Study Trip Report on

ISHINOMAKI HARBOR COMBINATION GOVERNMENT BUILDING

By: ZHANG Lifen, Kyi Kyi Swe (S-course)

On March 11th, 2011, a massive earthquake with moment magnitude Mw 9.0 occurred off the Pacific coast of the northeastern part of the Japanese main land (Tohoku Region), which is the largest in Japan up to the present. According to Japan Meteorological Agency, this earthquake epicenter is located approximately 100 km off Miyagi at focal depth of 24 km. This event caused huge destructive damages and had a maximum seismic intensity 7 observed in Kurihara City, Miyagi prefecture. Because this earthquake occurred in the sea, tsunami wave was generated in the Pacific coast from the Hokkaido to the Tohoku and the Kanto regions.

6 months after the giant disaster, the seismology group and the earthquake engineering group obtained the opportunity to visit the most seriously affected area. This study trip lasted for 3 days, from 5th to 7th, September. During this study trip, Dr. Ando, Dr. Shibazaki, Dr. Kashima, Mr. Kanai and Mr. Ajima accompanied us. In this report, we will only focus on the damages of the Ishinmomaki Harbor Combination Government Building.

1. Observation Area Introduction

The Ishinomaki harbor combination government building is located to the north of the Ishinomaki bay. It is very close to the bay, only about 120 m or so. And a storage building is also situated to the north of the bay (Figure 1). The distance between this storage and the bay is about 100 m. Therefore, we can imagine how serious the two buildings were affected by tsunami.

Figure 1. Location of the Ishinomaki Harbor Combination Government Building (Google)

2. Damages of the Ishinomaki Harbor Combination Government Building

The Ishinomaki Harbor Combination Government Main Building is a 2-story frame building (Figure 1(b)). In this area, tsunami came around 1 hour after the Mw9.0 great Tohoku earthquake occurred. Based on the field observation at the Ishinomaki government main building, where the tsunami

reached to the second floor, the water height was about 3.8 m. The building was damaged mainly by tsunami, but the earthquake also had big influences. From Figure 1 (c), we saw that this earthquake caused serious scouring, which led to the building subside about 1 m. In addition, the fence of the building was collapsed due to the scouring.

(a)The gate of Ishinomaki harbor combination government building; (b) Front view of the building; (c) Side view, collapsed fence, and the building subsided due to scouring.

Figure 1. Building damages due to Tohoku earthquake and tsunami.

In Figure 2(b), the huge damage caused also by tsunami can be seen. The wall of the affiliated building was totally cracked due to the high water pressure. And from the backside of this building, it is easy to observe the damages both caused by tsunami and scouring (Figure 2 (a) and Figure 2 (c)). The house nearby the affiliated building tilted about 10˚ due to scouring (Figure 2 (a)).

(a)The affiliated building was seriously damaged by tsunami; (b) Front view of the affiliated building; (c) Scouring caused by earthquake.

Figure 2. The Affiliated Building damages due to Tohoku earthquake and tsunami.

Inside the main building, the clock on the wall was stopped at 3:49 (1 hour after the Mw9.0 Tohoku earthquake) (Figure 3(a)). And on the first floor, the ceilings fell down due to the earthquake and tsunami (Figure 3(b)). According to the observation on the spot, we found the tsunami water reached to the second floor, and the measurement results showed the tsunami height was about 3.8 m (Figure 3(c)).

(a)Clock stopped due to tsunami; (b) all the ceilings collapsed; (c) tsunami water height reached the second floor with height of 3.8 m.

Figure 3. Inside view of the main building damages due to Tohoku earthquake and tsunami.

3. Damages of a Warehouse

After that, we visited another building, which was opposite to the Ishinomaki harbor government building and the distance between the two buildings was around 100 m. From Figure 4(a), we found that the wall of the building was strongly damaged by tsunami. The wall was broken. It seemed like there were very huge horizontal pressure pushing the building. And the steel pole connecting the upper part and the lower part of the wall was broken. If we saw it carefully, it was not difficult to see that the basement had some cracks and rotation.

(a)Side view of a warehouse; (b) the basement cracked and rotated;
(c) Front view of the warehouse.

Figure 4. Warehouse damages due to Tohoku earthquake and tsunami.

4. Conclusion

Through this study trip, we really witnessed the destructive damages caused by this giant Tohoku earthquake. The buildings close to the coastline were seriously damaged by tsunami. However, in the case of Japan, many people live nearby the coastline. So, how to protect their lives and asset safety is a very essential, important and urgent topic. Although great progress has made in technology, we still have great difficulties in disaster mitigation and prevention. Citing Mr. Goto's words, "residents in coast areas judge the tsunami by their experience, using their eyes, noses, ears, mouths and brains". As engineers, we should also give more consideration to the knowledge and response from the local residents. When making disaster mitigation design and decision, we should depend not only on theory which we have learned, but also on their real experiences.