

Project Study on the Effective Countermeasures against Earthquake and Tsunami Disasters

Bulletin (No. 3)

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Study Team Conducted the Field Survey

The Study Team members conducted the field survey in Miyagi, Iwate and Aomori Prefectures from April 21 to 23, 2011 to understand the situation of damage, emergency response and evacuation shelter operation. The team visited the affected sites and conducted brief interviews with the officers of Shichigahama Town, Miyagi Prefecture and the principal and the teachers of Yamada High School, Iwate Prefecture.

1. Schedule of Field Survey

Date	Area	Program
21 April	Miyagi	Meeting with Tohoku Univ. Natori (Sendai Airport) → Sendai (Wakabayashi-Ward) → Shichigahama (Interview)
22 April	Miyagi Iwate	Kesennuma → Rikuzentakata → Ofunato → Kamaishi → Otsuchi → Yamada (Interview) → Miyako (Taro)
23 April	Iwate Aomori	Nodamura → Kuji → Taneichi → Hachinohe → Misawa

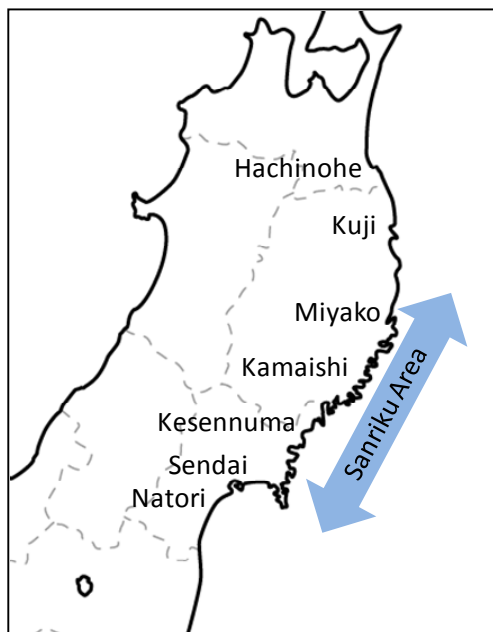


Figure 1 Visited Area

2. Field Survey

After discussions with Prof. Imamura, Tohoku University, the study team members visited several locations within the affected area which have different characteristics of tsunami damage.

The team started the field visit from South of Sendai (Natori city and Wakabayashi Ward, Sendai City).

These areas are located in the Sendai Plain and the tsunami with the maximum height of 10 m at the coastline reached about 4 km (in average, maximum 6 km) inland from the coast as the area has very flat topographic features.

Since the area is very convenient to commute to Sendai City, housing development was active and land use has changed recently from paddy and crop fields to residential areas. Due to this situation, human damages (deaths and missing) reached about 2,000 for these areas (as of April 23, 2011). In addition to the human damage, wide areas of paddy and crop fields were damaged as agriculture is still one of the main industries of the area.



Photo 1 Damaged residential area and surrounding agricultural fields

On the Day 2 and Day 3 of the field survey, the study team visited Sanriku area. According to the result of the tsunami survey conducted by the research group, the tsunami height mostly exceeded 10 m in these areas and the tsunami run-up height exceeded 30 m in some parts.

Sanriku Area has the “ria’s” type coastline. Because of these topographic features, many of the bays in Sanriku have been utilized as ports and cities and towns have been developed at the heads of the bays. The tsunami hit these areas and caused serious damage to human life and infrastructures even though these areas have relatively high awareness regarding tsunamis acquired through previous tsunami experiences and countermeasures to mitigate tsunami damage have been implemented.



Photo 2 Sea wall collapsed and residential area was washed away



Photo 3 Sign Board of “Estimation of Tsunami Inundation Area”, however, the tsunami reached more than estimated

3. Interviews

3-1 Shichigahama Town

The city was historically developed as a fishery village, but recently it has been developing as a town for workers commuting to Sendai City.

Damage Overview

The number of deaths and missing people is 74 from among the 20,991 of city population. This number of casualties is relatively low, compared with other neighboring cities. This is because most houses are located in hill areas. Also, people could escape from the tsunami to nearby high places easier than in other cities. Because of the tsunami, 650 houses were totally damaged, 300 houses were partially damaged, and 70 houses were inundated. Damages due to the earthquake’s upheaval were not reported.

Disaster Management Plans/Activities

The city government and communities did not prepare for this scale of tsunami. The observed height of the tsunami was 12.1 meters, while the predicted tsunami had a 3.5 meter height. The risk area portrayed on a hazard map produced before the disaster is much smaller than the actual damaged area. While the hazard map indicates narrow areas a few hundred meters in width along the sea coast as risk areas, the tsunami devastated all low land areas in the city, or some one third of the total area of the city, covering two kilometers inland from the sea at the furthest point. Also, the last tsunamis in 1933 and 1960 caused only small damages. The city hall is located in a hilly area, and was not damaged in either of those two tsunamis, but two members of the city government staff lost their lives.

The city government revised their disaster management plan in March 2010, and produced a contingency plan in September 2010. These documents were useful for staff response to the disaster. The city government produced a manual for managing evacuation shelters in March 2010. This manual was not utilized, since they did not have time to share the manual with staff before the disaster. Twenty Jishubousai-Soshiki, a community-based

organizations for disaster management, formed before the disasters, and have annually conducted disaster management drills.

Early Warning and Evacuation

Tsunami information and evacuation orders were issued as follows:

- 14:46 Main shock of Earthquake
- 14:49 Japan Meteorological Agency issued a tsunami warning predicting over three meter high tsunamis
- 14:50 Communication towers did not function because of power failure, therefore, the city government announced an evacuation order by employing vehicles from a firefighting organization and personnel from community based firefighting organizations.
- 15:51 The first wave of the tsunami arrived.

Emergency Response

The city government prepared for evacuation of 1,000 people before the disaster. At the highest, 6,143 people, which is over six times the number planned for, were evacuated to 36 sites on 12 March. The government faced difficulties in distribution of food and other materials. As of 20 April, 731 evacuees were still lodged at three sites. One hundred fifteen temporary shelters will be constructed before 28 April. Thirty five shelters will start construction.



Reinforcement of the building was done in recent years
Photo 4 Shichigahama City Government Building



Photo 5 Interview with city official

3-2 Yamada High School

After the Earthquake

When the earthquake struck, the school had finished regular classes and many of students were in club activities. After the earthquake, electricity was cut off, but warnings of imminent disaster through the wireless loud speaker, which is operated by the city government, could be heard. Since the electricity was cut off, information on tsunami was limited and only digital television for mobile phones was available. It showed the tsunami wave in Miyako city, but it was hardly believable that it could come to Yamada city.



Photo 6 Yamada High School Overview

Since Yamada high school had not been designated as an evacuation site by the city government, the school teachers were not trained for evacuation site operation. At the instruction someone from the city diet members, food and heaters were prepared. Moreover, since the school has a facility for cooking and a training camp, it made possible to accommodate evacuees.

Many of people escaped from the tsunami to the hill side of the city reached the school and asked for help there. Although the school was not a designated evacuation site, the school received the evacuated people and they were directed to a gymnasium or a lecture hall. There were about 600 evacuees in the first day.

Operation of the evacuation center

Since Yamada High school had a sufficient space to accommodate many evacuees, the number of evacuees reached about 1,400 persons on fourth day after the earthquake. An evacuees list was prepared by the school teachers and the teachers took care of the evacuees as they are familiar with the facilities.

No information came to the school for a couple of days after the earthquake because of no electricity. The official from the city government finally came to the school 3 days after the earthquake. The main task was to communicate with the disaster management headquarters at the city government and with the self-defense force.

The most serious problems for keep the school as evacuation site were to secure drinking water and water for the toilets. Drinking water was provided by the self-defense force, and the water for the toilets was dipped up from a fish breeding pond and brought to the school by car.

The evacuees were asked to take care of themselves and to formulate associations for the evacuees after a week.

Preparedness on Disaster

As mentioned above, the school was not designated as the evacuation site, site operation trainings were not provided for the school teachers and workers. Only limited disaster management trainings for fire and earthquake have been conducted at the high schools.

4. Findings

1. Most of the damage is caused by the tsunami, earthquake damage was limited. It is also found that characteristics of damages were different between the south



Photo 7 Evacuation Center (Gymnasium of Yamada High School)

- of Sendai and Sanriku area because of the different topographic features.
2. A disaster management plan at city level was prepared by the city government. The plan can be used at the disaster response phase. However, many unexpected things happened all at the same time; for example, electricity cut, lack of gasoline, lack of information and lack of logistic supply etc.
3. After the earthquake, city officials faced great stress because much work needed to be done in a short period and simultaneously.
4. In general, the height of the tsunami was greater than was expected. Many procedures and plans were based on the lower predictions; therefore, the plan should be modified based on actual conditions.
5. The high school was not designated as an evacuation site even the school actually acted as the evacuation site because the school is owned by the prefectural government, while evacuation sites are designated by the city government. In this regards, further coordination is required among the managers of public facilities for efficient operation of evacuation centers.
6. Evacuees should take part in the operation of the evacuation site rather just be a "guest" in the evacuation site.

References:

- <http://www.coastal.jp/tsunami2011/>
- Filed notes for site survey