

ACTIVITIES AND PRODUCTS AFTER 3.11: EFFORTS OF JAPAN SOCIETY OF CIVIL ENGINEERS

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ABSTRACT: This paper introduces the activities and the products of Japan Society of Civil Engineers (JSCE) during one year after 3.11, especially focusing on the efforts of the members of JSCE on extensive and intensive field surveys, as well as their professional proposals to the public and their contributions to the actual infrastructure policy by the government and regeneration planning in the damaged areas.

Key words: civil engineering, public interest incorporated association, infrastructure, regional regeneration, tsunami, earthquake

ABOUT US

Japan Society of Civil Engineers (JSCE) now headed by the 99th president, Mr. Takuro YAMAMOTO is a public interest incorporated association with around 30 thousand members (full members in various practical and academic fields as well as student members), which is one of the largest and longest-established engineering societies in Japan. The official establishing year of JSCE is 1914, however, modern civil engineers actively played their professional communication even before that year based in “Ko-gakkai” (the origin of the Japan Federation of Engineering Societies) which was firstly established in 1879 covering seven major engineering fields including civil engineering.

JSCE has been covering seven major fields such as I: Structural Engineering, II: River, Coast and Water Engineering, III: Geotechnical Engineering, IV: Infrastructure and Regional Planning, V: Concrete Engineering, VI: Construction Management, and VII: Environment and Energy. Having really wide academic coverage as well as widest geographical scope (from micro-meter to 10,000 km) might be one of the significant characteristics of JSCE.

JSCE is now managed by around 30 standing research committees, around 40 administrative committees, eight domestic and nine oversea branches. JSCE became a public interest incorporated association last year and identified its three basic principles as clearly as 1st: the contribution to the life and the happiness of human-beings, 2nd: the contribution to the coexistence of the nature and human-beings, 3rd: fresh look at the synthetic approach as the origin of civil engineering.

ACTIVITIES OF JSCE AFTER 3.11

Right after 3.11 the *then* president of JSCE, Mr. Kenji SAKATA convened the emergency meeting of the executives of JSCE and discussed how to tackle this huge disaster and how to professionally contribute to the public, and started its activities in organizational settings, conducting field surveys, presenting and publishing outcomes immediately, and appealing practical proposals as quick as possible under close communication and cooperation with relating public and private organizations.

Many of the JSCE's activities were conducted with hand-by-hand collaboration together with academic and practical partners of JSCE especially those such as Japanese Geotechnical Society, the City Planning Institute of Japan, the Institute of Electrical Engineers of Japan, the Ministry of Land, Infrastructure, Transport and Tourism, the governments of prefectures, cities, and towns, private companies such as East Japan Railway Company, and East Nippon Expressway Company. It must be also noted that young generations including students have really deeply contributed.

Organizational Setting-up

JSCE established “3.11 Special Committee” right after 3.11 for implementing survey and research, and for providing outcomes and proposals for the governments and the public. This committee is chaired the president of JSCE with around 30 members including the executives and the representatives of existing relating research committees of JSCE.

In order to efficiently complete these purposes nine “Mission-Sub-Committees (MSC)” were installed as follows:

- Tsunami Study MSC, chaired by Mr. Fumihiko IMAMURA
- Liquefaction Study MSC, chaired by Mr. Ikuo Towhata
- Civil Engineering for the Safety of Nuclear Power Plant MSC, chaired by Mr. Junichi TOMA
- Regional Regeneration Policy MSC, chaired by Mr. Takayuki KISHII
- Regional Anti-Disaster Program MSC, chaired by Mr. Kimiro MEGURO
- ICT-based Anti-Disaster Measures MSC, chaired by Mr. Hirohisa KAWASHIMA
- Construction Technology MSC, chaired by Mr. Akira YOSHIDA
- Consensus Building for Regional Regeneration MSC, chaired by Mr. Hidenori NOZAKI
- Crisis Management Study mission-sub-committee, chaired by Mr. Shin-Ei TAKANO

Several Ad-Hoc Programs were also started in order to tackle important special issues in a more flexible and integrated approach. The following three activities are standing at this moment.

- Comprehensive Technical Task Force on Tsunami Estimation and Disaster Mitigation, chaired by Mr. Kyuichi MARUYAMA
- “Safety and Society” Forum, chaired Mr. Takuro YAMAMOTO
- Inter-branch Cooperation Program for Regional Anti-Disaster Safety, chaired by Mr. Yoshitsugu HAYASHI

“Compilation Special Committee” was also started in January 2012 for making a series of comprehensive reports of the Great East Japan Earthquake, which is chaired by Mr. Kenji SAKATA (the president on the day of 3.11) under the cooperation with six relating scientific and engineering societies. Issues will be published step by step electronically almost within five years.

Field Surveys

Many field surveys were implemented under the umbrella of JSCE. According to the record of registration to JSCE, 65 field survey missions were sent to the damaged area attacked by the 3.11 disaster, and huge number of professionals voluntarily contributed for such surveys. Students in civil

engineering departments of various universities and schools provided significantly great contribution for field works and studies. There were three different types in field surveys.

One was “Specialized Surveys”. A typical example was “Tsunami Trace Survey” to grasp the geographical distribution of the depth and the reach of tsunami waves, which was conducted by around 300 persons along the coast from Hokkai-do prefecture of the north to Kagoshima-ken prefecture of the south (approximately 1,900 km). “Ground Liquefaction Survey” was also a good example of specialized extensive survey which covered around 50 km² of seven prefectures (96 municipalities) mainly locating around Tokyo bay. The upper mentioned Mission-Sub-Committees quite deeply contributed this type of surveys.

The second type of survey was region-wise integrated surveys mainly organized by domestic branches of JSCE such as Kanto Branch, or by the Inter-branch Cooperation Program for Anti-Disaster Regional Safety.

The third type was “Comprehensive Surveys” under strong and interactive cooperation of professionals of many different fields. This approach was strongly supported by one of the principle of JSCE: “fresh look at the synthetic approach as the origin of civil engineering”. JSCE organized such kind of surveys three times after 3.11 as follows.

The 1st Comprehensive Survey

This survey was conducted from March 27 to April 12 with multi-disciplinary specialists (coastal, structural, material, and environmental engineers, and regional and transport planners, etc.) under the leadership of the *then* president of JSCE, Mr. Kenji SAKATA as well as the strong cooperation with Japanese Geotechnical Society, the City Planning Institute of Japan. The major mission of this survey was to understand the phenomena and the damages in a holistic approach.

The 2nd Comprehensive Survey

This survey chaired by Mr. Takayuki KISHII was from April 29 to May 7 with special focus on the measures of regeneration of the damaged areas by the quake and tsunami on 3.11 by taking six typical damaged areas: Miyako city, Ohfunato city, Rikuzen-Takada city, Minami-Sanriku town, Ishinomaki city, and Towns in Sen-nan from the north to the south, which was conducted by inviting specialists of various relating fields such as agriculture, fishery, geology and topography in addition to the specialists of various fields of civil engineering including regional and transport planners. It was conducted together with the City Planning Institute of Japan. The Regional Regeneration Policy MSC was organized after this survey with the core members of this survey.

The 3rd Comprehensive Survey

This survey chaired by Mr. Hirohisa KAWASHIMA was organized from June 9 to June 11 based on the proposals of the 1st and the 2nd Comprehensive Survey which claimed the importance of the full application of new IC technologies for the regeneration of the damaged areas. It was conducted under the close cooperation with the Institute of Electrical Engineers of Japan. This survey also played the leading roll to newly construct ICT-based Anti-Disaster Measures MSC.

PRODUCTS OF JSCE AFTER 3.11

JSCE and its members have been providing many kinds of products grasped and acquired through field surveys, scientific analysis, and through professional discussions. Some of the typical products are shown in this chapter. It is also introduced how these products have been realized in the real world such as in policies, plans, projects, managements, etc.

Presentations and Publications

JSCE announced on April 23 the first message regarding the disaster mentioned by the *then* president, Mr. Kenji SAKATA together with the presidents of Japanese Geotechnical Society and the City Planning Institute of Japan. The presidents' timely comment which mentioned that we, engineers, have to be free from the world of excuse to say "*the case was beyond the assumed situation*" attracted the public support. Based on surveys and researches JSCE has been appealing many times till now after 3.11 its outcomes for the public as well as proposing professional ideas for the better technical and institutional systems for ensuring safety against earthquake and tsunamis and for the better regeneration of the damaged areas.

Scientific outcomes have been presented not just in the standing conferences of JSCE but also in the ad-hoc conferences and press conferences for the public. The number of specially designated conferences and press conferences regarding 3.11 reached 26 times including joint events with partner societies during the last one year after 3.11.

The monthly magazine of JSCE, "Civil Engineering" published three comprehensive special issues and nine field specific special issues in the last one year. The total articles regarding 3.11 topics reached more than 500 pages. JSCE is going to publish enlarged special issues in March and April 2012 in commemoration of the 3.11 disaster.

Proposals

By the 1st Comprehensive Survey on April 25th regarding Comprehensive Anti-Disaster Design

16 proposals and 7 items for further studies were shown regarding the damages of infrastructure facilities, urban areas and villages, functions of lifeline systems, and vulnerability of industrial and residential infrastructure in large conurbations. Some of the especially important proposals are shown as follows:

- Coastal protection against tsunami has to be improved especially focusing on saving people's life through hardware improvement in anti-disaster facilities and in software improvement in land-use control and suitable evacuation management. (Comprehensive Anti-Disaster Protection)
- Concept of double stage anti-disaster design which was already introduced in anti-quake design of concrete bridges should be widely applied: 1st stage of "prevention" for lower but frequent external actions, and 2nd stage of "mitigation" of saving life and to reduce damage and to shorten the required time of recovery for rare but huge external actions. (Double Stage Anti-Disaster Design)
- Anti-tsunami (or flood-tide) coastal and river facilities such as breakwaters and seawalls have to be *more resiliently* designed to be prepared against erosion by stream of huge tide. (Enhancing Resilience in Design of Anti-Disaster Facilities)
- Interregional transport facilities especially road network and ports has to be efficiently improved to ensure the reliability and to prevent regional isolation under huge natural disasters by focusing on "missing links". (Improving Reliability of Transport Network)

By the 2nd Comprehensive Survey on May 27th regarding Regional Regeneration

18 items for general and 67 items for the specific sample areas were proposed for the better regeneration of the damaged areas of 3.11. Some of the especially important proposals are shown as follows:

- Safety reconstruction, residential reconstruction and industrial (occupational) reconstruction should be well balanced in regional regeneration planning. (Balance in 3 Dimensions of Reconstructions in Regional Regeneration)
- Regeneration plan has to be designed based on large geographic scope beyond an individual city

or town to enhance the function-sharing in neighboring municipalities under the expected rapid demographic reduction. Interregional road network has to be improved in damaged areas to promote the function-sharing by ensuring the interregional mobility. (Regeneration Planning in the Large Geographic Scope)

- Reorganization and relocation of urban areas have to be promoted in such a way to avoid unsuitable dispersion and to orient for *compact cities* under the expected demographic reduction. (Urban Reorganization for Compact Cities)
- Social bond in communities (keiyaku-kai or kou system) which is still well working in fishery villages in the *ria*-coast area will be the best basis of regeneration in the area. (Regeneration based on Social Bond)
- Damaged facilities have to be selectively restored in a way of “*improving restoration*” (beyond original form restoration) to strengthen the anti-disaster performance or to enrich the usability. (Selective Improving Restoration)
- Contemporary technologies (ICT, cars, simulation technology, spatial information technology, etc.) have to be fully considered and applied for regional regeneration tightly incorporated with traditional measures. (Use of Contemporary Technologies in Regeneration)

From the 3rd Comprehensive Survey on July 13th regarding ICT-based Anti-Disaster Measures

18 items were proposed, 5 items and 4 items among which were for the immediate tackle and for the technological development as early as possible respectively. The proposals cover various dimensions from microscopic technical improvements to comprehensive orientation of social systems for example:

- Comprehensive measures to improve reliability of mobile information devices under huge disasters,
- Measures to improve the precision and reliability of tsunami detection system,
- Redesigning SA/PA in expressway and road-side rest stations (“*michi-no-eki*”) to be terminals for evacuation and logistics, or
- Round-about intersections to ensure the reliable operation even under the deficiency in electricity.

Proposals from Mission-Sub-Committees

Many technical proposals were shown off by Mission-Sub-Committees (MSCs). Followings are some of the especially important proposed items excluding the overlapped items already introduced in the last section.

- Identification of the two different class tsunami L1 (frequent class tsunami) and L2 (maximum class tsunami), and the required performance of anti-disaster facilities and systems (Tsunami Study MSC)
- Measure to set up the height of L2 tsunami by using both numerical calculation and historic tsunami trace (Tsunami Study MSC)
- Evacuation facilities and plan under the worst situation (Tsunami Study MSC)
- Regional Anti-Disaster Program which ensures minimum regional function even under super-large disasters with the least frequency (Regional Anti-Disaster Program MSC)
- Regional Anti-Disaster Program to be equipped with clear achievement target and effective management procedures (Regional Anti-Disaster Program MSC)
- Introduction of “Earthquake Disaster Assessment” (Regional Anti-Disaster Program MSC)
- Technical measures to utilize debris in the damaged area for embankment material (Construction Technology MSC)
- “Consensus Building Guideline for Urban Regeneration of the Damaged Area” to be used by municipalities and consulting firms (Consensus Building for Regional Regeneration MSC)

Realization of Proposals in the Real World

Products of JSCE from the new facts discovered by the surveys and researches to the conceptual

policy proposals have been widely reflected or realized in the real world through various activities. For example, in the Ministry of Land, Infrastructure, Transport and Tourism, Japan (MLIT), eleven committees under the deliberative councils on “National Land”, “Infrastructure Development”, and “Transport Policy” has been discussing the anti-disaster policy after 3.11 and realizing actual policies. Members of JSCE are taking the role of leadership in many of them such as in the Road Committee, the River Committee, the Port Committee, the Railway Committee, the City Planning Committee, the Environment Committee, as well as in the General Planning Committee. Many proposals from JSCE and relating organizations have been realized in the real policies on these *rings*.

One typical example of the realization of our proposals was on the newly built law of “Anti-Tsunami Regional Construction Law” (October 2011). Many ideas such as the concept of “Multiplex Protection”, “Secondary Protection Line” utilizing road / railway embankments, or “Land-use Restriction Area” were widely and deeply reflecting our proposals.

Expressway Policy Committee issued a report claiming the importance of the construction of missing links of nation-wide expressway network from the viewpoint of reliability of the national land as well as constructing the missing links in the damaged area for promoting efficient and the role-sharing regeneration of wide areas under the reduction of population. This orientation was endorsed by the Road Committee of the Infrastructure Development Council. This was also reflecting the proposals of JSCE.

The 2nd Comprehensive survey team proposed the orientation of the regeneration of the damaged areas. Many of the members of the team and the MSC were involved in the official planning committees for constructing regeneration plan of each municipality which were heavily damaged by tsunami or quakes of 3.11 after completing the survey. JSCE members are contributing in these planning committees in the two thirds of 32 municipalities. The principal mind and concrete measures of our proposals are expected to be more or less realized through these human-based contributions.

CONCLUDING REMARKS

This paper reported what JSCE has been providing up to now (February 2012). JSCE is now preparing for the new release of the outcomes and proposals of the MSCs on Liquefaction Study and Civil Engineering for the Safety of Nuclear Power Plant, as well as of the Comprehensive Technical Task Force on Tsunami Estimation and Disaster Mitigation in the near future.

One year was already past after 3.11. The author of this paper is proud to inform the readers that JSCE and its members have been making the considerable efforts for various anti-disaster measures and for the better regeneration of the damaged areas, and have been contributing to provide academic and practical outcomes to the public as shown before. However, we are still in the starting stage of the betterment path which was requested to be completely revised by the event of 3.11. JSCE promises never ending efforts for the future.