now review damage caused and the structure of the influence of such a disaster, construction methods for disaster scenarios, and disaster risk and impact evaluations etc.; and we are considering how risk management against excess external force **and** complex natural disasters should be done or how highly robust basic facilities for disaster prevention should be planned.

4. Improvement of regional disaster-prevention capacity

We have introduced initiatives from the perspectives of understanding damage status, and of collecting and analyzing disaster information. To reduce damage caused by large-scale natural disasters, communities and residents, who receive this disaster related information, need to properly understand this information and take adequate and efficient actions without losing time. For that purpose, it is necessary to improve the disaster prevention capacity of communities and residents through disaster preventive training, practical disaster preventive drills, passing on the disaster preventive culture to later generations and so forth. For the future, we would like to work on further deepening our considerations about improving area disaster preventive capacity and construct reliable warning and evacuation systems.

[Reference]

1) [Concept of town development to prevent tsunami disasters] proposed urgently by Council for Social Infrastructure Development (Shakai Shihon Seibi Shingi Kai), Transportation System Planning Section in the Council for Transportation Policies (Kotsu Seisaku Shingi Kai Kotsu Taikei Bunka Kai Keikaku Bukai) in July 2011.