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Ⅰ. Executive Summary

The Great East Japan Earthquake, with a magnitude of 9.0, occurred on March 11, 2011, and Japan suffered tremendous earthquake and tsunami damage. Nationwide, the total area flooded by the tsunami was 561km^2, with total fatalities at 15,883, and another 2,656 persons still listed as missing. Furthermore, with regards to damage to housing, 126,483 homes were completely destroyed and 272,287 homes were partially destroyed, and damages are estimated at around ¥17 trillion.

While many businesses were damaged by this unparalleled earthquake, the construction companies, which retained their materials, equipment and their capabilities in terms of personnel, applied their extensive knowledge of local geography, terrestrial phenomena and conditions and above all their sense of mission, and commenced work to open up emergency transportation routes and build provisional temporary housing immediately after the earthquake. Since the disaster and through to this day, these companies have been fulfilling a central role in the recovery of infrastructure, the disposal of the huge amounts waste generated by the disaster and the reconstruction of towns.

Earthquakes are not the only natural disasters that occur in Japan. Japan has a long thin shape with a mountainous region running all the way through the archipelago, and as 70% of the land is either mountainous or hilly terrain, stream gradients are extremely steep. Furthermore, in addition to high annual precipitation, rainfall is concentrated in the early summer rainy season and the typhoon season, so landslides and flooding can easily occur. Even in relation to these types of disasters, construction companies perform a central role in emergency responses such as the maintenance of erosion controls and levees, the emergency recovery of roads and waterways, the removal of deposited sands, etc. and urban flooding measures, etc.

At this conference, we will be introducing the responses to disasters in Japan, focusing on the efforts of construction companies.

Ⅱ. Disaster Reduction Japan

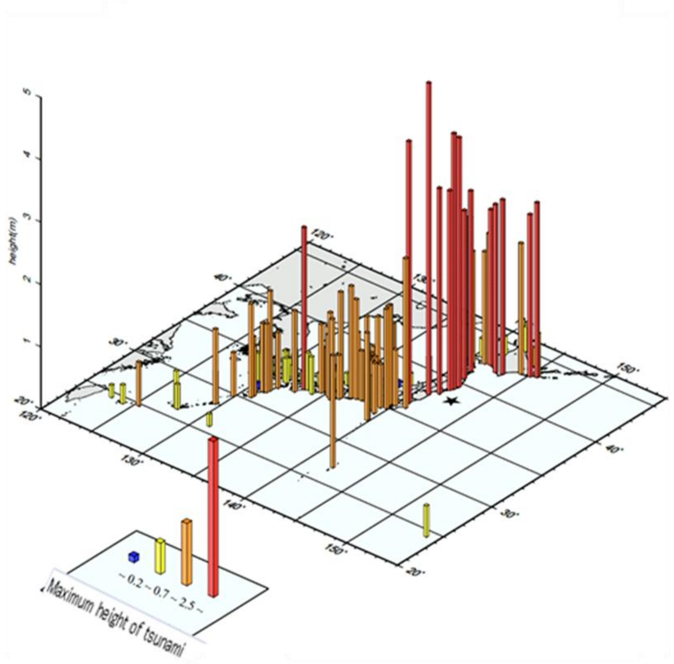
1. The Great East Japan Earthquake

(1) Summary of the Great East Japan Earthquake

① Summary of the Earthquake and Tsunami

At 14:46 hours on March 11, 2011, a magnitude 9.0 earthquake occurred off the Sanriku coast of the North-Eastern. Tremors were recorded over a wide area of Japan from Hokkaido to Kyushu, and this earthquake also triggered a huge tsunami.

Figure 1: Tsunami observation status



(Source) Japan Meteorological Agency

(Reference) Comparison with the earthquake off the coast of Indonesia/Sumatra in 2004

An earthquake, Mw9.1, occurred off a peninsula about 20km south of Banda Aceh on the Island of Sumatra, Indonesia. The maximum recorded height of the subsequent tsunami was 48.9m. The tsunami reached Indonesia, Thailand, Malaysia, India, Sri-Lanka, the Maldives and as far as the African continent, and the total number of fatalities and missing persons is said to be in excess of 300,000.

Figure 2: Major earthquakes world wide since 1950

Year	Location	Magnitude
1960	Chile	9.5
1964	Gulf of Alaska	9.2
2004	**West Coast of Northern Sumatra, Indonesia**	**9.1**
2011	**Great East Japan Earthquake**	**9.0**
1952	Kamchatka peninsula	9.0
2010	Maule Coast, Chile	8.8
1906	Ecuador Coast	8.8
1965	Aleutian Archipelago, Alaska	8.7
2005	Northern Sumatra, Indonesia	8.6
1950	Assam, Tibet	8.6
1957	Aleutian Archipelago, Alaska	8.6

(Source) Japan Meteorological Agency

② Outline of damage

The Great East Japan Earthquake was the largest in recorded history of Japan, and as this earthquake triggered a tsunami, the damages were extensive. The total area flooded by the tsunami was 561km^2, and as of February 2013, the total number of fatalities was 15,883and 2,656 persons are still listed as missing. In addition, 126,483 homes were completely destroyed, 272,287 were partially destroyed, and infrastructure such as roads and waterways were extensively damaged.

Figure 3: Damage status ①

Fatalities/missing	Fatalities: 15,883, Missing persons: 2,656
Building damage (Homes)	Completely destroyed: 126,483, Partially destroyed: 272,287
Waterway damage	2,115 sites
Levee revetment damage	Complete or partial damage to about 190km of a total 300km levee revetment through the three prefectures of Iwate, Miyagi and Fukushima of the North-Eastern
Port/harbour damage	International and important ports/harbours: 11, Regional ports/harbours: 18
Sewer system damage	Terminated sewage treatment sites: 18 (coastal sewage treatment sites in Iwate, Miyagi, Fukushima and Ibaraki prefectures) Damage to 957km of sewage pipes and rains out of 66,086km covering 137 cities and towns, etc.
Total road damage	15 expressway routes, 69 sections of national highways under direct government management, 102 sections of national highways under the management of prefectures, etc. 539 sections of prefectural routes
Area flooded due to tsunami	Iwate prefecture: 58km^2, Miyagi prefecture: 327km^2, Fukushima prefecture: 112km^2

(Source) Created from materials by NPA and MLIT

Figure 4: Damage status ②

(Source) Tohoku Regional Bureau, MLIT

(Reference) Estimated damage amounts

As of June 2013, total damages by the Great East Japan Earthquake are estimated at ¥16.9 trillion including rehabilitation of destroyed infrastructure and relocation of communities toward inland areas. The total national recovery budget for 2011 – 2013 was about ¥23.6 trillion.

Figure 5: Estimate damage amounts

Item	Estimated damages
Buildings, etc. (Housing/sites, shops/offices, factories, machinery, etc.)	Approx. ¥10.4 trillion
Lifeline facilities (Water, gas, electricity, communications/broadcasting facilities)	Approx. ¥1.3 trillion
Social infrastructure facilities (Waterways, roads, ports/harbours, sewage systems, airports, etc.)	Approx. ¥2.2 trillion
Agriculture, forestry and fishery related (Agricultural land/facilities, forestry/fishery related facilities, etc.)	Approx. ¥1.9 trillion
Other (Educational facilities, healthcare/welfare related facilities, waste disposal facilities, other public facilities, etc.)	Approx. ¥1.1 trillion
Total	Approx. ¥16.9 trillion

(Source) "Damage Estimates for the Great East Japan Earthquake", Cabinet Office

(2) Efforts of Construction Companies

① Initial response by construction companies

With the Great East Japan Earthquake, many local construction companies in the affected areas suffered serious damages, with their executives, employees and their families falling victim to the disaster. Many company buildings were damaged and their equipment and materials were washed away. However, under their own initiative, construction companies in these regions conducted surveys of damage status within their immediate vicinities, and in response to calls from government, implemented works to remove debris from roads and repair uneven surfaces, and to confirm the status of collapsed bridges. The large and medium sized construction companies established disaster response headquarters, put their cooperative systems on standby and began preparations to undertake safety checks on the properties of their customers. The dispatching of support personnel, the shipment of relief supplies and the shipment of materials for recovery works, etc. also commenced from an early stage.

Column: "Operation Comb"

"Operation Comb" involved the opening up of multiple routes from the Tohoku Expressway and National Route No.4, which run north to south in the inland areas of the North-Eastern, to the various national routes that run along the coastal areas, like the teeth of a comb, in order to secure rescue and relief routes.

Due to the unimaginable size of the tsunami, the regions along the Pacific coast suffered catastrophic damage and became isolated due to the amounts of debris generated by the disaster. In order to secure emergency routes to the coastal areas, prefectural staff, the Ground Self-Defense Force, construction companies and personnel from the Ministry of Land, Infrastructure, Transport and Tourism, worked together to break through this debris, and had opened 11 routes by the day after the disaster (12th) and 15 routes by the 15th. This enabled passage for ambulances, and police and self-defense force vehicles, allowed medical teams to gain access to the affected areas, and enabled the distribution of relief supplies.

The reason why this opening of routes was concluded in such a short time is that, following the damage to roads observed after the Great Hanshin-Awaji Earthquake of 1995, the Tohoku region implemented a seismic reinforcement measures on 490 bridges, and this was a significant factor that contributed to the avoidance of life-threatening damages such as collapsed bridges.

These opened routes also functioned as materials transportation roads for recovery works.

Figure 6: Operation Comb in Progress

(Source) Tohoku Regional Bureau, MLIT

○ **Emergency recovery**

Construction companies commenced work immediately after the earthquake and proceeded vigorously in the recovery of facilities such as roads, ports/harbours, airports, railways and waterways, etc. In addition, with regards to emergency provisional housing, at the time of the disaster, local authorities estimated the need for such housing at 52,000 units. In the construction of emergency provisional housing, local construction companies, as well housing manufacturers, sought to meet the demand, with 4,000 units built by construction companies, 1,300 units built by the Fukushima General Construction Association and 2,700 units built by another 11 construction companies. After about 6 months from the disaster, construction of 51,000 of the required 52,000 housing units had been completed.

Figure 7: Emergency recovery of Bridge (Rikuzen-Takata City, Iwate Prefecture)

(Damage status) After emergency recovery (July 12, 2011)

(Source) Tohoku Regional Bureau, MLIT

Figure 8: Emergency recovery of coast works (Iwanuma city, Miyagi Pref.)

(Source) Tohoku Regional Bureau, MLIT

Figure 9: Emergency housing

(Source) MLIT

○ Removal and disposal of Tsunami debris

As previously stated, the earthquake and the tsunami caused by the Great East Japan Earthquake generated 19.3 million tons of waste and 10.2 million tons of tsunami debris. The debris were an obstruction to the smooth progress of land utilization for reconstruction, and also constituted fire hazards, breeding grounds for harmful insects and noxious odours, early removal and disposal was necessary.

To this end, the prefectures set up “Disaster waste processing actions plans” defining processing procedures and schedules, and work is progressing with the aim of completing all waste processing by March 2014, within three years of the disaster.

For processing, the general procedure was to dismantle waste at the disaster sites, and then to transport the waste to initial temporary placement sites for rough sorting and rough crushing. This waste was then collected and transported to a secondary temporary placement site for intermediate processing (crushing, sorting, incineration, etc.), finally followed by recycling and disposal.

Joint ventures (JV) have been commissioned to undertake each disposal classification in this series of processing, and the construction companies that possess the wide ranging know-how to cover the establishment of waste disposal facilities, the improvement of foundations, the removal of various toxic wastes and responses to radiation, and recycling technologies, form the core of these JVs.

As of July 2013, 76% of disaster waste and 50% of tsunami debris had been cleared, and of the processed disaster waste, 82% was recycled.

Figure 10: Flow of disaster waste processing

① Temporary placement

② Separation processing

③ Incineration facility

④ Incineration ash recycling facility
Special chemicals are used to render incineration ash generated from incinerated waste insoluble (by sealing in heavy metals, etc.), cement is then used to solidify this ash into granules, which is then used as reconstruction material once safety has been confirmed.

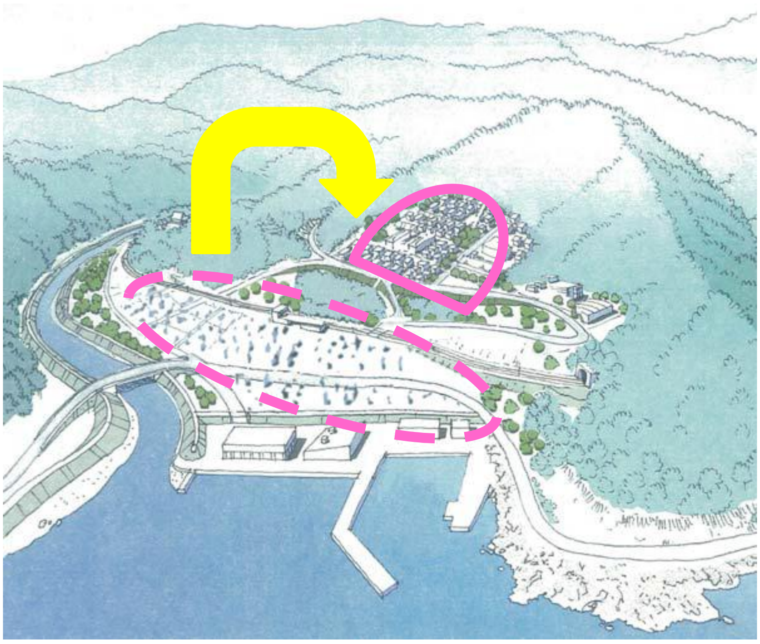
(Source) MOE, Japan Federation of Construction Contractors

○ **Town reconstruction**

In the regions that were damaged by the Great East Japan Earthquake, town reconstruction projects, such as the relocation of towns to higher ground and land readjustment are undertaken. In relation to areas where disasters occurred and disaster risk areas, with regards to residences that are located within areas that are recognised as being unsuitable for residential purposes, schemes such as those listed below are being used to promote collective relocation. As of the end June 2013, development had commenced at 119 sites; 36% of sites for which plans for such projects have been made.

It is necessary to carry out large-scale construction speedily while the workers of constructing agency is short, so the new type of contract system, CM method, has been performed instead of a previous contract system. Generally, in the application of CM method, the assistants of the contracting agency, Construction Manager, carry out various management services such as the examination of the design and the construction ordering method, process control, and the cost control. This CM method has been already utilized in 15 districts of the stricken area, and the construction companies have taken the central role.

Figure 11: Envisaged relocation to higher ground



(Source) Created from MLIT materials

③ Infrastructure contributed to damage mitigation

As seen with roads that functioned as coastal levees and levees that functioned as evacuation shelters and protected residents' lives against the tsunami, existing infrastructure demonstrated preventive and mitigating capabilities in addition to their normal functions.

○ Road as a shelter (Sendai-Tobu Road)

This road was built on an earthen embankment (7-10m), and about 230 persons evacuated themselves toward this road as a shelter, and they have escaped the tsunami. This highway structure also demonstrated a preventive function by inhibiting the flow of the tsunami and debris from penetrating into inland areas.

Figure 12: Disaster mitigation by the "Sendai-Tobu Road"

(Source) Tohoku Regional Bureau, MLIT

○Contributing to emergency transportation (Sanriku Expressway)

The Sanriku Expressway was not damaged by the earthquake or tsunami as its route was planned on high ground following consideration of a past tsunami, and consequently contributed greatly to emergency transportation, etc. and played as an alternative logistics network during the reconstruction stage.

Figure 13: Sanriku Expressway

Sanriku Expressway **National Route No.45**

(Source) Tohoku Regional Bureau, MLIT

④ Issues presented by the Great East Japan Earthquake

Although many lessons were learned from the Great East Japan Earthquake, the major issues that arose immediately after the earthquake are given below.

○ **Fuel Shortages**

In addition to the disruption of the fuel supply as roads in the affected areas were severed, the refineries of oil distributors ceased operations due to tsunami damage, and after 2 to 3 days, fuel shortages constituted a serious hindrance to recovery activities. Fuel shortages were alleviated in early April.

○ **Loss of Construction equipment**

Construction equipment suffered significant damage by seawater from the tsunami and being washed away. Construction equipment is essential to the continuous operation of construction companies and their involvement in recovery/reconstruction activities. With regards to emergency temporary housing, due to the huge volume required, there were concerns about materials shortages and completion within the fixed period was doubtful. In addition, this earthquake forced many construction companies to replace their construction equipment, and in replacing this equipment, these companies had to take on new debt on top of their existing debt.

○ **Construction company cash-flow**

With regards to construction company cash-flow, various issues arose such as issues concerning payments related to construction work conducted on sites that had been washed away by the tsunami, and issues concerning non-payment for emergency recovery work and debris removal work, etc. Aware that the assistance of local construction companies was essential to recovery, the government implemented cash-flow support measures such as the simplification of fee-for-service payments in relation to work conducted in the affected areas and increased percentage outlay for advance payments, etc. These efforts were successful, and the cash-flow and financial conditions of construction companies in the affected areas did not become as harsh as initially feared, and according to business confidence surveys, data now shows evidence of improvement since the earthquake occurred.

⑤Preparing for mega-scale disasters

Japan is a land of disasters, and the occurrence of major earthquakes such as the Nankai Trough Earthquake and the Tokyo Inland Earthquake, which will be described later, has been envisaged. Efforts that aim to prepare for future large-scale disasters through cooperation between the agencies involved, by creating business continuity plans for construction companies and disseminating/promoting greater cooperation with administrative authorities, and by establishing wide-area cooperation that extends beyond regional boundaries, are currently in progress.

○ **Creating Business Continuity Plans (BCP) for times of disaster**

In order for the construction industry to fulfill its social mission in times of disaster, construction companies must, of their own accord, maintain a stance that enables them to continue business operations. For construction companies, BCPs for times of disaster must not only minimize damage to the company and business interruption, they are also important for rapid engagement in emergency recovery and secondary disaster prevention activities demanded by local societies. The main items contained in BCPs are as follows.

(1) Creation of emergency response plans, preparation of manuals for each division
- Organization of responses that the company should undertake along a time-line immediately after a disaster occurs.
- Preparation of chain-of-command, organizational structure, emergency contacts lists, and response manuals for each division.

(2) Creation of advance measure implementation plans, and their implementation
- Creation of implementation plans for advance measures that will facilitate the achievement of target times, and ensuring the implementation of these plans.

(3) Plans to train, maintain and improve, and their implementation
- Setting forth training plans and ensuring their implementation. Evaluating results and linking this to further improvements.
- Creation of implementation plans for the maintenance and improvement of plan documents and manuals, etc. and periodic reviews.

Although the progress of these efforts toward business continuity focuses on administrative agencies and major construction companies, it is also important to promote business continuity efforts among the local construction companies to whom cooperation will be offered.

○ **Overarching, trans-regional cooperation among stakeholder**

In the event of a large-scale disaster, in order to respond to demand for cooperative action from the construction industry as a whole, centring on the prefectural constructors associations of the affected areas, proactive cooperation towards disaster recovery activities undertaken by administrative agencies, etc. through close cooperation between the Associated General Constructors of Japan, regional blocks and the prefectural constructors associations of neighbouring prefectures is necessary.

Beginning in 2008, regional constructors associations of the four Tokai prefectures of the Central Japan, set forth pre-determined rules concerning mutual support in the event of large-scale natural disasters. The four Shikoku prefectures of the Western Japan subsequently established mutual support agreements in 2012, covering wide-area disasters, so emergency disaster measures will be implemented swiftly and smoothly through mutual cooperation.

In preparation for the Tokyo Inland Earthquake and the Tokai/Tonankai/Nankai chain reaction earthquakes, etc. that are expected to occur in the near future, it is necessary to pro-actively promote mutual support agreements within individual regional blocks, prepare a structure through which the entire regional block can respond effectively.

○ **Public-private agreements**

In order to achieve swift and accurate responses in relation to disasters, it is necessary to establish sufficient advance communications between administrative agencies and the construction industry. To this end, general construction associations have concluded disaster agreements with prefectures and the regional bureaus of the MLIT covering basic items such as specific cooperative operations and cost burden, etc. in times of disaster.

Disaster agreements provide a basis for organized cooperative activity by the construction industry in times of disaster, and as such, set forth advance measures (advance information exchange, notification of implementation structure, appointment of debris processing sites, awareness/notification of available equipment/materials status), details of activities (appointment of responsible officers/operational directors, provision of equipment/materials, information gathering through local surveys, maintenance of roads/waterways and removal of obstacles, emergency recovery works), and cost burden, etc.

(Reference) Response to the Nankai Trough and Tokyo Inland earthquakes

① Nankai Trough earthquake

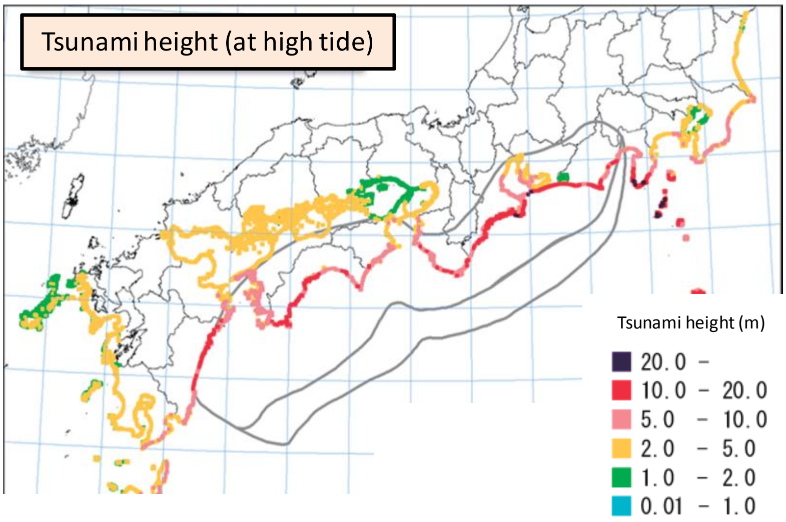
The Nankai Trough, running from Suruga Bay of the Central Japan to Kyushu of the Central Japan, is formed at the boundary where the Philippine Sea plate meets the

Eurasian plate of the Japanese Archipelago. Historically Magnitude 8 class mega-earthquakes occurred on a cycle of 100 to 150 years in the Nankai Trough, triggering three Tokai, Tonankai and Nankai earthquakes in the past. There are concerns that an earthquake will occur in this area during the first half of the 21st century.

A working group for the study of measures against large earthquakes occurring in the Nankai Trough was established under the Central Disaster Management Council headed by the Prime Minister in 2012, and this group estimated tsunami height, flood area, etc. as well as human damage, damage to buildings and damage to the economy, etc. In future, with regards to advance disaster prevention and responses and preparations for when disasters occur, this group is scheduled to promote holistic disaster prevention measures.

For more information on a simulation of a tsunami generated by a Nankai Trough earthquake, please refer to: http://www.youtube.com/watch?v=PB10ksFhhTk.

Figure 14: Maximum tsunami height



(Source) Cabinet Office “Nankai Trough Large Earthquake Model Review Committee”, material

② Tokyo Inland Earthquake

If a large earthquake hits the Tokyo metropolitan area, this will have a serious adverse effect on citizens’ lives and economic activities throughout Japan. Large magnitude 8 class earthquakes are estimated to occur in the metropolitan area every 200 to 300 years. In addition, several magnitude 7 class “Tokyo Inland” earthquakes are expected to occur and the imminent possibility of such events has been highlighted.

To this end, a working group of seismologists was established under the Central Disaster Management Council to review measures against Tokyo Inland earthquakes, and this group has summarized ways of ensuring the continuity of government operations and rescue measures for the huge numbers of workers who might be stranded, having difficulty in returning to their homes. The revision of damage estimates and measures against Tokyo Inland earthquakes, based on reviews of future earthquake distribution and tsunami height, is scheduled.

(3) International aid in the Great East Japan Earthquake

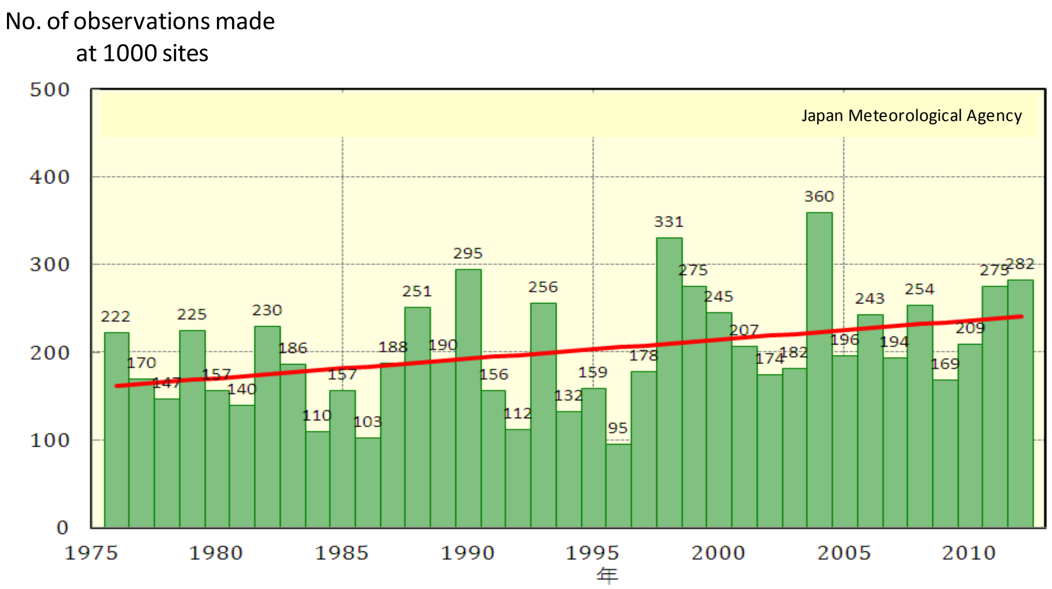
In relation to the Tohoku-Pacific Coast Earthquake, Japan has, as of December 2012, received aid from 163 countries and regions, and 43 international organizations, and has received supplies and donations from 128 countries, regions and organizations. The support provided by the rescue teams from each country, the rescue dogs, nuclear power specialists, and also the human support provided by the U.S. military in Japan, material support in the form of food, medicine and blankets, etc. and offers of assistance from over 670 NGOs, has been hugely encouraging for the people of Japan.

2. Disaster Prevention against landsides and flooding

(1) Characteristics of Japan's land and climate

The land structure of Japan is a long thin shape with a mountainous region running all the way through the middle of the archipelago. As 70% of national land is either mountainous or hilly, the terrain is precipitous and there is little sufficiently wide flat land available for habitation. Furthermore, rainfall is concentrated in the monsoon and the typhoon season, so flooding and landslides can easily occur. In recent years, the frequency of short-burst concentrated downpours has increased, and this has heightened the danger of flooding and landslides occurring. For the future, as the IPCC presides, temperature increases, greater frequency of heavy rains, increased intensity of typhoons, rising sea levels, and greater fluctuations in rainfall, etc. are expected.

Figure 15: No. of times rainfall greater than 50mm/hour has been observed over one year



(Source) Japan Meteorological Agency

(2) Landslide/flooding incidence status in Japan and measures

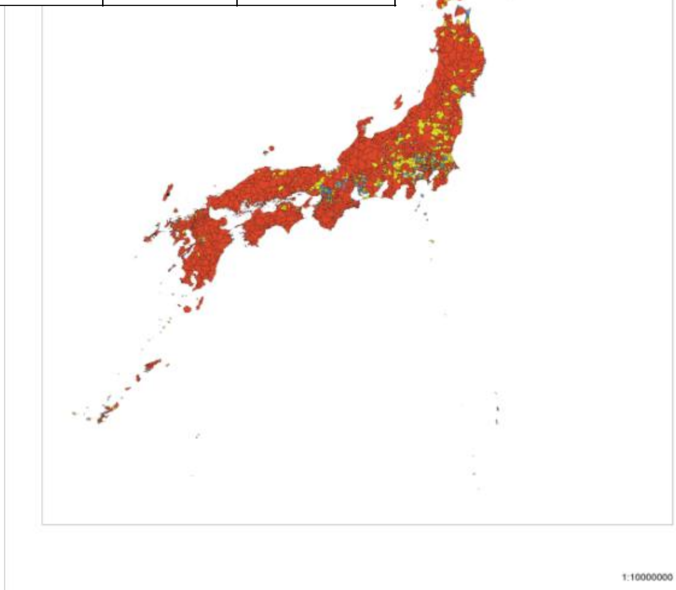
① Incidence status of landslides/flooding

The average annual number of landslide incidents occurring in Japan over the past ten years (2002 – 2012) is in excess of 1,000. A large percentage of the victims of natural disasters are attributable to landslides, which have caused enormous levels of damage. The causes of landslides can be broadly classified into three categories; "concentrated downpours", "volcanoes" and "earthquakes". The concentrated downpour that is still fresh in memory is the North Kyushu Downpour of July 2012, which caused 268 landslides and enormous damage with 23 fatalities/persons reported missing. In addition, in 2011, downpours accompanying typhoon No.12 caused an enormous landslide in the central Japan peninsula area.

Furthermore, when looking at changing trends in the incidence of short-burst downpours with over 50ml/hour rainfall and heavy rains of more than 200ml/day, both are increasing, and incidents of flooding and inundation damage, etc. are occurring. Although central and local governments have paid much effort in strengthening flood-proof facilities and have steadily improved flood control safety levels, recent extreme meteorological disasters such as the Kyushu downpour of July 2012 caused significant damage. As shown in the figure below, the vast majority of municipalities in Japan experience at least one flood or landslide per year.

Figure 16: Number of landslide disasters occurring between 2002 and 2011

	Municipalities with 10+ floods/landslides	983	58.2%
	Municipalities with 5 - 9 floods/landslides	449	25.7%
	Municipalities with 1 - 4 floods/landslides	227	15%
	Municipalities with 0 floods/landslides	41	2.3%



(Source) MLIT

② Efforts against landslides and floods, and their effectiveness

○ Landslide measures taken in relation to typhoon No.12 of 2011

- Damage caused by typhoon No.12, 2011

As this typhoon was large and slow-moving, extremely moist air flowed in around the typhoon over a prolonged period, causing record breaking heavy rains to fall over a wide area centring along the mountains from West Japan to North Japan. In some regions, the heavy rainfall exceeded 2,000mm which is almost same as total annual rainfall of usual years. General damage in the Kinki region came to 72 fatalities, 16 persons reported missing, 65 persons injured, 3,390 houses completely or partially destroyed, 4,398 inundations above floor level and 9,336 inundations below floor level (Fire and Disaster Management Agency (FDMA), March 19, 2012).

- Efforts by construction companies

Together with the approach of the typhoon, and as torrential rains fell over a prolonged period causing waterways to flood and landslides, local construction companies reacted promptly, and devoted themselves to emergency recovery of roads/waterways, etc. and the removal of earthen deposits, etc.

Figure 17: Emergency works on a collapsed road

Figure 18: Emergency removal of earth from waterways

(Source) Mie prefecture of the Central Japan

- Damage mitigated by facilities

Although landslides occurred widely as a result of downpours rainfall, many landslides were trapped by sediment control dams.

Figure 19: The effects of landslide prevention works (Wakayama prefecture)

(Source) MLIT

- **Advanced efforts in measures against landslides (Introduction of large-scale collapse monitoring and warning system)**

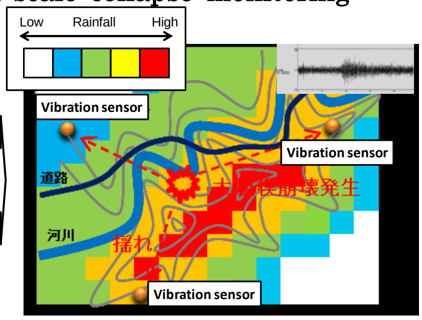
The MLIT is currently building a large-scale monitoring and warning in the regions where risk of deep-seated collapses is particularly high. This system will utilize early technologies such as rainfall radars, large-scale ground movement detection systems, and satellite image analysis to confirm collapse sites and measure the scale of collapses.

Column: Large-scale collapse monitoring and warning system

As typhoon No.12 of 2011 caused multiple large-scale landslides called "deep-seated collapses", the MLIT, working in cooperation with the relevant municipalities, employed various technologies such as vibration sensors and satellite image analysis, etc. and installed the world's first monitoring/warning system for large-scale collapses in the Kii mountains of the Central Japan, based on the recognition that a system that enables early understanding and sharing of information on location and scale when a deep-seated collapse occurs is essential to the prevention of damage.

When a deep-seated collapse occurs, vibration sensors detect large-scale ground movement. The location is estimated from the time differences in vibrations reaching 3 or more vibration sensors, and satellite radar is used to pinpoint location and measure scale regardless of time of day or weather conditions. Incidence information is shared with related parties.

Figure 20: Large-scale collapse monitoring



Incidence information shared with related parties

(Source) MLIT

○ Underground flood prevention reservoirs

In recent years, the frequency of heavy rainfalls in Tokyo exceeding 50ml/hour has increased. This type of heavy rainfall has a tendency to concentrate in particular areas and it is possible that this increasing trend in heavy rainfall frequency will continue.

For the Kanda River Basin in Tokyo, in order to mitigate inundation damage, the 540,000m^3 Kanda River/Ring Road No.7 Underground Flood Control Reservoir (Kan-7 Underground Reservoir) was installed (in 1997) under the ground below Ring Road No.7.As a result, inundation damage in the Kanda River Basin was significantly mitigated.

Figure 21: Shield Machine

Figure 22: Underground Flood Control Reservoir

Figure 23: Damage status mitigation effect of the flood reservoir (1993 and 2004)

	Typhoon No.11 (August 1993)	Typhoon No.22 (October 2004)
Total rainfall (per hour)	288(47)mm	284(57)mm
Inundated area	85ha	Less than 1ha
Inundated homes (below/above floor)	3,117 units	7 units

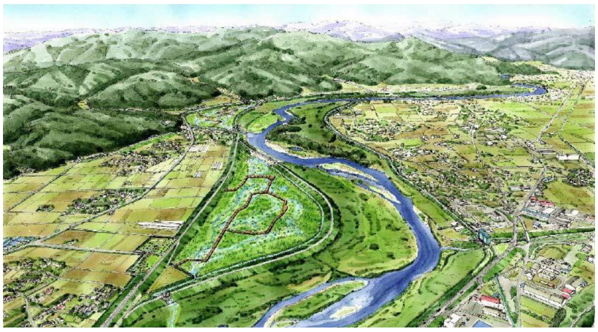
(Source) MLIT

○ **Flood control consideration for environment**

The Maruyama River in Hyogo prefecture of the Central Japan was greatly damaged by floods caused by typhoon No.23 in 2004. The occasion was exploited to implement works such as the raising of levees, the deepening of river channels and the rebuilding of bridges, etc. that would mitigate future flood damage. Further downstream, harmony with the natural environment and scenery is fully considered in the promotion of waterway maintenance, as the area is located within a national park and registered under the Ramsar Convention. The regeneration of large-scale wetland environments in the areas inside the flow of the river aims to secure wetland areas almost as large as those in the past that provided habitat for many storks (about 160ha) and regenerate high quality wetlands.

Figure 24: Downstream inundation status (October 2004 flood)

Figure 25: Envisaged wetland regeneration



(Source) Kinki Regional Development Bureau, MLIT

Ⅲ. Conclusion

Japan is a country in which many disasters occur, and every year, the occurrence of earthquakes, typhoons and heavy rains cause serious damage to citizens' lives and property. The construction companies, who are the active stakeholders in these disaster scenarios, have performed extremely important roles.

With the Great East Japan Earthquake, construction companies performed central roles beginning with initial responses immediately after the earthquake, and with regards to emergency recovery of main lifeline and public services, etc. practically completed all recovery works within six months of the March 2011 disaster.

For the accurate implementation of recovery/reconstruction following the Great East Japan Earthquake and disaster prevention/mitigation measures in preparation for future disasters, it is essential to bring together the expertise of the construction companies and related agencies, etc. and improve knowledge and technologies through international cooperation.Meanwhile, responses to anticipated disasters are also being handled with a sense of urgency. Large-scale earthquake/tsunamis that will affect wide areas, such as the Nankai Trough earthquakes and Tokyo Inland earthquakes are anticipated. The danger of flooding and landslides has also increased, and the implementation of disaster prevention/mitigation measures has become a matter of urgent need.

Multiple disasters such as earthquakes and floods are occurring in Asian countries, too. Sharing disaster related knowledge will certainly benefit member countries of Asia construct. Working towards building nations with assured safety and security against natural disaster, Japan's experience and responses will, contribute to other member countries.