

# **Japan Society of Civil Engineers-2003 Study Tour Report**

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## **1. Introduction**

I have visited Japan on a Study Tour from September 17 through September 27, 2003 with the assistance of Fund for the International Cooperation and Exchange of Engineers of Japan Society of Civil Engineers and under the framework of cooperation between Mongolian Association of Civil Engineers and Japan Society of Civil Engineers and got introduced with the science institutions of Japan which are operational in the fields of construction and earthquake.

According to my occupation and duties, it was my intention to see the followings during my visit.

- Level and scope of the researches for decreasing risks during earthquake and natural disasters and how did they introduced to the construction,
- Features of Japanese construction sector,



## **2. Study Tour**

The objectives of the study tour are to strengthen our cooperation with Japan Society of Civil Engineers and associations and societies of other countries, change experiences and advertise latest advanced technologies and successes of construction and science institutions of Japan.

I have traveled Tokyo, Kobe and Tokushima cities in accordance with the plan developed by JSCE staffs based on our request and visited following organizations;

1. Headquarter and Library of Japan Society of Civil Engineers,
2. Construction process of 40 floor apartment building by Kajima corporation in

Akihabara station of Tokyo city,

3. Scientific institution of Kajima corporation,
4. International Institute of Seismology and Earthquake Engineering and Public Works Research Institute in Tsukuba,
5. Earthquake Research Institute of Tokyo University,

As well as, I have participated Round Table Meeting (as an observer) English Common Session of Annual Meeting which was held by Japan Society of Civil Engineers in Tokushima city as an observer and seen Ohnaruto bridge which is one of the famous bridges connecting Honshu and Shikoku islands in 3 routes.

Japan has approximately 350000 square kilometers' territory and 120 million populations. Tokyo, the capital city, has 14 million populations and is one of the biggest cities of the world. The most urgent problems of today's Japan, especially of Tokyo city, are a small territory and public transportation like many other European and South Asian countries, which have high density of population. Therefore, Japan has organized building constructions in an amazingly accurate ways without breaking the urban environment and we could see it from the researches taking place at Kajima Technical Research Institute and Public Works Research Institute and construction process of apartment building in Akihabara.

### **3. Japan Society of Civil Engineers and International Activity**

My journey in Japan began from the central office of Japan Society of Civil Engineers in Shinjuku district, Tokyo city. I met with the executive director of JSCE, Mr. Moriyasu FURUKI and the staffs of IAD and visited Civil Engineering Library there.

The Japan Society of Civil Engineers was founded in 1914 and has more than 40000 members and 11 divisions. As of 2003, it is collaborating with the associations of 23 countries those are in the same field of activity. The Mongolian Association of Civil Engineers signed cooperation agreement with Japan Society of Civil Engineers in 2002. Since then, it established cooperation with Nepalese and Indian Engineering Institute and Society. JSCE has a mission "contribute to the advancement of scientific culture and the development of society, by promoting the field of civil engineering, developing civil engineering activities and improving civil engineering skills".

It can be seen that Japan Society of Civil Engineers is paying much attention on assisting developing countries from Study Tour Grant to countries like Vietnam and Bangladesh in the recent years. Generally, the Japan Society of Civil Engineers is running international activities intensively.

As a professional and public organization, which has the membership from construction and infrastructure specialists, the society has 5 permanent publications and large library with over 30000 books in the central office in accordance with the professional improvements of its members and introducing them with up-to-date technologies.

As well as, JSCE Annual Meeting is held in every autumn and launches discussions on the problems and future goals of society. This year's Annual Meeting has been held in Tokushima city of Shikoku island and I'm glad that I had a nice opportunity to participate in this event.

#### **4. Intellectual Investment in the Construction and Infrastructure of Japan**

The territory of Japan has often suffered from earthquake, which influenced by the movements and transitions of tectonic flats of Eurasia and Pacific Ocean. Therefore, scientific institutions have been doing much for overcoming this disaster, decreasing the losses from it and protecting the people and have achieved remarkable success. The other natural disasters such as tornado, snow and ground downfall and extremely difficult conditions of ground are very harmful for state economy, especially construction and infrastructure and activities against them are also taken.

BRI and PWRI are located in Tsukuba Science City, which is about 60 km from Tokyo city. This calm and silent city, named after the Tsukuba Mountain, is one of the biggest science centers of Japan. The government provides all the necessary assistances and opportunities of achieving success. The above named 2 institutes of the government have been operational with Independent Administrative Institution status since April 2001 and it is affecting their activities positively.

##### **4.1 Building Research Institute and International Institute of Seismology and Earthquake Engineering**

My tour in Tsukuba science city took place at the biggest institute of research in the field of building engineering and technologies of Japan. It consists of the following departments:

- Department of structural engineering
- Department of environmental engineering
- Department of fire engineering
- Department of production engineering
- Department of building materials and components
- Department of housing and urban planning

and International Institute of Seismology and Earthquake Engineering.

The crew of this organization which has annual budget of 2.3 billion yens (23 billion MNT or the salary of 20000 people with average salary per annum), employs 101 (including 64 researchers) who works for fulfilling the purposes “ to advance construction and city planning technologies and systematically perform research and development activities for constructing and improving buildings and cities, and to quickly respond to issues of major public interest concerning the construction and improvement of buildings and cities “.

According to the schedule of Study Tour, we got introduced with Large-scale structural laboratory, construction testing laboratory, building foundation and ground laboratory after watching instruction video about BRI. The Large-scale structural laboratory with Reaction wall with 20x25x6.6 (WxHxT); 15x15x3.0 (WxHxT) size was the most interesting among them. The dynamic experiments on the sample of building and facility are accomplished with the help of actuator and reaction frame, which are installed to these enormous walls and their basements. The Japanese are often based on experimental results in introducing new structures to consumption and experimental samples are selected to be same as the actual operations of building structures.

The specialists of BRI are running researches for introducing high quality concrete with special accessories to the production. During the determination of the solidity of these concrete, steel profiles installed in the structure was losing steadiness and it shows that researches are much successful. Generally, BRI and all other research institutes we've visited have been very active and achieving outstanding results. Thus, it can be inferred that Japan is much more successful in fight against natural disasters than any country in the world.

The training held by JICA at International Institute of Seismology and Earthquake engineering make their contributions to decreasing risks caused by natural disasters in developing countries. This organization was founded in 1962 and has trained 1164 specialists of 89 countries during its 40 years' history. The IISEE held an annual training from September to July and 5 Mongolians were attended it. Other 2 are attending in 2003 to 2004 training.

#### **4.2 Public Works Research Institute**

The Public Works Research Institute is the biggest institute in the field of civil engineering in Japan, which has more than 80 years of history. Its Civil Engineering Laboratory was founded in 1922 and currently, it has 219 employees (including 151 researchers), 50 research laboratories equipped with advanced technologies and spends 6 billion yens' budget per year. Also, it works hand in hand with over 10 foreign research organizations and devotes much effort on providing technical assistance to developing countries through JICA.

I visited Vibration laboratory, Earthquake engineering laboratory and Dynamic geotechnical centrifuge laboratory of Earthquake disaster prevention research group, which is one of the 7 research groups of PWRI.

Vibration laboratory has 6 shaking tables and three dimensional shaking table with up to 300 tones carrying capacity and 8x8 size which is the largest among others, was created after the earthquake occurred in Hyogo-ken Nambu in January 1995. This shaking table has the potential to generate 60 cm; 30 cm displacement, 200 cm / s; 100 cm / s velocity and 2.0 G; 1.0 G acceleration in vertical and horizontal directions. These are 2 times more than the most indexes of earthquakes, which occurred in Japan in the last 25 years.

Its basement alone is 8700 tones weight and utilization expenses are extremely high that only the energy expense of one experiment estimates 1000 USD. However, it can't be imagined that how much assets of state and private enterprises and human life rescued by it.

I've got introduced with the research of improving horizontal carrying capacity of currently used multidimensional bridges during an earthquake at Earthquake engineering laboratory. Even though I'm not a road or bridge professional, the results of this research seems to be able to use in some building structures.

#### **4.3 Kajima Technical Research Institute**

Like Obayashi, Shimizu and Taisei corporations, which are the construction giants of Japan, Kajima Corporation contains 2 big research institutes, which are Kajima Technical Research Institute and Kobori Research Center. Kajima Corporation established the first construction research institute of Japan in 1949. It was Kajima Technical Research Institute. As of 1<sup>st</sup> April 2003, KaTRI has approximately 250 employees (including 63 researchers with doctorate degree) and 20 laboratories with most advanced equipment. Kajima corporation is the first in many improvements of Japanese civil engineering and KaTRI is its main reason of successes.

Kajima's experimental earthquake engineering research facilities are impressive. We have visited large size structure laboratory, shaking table laboratory, wind tunnel, three story building with base isolation and an exhibit and I must admit that I admired the Wind Tunnel laboratory. The model building where the air circulation is generated with the help of enormous ventilator with 4.3 meters' diameter was explored.

Like other Research Institutes of Japan, one of KaTRI's main research fields is improvement of earthquake resistance of the high buildings. In accordance with the structure and dynamic burden degree of building, Kajima Corporation used 9 systems such as HiDAX, DUOX, HDS and HiDAM in about 30 large buildings and it was very successful.

#### **4.4 Earthquake Research Institute, University of Tokyo**

Earthquake Research Institute of Tokyo University is the core to Japanese seismology. In its 80 year's of history, it has been playing a leading role to the modern earthquake research. It receives records from the stations located in territory of Japan and ocean by satellite network and makes estimations and conclusions after analyzing them with the help of computers and software with high potentiality besides exchanging information and experiences with international and domestic institutes.

As of April 2003, ERI consists of 4 divisions and 5 research centers.

Assoc. Prof. DOI Keiji of Earthquake Information Center who met us there introduced their researches, equipment, pop-up, long term broadband ocean bottom seismometer, 3D simulation of seismic wave propagation and strong ground motion, seismic profile line comprehensively. Earthquake Information Center has a central role of Japan University Network for the Earthquake Prediction program, making archives of all seismic data observed in Japan.

#### **5. Annual Meeting**

JSCE organizes Annual Meeting of its members and public in every autumn. This year's Annual Meeting was held in Tokushima city, which is well known for its Awa Odori national dance festival and Indigo dye textiles. The city is located in Northern part of Shikoku island and has approximately 300000 populations.

The meeting was attended by more than 6000 delegates from all corners of Japan, 8 delegates from Association, Society and Institute of Korea, China and Mongolia, which is the partners of JSCE, and 4 delegates of JSCE's international sections.

I had the opportunities to attend Round Table meeting and English common session of Annual Meeting. The main discussion of Round table meeting was International Academic journal on civil engineering field. Unfortunately, we couldn't make any important decisions.

In my point of view, Round table meeting and English common session are the evidences of intense foreign activities of JSCE.

#### **6. Construction site**

During the Study Tour, we have visited construction process of apartment building in Akihabara of Tokyo city. The organization of construction process was interesting for me. It is clear that Japan and Mongolia have numerous differences in requirements for solidity of building structure during the emergency case. Because we are extremely different in natural

effects to construction and population density. As well as, the gross domestic product of our countries differs 60 times. 319 household apartment building which is being constructed by Kajima corporation, has 30 X 36 meters; size and 40 stories, 138,8 high above the surface and with core wall and concrete column. High Damping System is used for its construction in order to minimize the earthquake effects. 140 cubic meters' of concrete is used for cover and core walls of this building daily and they are supplied from concrete plants.

The damp and warm climate of Japan makes it easier to perform these constructions than continental and dry climate of Mongolia. Most of the constructions work in Chofu and Shinjuku and other districts of Tokyo are using concretes.

## **7. Conclusion**

Japan has a very good system of standards and regulations meeting with its features. As a result, they could go through the natural disasters and difficult ground conditions than any other countries in the world and developed its construction and infrastructure in the level of world leading country.

In accordance with the high population density, the construction works are effectively organized in small fields. I think the Mongolia, which is privatizing its lands and is experiencing the increase of land price, must learn and introduce this experience.

The research works and laboratory equipments used by Japanese engineers against earthquake and tornado are the best examples for any institutes in the world.

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