April 2012 No.59
Japanese Infrastructure Newsletter

IDI QUARTERLY

Infrastructure Development Institute—JAPAN

Shin-Tomei Expressway
(Photos by Central Nippon Expressway Co, Ltd.)

Surugawan Numazu Service Area (Eastbound)

CONTENTS

Infrastructure Development Institute – Japan (IDI)
New Kojimachi Bldg, 5-3-23, Kojimachi, Chiyoda-ku, Tokyo, 102-0083, JAPAN
Tel: +81-3-3263-7813 Fax: +81-3-3230-4030 E-Mail: 1bu05@idi.or.jp Homepage: http://www.idi.or.jp/english/00index.htm

One year has passed since the huge earthquake hit Japan

A little more than one year has passed since the "Great East Japan Earthquake" and subsequent tsunami attacked eastern Japan on March 11th last year. Although the number of aftershock is gradually decreasing, magnitude 6 class aftershocks had occurred two times in March of this year, at the location within the epicenter zone. So the cumulative number of aftershocks greater than M7.0 is 6 times and greater than M6.0 is 99 times since the outbreak of huge quake last year.

The total number of disaster victims who lost their housing and obliged to evacuate from their home town due to the quake, tsunami and nuclear plant accident, has reached to 344,000. Among them, 327,000 people had relocated to the temporary housing or public housing provided by local authorities as at early April. Some 17,000 people make a living at their relative's or friend's residence, but 300 people still remain in an evacuation center.

Regarding the remaining massive disaster debris resulting from the devastation of buildings and structures caused by quake or tsunami, 97% was removed from the site to the temporary piling yards. However, only 9% of the pile-up debris was incinerated up to present. The authority of the afflicted prefecture is requesting incineration of these debris to other prefecture and municipal government and expects to complete incineration by March 2014 but facing many difficulties.

Regarding the utility lifelines such as electricity, gas, water supply and telephone, restoration work is almost completed excluding villages and settlements washed away by tsunami. National road is restored 100%, and railway trunk line is restored 98.5%. As for port facilities, berthing to the wharf became possible in every port, although some restrictions still remain such as draft, cargo load, partial facility use.

The original targets of restoration immediately after the outbreak of a disaster, i.e., "The restoration of damaged infrastructure that requires quick response", and "Securement of housing for the disaster afflicted people" are just about completed. From now on, we will step up to the full-scale restoration stage based on individual local requirement and restoration program.

Debris was removed from the site and piled at the temporary pilling yards

(photos by IDI)

"Tough-Road" construction method

Economical reinforcement of the road situated on the ground where liquefaction is predicted at an outbreak of earthquake

Obayashi Corporation has developed a construction technology named "Tough-Road" construction method that can economically reinforce the road on the soil, which is prone to liquefaction once an earthquake occurs.

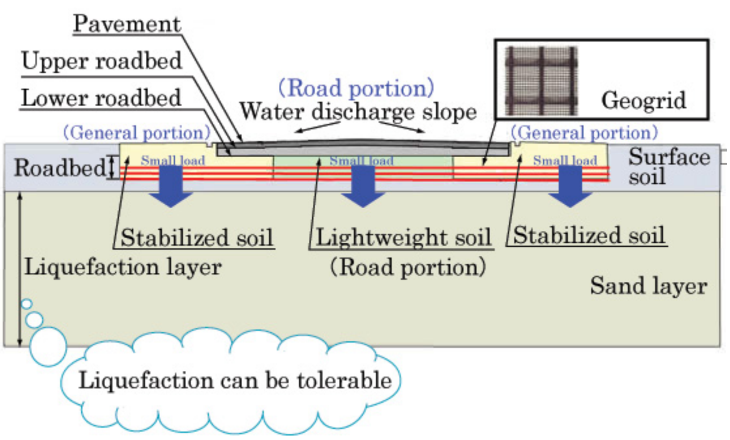
At the Great East Japan Earthquake occurred in March 2011, ground liquefaction damages were observed in the wide coastal areas alongside the Pacific Ocean. Soil liquefaction is the phenomena that the sandy soil containing water or the soil with high level of underground water strongly moves like liquid, triggered by earthquake's energy. And eventually sand containing water blows out from underground to the surface; leading to damages of buried clay pipes and manholes coming out to the ground, and tilting of housings and buildings may occur.

Ground liquefaction tend to occur at coastal areas as well as river basin. So many ground liquefactions were observed at the reclaimed land in the waterfront areas, where many factories and warehouses are located. While business enterprises there are obliged to take anti-liquefaction measures in the road of their premises in order to secure safety traffic flow after earthquake, the conventional anti-liquefaction construction method requires complex construction procedures, and a lot amount of time and money.

The newly developed "Tough-Road" construction method is an economical anti-seismic reinforcement technology that utilizes geogrid and lightweight soil to reinforce the road on the basement subject to liquefaction. Paved portion of the road is heavier than the surrounding soil in general, so once liquefaction occurs, the soil directly beneath the pavement spreads out to peripheral areas due to weight difference and that causes deformation of the paved road. In this method, replacing soil underneath the road by the lightweight soil, road can balance with the surrounding soil. Also this method can prevent extreme road sinkage or uplift, by reinforcing whole roadbed with geogrid system. Although liquefaction will occur at the underground portion beneath the surface soil, the surface portion of the pavement is flat and water discharge slope can be hold, so traffic flow can be maintained as usual even after quake.

In this method, anti-liquefaction countermeasures are not necessary for the portion of underground deep sand layer, construction cost can be reduced by 30-50% comparing with the least expensive conventional method (Sand Compaction Pile Method) and construction time can also be shortened.

From the ecological point of view, industrial by-product such as clinker ash and granulated slug can effectively be utilized by using these materials as a lightweight soil required for this method.



Contact

Satoru KAWAUCHI

OBAYASHI CORPORATION

E-Mail: kawauchi.satoru@obayashi.co.jp

Tel: +81-3-5769-1254

Fax: +81-3-5769-1962

A part of the "Shin-Tomei Expressway" opened to traffic

162km of the "Shin-Tomei Expressway" opened in Shizuoka prefecture on April 14th, 2012. The Shin-Tomei Expressway has two lanes each, running north parallel to the existing "Tomei Expressway" linking Tokyo and Nagoya.

The completion of the Shin-Tomei Expressway creates a double network with the Tomei Expressway. The interconnected expressways allow drivers to choose either route depending on traffic conditions. The new expressway alleviates traffic congestion on the existing Tomei Expressway and serves an alternate route in case of natural disasters, all of which contribute to building greater reliability. Since the new expressway runs at higher altitude and lies more inland than the Tomei Expressway, it is expected to be unaffected even if strong tremors and massive tsunami are caused by the coming "Great Tokai Earthquake".

Gentler curves and gradients compared to the Tomei Expressway are the largest structural feature of the Shin-Tomei Expressway. The minimum radius of curvature is 3,000m, and the maximum gradient is limited to 2%, for a safer and more eco-friendly driving.

Closed-circuit television cameras installed every 2km apart along the road monitor and analyze the situation of the road ahead. Once cameras detect car accidents or obstacles, such information is instantly transmitted through DSRC (Dedicated Short Range Communication) to various information supply devices such as roadside traffic information boards and on-board DSRC devices.

The Shin-Tomei Expressway, passing through mountainous areas, required the construction of a number of large-scale bridges and tunnels. In the construction stage of these structures, the latest technologies and construction methods were introduced to ensure the safety and quality of the structures and to minimize the construction cost.

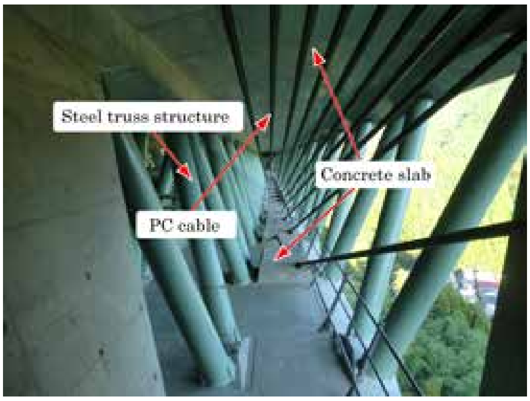
The "Sarutagawa Bridge" and the "Tomoegawa Bridge", elevated viaducts that received "Bridge and Structural Engineering Award" from the Japan Society of Civil Engineers, are rigid-frame, PC (Pre-stressed Concrete) continuous composite truss bridges with a maximum span of 119m. The total length of the section is 1.2km: 610m-long Sarutagawa Bridge (7 spans), 479m-long Tomoegawa Bridge (5 spans), and 60m-long earthwork section in between. This type of technology was adopted for the first time in Japan. The use of the lightweight composite structure combining pre-stressed concrete slabs and steel trusses reduced the weight of the bridges compared to a conventional concrete bridge and saved materials for bridge piers and foundations. These latest technologies made the construction process simpler and more efficient, thereby resulting in the cost reduction. The scenery visible through the truss structure

Tomei Expressway and Shin-Tomei Expressway
Figure by Central Nippon Expressway Co. Ltd

alleviates oppressive feeling caused by heavy concrete structures, making the bridges a unique landmark in harmony with the surrounding.

Environmental considerations have been high on the agenda of the Shin-Tomei Expressway project. During the construction stage, impacts to the environment were carefully examined and materials were reused or recycled. The energy efficiency and renewable energy also belong to priority areas. For example, the Shizuoka Service Area (rest area) is expected to reduce its electricity/water consumption to a half of that of a conventional rest area by introducing solar power, geothermal heating and cooling system, thermal insulation of building walls and utilizing rain and recycled water. This is equivalent to 750 tons of CO_2 reduction per year. The recycling of cooking oil from the rest areas has also been encouraged. The oil is refined at the biodiesel manufacturing plant and used as fuel for expressway maintenance vehicles. This will reduce 190 tons of CO_2 emissions per year.

As for the uncompleted sections of the new expressway, the west-bound (Nagoya-bound) sections and the east-bound (Tokyo-bound) sections are scheduled to be opened in fiscal year 2014 and 2020 respectively.



Sarutagawa Bridge and Tomoegawa Bridge (Photos by Central Nippon Expressway Co. Ltd)

Flood protection projects implemented in Niigata Plain

A lot of river flooding damages are occurring in the present world now. But historically speaking, mankind had constructed villages and towns at the location close to the river mouth which is exposed to flooding disaster. This is because they need to search for a fertile land and fresh water. Focusing on the countermeasures against flooding, we will introduce the past and recent case examples which were adopted by the Japanese communities.

Niigata city is one of the major cities facing the Sea of Japan and is the capital of Niigata prefecture. The city is located in the Niigata Plain and the altitude of the flat land is less than 5m, and also big two rivers (Shinano and Agano River) are flowing through the middle of city and flow into the sea, hence the flooding risk was quite high. In the past, flooding disasters were repeated in Niigata city and surrounding areas. Heavy flood periodically hit this area, i.e., once in four years up until 19th century.

In the past, civil works has been conducted in order to change the river flow in this area from 16th century. Among others, the most outstanding project is the construction of "Ohkouzu Diversion Channel", which partially diverts the flow of Shinano River directly into the Sea of Japan at 58km upstream point from the Shinano river mouth before the floodwaters enter into the Shinano Plain. This project was completed in 1922.

In 1972, "Sekiya Divertion Channel" was constructed at the west side of Niigata city that connects Shinano River to the Japan Sea also to divert floodwater.
This channel alleviates not only flood damage in Niigata city, but also contributes the prevention of sedimentation deposition of the port and coastal erosion of the beaches.

In recent years, torrential rain caused by abnormal weather is frequently occurring.

In August 1998, Niigata city was struck by the heavy torrential rainfall with 97mm/hr, and 10,000 houses were inundated.

Another torrential rain that hit Niigata prefecture on July 13, 2004, the rainfall during 24hours exceeded more than normal year's average monthly rainfall and the cumulative rainfall reached 647mm, as a result, 15 persons were killed, 20,000 houses were inundated and embankments at 11 points were breached. Following this bitter disaster experience, actions shown below were taken.

Fig. 1 Overview of the river basin of Shinano River
(Figure by The Shinano River Work Office, Ministry of Land, Infrastructure Transport and Tourism:MLIT)

Fig. 2 Ohkouzu Diversion Channel
(Photo by Hokuriku Regional Development Bureau, MLIT)

・Strengthening of the existing river bank: Newly-constructed river bank, Raising of the river bank height, Bank protection work, Leakage protection of the embankment

・Straightening of the S shaped river to achieve smooth river flow while flooding

・Try to drain out the floodwater, by dredging river bed, and by widening the river width

・Installation of the flood control basin, at the upstream of urban area, in order to alleviate the over duty of river flowing capacity

Fig. 3 River Channel and Levee Improvement

(Figure by Niigata Prefecture)

Among 15 victims suffered in the torrential rain in 2004, some of them were elderly people trapped in their inundated houses, others were pedestrians escaping from flood. Therefore, emphasis was placed on how to transmit flood information to the local residents and how to improve evacuation methodology.

The basic principle to cope with the flooding disaster is the early evacuation. Meteorological forecast and warning is issued when necessary through mass media such as TV, radio, internet and others. Local residents should pay attention to this information and should fend off the disaster. The hazard map shown in Fig. 4 illustrates not only local flood depth but also indicates in more details; to which floor flood reaches in your house, and how many hours the flood water remains in your area. Once people get this information, they can judge whether staying in the second floor is much safer than going out for help or not.

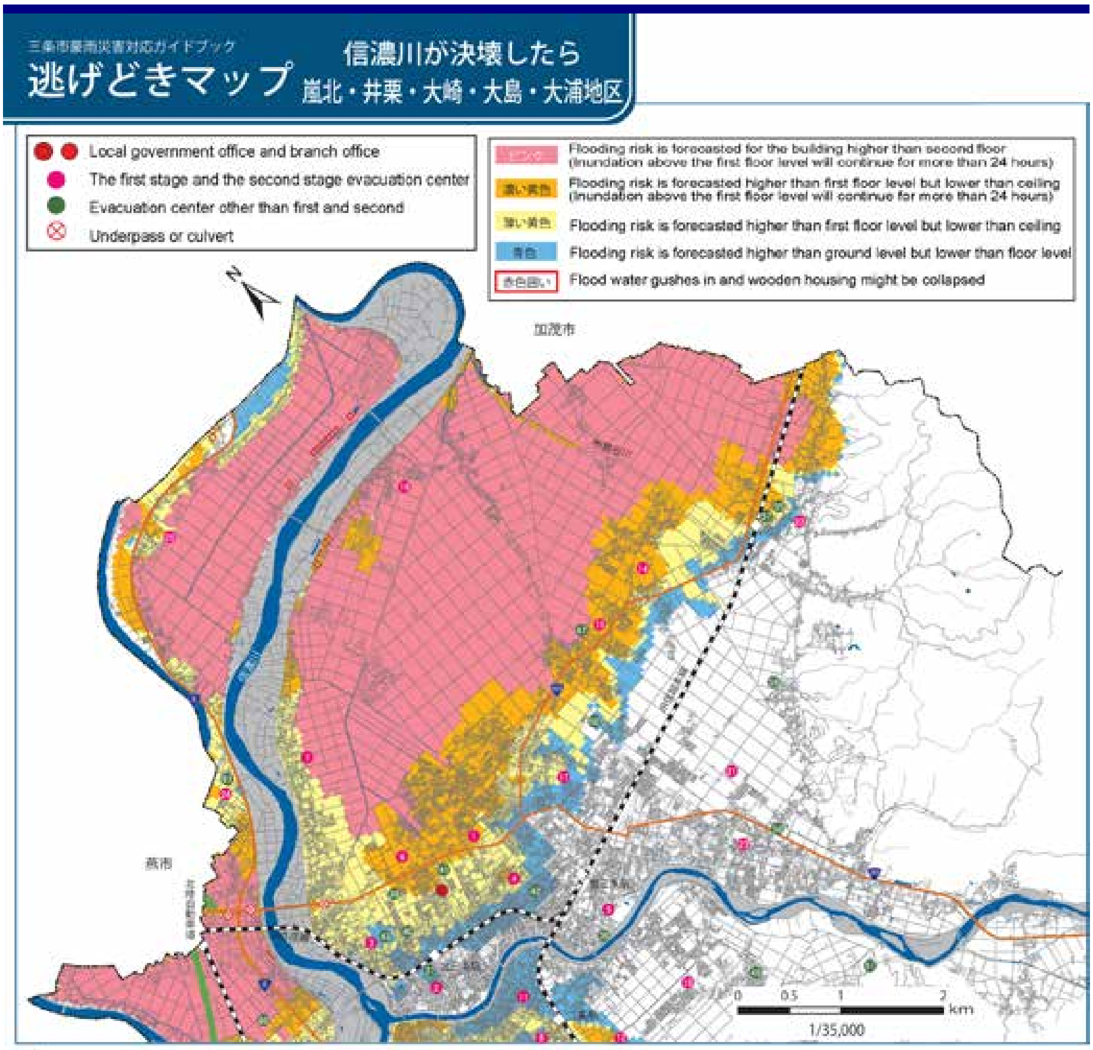


Fig. 4 Hazard map of Shinano River in Sanjo city

(Figure by Sanjo City)

For the elderly people, disabled people and people who require nursing care, in order to urge early evacuation, local authority lend out emergency notification FM radio, that automatically switch-on in emergency, and catch the broadcast and convey messages and orders for the evacuation in a big sound.

Last year, in July 2011, Niigata prefecture was again hit by the heavy torrential rain, and cumulative rainfall had reached 1,006mm, which is 1.6 times higher than the previous record of July, 2004. Although record breaking water level, higher than 2004 record, was observed in some water level observatory at the downstream of Shinano River, flood damages were far less than 2004 flooding. This is due to the effort to enhance flood-control capability since 2004, as well as improvement of an emergency evacuation system. The damaged houses at the downstream of Shinano River basin were 421, which is 90% less than damages in 2004, and the death toll remains just only one.

This case example was presented at the “Sixth World Water Forum” convened in Marseille, France, at March, 2012, by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and Infrastructure Development Institute, Japan (IDI).

About IDI and IDI-quarterly

The Infrastructure Development Institute (IDI)-Japan is a not-for-profit organization
IDI provides consulting services for Japanese official development aids (ODA), facilitates exchange of specialists around the world and exchange information about both developed and developing countries in the field of infrastructure.

IDI has been publishing the free quarterly journal “IDI Quarterly” since1996 for the purpose of introducing information relating to our public works and construction technology to foreign countries. We have distributed the journal to administration officials in more than 90 countries around the world by e-mail.

We also welcome project information from your country. If you have a manuscript, please send to us. We may include it as an article in our journal IDI-Quarterly. Please refer an example article “Water Pipeline Projects” from Mongolia. (Refer IDI Quarterly No.52).
If you have an interest, send manuscripts to us according to the instructions below.

Instructions for contributors:

- Texts must be written in English within 800 words.
- Ms-word.doc or text.txt files are acceptable.
- Figures and photos should be supplied in an electric format.
- All manuscripts will undergo some editorial modification.
- The editor reserves the right not to publish manuscripts that are not appropriate for this journal.
- Manuscript fee will not be paid.
- Please send manuscript files to “1bu05@idi.or.jp” by e-mail.