The Great East Japan Earthquake 2011
case studies
This report was jointly developed by Tohoku University, Kobe University, and individual experts with the support and supervision of the International Recovery Platform (IRP) and Prof. Yasuo Tanaka of University Tunku Abdul Rahman/Kobe University.

International Recovery Platform

Yasuo Kawawaki, Senior Recovery Expert
Yoshiyuki Akamatsu, Senior Researcher
Sanjaya Bhatia, Knowledge Management Officer
Gerald Potutan, Recovery Expert

The findings, interpretations, and conclusions expressed in this report do not necessarily reflect the views of IRP partners and governments. The information contained in this publication is provided as general guidance only. Every effort has been made to ensure the accuracy of the information. This report may be freely quoted but acknowledgment of source is requested.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table of Contents</td>
<td>i</td>
</tr>
<tr>
<td>Foreword</td>
<td>1</td>
</tr>
<tr>
<td>Overview of the Great East Japan Earthquake</td>
<td>3</td>
</tr>
<tr>
<td>Two Years After the Great East Japan Earthquake: Current Status and the Challenges Ahead</td>
<td>5</td>
</tr>
<tr>
<td><strong>Chapter 1: Debris Management</strong></td>
<td>11</td>
</tr>
<tr>
<td>1.1. The Current Status and Future Challenges Related to Earthquake Debris Management in Disaster-Affected Areas</td>
<td>11</td>
</tr>
<tr>
<td><strong>Chapter 2: Infrastructure</strong></td>
<td>22</td>
</tr>
<tr>
<td>2.1. The Impact of the 2011 Tohoku Earthquake Tsunami Disaster: Implications to the Recovery and Reconstruction</td>
<td>22</td>
</tr>
<tr>
<td>2.2. Designing Infrastructures for Very Infrequent Hazards</td>
<td>28</td>
</tr>
<tr>
<td>2.3. Restoration of Lifeline Systems</td>
<td>31</td>
</tr>
<tr>
<td><strong>Chapter 3: Recovery Planning</strong></td>
<td>37</td>
</tr>
<tr>
<td>3.1. Reconstruction Urban Planning: Current Status and Future Challenges</td>
<td>37</td>
</tr>
<tr>
<td>3.2. Reconstruction Plan Case Studies</td>
<td>45</td>
</tr>
<tr>
<td><strong>Chapter 4: Supporting Municipality Functions</strong></td>
<td>49</td>
</tr>
<tr>
<td>4.1. Logistical Support for Devastated Municipalities: Examples and Legal Reforms after the Great East Japan Earthquake</td>
<td>49</td>
</tr>
<tr>
<td>4.2. Support for Recovery Plan Formulation by Outside Experts: The Case of Ishinomaki</td>
<td>56</td>
</tr>
<tr>
<td><strong>Chapter 5: Shelter</strong></td>
<td>64</td>
</tr>
<tr>
<td>5.1. Housing Reconstruction and Community Development</td>
<td>64</td>
</tr>
<tr>
<td>5.2. Reconstruction Public Housing: The Case of Shichigahama-machi in Miyagi Prefecture</td>
<td>71</td>
</tr>
<tr>
<td>5.3. Wooden Temporary Housing in Fukushima Prefecture: Focusing on Log Construction</td>
<td>75</td>
</tr>
<tr>
<td><strong>Chapter 6: Rescuing Historical Material &amp; Preserving and Collecting Documents</strong></td>
<td>80</td>
</tr>
<tr>
<td>6.1. The Development and Significance of Efforts to Preserve Historical Records and Disaster Materials After Major Disasters</td>
<td>80</td>
</tr>
<tr>
<td>6.2. The Preservation and Collection of Disaster Materials</td>
<td>85</td>
</tr>
<tr>
<td>6.3. Historical Record Rescue Activities of the Miyagi Shiryo Network</td>
<td>88</td>
</tr>
<tr>
<td><strong>Chapter 7: Business Continuity Plan</strong></td>
<td>99</td>
</tr>
<tr>
<td>7.1. Business Continuity Plan (BCP) of Companies and Public Organizations</td>
<td>99</td>
</tr>
<tr>
<td><strong>Annex</strong></td>
<td>107</td>
</tr>
</tbody>
</table>
The March 11, 2011 disaster is unprecedented, complex, and historically significant, especially in the context of disaster risk reduction and recovery. Practitioners, experts, scholars, and other stakeholders generally agree that lessons learned from this mega-disaster are important to minimize the impacts of future disasters. These lessons need to be documented and disseminated to the global audience, especially to countries and communities facing similar risks and vulnerabilities.

In view of this, the International Recovery Platform (IRP) – specifically the Cabinet Office of Japan (CAO), the Asian Disaster Reduction Center (ADRC), and the United Nations International Strategy for Disaster Reduction (UNISDR) – in collaboration with Tohoku University and Kobe University – has developed a “Recovery Status Report on the Great East Japan Earthquake”. This project, which consists of 1) Case Studies 2) Implementation of Expert Group Meetings and National Consultation 3) Consolidation and Analysis, intends to highlight the recovery process as well as integrate the key conclusions from existing reports on the Great East Japan Earthquake (GEJE) such as those developed by IRP members including the Knowledge Notes on Recovery by the World Bank and Expert Group Meetings facilitated by the Cabinet Office of Japan. The overall objective of the report is to document the process, successes, and challenges encountered in planning and recovery operations. Specifically, it aims to achieve the following:

1. To produce sectoral case studies that outline the recovery process
2. To draw views from affected communities, government officials, experts, and other stakeholders through organization of learning events including expert group meetings and national consultation
3. To consolidate and analyze the case studies and inputs from various stakeholders

In achieving these objectives, this project, which consists of 1) Case Studies, 2) implementation of Expert Group Meetings and National Consultation, 3) Consolidation and Analysis, has been developed through mutual coordination among the Government of Japan, international organizations, and Japanese research institutions as shown in Figure 0.1.

![Diagram of Developing the Report](image-url)
The lessons, as documented in this report, are disseminated globally, including showcasing at the International Recovery Forum, January 2013 in Kobe, Japan and at the Fourth Session of the Global Platform on Disaster Risk Reduction, 21-23 May 2013 in Geneva, Switzerland. It is expected that the lessons contained in this report will inform the strategic recommendations for more explicit provisions on recovery in the Post-2015 Disaster Risk Reduction Framework (HFA2). Additionally, it hopes to further inform key measures for integrating recovery in development planning as well as strengthen efforts towards effective recovery strategy and frameworks.

International Recovery Platform Secretariat
OVERVIEW OF THE GREAT EAST JAPAN EARTHQUAKE

The 2011 Tohoku Pacific Offshore Earthquake (the name assigned by the Japan Meteorological Agency) that caused the Great East Japan Earthquake disaster was a massive magnitude 9.0 earthquake, the largest ever recorded in Japanese history and the fourth largest to occur anywhere in the world since 1900. The epicentral area extended from offshore of Iwate Prefecture to offshore of Ibaraki Prefecture and a fault extending 450 km in length and 200 km in width is believed to have been ruptured over the course of about three minutes. As a result, shaking was measured across a wide area and a large tsunami was subsequently generated, causing extensive and widespread damage.

Damage Statistics on the Great East Japan Earthquake

- There were a total of 15,879 deaths and 2,712 missing persons reported across 12 prefectures (as of December 26, 2012).
- About 130,000 homes in 10 prefectures were completely destroyed, and about 260,000 homes in 13 prefectures were half-destroyed.
- There were approximately 27,000 cases of home damage due to soil liquefaction in nine prefectures extending from the Tohoku to the Kanto region.
- Because of the long-period ground motion, significant shaking was measured in high-rise buildings as far away as the capital region and Osaka Prefecture.
- Municipal administration buildings were destroyed in 237 of the 352 municipalities across eight prefectures where a magnitude weak-6 or stronger earthquake was recorded.

 Restoration Status

- There were about 470,000 evacuees located primarily in the prefectures of Iwate, Miyagi, and Fukushima (as of March 14, 2011), but that number has fallen to just over 341,000 (as of May 10, 2012). Of those, 254 are still living in evacuation shelters while the remainder are living in emergency temporary housing or public housing (in about 1,200 municipalities across all 47 Japanese prefectures).
- In terms of the infrastructure and public services, considerable progress has been made on emergency restoration activities, except in areas where homes and other structures were washed away and in the nuclear accident hazard zone.
- To provide reconstruction support for businesses, the government has adopted support measures to provide a total of ¥22.6 trillion in basic operating costs through Great East Japan Earthquake Recovery Special Loans and the Great East Japan Earthquake Recovery Emergency Guarantee Program (as of April 20, 2012).
- The Organization for Small and Medium Enterprises and Regional Innovation is providing support for temporary shops and factories, and operations have launched at 433 locations.
- Support is being provided to farmers to facilitate the procurement of capital needed for restarting their operations, and 4,090 businesses accounting for about 40% of the agricultural businesses that sustained tsunami damage, have restarted their operations (as of March 11, 2012).
- About half (417) of the seafood processing facilities that were damaged across the three affected prefectures have restarted their operations (as of April 2, 2012).

New Efforts toward Reconstruction

- Establishment of the Reconstruction Agency (February 2012)
- System of Special Zones for Reconstruction
  Approval has been given to 14 Reconstruction Promotion Plans (in five prefectures) formulated independently or jointly by prefectural and municipal governments in a bid for access to special treatment with regard to individual regulations and procedures, and special tax breaks (as of April 2012). In areas promoting community development, Reconstruction Project Plans formulated by municipal
The Great East Japan Earthquake 2011

Governments independently or jointly with the prefecture in a bid for access to special permits and procedures with regard to land use restructuring, have been announced by four municipalities in Iwate Prefecture and five municipalities in Miyagi Prefecture (as of the end of April 2012).

- **Reconstruction Grant System**
  A reconstruction grant system has been established to enable downtown reconstruction to be pursued all at once. In the first round, grants were awarded to 59 municipalities in seven prefectures on March 2, 2012. The amounts distributed were ¥305.3 billion in operating costs and ¥250.9 billion in government costs.

- **The Great East Japan Earthquake Enterprise Turnaround Support Agency was established (February 2012) to address the double-loan problem being faced by businesses.**

---

**Framework of the law for Special Zone for Reconstruction**

- **Basic Guidelines for the Special Zone for Reconstruction** (To be decided by the Cabinet)
  - Significance of smooth and swift reconstruction in the Special Zone for Reconstruction
  - Basic guidelines for necessary assistance and other measures to be taken by the Government for afflicted municipalities for smooth and swift reconstruction in the Special Zones
  - Basic elements of approval system of Reconstruction Acceleration Plans
  - Special measures and arrangements to be taken in the Special Zones

---

**Consultative body of Central and Local Governments**

Established in each Prefecture, held in regions affected by the disaster and directed by the future Reconstruction Agency to discuss proposals from local authorities on special arrangements and other related elements (working groups can be set up by region).

---

**Figure 0.2 Framework of the Law for Special Zone for Reconstruction**

**Source:** 2012 White Paper on Disaster Management
TWO YEARS AFTER THE GREAT EAST JAPAN EARTHQUAKE: CURRENT STATUS AND THE CHALLENGES AHEAD

The damage caused by the Great East Japan Earthquake was massive, and much of it is still having economic and social impacts across the Tohoku region. The communities there are really just starting to get a handle on reconstruction. It is important for a wide range of private entities in the Tohoku region to make use of the experience and lessons from the disaster, and to partner together on efforts to confront the remaining issues and pursue reconstruction.

According to the Capital Stock Damage Estimate compiled by the Development Bank of Japan (DBJ) in April of last year, immediately after the earthquake, the physical damage to the four hardest-hit prefectures of Iwate, Miyagi, Fukushima, and Ibaraki was estimated at ¥16.4 trillion (Table 0.1), ¥11.8 trillion of which was attributed primarily to tsunami damage.

The ratio of damage to the coastal areas of Iwate Prefecture was estimated at 47.3%, with nearly half of the buildings there having been destroyed. In Miyagi Prefecture, about 20% of the coastal areas were destroyed, with damage there estimated at ¥4.9 trillion. The damage to capital stock is lower in Fukushima Prefecture than in either Iwate or Miyagi Prefecture, but the damage caused by the nuclear power plant accident is not included in the estimates. Even now, nearly two years after this disaster, there are still about 320,000 people living in public housing or temporary housing. The transportation infrastructure has been large restored, except in the hazard zones, but there are still many areas in the tsunami inundation zones that remain vacant and undeveloped.

Table 0.1 Estimated Capital Stock Damage (published April 2011)

<table>
<thead>
<tr>
<th>Prefecture</th>
<th>Inland Area</th>
<th>Coastal Area</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iwate</td>
<td>26.4</td>
<td>7.4</td>
<td>33.8</td>
</tr>
<tr>
<td>Miyagi</td>
<td>31.4</td>
<td>23.2</td>
<td>54.6</td>
</tr>
<tr>
<td>Fukushima</td>
<td>34.3</td>
<td>15.9</td>
<td>50.3</td>
</tr>
<tr>
<td>Ibaraki</td>
<td>47.8</td>
<td>21.7</td>
<td>69.6</td>
</tr>
<tr>
<td>Total</td>
<td>140.0</td>
<td>68.3</td>
<td>208.3</td>
</tr>
</tbody>
</table>

*Notes:*
1. Coastal areas are the municipalities with coastlines. Inland areas are all other municipalities.
2. The estimated capital stock and amount of damage to same are both calculated based on the repurchase value.
3. Damage caused by the Fukushima Daiichi Nuclear Power Plant accident is not included in these estimates.

As of end of Jan

<table>
<thead>
<tr>
<th>Disposal</th>
<th>Amount removed (B)</th>
<th>Removal rate (B/A)</th>
<th>Amount processed/disposed (C)</th>
<th>Process/disposal ratio (C/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disaster waste</td>
<td>16,280,000 t</td>
<td>14,579,000 t</td>
<td>89%</td>
<td>7,543,000 t</td>
</tr>
<tr>
<td>Tsunami sediment</td>
<td>10,400,000 t</td>
<td>6,690,000 t</td>
<td>64%</td>
<td>1,890,000 t</td>
</tr>
</tbody>
</table>

Figure 0.3 Trends in the industrial output index (11/2=100 seasonally adjusted)
Table 0.2 shows the current status of the disaster waste processed. A goal was set for the completion of disaster waste processing by March 2014, as of the end of January 2013, 46% of the disaster waste had been processed and disposed of.

The Industrial Output Index (IOI) showing the production activity status of companies in the mining and manufacturing industries fell particularly far in Miyagi Prefecture, hitting 48.2 in March 2011. Though it later rebounded, it is still only at about 90% of its pre-disaster level and at present seems to be moving into a period of decline (Figure 0.3).

A breakdown by industry shows that the IOI increased dramatically in the transportation industry as restoration activities progressed, but it peaked in the spring of 2012, after which it began to decline and then to approach its pre-disaster level. There is considerable variation by industry, with sluggish restoration being reported in the general machinery, telecommunications equipment, and food and tobacco products industries (Figure 0.4).

The ratio of job offers to job seekers in the three hardest-hit prefectures in Tohoku fell immediately after the quake, hitting bottom in April 2011 before beginning to rebound. At present, it is on an upward trend nationwide (Figure 0.5). However, a breakdown of this statistic reveals a considerable mismatch between job seekers and job offers. While there are many job seekers in administrative and manufacturing fields, there are many job openings in specialized and technical jobs, the service industry, and civil engineering (Figure 0.6).

Since July of last year, there has been excess migration into Miyagi Prefecture, while Fukushima Prefecture continues to experience excessive outward (Figure 0.7, Figure 0.8). A lot of migration is happening out of the coastal areas in particular, with an age breakdown showing migration among young people to be particularly remarkable.
If we use the Great Hanshin-Awaji Earthquake of 1995 as a point of reference, we see that the Industrial Output Index fell much further after the Great East Japan Earthquake than it did after the 1995 disaster.

The gross regional product (GRP) of Hyogo Prefecture, the area affected by the Great Hanshin-Awaji Earthquake, as a percentage of nationwide GDP exceeded the national GDP immediately after the quake, but fell several years later. Since then, the gap between the economic growth rates regionally and nationally has been widening (Figure 0.9).

The population growth trends in Hyogo Prefecture show that the population fell sharply due to an increase in outward migration immediately after the earthquake, and did not return to previous levels over the course of several years. Though the population later recovered, the cumulative mechanical growth was negative, with figures indicating that about half of the residents who left never returned (Figure 0.10).

The affected areas of Tohoku suffered greater hardship than the large urban area affected by the Great Hanshin-Awaji Earthquake, in part due to the damage caused by the tsunami. There are concerns about trends in the economic indices going forward.

Next, let's look at the impact of the disaster on various Asian countries based on an online Japan Tourism Attitude Survey conducted by the Development Bank of Japan after the Great East Japan Earthquake. The survey was conducted in the eight regions of China (Beijing, Shanghai), Taiwan, Hong Kong, South Korea, Malaysia, Thailand, and Indonesia, but the response "Wished for Japan's quick recovery" was selected...
by the highest number of respondents (47%). Responses favorable to Japan were particularly numerous among tourists from Malaysia, Thailand, Indonesia, and Hong Kong, including the response "Felt compassion for the Japanese people." On the other hand, some respondents indicated negative attitudes, such as "No longer saw Japan as such a safe place" (Figure 0.11, Figure 0.12).

As many as 70% of respondents indicated that they "would consider visiting Japan despite the earthquake" or that they "didn't want to visit right after the quake, but would consider it now." This percentage is especially high in some regions that is, in Thai, Malaysia, Indonesia, and Taiwan (Figure 0.13). These regions also indicated a strong interest in disaster-area tourism.

![Figure 0.11. Japan Tourism Attitudes After the Great East Japan Earthquake (1)-1](image)

![Figure 0.12. Japan Tourism Attitudes After the Great East Japan Earthquake (1)-2](image)

![Figure 0.13. Japan Tourism Attitudes After the Great East Japan Earthquake (2)](image)

**Challenges and Responses**

**1. Challenges and Responses by Area**

If the Tohoku region is divided up into coastal and inland areas, a comparison of those areas reveals that each faces different challenges and thus requires different responses. In the coastal areas affected by the
tsunami, many communities suffered tremendous human and property damage, and in some cases whole communities were lost. Here, community reconstruction has to start from scratch, even as efforts are made to implement livelihood policies for residents who evacuated. Also, in many of the coastal communities extending from southern Aomori Prefecture to central Miyagi Prefecture, fisheries and agriculture were the primary industries. Thus, many people who lost both their homes and workplaces to the disaster were left with no choice but to leave for other areas. In these coastal areas, several efforts have to be pursued simultaneously, including community zoning, industry reconstruction (especially the fisheries industry), provision of housing, and public function restoration (government services, medical and welfare services). It is important in these situations for local municipalities as well as the prefectural governments, national government, and local businesses and residents to partner and collaborate with one another in their efforts.

The inland areas did not sustain tsunami damage, but some areas recorded earthquake magnitudes of 6-strong or higher, and thus sustained considerable earthquake damage. In some communities, the city halls and other public facilities sustained so much damage that they were rendered unusable. With local governments under considerable financial strain even before the disaster, even those that can use their reconstruction budgets to take initial response measures are eventually going to have to pursue efforts that take advantage of private funding and know-how to achieve their massive reconstruction projects.

The problem of radioactivity contamination due to the nuclear power plant accident has affected not only Fukushima Prefecture, but the entire Tohoku region, with significant damage to primary industries, including agriculture, and tourism coming from speculation and rumors. Even today these are having a negative effect. As is evident from the Industrial Output Index, the manufacturing industry has not yet returned to pre-disaster levels. Industrial reconstruction and revitalization efforts in the inland areas are expected to make up for the tsunami-affected areas where early reconstruction will be more difficult, and to become a driving force for the local economy.

2. The Influence on Tourism and Policy

The number of tourists to the Tohoku region temporarily fell as a result of the earthquake and tsunami, in combination with the nuclear power plant accident. Interestingly, it is not just the massively damaged Pacific coast that has been affected; the Japanese Sea coast has been also affected. In some parts of the affected areas, a certain level of tourism demand has been maintained due to the demand related to reconstruction support, but this has not reached the level of a genuine recovery in tourism. Given this, disaster tourism, including the sharing of personal stories by affected residents (storytellers), is being adopted in various regions. This kind of experience-oriented tourism planning could serve as an effective gateway that links to community restoration through the restoration of local industries.

It is also important to try to attract visitors from Asian countries, a main target of inbound tourism promotion. Perhaps because Thailand and Indonesia have experienced their own massive tsunami and flood disasters, survey respondents from those countries indicated some of the most forward-looking attitudes toward tourism in Japan, including visits to disaster-stricken regions. It is important to create and develop tourism plans that take advantage of the Tohoku region’s unique experience and story, including tourism of the affected areas as well as visits to Hiraizumi, a world heritage site, and to Sendai, which has connections to Lu Xun, a famous figure in China.

3. Population Emigration and Finding Workers

Given that population emigration due to the disaster is largely occurring among young people, finding workers has become an important issue in the region. On the one hand, companies are facing the problem of having to figure out how to find workers under the current conditions. It also has not been easy for local governments to find workers, and some local government fixed-term jobs have actually ended up impeding efforts by local companies to find workers.

Various reconstruction projects were successively launched starting right after the earthquake, and those that were promoted through the efforts of individual companies have shown some progress. However, partnership-based projects have proceeded at a slower pace, as there is no company at the core of the project willing to engage in risk-taking.

The Great East Japan Earthquake deeply wounded the people and communities of the Tohoku region, but that experience and the subsequent lessons learned, as well as the issues faced and response measures
taken in the reconstruction process reflect knowledge and know-how unique to the Tohoku region, and thus are sure to prove useful when future disasters strike, whether in Japan or abroad. To ensure that this information and know-how is collected and utilized, it is important for the entire Tohoku region to work together on disaster management, disaster risk countermeasures, and reconstruction.

Authors: Tadao HASUE
Kumi ONUMA
Tohoku Revival Reinforcement Office, Tohoku Branch
Development Bank of Japan
CHAPTER 1: DEBRIS MANAGEMENT

1.1. The Current Status and Future Challenges Related to Earthquake Debris Management in Disaster-Affected Areas

It has been more than two years since Japan experienced the unprecedented calamity of the Great East Japan Earthquake, but the affected areas are still facing extraordinary difficulties in terms of the processing and disposal of earthquake debris, which are the first tasks of disaster restoration and reconstruction and must be completed quickly. Given the extreme shortage of reconstruction materials, such as aggregate and concrete, there is a serious need to recycle earthquake debris and use it in restoration and reconstruction work, but there are many problems to be addressed when trying to reuse earthquake debris, including issues with product quality as well as with the time and space needed for making it usable.

Preface

More than 20 million tons of debris was strewn across an expansive area as a result of the Great East Japan Earthquake, and all of the affected local governments are working to recycle and make effective use of that debris. The schemes developed for processing the debris vary widely by local government, but all are expected to provide a valuable source of reference material in terms of offering lessons for future disasters. Several of the problems that have been exposed in this process will also provide important information for the future.

- How was the course toward the recycling and effective use of earthquake debris formed?
- How are individual local governments promoting the processing and effective use of earthquake debris?
- What issues must be taken into consideration when using earthquake debris?
- What are the advantages and disadvantages of processing debris across dispersed locations nationwide?
- And what are the issues that have yet to be solved even now, two years after the quake?

Course toward Earthquake Debris Processing

Past Examples: The Great Kanto Earthquake and the Great Hanshin-Awaji Earthquake

As is well known, Japan is distinctive for having experienced many large-scale natural disasters, particularly earthquakes. The Japanese people have a national character of which they are rightfully proud and which has been applauded by the international community, as it has enabled them to achieve astounding restoration and reconstruction achievements. Today, even with the earnest pursuit of earthquake debris processing efforts in the affected regions, the Japanese people are focused on making the maximum effective use of the debris, an effort that is likely to earn them special praise from other countries.

In Japan’s previous large-scale earthquakes, the Great Kanto Earthquake (1923) and the Great Hanshin-Awaji Earthquake (1995), the preferred method of disposing of the earthquake debris was to use it as landfill. The earthquake debris generated by the Great Kanto Earthquake was used quickly after the quake to fill in the coastline of Yokohama in Kanagawa Prefecture. The plan was to use this area for a coastal walking path, but it has now been developed into Yamashita Park. Most of the debris generated by the Great Hanshin-Awaji Earthquake was also used as landfill, with 2.62 million of the total 14.5 million tons generated used as landfill for the Osaka Bay Phoenix Plan (launched in 1987).
Course toward Earthquake Debris Processing after the Great East Japan Earthquake

In accordance with previous historical examples, the option of using the rubble created by an earthquake as landfill seems to be an optimal solution not only in terms of cost, but also in terms of promoting the fastest possible reconstruction. Nonetheless, the earthquake debris generated by the Great East Japan Earthquake is vastly larger in volume than that produced by the earlier two quakes, and a course was chosen quickly after this disaster toward processing and disposing of the debris in such a way that it would be put to the most effective use. How was that course chosen?

The Ministry of the Environment stated the need to make effective use of the earthquake debris in its Basic Policy on Reconstruction from the Great East Japan Earthquake (May 2011). The recommendations issued by the Reconstruction Design Council established immediately after the quake in June 2011 also stated the need to consider various uses for earthquake debris, such as in the development of seawalls. These government recommendations created an opportunity for setting the course for earthquake debris management in the direction favoring effective use.

Figure 1.1 Sample use of earthquake debris presented by the Reconstruction Design Council (Type 4: Image of reconstruction on a coastal plain)

Also, Japan has ratified the Protocol Regarding the United Nations Framework Convention on Climate Change (known as the Kyoto Protocol) that was adopted at the Third Conference of Parties to the UNFCC (Kyoto Climate Change Conference, COP3, 1997). Since then, the Japanese construction industry has made vigorous strides in developing technologies for effectively using the leftover soil and concrete waste generated at construction sites. The availability of these technologies, which should also be easily applied to the effective use of earthquake debris, may be one of the supporting factors in the decision to pursue a course toward effective use.

Framework for Earthquake Debris Processing

The amount of earthquake debris estimated to have been generated by the Great East Japan Earthquake in the hardest-hit prefectures of Iwate, Miyagi, and Fukushima is 5.25 million tons, 18.73 million tons, and 3.61 million tons, respectively (Figure 1.2). All of these local governments created plans for achieving reconstruction within 10 years, starting from the time the earthquake struck in 2011.

They designated the first three years of their reconstruction plans as the "restoration period" and set a goal of completing the processing of earthquake debris within this period. All of the local governments are processing earthquake debris in accordance with the same general flow, described below.

- The earthquake debris scattered immediately after the quake, before processing, was removed by local construction company volunteers with heavy machinery, at the request of the Self-Defense Forces, fire fighters, and police officers in the process of conducting the higher priority search and rescue activities.
- In the first phase of the processing scheme, each municipality hired construction companies to transport debris to a primary collection site.
- In the second phase, the prefectural government, under contract with each city, hired construction companies to transport debris to a secondary collection site, where it was processed and disposed of.
However, the final processing of the earthquake debris handled at the secondary collection site, and the process for getting it into usable form differed considerably between the three prefectures.

Framework for Processing Earthquake Debris in Iwate Prefecture

The Taiheiyo Cement Ofunato Plant (Ofunato City) and the Mitsubishi Material Iwate Plant (Ichinoseki City) are located in Iwate Prefecture. At a cement factory, it is possible to process many different types of earthquake debris, if it is combustible, and to use this as raw material or fuel in making cement. In addition, since the cement produced here can be used in restoration and reconstruction work in the affected region; this is a highly effective processing method.

Iwate Prefecture is expected to process 450,000 tons of its 5.25 million tons of earthquake debris through a nationwide dispersed processing and disposal scheme, but it is moving forward on debris processing by making maximum use of the cement plants as processing centers that were sorted at a secondary collection site to the cement plant, and reusing the cement manufactured through this process (Figure 1.3). For this reason, orders for secondary processing services of earthquake debris in Iwate Prefecture only extend to the stage of debris sorting, until it is shipped to the cement plant; final processing is not included.

The Taiheiyo Cement Ofunato Plant was damaged by the March 11 tsunami and lost one of the incineration kilns essential to cement manufacturing. The facility was restored in June 2012, and today it desalinates the earthquake debris it receives and turns it into raw materials that it uses to produce 750 tons/day of cement.

Figure 1.3 Framework for processing earthquake debris in Iwate Prefecture

Framework for Processing Earthquake Debris in Miyagi Prefecture

Unfortunately, the coastal areas of Miyagi Prefecture do not have the ability to effectively turn earthquake debris into raw materials, as can be done at a cement plant. The estimated volume of earthquake debris generated in Miyagi was 18.73 million tons, the largest of the three affected prefectures. In addition, the particular geography of Miyagi Prefecture is such that while the northern region is sharply sloped, with little flatland, the southern area is home to the expansive Sendai Plain. It is also home to many prominent Japanese fishing ports, including Kessennuma, Ishinomaki, and Shiogama. For this reason, the characteristics of the collected earthquake debris vary by region of origin.

Given these conditions, Miyagi Prefecture divided its coastal areas into four blocks, as shown in Figure 1.4, built incineration facilities in each, and contracted services ranging from the sorting to the processing of earthquake debris, which were conducted by major construction companies.

The volume of earthquake debris in Ishinomaki City, Miyagi Prefecture is estimated to be 6.16 million tons, which means that about 100 years worth of normal waste processing has to be done as the result of...
The earthquake debris is being divided up between the prefectoral and municipal governments for processing, but the constraint imposed by the extreme difficulty involved in securing final processing may have set the stage for the emergence of a strong desire to make effective use of the debris. Miyagi Prefecture expects to process and dispose of 910,000 tons of its 18.73 million tons of earthquake debris through nationwide dispersed processing.

Sendai City, which is the only city designated by ordinance in the Tohoku region, has 2.65 million tons of debris to be processed, but it seems to have been able to process that debris more quickly than other local governments. The reason Sendai was able to move through this process so quickly was because it was able to secure an expansive site on the Sendai Plain in the coastal areas, had large numbers of local government workers available, was able to form teams that could specialize in earthquake debris processing, quickly restored the transportation and information networks based in the city, frequently shared information with outside parties, and was able to obtain highly valuable advice.

**Framework for Processing Earthquake Debris in Fukushima Prefecture**

The framework for processing earthquake debris in Fukushima Prefecture is fundamentally quite different from that found in Iwate and Miyagi. Unfortunately, we cannot but assume that the processing and disposal of earthquake debris in Fukushima Prefecture is going to take a lot more time than debris from other locations.

In the areas that ended up as evacuation zones, primarily around the Tokyo Electric Power Fukushima Daiichi Nuclear Power Plant, conditions are still exactly as they were when the disaster struck. In other areas as well, authorities continue to have to place the highest priority on decontamination work to remove soil contaminated by radioactivity before they can deal with earthquake debris processing and disposal.

**Difficulties Involved in Nationwide Dispersed Processing**

In this earthquake, an enormous volume of earthquake debris was scattered across many regions covering a wide area. Many of the affected local governments are not expected to have the reserves for quickly processing and disposing of that rubble. Thus, the promotion of nationwide dispersed processing of earthquake debris is being strongly advocated by the national government.

On the other hand, because of the nuclear power plant accident, concerns about the radioactivity contamination of earthquake debris has been widely reported in the media. A plan to incinerate earthquake debris from Rikuzen-takata, Miyagi Prefecture at Kyoto’s Daimonji-Yaki Festival to provide repose for the souls of the victims was ultimately rejected.

Today, 450,000 tons of debris from Iwate Prefecture and 910,000 tons from Miyagi Prefecture are expected to be processed and disposed of through the nationwide dispersed processing scheme, as 12 prefectoral governments are now accepting earthquake debris. However, as of the end of 2012, only 160,000 tons of debris had been processed through this scheme.
There are many challenges involved in processing debris in locations nationwide, including the spread of rumors, transportation costs, information disclosure to local residents, and conditions on the quality of debris that can be accepted, among others. It took three months of test incinerations of earthquake debris before the residents of Kitakyushu City were willing to accept debris for processing. If there were no concerns regarding potential damage caused by radiation, dispersed nationwide processing efforts may have proceeded more smoothly.

**Removal, Sorting, Use, and Disposal of Earthquake Debris**

Today, the earthquake debris that is being processed and disposed of in the affected regions can be categorized as either earthquake waste or tsunami deposits. Earthquake waste consists of concrete, asphalt, mixed combustibles, mixed noncombustibles, houses and other assembled steel, vehicles, boats, and legally regulated hazardous substances, such as PCB. Tsunami deposits consist of sediment that contains a mixture of soil and miscellaneous matter carried up from the sea floor by the tsunami, and are very difficult to sort.

Figure 1.5 shows the processing flow for earthquake debris in the affected regions. Concrete, asphalt, mixed combustibles, mixed noncombustibles, and tsunami deposits are sorted and processed at debris processing sites established in the affected areas. The houses and other assembled steel, vehicles, boats, and legally regulated hazardous substances, such as PCB, are processed under a different scheme.

There is little concern about radiation contamination with regard to the vast majority of earthquake debris processed in Miyagi and Iwate Prefectures. For this reason, investigations regarding the uses of earthquake debris are proceeding vigorously in both prefectures. Nonetheless, some of the incinerated ash from mixed combustibles contains high levels of radiation, making it difficult to investigate its effective use.

**Debris that Should be Processed and Effectively Used Locally**

There are many different types of earthquake debris. Of these, concrete rubble and tsunami deposits are noncombustible and heavy, and thus are not well suited to any processing that involves transportation, such as nationwide dispersed processing. Also, the residuals (incineration ash) produced by local incineration would ordinarily have to go through final processing, and this too would be difficult to manage through the nationwide dispersed processing scheme.

Earthquake debris can also include assembled steel from houses and factories, highly radioactive trees from destroyed tidal control forests, vehicles, boats, and hazardous waste that contain substances like PCB, but the processing and effective use of these types of debris are either incorporated into existing metal recycling frameworks, or promoted through environmental standards and other frameworks under the jurisdiction of the Ministry of the Environment. This being the case, there are three items that authorities are now strongly insisting be processed and effectively used locally: concrete rubble, tsunami deposits, and incineration residuals (incineration ash; Figure 1.6).
Earthquake debris is carefully sorted to the extent possible. At the debris processing site in Miyagi Prefecture, debris that cannot be mechanically sorted is sorted manually by workers (Figure 1.7). In the manual sorting process, there is a box labeled “Memories” that is not shown on the flow chart in Figure 1.5. Workers use this box for collecting photos, albums, and other items of sentimental value. The owners of these items may not even have survived, and it is unclear if they will ever be retrieved. Even heavily soiled items are set aside rather than being sorted as combustibles (Figure 1.9).

This kind of sorting proceeds quietly in the affected regions, though no one has been specifically instructed to do it.

Several new problems have arisen in the process of debris processing.

- Considering the constraints on final processing volumes, active thought must be given to the effective use of the various residuals that are ultimately collected after everything has been fully sorted.
- If lead in a fishing net is thrown into an incinerator, it will impede the effective use of the incineration ash. Thus, care must be taken in such cases.
- From the perspective of securing shipping routes and fishing grounds, there are plans to salvage debris from the seabed in this region, but methods for processing such debris have not yet been examined.
- Unfortunately, there are no discussions at present regarding debris floating in the open ocean.
- With regard to asbestos that might be contained in the earthquake debris, workers are warned to take precautions, but no serious discussions are taking place around this issue in the use phase.

**Striving for the Effective Use of Earthquake Debris**

As mentioned above, the types of earthquake waste that are particularly better suited for local processing and effective use include concrete rubble, tsunami deposits, and debris incineration residuals (incineration ash). The processing and effective use of these items is expected to be achieved through the mobilization of civil engineering technologies. The flow of earthquake waste in Miyagi Prefecture is such that waste is first transported from the affected area to an area called a primary collection site. It is at this stage that rough sorting is conducted. The debris is then transported to a secondary collection site, where it is more carefully sorted, washed, crushed, and incinerated, and ultimately taken through the stage of final disposal.

However, a visit to these earthquake waste processing sites would reveal that they all differ slightly in terms of the local characteristics of the earthquake waste collected and the methods being used for sorting. It is not a situation in which processing and effective use can be uniformly defined. Here I compile the technical challenges involved in promoting the processing and effective use of earthquake waste.

**Concrete Debris**

The concrete waste generated at construction sites is already being used as recycled aggregate, and the technical know-how developed for this process during non-emergency (ordinary) times is expected to be applied to the effective use of concrete debris from this earthquake. What issues must be considered with regard to the effective use of concrete debris during the current emergency situation when applying technologies developed during ordinary times?
The Japanese Industrial Standard (JIS) establishes three levels (H, M, L) of regulations regarding the quality of recycled aggregate. For the quality of concrete debris to meet these regulations, it must be appropriately sorted and washed, and investigations must be performed regarding the removal of hazardous substances and the possibility that reactivity aggregate, or in some cases asbestos, has become mixed in with the debris.

It would seem to be important to select a course that involves restricting the uses of this recycled concrete and introducing technologies that would allow concrete debris processed at current levels to be accepted. That is, moving toward processing waste such that it will meet the JIS regulations is not the only option. It is also important to think about options for how less processed materials might also be used (Figure 1.10).

Through the application of technologies designed for uses of particular materials in particular locations, it becomes possible to forgo excessive processing, thus speeding up the earthquake waste processing efforts. For example, the cemented sand and gravel construction method (as well as technologies that use this method) offers some degree of tolerance for the inclusion of pre-packed concrete and post-packed concrete, which can be used as aggregate, as is, even with large lumps of concrete, as well as fine granules and miscellaneous items. Another technology is known as seawater-mixed concrete, which can tolerate the incorporation of adhered salt in the concrete debris.

**Tsunami Deposits**

Tsunami deposits are expected to be used as embankment materials in seawalls and as materials for raising levees in areas where land subsidence has occurred. Especially in coastal areas where land subsidence was particularly severe, large quantities of earth and soil are going to be needed for ports and other facilities. General soil improvement technologies include (1) stability processing, (2) slurrying stability processing, (3) water removal, (4) drying, (5) particle size control, (6) advanced stability processing, and (7) baking. However, while these technologies have the potential to be effectively used, authorities must clarify how the quality of tsunami deposits, which vary by processing site, will be ascertained, and what levels of quality will be allowable for those deposits to quality for effective use.

The tsunami deposits accumulated in residential areas are comprised of sandy soil, and are of sufficiently good quality to be used as is for road embankments. By contrast, the tsunami deposits accumulated in farming areas contains large amounts of clay and silt, whose viscosity differs depending on the degree to which it is shoveled up. The effects of the salt in the seawater can apparently be expected to have been reduced by the dilution effects of rainfall, but there is still a need to ascertain whether any hazardous substances have been mixed into the waste due to the thick grass that accumulated after more than a year of neglect. It is also necessary to ascertain the content of heavy metals or other hazardous substances that might have gotten mixed into the earthquake waste, such as wood and metal scraps carried in by the tsunami. Authorities will have to clarify the allowable limits on impurities when decisions are made about effective use (Figure 1.11).
In the case of tsunami deposits, because of concerns regarding the proliferation of smells and microorganisms, thought must be given to the appropriate pre-processing methods that might be used before the material can be put to effective use.

**Debris Incineration Ash**

The part of the incineration ash that is being examined with regard to its potential effective use is the main ash. Fly ash is unlikely to be put to effective use because of the radioactivity concentration that occurs during the incineration process. The use of main ash as a solidified substance is currently under investigation, so here I outline the challenges involved in promoting the effective use of main ash in solid form.

First, the binders used in solidification processing may include blended cements, such as ordinary portland cement or blast furnace cement, so it is important to appropriately ascertain the chemical reaction compatibility in consideration of the mix ratio and curing conditions of the binders and incineration ash used. It is also important to determine the degree to which the liquidation of hazardous substances in the incineration ash will be constrained by the binder used. Because the shape of the packaging of the solidified product, either as granules or blocks, could impact the liquidation characteristics of hazardous substances after the product is put into effective use, care must be taken in setting the investigation parameters (Figure 1.12).

Since some earthquake waste processing sites may use chemicals on main ash after incineration for the purpose of controlling the liquidation of heavy metals, it is important to clarify the impact that these chemicals will have on the solidification characteristics of the binders. Also, if solidified incineration ash is to be used as landfill, it will be important to establish a trial period and to appropriately ascertain the various characteristics that exist under the various exposure conditions in which it will be used, such as uses in seawater, tidal zones, inland areas, and soil.
Issues in Promoting the Effective Use of Earthquake Debris

**Technology Matching**

To speed up the processing and effective use of earthquake waste and promote early reconstruction, it would be helpful to match the needs of the affected regions, as identified in their reconstruction plans, with the technology seeds of industries and academic institutions capable of meeting those needs (Figure 1.13).

Thus, forming a consortium that allows local government officials and representatives of both industrial and academic organizations that possess relevant technologies to meet with one another may be one solution for creating a framework comprised of people who share the same goal: the reconstruction of the affected region.

**Location Matching**

To convert earthquake debris into usable resources and achieve their effective use, that debris must be transported to primary and secondary collection sites, and later to the restoration project sites where they will be used. However, there are costs involved in transportation, and rationality is needed in terms of the cost of this material versus the costs of using natural earth and sand. This means that location matching is also necessary, and figuring out how to overcome this challenge is an issue in promoting the effective use of recycled materials (Figure 1.14).

**Time Matching**

Efforts also need to be made in time matching, or matching the time periods in which authorities want to make effective use of earthquake waste, such as during disaster restoration construction projects, and the time period when materials for use as construction materials will be produced by the earthquake waste processing sites. At present, the earthquake waste processing sites have to complete their processing by March 2014, and a considerable number of disaster restoration construction projects have already been ordered. However, disaster restoration projects will take the next five to 10 years, and during this time, it is highly likely that the earthquake waste processing sites will close (Figure 1.15). Given this, there is going to be a need to store the earthquake waste somewhere until the time that it can be used as construction materials.
Dealing with Resource Shortages during Restoration and Reconstruction

During post-earthquake restoration and reconstruction, large quantities of materials (so large, in fact, as to be virtually incomparable to the quantities ordinarily needed) are needed in a short period of time. In Miyagi Prefecture and Iwate Prefecture where the Great East Japan Earthquake struck, severe resource shortages are going to occur starting around the summer of 2012. The most severe of the shortages is going to be seen in aggregate (sand, gravel) and concrete. Aggregate in particular is not only used as a material in making concrete, but also is an effective material in raising the ground level in coastal areas where subsidence occurred as a result of the earthquake.

In simplistic terms, increasing the manufacture of aggregate and concrete will require local companies to make capital investments and increase supplies to meet the level of demand. For aggregate, it may be possible to meet this skyrocketing demand by increasing transports from other areas. The reality, however, is that local companies are not making moves to increase the supply of these materials. Why is this?

A previous example can be seen in the 1995 Great Hanshin-Awaji Earthquake. After that disaster, there was a sudden increase in demand for aggregate and concrete during the reconstruction process, and many local companies expanded their businesses to so that they could increase the supply of those materials. However, as reconstruction progressed and the demand for these materials declined, many companies ended up having to either shrink their operations or go out of business.

Given this precedent, no matter how drastic the increase in demand for aggregate and concrete, there are virtually no companies choosing to expand their businesses to meet that demand. In addition, it is important to consider the conditions facing the Tohoku region just before the Great East Japan Earthquake, that is, in March 2011. Facing a global economic recession caused by the collapse of Lehman Brothers, the entire construction industry was trying to figure out how to survive, with companies having to make desperate decisions about how they could shrink their businesses.

**Measure 1 for Meeting the Spike in Demand for Materials: Supply Side**

Given these tight conditions, how can the current demand for aggregate and concrete be met? Perhaps we can think about the issue as shown in Figure 1.16.

That is, we can secure supply quantities in the Tohoku region that can meet the spike in demand for aggregate without increasing the size of businesses in the industry. Procuring materials from outside the affected region should be maintained at levels that do not disrupt supply levels elsewhere, and any expected shortfalls should be made up for with the effective use of unused resources, such as recycled earthquake debris, which is concurrently being processed, and slag aggregate. It is also important to meet the spike in demand for concrete not only with raw concrete manufactured using the usual materials, but by taking all measures imaginable, such as securing a supply system for precast products.

We can also newly develop raw concrete that is made using unused materials, and can expand the supply system by using the recycling certification system being promoted by local governments with regard to precast products.

**Measure 2 for Meeting the Spike in Demand for Materials: Systems**

To take systemic measures, it is necessary to clarify the current scope of business activities of private companies and clarify jurisdictional issues with regard to permits by government institutions. The scope of
jurisdiction with regard to the business activities of private companies and permits issued by government institutions in Japan is as follows:

**Scope of business of private companies**

- **Aggregate supply**: Crushed stone, gravel, sand
- **Unused resources**: Steel, non-ferrous metals (slag), electric power (coal ash), paper manufacture (pulp incineration ash)
- **Concrete**: Raw concrete, precast products
- **Restoration and reconstruction work**: Large general contractors, local general contractors
- **Debris processing**: General contractors, cement manufacturers

**Scope of work regarding permits by government institutions**

- **Quality (JIS)**: Ministry of Economy, Trade and Industry
- **Environmental safety**: Ministry of the Environment
- **Use (reconstruction)**: Ministry of Land, Infrastructure, and Transport, Ministry of Agriculture, Forestry and Fisheries, civil engineering departments of local governments
- **Recycling certification**: Environmental departments of local governments
- **Debris processing**: Environmental and waste management departments of local governments

To recycle earthquake debris and quickly utilize it in restoration and reconstruction, these various fields must work together to achieve sufficient synergies. The ability to comprehensively manage various types of private companies and government institutions is also essential.

**Recommendations**

It is important that disaster preparations include the preparation of some type of methodology for dealing with the processing, disposal, and effective use of earthquake debris. That said, there is considerable variation in the conditions in the regions affected that will have to be taken into consideration, including the breakdown of the estimated quantity and types of earthquake debris in affected areas, as well as access to a site where processing and disposal work can be done, the availability of facilities needed for processing and disposal, the advisability of procuring materials and equipment, the availability of applications for the reuse of materials in restoration and reconstruction projects, transportation issues, and the availability of human resources, among others. Thus, to prepare in advance for disasters, it is important to make the decision to have the right people in the right places, and to conduct considerable investigations into what kinds of systems must be adopted to facilitate prompt action.

**References**


**Author: Makoto HISADA**

Graduate School of Engineering, Tohoku University
CHAPTER 2: INFRASTRUCTURE

2.1. The Impact of the 2011 Tohoku Earthquake Tsunami Disaster: Implications to the Recovery and Reconstruction

A comprehensive study was conducted to identify the impact of the 2011 Tohoku tsunami disaster with particular regard to structural damage and to understand the lessons towards the reconstruction of Tohoku to build tsunami-resilient communities. Through an integrated investigation of field measurement, remote sensing, and numerical modeling with spatial information sciences, the results lead to new understandings of structural vulnerability to tsunami and an implication for land use management and relocation planning to reconstruct resilient coastal communities.

Introduction

On 11 March 2011, a devastating tsunami accompanied with M9.0 earthquake attacked the northern Pacific coast of Japan (Tohoku), and the coastal communities especially in Iwate, Miyagi, and Fukushima Prefectures were totally devastated. The total affected area by the tsunami was reported as 561 km² along the Pacific coast of Japan (GSI, 2011a), and the maximum tsunami run-up height reached up to 40 m in Iwate Prefecture (Mori et al., 2012). As of February 2013, National Police Agency reported 15,880 dead (4,673 in Iwate, 9,535 in Miyagi, and 1,606 in Fukushima) and 2,694 missing, 128,918 buildings/houses were collapsed or washed-away (National Police Agency, 2013). The economic impacts were estimated as 16 to 25 trillion yen (Cabinet Office, 2011), while FY2011 national budget of Japan was 92 trillion yen (Ministry of Finance Japan, 2011).

Having passed two years since the event occurred, the devastated areas have started moving forward to reconstruct their communities. Though the recovery processes are still underway, the local governments completed the draft of reconstruction plan including infrastructure design, transportation, land use management, urban design, relocation, and economic and industrial outlooks.

This paper aims to summarize the impact of the 2011 Tohoku tsunami disaster with particular regard to structural damage, to understand the lessons towards recovery and reconstruction of Tohoku region. To identify the tsunami impact, we conducted an integrated study of field measurement, remote sensing and numerical modeling with the approach of spatial information sciences. The results lead to understandings of structural vulnerability against the 2011 tsunami and to an implication for land use management and relocation planning to reconstruct resilient coastal communities.

Tsunami Hazard

Tsunami is categorized as a “long wave” in water surface waves, which has much longer wavelength (L) than the water depth (h). When h/L of a water surface wave (train) is smaller than 1/20—in other words, when a wavelength is 20 times longer than the water depth (often hundreds of kilometers long, whereas normal ocean waves have a wavelength of only 30 or 40 meters), it has the characteristics of a long wave. Consider the moment that a tsunami is generated offshore at depths of several thousand meters by a sudden sea bottom deformation. Assuming the wavelength of a tsunami as a hundred kilometers and the initial height of the sea surface as several meters or even 10 meters, the horizontal scale of that tsunami is much larger than the vertical scale of sea surface movement. In this sense, tsunamis generally travel unnoticed in the deep sea, and ships are hardly aware of the wave’s passage.

Simply, how fast a tsunami travels in the ocean can be described by the formula, \( c = \sqrt{gh} \), where \( c \) (m/s) is the travel speed of the tsunami (travel speed of long wave), \( g \) is the gravitational acceleration (≈9.8 m/s²),
and \( h \) is the local water depth (m). Thus, the speed of tsunami propagation only depends on the water depth; a tsunami travels faster in the deeper ocean and slower in shallower sea. When we assume \( h=4000 \) m as an approximate average water depth in the Pacific Ocean, \( c \) is calculated as \( 198 \, \text{m/s} = 713 \, \text{km/h} \). This is almost the same order of speed as the cruising speed of a jet plane. However, when a tsunami propagates near shore area or in a bay entrance (e.g. \( h=30 \) m, \( c \) is as \( 17 \, \text{m/s} = 61 \, \text{km/h} \)), its traveling speed is equivalent to the speed of a car. Finally, when a 5 m tsunami reaches a coast, \( c \) is reduced to 7 m/s = 25 km/h, comparable to the speed of a small motorcycle.

As the tsunami approaches the coast and the water depth becomes shallower, reducing the tsunami’s traveling speed, wave shoaling (the effect by which surface waves entering shallower water increase in wave height) compresses the tsunami, and its amplitude increases significantly. When fishermen who had not noticed a tsunami’s passage, while they were at sea fishing, came back to shore, they could find their harbor and village devastated by a huge wave. This is why the term “tsunami” means “harbor wave”.

### The 2011 Tohoku Earthquake and Tsunami

The March 11 Tohoku earthquake was caused by thrust faulting on the plate boundary between the Pacific and North American plates. There, the Pacific plate moves westwards at a speed of 8.5 cm/year and is subducting beneath the North American plate at the Japan Trench. Earthquake source studies imply that the fault rupture occurred with a slip amount of 30 m, over an area approximately 450 km by 150 km.

Since 1973, nine earthquakes M7 or greater have occurred in the Japan Trench subduction zone (USGS, 2011). The largest one was M 7.8 (the 1994 offshore Sanriku earthquake) and occurred approximately 260 km north of the March 11 earthquake’s epicenter. The Sanriku earthquake caused three fatalities and more than 700 injuries. In June 1978, a M 7.7 earthquake 35 km southwest of the March 11 epicenter caused 28 fatalities. Large offshore earthquakes occurred in the same subduction zone in 1611 (Keicho era), 1896 (Meiji era) and 1933 (Showa era), generating devastating tsunamis on the Pacific northeast coast of Tohoku (Sanriku).

The Sanriku coastline is particularly vulnerable to tsunamis, because it has many V-shaped bays that cause tsunami energy to converge and amplify. For example, the 1896 Meiji earthquake (M7.6) generated a tsunami as high as 38 m, which resulted in a reported death toll of 22,000. The 1933 Showa earthquake (M 8.6) tsunami reached as high as 29 m on the Sanriku coast and caused more than 3000 fatalities. Few earthquakes larger then M 8.0 have occurred along the northern part of the Japan trench and Kuril trench (off north Miyagi to Hokkaido), excepting the 869 (Jogan) and 1611 (Keicho) earthquakes.

### Structural Damage and Vulnerability

Structural vulnerability to tsunamis is a critical issue in planning for tsunami-resilient communities. Figure 2.1 shows the result of mapping building damage (Gokon and Koshimura, 2012) in Ishinomaki and Higashi-Matsushima cities by interpreting aerial photos that the Geospatial Information Authority of Japan acquired of the devastated area (GSI, 2011b). By mapping the structural damage and overlooking its spatial distribution, not only the impact of tsunami, but also the protective effect of coastal infrastructure and vegetation can be seen.

Combined with the results of mapping inundation zone, structural damage mapping results enable to determine the number of exposed structures, then calculate the damage probability, as the proportion of the number of structure classified as "washed-away" and the number of exposed structure. Almost 30 % of the structures in the tsunami inundation zone in Miyagi Prefecture were devastated and high proportion of devastated buildings are concentrated in the northern part of Miyagi Prefecture (Sanriku region).

Integrating structural damage mapping with field survey data, such as flow depths (Figure 2.2), produces a new measure of structural vulnerability to tsunamis, as a form of tsunami fragility curve or tsunami fragility function. A tsunami fragility curve is defined as the structural damage probability or fatality ratio with particular regard to the hydrodynamic features of tsunami inundation flow, such as flow depth, current velocity and hydrodynamic force (Koshimura et al., 2009). The tsunami fragility curve is preliminarily obtained as shown in Figure 2.4. The fragility curve shown in the figure indicates the damage probabilities of structural destruction equivalent to the flow depth. Structures in Miyagi Prefecture were especially vulnerable when
the local flow depth exceeded 2 m, while a 6 m flow depth would cause everything to be washed away. This finding can inform land use planning (zoning), so that residential areas will not be inundated more than 2 m.

Figure 2.1 The result of damage inspection in Ishinomaki city and Higashi-Matsushima city (Gokon and Koshimura, 2012).

Figure 2.2 Mapping the tsunami flow depth measured by Miyagi Prefectural government and our survey team (Abe et al, 2011). Black dots indicate the measured points.

Figure 2.4 Tsunami fragility curve for structural destruction (washed-away structures). The solid line is obtained from Miyagi Prefecture (from the 2011 event) and the dashed one is from Banda Aceh, Indonesia (the 2004 Indian Ocean tsunami).

Figure 2.3 (a) Tsunami breakwater in Kamaishi city, Iwate Prefecture (Ministry of Land, Infrastructure, Transport and Tourism). (b) Damaged Kamaishi tsunami breakwater (northern part).
Coastal Protection Infrastructure

In Miyagi Prefecture, north of Ishinomaki, the coastline becomes rugged and steep forming a V-shaped bay, with potential to amplify a tsunami. Since the 1896 Meiji Sanriku earthquake tsunami that killed 22,000 people, and since the more recent 1960 Chilean earthquake tsunami, Japan has developed a coastal protection infrastructure of seawalls and breakwaters. Especially in Iwate Prefecture, 10 m high seawalls have been built along the coast to protect communities that have been devastated many times throughout history.

The Kamaishi tsunami breakwater (Figure 2.3), which is in the Guinness World Book of Records as the deepest tsunami breakwater at nearly 63 m deep, was designed to protect the densely populated area in Kamaishi city, which is located at the bottom of the bay. Its construction started in 1978 and was completed in 2006, requiring an investment of almost 30 years and 120 billion yen. But even this barrier could not protect citizens from the 2011 tsunami, although it earned them a six minute delay before the tsunami penetrated to Kamaishi city. One can understand how, with this huge concrete breakwater, people in Kamaishi city would feel well protected, and yet the 2011 tsunami caused 1253 fatalities.

The lesson is that even great seawalls can fail. Seawalls should be designed with the assumption of overtopping and destruction, and we should not rely so heavily on coastal infrastructure.

Evaluation of Reconstruction Plan

In April 2011, one month after the event occurred, the central government established the reconstruction policy council to develop a national recovery and reconstruction outlook for tsunami-resilient community. Besides, the central government decided the policy of coastal protection such as seawalls and breakwaters, which would be designed to ensure their performance to potential tsunami level of approximately 150 year recurrence interval. In this sense, the government policy of designing coastal protection is for 150-year tsunami level (this is called “Prevention Level”) which ensures to protect lives and properties. And for the tsunami level more than 150-year recurrence interval, so-called extreme event, the government calls “Preparedness/Mitigation Level” to reduce the losses and damage by all of the efforts of coastal protection, urban planning, evacuation, and public education.

When the proposed reconstruction plan should be verified, numerical model becomes a powerful tool. Figure 2.5 shows the result of numerical modeling of the 2011 tsunami inundation in Sendai city (Maximum flow depth). After the event occurred, the authors attempted to understand how the tsunami inundated to the Sendai coast by the tsunami inundation modeling using a 10 m topography grid, with a tsunami source model proposed by the authors. As shown in the figure, the tsunami penetrated more than 5 km inland to have caused devastation on the coast and to be consistent with the observed tsunami inundation extent. After several aspects of validations the tsunami numerical models can be used for evaluation of reconstruction plans from the view point of tsunami disaster mitigation.

Under the limitations and uncertain conditions of funding, prefectural and local governments have developed their own recovery and reconstruction plans, which assume 10 years to be completed. These plans consist of the combination of structural prevention/mitigation, urban planning, preparedness, and suggest their land use management, relocation, housing reconstruction and tsunami disaster mitigation plans. The key role of academia, in engineering point of view, is to verify and evaluate if these plans really work for future disaster reduction. For instance, based on the findings regarding the structural vulnerability (Figure 2.4), Sendai city determined a reconstruction plan (Sendai city, 2011) to reduce the tsunami flow depth less than 2 m in the populated area with a conceptual image of multiple coastal protection, the land use management and relocation (Figure 2.6).

A significant feature of the Sendai city’s reconstruction plan is integrating several coastal protection facilities such as seawalls, coastal forests, park (artificial hill) and elevated roads to minimize the potential losses. Figure 2.7 indicates the plan view of the multiple protection of Sendai city with a 7.2 m seawall and river dike and 6 m elevated prefectural road. The authors conducted a tsunami numerical modeling under the 2001 tsunami source scenario, by incorporating the reconstruction plan, to evaluate how these protections will work in terms of tsunami reduction. Figure 2.8 shows one example from preliminary results.
Figure 2.5 The result of numerical modeling of the 2011 tsunami inundation in Sendai city (Maximum flow depth). Black solid line is the tsunami inundation extent obtained by GSI (GSI, 2011b).

Figure 2.6 Conceptual image of reconstruction and land use plan in Sendai city (Sendai city, 2011).

Figure 2.7 Setting of tsunami prevention facilities in Sendai city reconstruction plan.

Figure 2.8 Preliminary result of tsunami numerical modeling to evaluate the effect of the proposed reconstruction plan in Sendai city (Maximum flow depth).
As indicated in the figure, we found that the multiple protections will contribute on substantial reduction of the tsunami inundation zone, and flow depth on Sendai plain especially at the western side of 6 m elevated prefectural road. Using this result, Sendai city determined the land used plan and the area of housing reconstruction and relocation. However, note that the tsunami (the 2011 scenario) will overtop even 7.2 m seawall and the 6 m elevated road. Here, the model assumes no destruction of structures. In this sense, the model cannot reproduce all the aspects of tsunami inland penetration. Coastal infrastructure such as breakwaters and seawalls cannot always protect life and property. Seawalls or coastal structures should be designed with the assumption of overtopping and resiliency, and communities should not rely on coastal infrastructures alone for protection.

**Summary and Recommendations**

Throughout the comprehensive studies based on field measurement, remote sensing, numerical models and spatial information sciences, the authors summarized the impact of the 2011 Tohoku earthquake tsunami disaster and discussed the lessons towards the reconstruction of Tohoku region.

The 2011 event offers valuable lessons that should be applied, in order to build safer and more resilient coastal communities.

As observed in the devastated areas in Miyagi Prefecture, the tsunami flow depth over 2 m has potential to severely damage houses, and more than 6 m flow depth will cause total devastation. This finding can inform land use planning (zoning) or one goal of comprehensive tsunami disaster mitigation, so that residential areas will not be inundated more than 2m.

Since the 1896 Meiji Sanriku earthquake tsunami that killed 22,000 people, the 1933 Showa earthquake tsunami and since the more recent 1960 Chilean earthquake tsunami, Tohoku region has developed the coastal protection infrastructure of seawalls and breakwaters that have never been devastated throughout the history since 1934. Again, we need to note that coastal infrastructure cannot always protect life and property: even great seawalls may fail. Seawalls should be designed with the assumption of overtopping and resiliency, and communities should not rely on coastal infrastructures alone for protection.

**References**

Geospatial Information Authority of Japan (GSI) (2011a), Available online at: http://www.gsi.go.jp/


Abe, I. et al. (2011), High resolution survey results for the inundation limit and height of the 2011 Tohoku earthquake tsunami, Abstract of Japan Geoscience Union Meeting 2011, MIS036-P120, Available online at: http://www2.jgmu.org/meeting/2011/yokou/MIS036-P120.pdf


**Author(s): Shunichi KOSHIMURA1, Hideomi GOKON2, Satomi HAYASHI2**

1) International Research Institute of Disaster Science, Tohoku University
2) Graduate School of Engineering, Tohoku University
2.2. Designing Infrastructures for Very Infrequent Hazards

Design levels of Tsunami L1 & L2 were introduced for reconstructing seawalls along the coast of Japan first time after GEJE. It is a similar earthquake design approach for strong seismic motion of L1 & L2, for frequent and very infrequent earthquakes respectively, as adapted in Japan after the 1995 Kobe Earthquake. This paper discusses the implication of this approach on the reconstruction of communities in coastal area, and the solutions yet to be derived.

Earthquake Design for Very Infrequent Event and Performance Based Design of Infrastructures

Reconstruction of Seawalls and Coastal Communities

A new tsunami design approach for coastal structures was recommended by the Reconstruction Design Council in June 2011, and a L2 tsunami concept was introduced for building resilient seawalls that allow overtopping of tsunami but still function against damages such as scarring at back in case of very infrequent but extremely severe tsunami events. World Bank Knowledge Notes 1-1 & 6-5 describes details and countermeasures for L1 & L2 tsunamis. By reevaluating the L1 design height, which is a minimum countermeasure for frequent tsunami, reconstruction plan of seawalls along the coastal areas in Iwate to northern part of Miyagi prefectures was announced in Fall 2011 (see Figure 2.9 for the coasts in Iwate Prefecture).

The proposal of new seawall heights has sparked vivid and wide concerns among the residents in coastal area as the wall reconstruction to new heights results in the following consequences;

1. In many areas, a much higher seawall is built to separate the living area from the seacoast. This is because of the new L1 level assuming about 1.5 times higher design tsunami than the previous.

2. Without the seawall or with lower seawall height, an inundation area will be declared to limit the living activities in that area.

To study and learn from the lessons through the recoveries and reconstructions of infrastructures after the 2011 GEJE, it is extremely important to understand the timelines for those after March 11th 2011. After the announcement of reconstruction strategy in June 2011, the local and municipal governments have produced the outline of their reconstruction plans in Fall 2011 while the detailed study of L1 & L2 tsunami levels were made simultaneously mainly through central government agencies. Following the national fiscal plan for reconstruction (the 3rd amendment) being approved in late Nov. 2011, the detailed reconstruction plan at municipal level started to be worked out while the national Reconstruction Agency started functioning in Feb. 2012.

It is also important to understand the responsibilities of various institutions with respect to coastal structures. The national government has an authority to build the structures, while the prefectoral government is given the responsibility of management. The municipal government has no authority to modify the structural design, while the environmental considerations and community participation are required.

The issue discussed in this paper is how to utilize the L1 & L2 concept for earthquake design, and its applicability and limitation for implementing DRR through constructing infrastructures.
L1 & L2 Earthquake Levels for Strong Motion

After the 1995 Kobe Earthquake, JSCE (Japan Society of Civil Engineers) has proposed two design levels for strong motion, L1 & L2, to account for both frequent and very infrequent earthquakes. This procedure is now widely accepted in designing infrastructures managed by national and local governments. The L1 & L2 concept is the same both for tsunami and strong motion, the design to prevent structural damages for L1 strong motion or tsunami and L2 for preventing the human casualties even if the structure being damaged. It is very unfortunate that there was a time delay of over 15 years in introducing the same concept for structural and hydraulic fields.

By the introduction of L2 design for strong motion, the design required to analyze the collapse or yielding behavior & performance of structure when subjected to strong motion beyond the L1 level. The serviceability of structure is an issue, and its function not to cause human casualties is to be examined through a performance based design. The current L2 design for tsunami is not extended to that level yet, and the secondary damages by tsunami, such as debris flow and fire, need to be analyzed in future.

Also it is important to note the strong motion design aims at directly the safety of individual structure while the tsunami design affects directly the safety of an area where human activities exist. This difference of design implications against two hazards has to be rigorously examined.

The Implication and Limitation of L1 & L2 Tsunami Levels

As noted earlier, the acceptance or not of L1 tsunami protection measures by the community will have a decisive consequence on their land use plan through that the community can select the areas for residential and industrial facilities. As the new L1 tsunami level has been designated for coastal areas in much finer divisions, compared with a single tsunami level for much wider coast in previous scheme, the community has a better capability for adjusting their land use plan. However, the community is faced with a dilemma of choosing either a high seawall separating their residential area from the seacoast where they make their living, or moving into a higher residential ground from where they commute to the industrial areas.

Many small municipalities along the coast of Iwate and northern Miyagi prefectures are faced with this difficult choice and consensus building on the new level of seawalls in each area. Also the time allowed to discuss and decide their choice is very limited as only a maximum period of 5 years is given for completing the reconstruction. The actual building for reconstruction is due to start from April 2013.

There have been many dialogue and consultation meetings on this subject at those municipalities noted above, but most of the meetings have been a one-way explanation from the prefecture to the local communities. There were few exceptions however in this dialogue process at municipalities where there was a strong community activity. In Kesen-numa City of Miyagi prefecture, about 30 individuals have created a study group to learn and disseminate the information among the City citizens regarding the seawall plan so that they can better respond to and dialogue with the governing institutions (see Box). Their dialogue process is well documented and disseminated through their web page. The results of their efforts are yet to be seen in forthcoming months, but the information and process they have disseminated have been shared among the affected communities along the coast.

The above example clearly indicates the difference of L1 & L2 concepts for earthquake design between strong motion and tsunami. The tsunami design of seawall directly affects the community while the strong motion primarily the individual structures. Even for L1 tsunami level, the decision by a community needs to be involved. The L2 tsunami design is to be implemented by using both structural and non-structural measures, such as disaster educations, early warning and land use plan. However, a similar dialogue process with community is needed for the L1 tsunami infrastructure.

KESEN-NUMA CITY - Study Group on Seawalls

In August 2012, an initiative of about 30 individuals has started at Kesen-numa City to study and discuss the implication of the proposed design height of seawalls that was given from the Miyagi Prefecture in 2011. The purpose of study group is to share the vital information such as governing institutions responsible for seawalls, legal procedures from planning to start of construction, reconstruction schedules and etc.
the residents of the City so that a better and safer community to be built through a good understanding of the recovery and reconstruction projects.

Three months from August, the group organized 13 study meetings by inviting various authorities from local government, universities, and research institutions, including the Deputy Mayor of City. The group has submitted a formal request in Nov. 2012 to the Governor of Miyagi Prefecture, and also similar requests to the governmental local offices that are responsible for managing the seawalls in their city. The final design of seawall be finalized by April 2013, and the construction to be completed over next 3 years. The activity of this group is regarded as the most well organized citizen’s initiative trying to influence the design decision of seawalls to be built in their community.

The Kesen-numa city has a population of about 70,000 and it is famous with its fishery industry and port. More than 1400 people were killed by tsunami, and the residents created a number of NPOs that serve for reconstruction. This study group is one of community initiatives originated in the City.


It may be useful to discuss here the reason for the difference in implementing the L1 & L2 design levels for tsunami and strong motion. The difference may be described as internal versus external countermeasures resisting against strong motion and tsunami respectively. For the strong motion, internal reinforcing or strengthening of structures is used to resist the external force due to L1 & L2 strong motions, in addition to providing regular service under the usual load. However, the seawall is built as an external countermeasure, i.e., measures at out side of the safety service area, and therefore the safety of functions or services inside of the protective measure has to be assessed independently. Similar argument of external measure may apply for the flood protective dykes, while the structural measures for windstorm may be of internal. However, designing of safe height of vertical evacuation structure against tsunami or flood can be internal measure.

Lessons

In this short note, the design strategy for frequent and very infrequent earthquake events is reviewed by comparing the strong motion and the tsunami hazards. The following lessons are obtained:

- The earthquake design philosophy for the strong motion and the tsunami against frequent and very infrequent events is now unified by introduction of L1 & L2 concept.
- However, there is a distinct difference of their design implications against two hazards and this difference has to be well understood and rigorously examined.
- The implementation of L1 & L2 tsunami levels requires a dialogue process between the local communities concerned and the managing prefecture, irrespective of the design levels. Therefore a good dialogue process between the two, such as done by the seawall study group in Kesen-numa City should be followed.

Recommendations

The DRR strategy on natural hazards for frequent and very infrequent events can be built by classifying the hazard levels into L1 and L2 respectively. By assigning the L2 design level for the extremely destructive hazard but of very infrequent occurrence, it would lead to a rational and economical “performance based design” approach and this approach leads to development of integrated DRR schemes of utilizing both structural and non-structural measures.

However, implementation of the above L1 & L2 design level to construct infrastructures should be carefully performed depending on the type of natural hazards. When planning and constructing infrastructures for tsunami or flood as protective structures, a dialogue between the communities concerned and the governments is vital to have a common understanding on how to build a safer and better society against these hazards with a good DRR strategy.
2.3. Restoration of Lifeline Systems

When the Tohoku earthquake occurred on March 11, 2011, lifeline services were cut to millions of households in East Japan. Lessons learned from the 1995 Kobe earthquake resulted in improvements in disaster-assistance frameworks that have been implemented in earthquakes since then. This report focuses on the nation-wide emergency-response capacity to repair damage and provide alternative lifeline services to stricken areas.

Recovery Process

Introduction

The outage of lifeline services caused by the Tohoku earthquake and the following earthquakes in Niigata and Nagano Prefectures affected about 8.9 million households in 18 prefectures among 4 electric power companies, about 2.25 million households in 19 prefectures for water supply, and about 460,000 households in 8 prefectures for piped-gas supply. These numbers of affected households were larger than those ever experienced in Japan.

Even though quick restoration of a lifeline system after an earthquake is expected for saving human life and maintaining daily existence, it is hampered by complex elements such as internal restoration work and inter-related problems with other lifeline systems. Alternative lifeline service such as generator, emergency water delivery by trucks, and voice mail system plays the role of normal lifeline service during an outage period. Emergency-response of lifeline system is therefore required quick system restoration as well as temporary service providing the alternatives. This report focuses on emergency-response capacity of lifeline authorities during a wide-area earthquake disaster. The emergency-response capacity can be explained by the system of organization, ability, experience and resource to respond demands caused by an event. The emergency-response demand from the extent of lifeline damage and restoration time during the Tohoku earthquake was reviewed on electric power, water and gas supplies, comparing to those in the Kobe earthquake.

Electric Power Supply

There was a power outage to 4.66 million households in the supplied area of the Tohoku Electric Power (Tohoku-EPCO), which are about...
70% of total customers. The number of affected households decreased up to 0.99 million (80% restored) by 3 days after the earthquake remaining the coastal area and Miyagi Prefecture, and to 0.26 million (94% restored) by 8 days after the earthquake. Until 8 days after the earthquake, the power supply was resumed except the tsunami-suffered area. In the supplied area of the Tokyo Electric Power (TEPCO), the power supply was cut to 4.05 million households. The number decreased up to 0.6 million (85% restored) by 1 day after the earthquake. The restoration was completed by 7 days after the earthquake. Figure 2.10 shows the number of households without power supply in the 3 affected prefectures. The restoration process in the affected prefectures except the Miyagi Prefecture is similar to that in the Kobe earthquake.

With regard to damage to facilities in the Tohoku-EPCO, three of thermal power plants located on the Pacific Coast were severely damaged and required a long time for restoration. The damage to substation was at 75 locations. While there were the large number of damage in the distribution facilities such as electric pole, cable and post (see as Figure 2.11), their damage rates were less than or equal to those in the Kobe earthquake. For the restoration in 100 days after the earthquake, the total number of the personnel composed of staff and members from construction companies and the other electric power companies were about 21,000 for substation, about 42,000 for transmission line and 214,000 for distribution line. Out of these numbers, the disaster assistance from the other power companies was on the repair of distribution line and accounted 4,176 man-days until April 1. Figure 2.12 shows the number of personnel for restoration works between the Tohoku and the Kobe earthquakes. The number of households for power outages during this earthquake was 8.9 million that is 3.4 times of 2.6 million in the Kobe earthquake. Although the restoration in Miyagi Prefecture required a week for restoration, the personnel for restoration works are in total double of those in the Kobe earthquake.

Water Supply

The water supply was cut to about 2.25 million households at its peak. Figure 2.13 shows the number of households affected by water-supply outages in affected prefectures in the days following the earthquake. These numbers are based on a report by the Ministry of Health, Labor, and Welfare (2011). The total number of households affected by water-supply outage in the Tohoku earthquake was twice that of the Kobe earthquake. The number decreased from 2.25 million to 1.2 million, 0.6 million, and 0.31 million by the 1st, 2nd, and 3rd week, respectively, after the earthquake. Although water-supply restoration was hardly evident in the first 3 days after the earthquake, it proceeded promptly, except for restoration in Miyagi Prefecture, where it was completed up to 90% by two weeks after the earthquake. In the Miyagi Prefecture, the two regional water-supply systems, Sennan-Senen and Osaki, had damage to large transmission pipelines, and it took 2–3 weeks for repair (see as Figure 2.14). Moreover, restoration speed stagnated when the water-supply outage rate was about 10%. Comparing with Kobe City in the Kobe earthquake, the total households of one city almost corresponds to one prefecture, the Miyagi. The restoration demand in the Tohoku earthquake was the double of that in the Kobe earthquake.
Just after the earthquake, the Japan Water Works Association (JWWA) gathered information on the stricken areas and requested water truck dispatches from each representative of unaffected JWWA regional branches; it then requested dispatches from each water-supply authority. Figure 2.15 shows the number of dispatched water trucks in the days following the earthquakes. The number of dispatched water trucks increased up to 300 vehicles after March 14 and stayed at that level between March 15 and the beginning of April. At its highest, the number of dispatched water trucks was 355 vehicles. The number of water truck dispatched in the Tohoku earthquake is not so much different from that in the Kobe earthquake, if vicinities of the Kobe City are regarded too.

On parallel to the emergency water delivery by the water truck, temporal water service stations were held at water storage tanks or on the main pipeline as shown in Figure 2.16.

**Gas Supply**

The gas-supply was cut to 16 piped-gas supply companies and about 460,000 households. The Japan Gas Association (JGA) sent an advance team to Sendai in the morning of March 12 and began dispatching disaster repair teams from March 14 based on the guideline of disaster assistance. Under the JGA headquarter of disaster-assistance in Tokyo, three main teams were organized; Sendai repair team, Sanriku (coastal area of Iwate Prefecture) support team, and Fukushima repair team. Since majority of the affected households were in Sendai City with 359,000 households (78% of all affected households), several sub-repair teams were composed of the teams dispatched from nationwide large gas companies. The most in the stricken area are in rural area and generally use the gas from propane-gas cylinder. The disaster-assistance personnel sent in
the JGA framework were 4,200 at its peak from 51 companies. While it took a few weeks for securing the plant function after the tsunami damage in Sendai and Ishinomaki Cities, the pipeline repair rate was fast so that the extent of pipeline damage was minor in comparison of those in the past earthquakes in Kobe and Niigata and the original role of the repair team was allotted to the teams of pipe repair and valve opening.

Figure 2.17 shows the number of households affected by gas-supply outages in affected prefectures in the days following the earthquake. The number of affected households was about 857,000 in the Kobe earthquake. The number of households affected by the gas-supply outage was about the half of that in the Kobe earthquake. After the Kobe earthquake, the large number of personnel as about 9,700 came to repair the damage. The number of disaster-assistance personnel dispatched was about the half as well. The disaster assistance can be considered to have been enough in this earthquake because emergency-response demand was fewer, except the tsunami damage to facilities.

**Nation-wide Disaster Assistance**

National disaster assistance of the lifeline systems in Japan began with the Kobe earthquake of January 17, 1995. This earthquake hit the modern urban area of Hanshin and caused severe malfunction of lifeline systems. In the Hyogo Prefecture regional disaster-prevention plan at the time, mainly typhoon and flood measures were assessed and prepared for, under consideration of the disaster history in that area. Earthquake measures were little described. Despite it, for instance, about 70% of the staff from the affected water-supply authorities promptly came to their offices on the day of the earthquake, and disaster-assistance teams from other cities arrived with water trucks to provide emergency water delivery. At its peak, disaster-assistance activity included 432 water trucks and 804 personnel from 83 cities, 20 private groups, and Self Defense Forces by one week after the earthquake. Thus, the Kobe earthquake challenged lifeline-related authorities to reconsider the disaster-assistance framework.

As for water-supply community, the JWWA reviewed its system for disaster assistance on the basis of lessons learned from the 1995 earthquake and summarized its findings in the “Report on responses in emergencies such as earthquakes.” Four main improvements were suggested in this report: (1) assistance should exceed the regional branch framework; (2) advanced team should be dispatched; (3) response to JWWA nonmembers such as private and small-scale water supply authorities should be provided; (4) disaster responses should be organized at the designated headquarters. The revised national and regional disaster-assistance systems ensured clear roles for representatives of prefectures and regional branches and the quick establishment of disaster-assistance headquarters after the 2004 Niigata Chuestu, the 2007 Noto, and the 2008 Niigata Chuestu-oki earthquakes in Japan.

The disaster assistance in this earthquake was based on the above for responses to emergencies like earthquakes. Detailed emergency response was the combined effort of affected prefecture and assisting regional branches. Figure 2.18 is a schematic of the relationships in the disaster-assistance system. Iwate, Miyagi, and Fukushima Prefectures were supported by several JWWA regional branches. Chiba and Ibaraki Prefectures were supported by their own Kanto regional branch. The combination of the regional branch and the affected prefecture for water supply was different from that for public administrative work. Because of the extent of the disaster, the representatives of water-supply authorities at the Tohoku regional branch and prefecture, who were expected to manage disaster assistance, could not respond. Until Sendai City, representative of the Tohoku regional branch, completed restoration early in April, the JWWA represented it on its behalf, as shown in Figure 2.18.

Disaster-assistance teams were dispatched from all over the country. Figure 2.19 shows the distribution of dispatched water-supply authorities 1 day, 3 days, and 1 week after the earthquake. Assisted water-supply authorities shown in Figure 2.19 refer to the ones with water-supply outages at the time. Initial dispatch action by megacities such as Tokyo, Yokohama, and Osaka was quite early. Sapporo, Niigata, and Nagoya followed 2 days later. Water trucks were sent from 118 water-supply authorities 3 days later, and 300 water-supply authorities were sent 1 week later. As can be seen, assisting water-supply authorities were not only from the vicinity of the stricken area but also from throughout the country, including the islands of Hokkaido, Shikoku, Kyushu, and Okinawa.

Since the suffered area was so large, the combination between the affected prefecture and assisting regional branch was first challenge in the disaster assisting system. It works not only in emergency but also in
reconstruction period. Though the disaster assistance for water supply is introduced as an example, the other lifelines also used the similar combination in the disaster assistance.

![Figure 2.17 Number of households affected by gas-supply outages in the days after the Tohoku earthquake in 3 affected prefectures. Date of the Kobe earthquake is adjusted from the day of earthquake.](image)

![Figure 2.18 Schematic of the disaster-assistance system followed during the Tohoku earthquake](image)

![Figure 2.19 Assisting and assisted water-supply authorities. (a) 1 day after earthquake (March 12), (b) 3 days after earthquake (March 14), (c) 1 week after earthquake (March 18)](image)

**Lessons**

- Since the users of piped gas supply were smaller than those in the Kobe earthquake, the dispatched personnel were smaller too. Outage of electric power and water supply in this earthquake was larger. Further restoration resources were sent to the suffered area. Especially the tsunami damage pattern was completely different from that of the Kobe.
- Although many restoration resources such as assistance personnel and machines were urgently required in Tohoku and Kanto regions, it took several days to gather information and dispatch a steady number of resources. It also took time to restore roads and transport fuel to the stricken areas. In the case of wide-area disaster, first three days after the event might not support from outside the suffered area.
- Most of the stricken lifeline-related authorities in this earthquake were in rural areas. Engineering staffs are a few and their managing of the assisting personnel and resources was hard.
- Large areas from North Kanto to the Tohoku regions could not get electric power for at least a few days after the earthquake. Most of lifeline-related authorities prepared emergency battery at most 1 day. Long-term black-out hampered the restoration of the other lifeline systems. The interrelation shortly after the earthquake between lifelines should be considered.
As the period of disaster assistance became long, the needs of suitable logistics for assisting teams increased. Especially the location of camping base, which is near the suffered area and can involve a large number of sleeping facilities, was hard to find in the rural area.

Regional and nation-wide disaster assistance system, which was revised after the 1995 Kobe earthquake and implemented in the several earthquakes in Japan, worked well in this earthquake.

The combination between the affected prefecture and assisting regional branch was first challenge in the disaster assisting system. It is necessary to prepare this framework for a large earthquake in future.

**Recommendations**

As for the wide-area earthquake disaster, the implemented disaster assistance system of lifeline communities worked well. The combination of the affected prefecture and assisting regional branch was first trial in the nation-wide disaster assistance. The one regional team keeps supporting the one suffered area in the period of lifeline restoration, the communication to the suffered area and disaster assistance itself work well. Such framework is necessary not only in the period of restoration but also in the period of reconstruction.

Although this report briefly analyzed on restoration and disaster assistance of only lifeline-related authorities, for example, emergency water delivery was also provided by Self Defense Forces as well as other organizations and groups. Water boats from the Maritime Self-Defense Force, Japan Coast Guard, and private companies provided disaster assistance at 11 places along the coast in the Kobe earthquake. Because the total number of restoration resources such as water truck was limited, it is necessary to cooperate with such organizations that can play the role of providing lifeline service.

Finally, it is difficult to estimate the extent of damage shortly after an earthquake, especially in a wide-area earthquake disaster, when communication and transportation systems are damaged and out of service. A disaster-assistance organization should be flexible enough to build up assistance at the level of prefecture, as well as at the level of region, when the disaster damage information is updated in real time. It is necessary for readership at the national level to arrange quickly combination between affected prefectures/cities and assisting prefectures.

**Key References**


**Author:** Yasuko KUWATA

Department of Civil Engineering, Kobe University
CHAPTER 3: RECOVERY PLANNING

3.1. Reconstruction Urban Planning: Current Status and Future Challenges

The issues being faced by the tsunami-devastated regions following the Great East Japan Earthquake are really the same issues being faced by all Japanese rural towns today. They all share similar planning challenges, specifically, the need for improvements in disaster resilience, the integrated and comprehensive planning of space, adaptations to population decline, low fertility, and the aging of the population, and the creation of unique and appealing communities. Addressing these types of issues and presenting and implementing solutions will contribute not only to the restoration and reconstruction of the affected areas, but also to everyday (non-emergency) urban planning and to so-called "pre-disaster reconstruction," which will help communities prepare for the next major disaster.

Introduction

The Great East Japan Earthquake was an unprecedented calamity that left 18,700 people either dead or missing and completely destroyed 130,000 homes. One of the reasons the for this level of destruction can be attributed to urban planning and development activities that were undertaken without sufficient consideration for disaster management issues, including tsunamis. However, the problems being faced in the tsunami-affected areas are not merely a result of their disaster readiness levels. They are the typical problems being faced by rural towns and farming villages all across Japan; they are only appearing in a more extreme form since the disaster.

That is, in addition to population decline, low fertility, and an aging population, these locations are experiencing low land liquidity, relatively high land prices, low local appeal (to attract new residents), and other problems, such that the populations of existing towns and spatial use density are declining. Particularly in the city centers, residential and commercial functions are dwindling, turning these areas into unpopular "shuttered avenues" (Figure 3.1). On the other hand, in the outskirts, it is easy to find residential developments with sprawling mini-detached houses, as households break apart into smaller units. The same is true of commercial developments along bypass roads.

In farming and fishing villages, population decline and aging, as well as declines in the functions that support residential living and employment, are also becoming more serious. In these locations, the very survival of the villages themselves is at risk. Further, the budgets needed to solve these problems are overwhelmingly lacking due to the financial problems being faced by local governments.

Solving these problems is not going to be possible with legal urban planning measures that are spatially and methodologically limited. Community development efforts that include "soft" elements must be undertaken through a bottom-up approach in collaboration with residents. However, these areas lack both the know-how and the personnel to make this happen.

The need for and importance of regional decentralization have been argued for a long time, but the authority over projects related to various types of physical infrastructure developments, and over land use regulations, continues as before to be centrally controlled in a vertical structure. One would be hard pressed to say that the lower-tier local governments that ultimately have control over the spaces where these projects are conducted are adequately fulfilling their roles.

There has been a shift from low-density, scattered urban structures to compact, network-style urban structures, and from centralized, top-down urban planning to decentralize bottom-up community
development. The recent tsunami disaster struck just as Japan's rural towns and farming communities were facing these typical problems. Thus, reconstruction policies that only try to solve the problems of disaster management are going to be insufficient to the task. Reconstruction will not be achieved unless the following more fundamental issues are addressed.

Overview of Urban Planning

A review of the reconstruction plans formulated by various local governments about a year after the disaster reveals that there is some variation in the tsunami countermeasures, achieved through physical infrastructure development and land use regulations, but the plans are largely similar on the following points.

That is, for a tsunami level "L1," which is the level that occurs once every several decades or once every hundred plus years according to tsunami simulation models, plans call for the creation of coastal seawalls that will fundamentally protect the downtown areas. On the other hand, for an even larger tsunami level "L2," which occurs only very infrequently, plans stipulate that areas expected to flood at a depth of 2 m or less (which was the case for many locations in the recent tsunami) are suitable for residential use, but areas expected to flood at a depth of more than 2 m are designated as non-habitable areas in the application of disaster hazard zone regulations. Land use in these areas is limited to industrial uses or parks; residential use is not permitted ("Tsunami Disaster Reduction Levels"). In such cases, the residential functions of villages and towns have to be moved to higher ground or to more inland locations, through disaster group relocation promotion projects, for example. In plains, where districts with an expected flood depth of 2 m or more extend across a very wide area, the expanse of those areas can be limited through the use of parallel embankments using interior roads, so as to create habitable zones. Situations where the expected flood depth is several meters can be addressed by raising residential embankments through land readjustment projects. These plans protect people against tsunami disasters by focusing on seawalls to protect against L1 events, and land use regulations, high-ground relocation programs, parallel embankment construction, and embankment raising efforts in residential areas to protect against L2 events (Figure 3.2).

Careful examinations are also being conducted on development plans for the new high ground relocation destinations, community development efforts focused on "soft" elements in the areas not designated as non-habitable (including the relocation destinations), and new land uses for low-lying non-habitable zones. A particularly important issue is how to use the non-habitable zones, which consist of expansive low-lying areas that have thus far been used for housing. In Minamisanriku, because the difference in the L1 and L2 heights is quite large, most people are no longer able to live in the coastal flatlands. Many local governments are focused on the “three piece set” of parks, tourism, and fisheries and fish processing for these areas, but there is still the question of who is going to pay for the development, management, and maintenance costs in areas identified for use as parks and green spaces, for example. Or if the areas are to be used for industry, there is a question of whether there is demand to support such developments. In any case, the challenges are numerous.
Sustainable Community Development

If one wanted to express the goal of reconstruction community development in a single word, it would be "sustainability." Sustainability in this context is not just a simple matter of maintaining and increasing numbers of people and facilities. In many cases this would not be realistic given the pre-disaster trends and current damage situation. Of course, maintaining certain levels in terms of quantity is important, and efforts in this regard are necessary (the arrangement wherein there are many small villages with few public facilities will be discussed below), but even more important, and important toward that end as well, is maintaining the quality of industry, and thus of livelihoods. To do this, ensuring the level of disaster resilience mentioned above is important, but insufficient. Even beyond this, there are many elements that must be considered for ensuring sustainability, and there are challenges associated with each.

Below I discuss the major elements to be considered. At the time of this writing, several of the reconstruction plans (specific plans at the community level) were still being formulated. Thus, I must warn you in advance that this is not a quantitative analysis, but one that focuses on a qualitative analysis of plans still in progress.

Adapting to Population Decline and Aging

The greatest issue facing the tsunami-affected areas is population decline and aging. This trend was neither accelerated nor decelerated by the recent disaster. Thus, when looking at the realities of each project plan, it is important to ask how the plan has been crafted to ensure sustainability, or, how have spaces been planned so as to ensure compact community development?

The first step that authorities can take, in the event that parts of the village were not destroyed or that nearby towns are still intact, is to think about assigning the highest priority not to the construction of new hills, but to an "infill" approach to relocation that makes effective use of vacant lands and homes in existing villages and towns. The reasons can be summarized in the following three key points.

1. **There are advantages to maintaining spatial, social integration and density.** It is clear that existing villages as well as newly developed hills are going to see increases in vacant lands and homes over the short term as residents continue to age. Given this, it is better not to usher in low density conditions in both the old and new areas, thus producing challenges in terms of the maintenance of public facilities and communities. Rather, the promotion of higher density living facilitates the maintenance of spatial and social integration over the long term.

2. **This approach makes effective use of time.** It may take some time to work out the coordination of various interests, but since there will be virtually no time needed for development and construction, the difference between this amount of time and the amount of time that would be needed for the vast amounts of development and construction work along the Sanriku coast to be completed, even though we cannot realistically know specifically how much time this will take, is obvious.

3. **There are financial advantages.** Land prices in villages in affected areas are about ¥10,000 to ¥20,000 per square meter. This means that a piece of land of 70 tsubo, or 250 m², can be purchased for ¥5 million. In the case of high ground relocation, the development costs for the same area would be about ¥30 million to ¥35 million. In Ishinomaki City, for example, a registration system known as the Public Project Vacant Lot Information Bank has been created to make effective use of vacant lots in existing downtown areas for the promotion of public projects. By allowing landowners of private land who are interested in cooperating with various city projects to register their lots, this system makes it possible to actively and strategically promote city projects in the downtown areas. However, as of the time of this writing, methods for the effective use of this system have yet to be fully developed and still remain to be addressed.

Another example can be seen in Miyako City, where the relocation site of a partially damaged small village was established near the train station of an adjacent, large village (currently not operating due to disaster damage) in an effort to promote concentrated urban development through the use of public transportation facilities.
A second way to promote sustainability, related to the first, is to actively examine the possibilities for integrating and consolidating small villages. Even before the disaster, the maintenance of various public service levels in small villages facing population decline and aging, which seem to be located at every inlet, and the possibility of integrating and consolidating those villages, were important issues. The relocation efforts associated with the recent disaster are, in a sense, providing an opportunity for individual villages to be integrated in a fair way, and for the quality of life of residents to be maintained through the creation of communities of a certain size.

However, while such efforts are being pursued by some local governments and districts, such as Iwanuma City and Minamisanriku-cho, little progress is actually being made. There are several possible reasons for this. Neighboring villages that have histories of conflict over fishing rights generally do not get along very well. Integrating them is therefore a rather difficult proposition. Also, senior citizens have a tendency to want to avoid major changes in their living environments, and thus usually want to rebuild in a location as close as possible to their former home. Since 100% of the relocation expenses are being borne by the national government, the local governments have no incentive to actively promote more dense living conditions. And more than anything else, since community development efforts were not being promoted in these areas before the earthquake, it is hard to convincing people that now are the time, in the midst of the post-disaster chaos, when they should start pursuing and implementing such efforts.

This is why separate new towns and villages are essentially being created for each village through land readjustment projects and high ground development projects. Even for villages with only a small number of homes, budgets of several hundred million yen are spent to build seawalls and to undertake embankment raising and development projects.

A third approach is to pursue compact community development that minimizes the size of these new towns and villages. All of the local governments are conducting detailed surveys regarding residents' preferences in terms of relocation sites, and are planning projects based on that information. In spite of these efforts, however, the reality is that in the near future, once those projects are complete, the new developments are going to start to have vacancies. In some villages, senior citizens account for more than 50% of the population, so it is natural to conclude that some of the homes constructed will be for senior households. Of course, efforts must be made to attract young people to these villages. In reality, however, expectations for these efforts are not very high.

The fourth way is to adopt land use planning and architectural planning strategies that both prevent and make effective use of vacant lots and homes. For example, if public housing is built with a certain level of density, those complexes can eventually be converted into a type of care housing, such that people who initially live there on their own can later become connected to one another as the aging trend continues. Or green spaces can be kept to a minimum during development so that vacant lots that emerge later can be converted and used as green spaces or for farmland. It is also important to start thinking now about vacancy management at the community level, such as the conversion to public ownership and the joint use and management of lots and buildings once their owners are gone. Also, authorities need to think about the possibility of village area management that includes real estate.

This process is really a matter of taking the vertical thread of planning focused on the human life cycle and the horizontal thread of planning focused on the life cycles of spaces and buildings, and weaving them together on the loom of time. At the moment, there are not many examples of such careful planning that extends down to the community level, and this is going to become an issue in the future.

A fifth strategy for promoting sustainability is to consider ways to use low-lying areas designated as disaster hazard zones. As mentioned above, many local governments have thus far been using the "three-piece set" of plans for these areas, designating them for parks, tourism, and fisheries and fish processing. However, in none of those cases are projections for land use demand or facility maintenance and management included as considerations.

For starters, not all of the lots designated as disaster hazard zones are going to be converted to publicly owned land. Only the lots that were used as pre-quake residential areas are going to be purchased. Lots used for commercial or industrial uses, or as parking lots, are not. However, these lots are unconnected and scattered across the area. If we resort to ultra-low density scattered private land use, such that the land in these non-residential areas is only sporadically used, the community will face problems with land use
efficiency and an extreme increase in infrastructure maintenance and management costs. Thus, land use consolidation is necessary for the sake of promoting the effective use of land in these zones.

In addition, in thinking about the costs versus benefits of publicly owned land, authorities may have to make the decision to forgo extraordinary, unreasonable efforts to use land for urban purposes (including park use, since parks have maintenance and management costs), and instead to actively eliminate infrastructure that is no longer necessary, such as roads and sewerage systems, and to let the land revert to nature. Thus far, however (as there are still plenty of budgetary and institutional framework issues that have yet to be resolved), there have been virtually no plans that include decisions to this effect.

**Regulations and Projects Based on Comprehensive Space Planning at the Community Level**

**Project Integration**

The current reconstruction-oriented community development efforts in progress are really a process of fundamentally reconfiguring the shape of towns or of entirely building them anew. The facilities that have to be developed span a wide range that includes seawalls, roads, schools, and homes, and there are as many different authorities in charge as there are facilities. There are both vertical and horizontal walls that exist between these, as each one operates based on its own (often standard) parameters and evaluation standards. It would be difficult to say that a comprehensive plan tailor-made to local conditions has been formulated based on sufficient levels of coordination between these parties, or that individual projects are being promoted based on such a plan.

As a result, we are seeing the following problems. First, the authorities are not engaging in efficient, effective planning. Rather, there seem to be rather considerable disadvantages afforded by the plans overall.

In the current reconstruction efforts, there are few budgetary restrictions on disaster management. When it comes to the distribution of funding, however, instead of a framework in which a comprehensive budget is allocated to each local government based on the damage incurred, allowing each local government to comprehensively manage its own affairs within the scope of that budget, the framework is such that each project department of the national and prefectural governments has its own budget, and disperses its funds according to its own parameters. This means that, ordinarily, the burden on the local government that needs the budget allocation is zero. It also means that rather than having to choose between “this project or that project,” it is both possible and necessary to do “this project AND that project.”

Thus, for example, while the civil engineering authorities may be building an embankment to protect the inland areas, the urban planning authorities may be building a town up on a hill rather than in the interior low-lying areas. As a result, an enormous sum of tax funding is used to build an embankment even though no one is sure what it is being built to protect. From a safety perspective, this cannot but be viewed as an overinvestment. Further, when fishing port facilities and residences are built in areas where there is little distance between the sea and the inland cliffs, the construction of high embankments can have significant impacts on the fishing and residential environments. In this case, if one compares the advantages of protection from expected wave heights, against the disadvantages associated with these impacts, the latter are sometimes obviously larger.

A second problem is that uncoordinated planning does not lead to the creation of attractive communities. It is important to pursue the creation of appealing communities through efforts in various fields. In addition, active efforts to provide temporal and spatial coordination between fields at the community level and to engage in integrated planning can not only help resolve various problems and conflicts that might arise out of a mutual relationship, but also may make it possible to more actively create new appealing spaces. A typical example of this is a plan that integrates an embankment with inland structures. An embankment is a wall that separates water from people. While it is designed to protect people from water, it also ends up keeping the water away from people. Creating a plan for an attractive space that integrates the embankment with the nearby structures not only mitigates the latter disadvantage, but also can create a venue (the embankment) where new activities can take place.
Integrating Land Use Regulations

Changes in various regulations related to land use play an important role alongside various projects in achieving reconstruction plans. To implement various projects, the hurdle of land use regulations must first be cleared. However, the same strategies apply here as have already been mentioned above.

Japanese land use regulations are vertically structured based on individual laws like the Urban Planning Act and the Agriculture Promotion Act. While one might expect the national land use plan (the Land Use Basic Plan) to be based on integrated, coordinated functions, that is hardly the case. Thus, one-stop regulation changes are being approved in the affected areas through the formulation of reconstruction and development plans.

That said, the permitting authorities are still ultimately vertically structured, and horizontal decision-making authority is not being given to the local governments in charge of formulating space plans at the community level. The authorities need to make their decisions by performing integrated evaluations of the comprehensiveness of components, that is, the various land uses, based on the comprehensiveness of evaluation standards, that is, comprehensive evaluation standards that go beyond the vertically structured standards.

Comprehensiveness of Evaluation Standards and Components in Urban Planning

As we have seen thus far, land use plans (space plans) must be established based on the comprehensive weighing of various components, including not only safety, but also convenience, comfort, economy, and environmental impact. The object of those evaluations is not only each individual component, but all of them taken together as a whole. That is, comprehensiveness is needed in both evaluation standards and components.

To achieve this, it is necessary to change and implement various regulations and projects in an integrated way, based on comprehensive plans at the community level. To achieve this integration, it is important to carefully coordinate the various regulations and projects. That said, this kind of coordination is difficult when final budget allocations and project decision-making authority are both vertically and horizontally decentralized. Thus, the centralization of decision-making and budget allocation authority related to plans, regulations, and projects is an important issue that needs to be addressed.

Tailor-Made Plan Formulation

The landscape of a town or village is shaped by an overlapping variety of tangible and intangible resources, including the local climate, geography, and history. Many of these were washed away in the recent tsunami, but there is no shortage of items left behind, items that must be kept, and items that must be refurbished or restored. The question is how to incorporate these items into the new towns in a way that raises their appeal. For example, this might be done through the use of a remaining building, the design of a town to incorporate a previous road alignment, or the development of a new housing complex that takes advantage of the natural topography.
However, particularly in regard to the latter two options, many of the development plans and town designs are standardized "new town" designs, developed with an emphasis on fairness between areas and on design efficiency and speed. Few of these plans sufficiently take into account the local historical or topographical conditions, or offer a sense of local flavor. Getting rid of such ready-made, cookie-cutter plans and instead formulating plans that are tailor-made to the unique characteristics of the local area, will allow for the formation of more attractive spaces.

Citizen Participation

Many of the affected local governments had little past experience in actively working with residents on regulations, projects, and community development work. Given this, and given the extreme conditions presented by this unprecedented tsunami disaster, all of the local governments have worked hard to encourage "active citizen participation" in the formulation of reconstruction plans. As a result, each local government has formulated their plans through some type of citizen-participatory process, and this is to be commended.

Some local governments held public information sessions, led by the head of government, from the very early stages immediately after the disaster and before planning proposals had been made. The continuation of that type of dialogue helped the plan formulation process proceed relatively smoothly.

That said, many local governments faced the following issues. First, they found it difficult to conduct the basic information communication and feedback gathering tasks that are involved in promoting citizen participation. In many cases, disaster victims were living in temporary housing in disparate locations, regardless of where they had lived before the disaster. Also, this tendency was even more pronounced with the use of the sublet temporary housing program. Thus, in addition to the use of conventional printed communications, such as block printed and paper newsletters, some local governments began to disseminate information using email and other new media, a strategy that proved somewhat effective. In the future, new active efforts in these types of communications will be needed.

Next, there were many cases in which adequate representation of the local population was not achieved. Citizens' opinions regarding post-disaster plans vary widely depending on the person's circumstances, occupation, status as a parent, age, gender, and most of all, individual ways of thinking. However, in many local communities, as during ordinary times, those who participated in plan formulation were the heads of various civic groups or industrial organizations, and were predominantly middle-age males. In fact, in some cases citizen participation was limited only to this population. This means that only a portion of the local opinions were actually reflected in the planning process. We need to conduct a more careful stakeholder analysis, different from what might be done for ordinary community development efforts, and to create opportunities for discussing the composition of citizens who reflect the results.

In the current reconstruction plan formulation process, there were some cases in which multiple workshops were held starting in the early concept phase, and in which a participatory process was carefully conducted even in the stage of narrowing down multiple proposals. In other cases, however, meetings were only held after the plan had essentially been finalized. These approaches can be categorized as either "formal participation," where the opinions of citizens were merely listened to, even though the substantive decision-making had already been done, or "genuine participation," where citizen participation was incorporated into the actual decision-making process, and the results of their participation had an impact on the final decisions made. Many local governments only went so far as the former. On the one hand, this can be attributed to factors on the local government side, such as a lack of familiarity with the participatory process, given the widespread lack of past experience with such, or a failure to understand the importance of citizen participation, or a lack of time, bandwidth, or manpower for managing a carefully executed participatory process in the wake of the massive pile of reconstruction-related work at hand. On the other hand, factors on the citizen side also played a role, as there was no shortage of citizens uninterested in making decisions and preferring instead for the government to take care of it for them.

A final problem that can be identified is the inherent difficulty in consolidating and integrating opinions. Typically, opinions are split between on-site reconstruction and relocation to higher ground. There is always the option of pursuing both paths, creating both a village and town that are half-sized, but half-finished towns means that various public facilities and convenience facilities will be disparately located, making them
difficult places to live over the medium to long term, and increasing the possibility that both will collapse. In this situation, a compromise plan is not possible; a decision has to be made one way or the other.

**Expert Support**

Citizens are amateurs when it comes to community development. It is therefore difficult for them to formulate plans on their own; their abilities are limited. Governments are generally in the position of having to formulate plans in careful and direct consultation with local residents, but given the enormous scope of this disaster in comparison with the scope of the governments involved, many of the affected local governments were unequipped to handle the situation.

Thus, outside experts are being called in to play a supplemental support role. The services required of outside experts are, first, the creation and presentation of objective materials and plans; second, the facilitation of discussions among citizens and assistance with consensus formation; and third, the ability to serve as a bridge in discussions between the government and citizens (they are neither agents of the government, nor spokespeople for the citizens) and to integrate the opinions on both sides.

In the current reconstruction process, many experts in architecture, civil engineering, and urban planning are working as volunteers to provide plan formulation support for citizens. The following three relationships involving outside experts are particularly important.

First is the relationship between experts and citizens. Work must be done to carefully survey the opinions of citizens, to create plans based on that information, and to further develop the content of those plans in consultation with citizens, while simultaneously striving to achieve consensus formation. What experts need to do in this context is not to merely compile the citizens’ opinions and draft a proposed plan. They need to incorporate their own professional opinions into the draft plan based on their understanding of the potential demands and requests. This is where they are going to really demonstrate their skill.

The second key relationships are that between various experts. When formulating a plan, adequate consideration must be given to the everyday activities that happen in a neighborhood, including educational activities, welfare activities, and commercial activities. This information will facilitate the development of spaces that are convenient and comfortable. From this perspective, it is important not only to work with experts in fields of physical infrastructure, such as civil engineering, architecture, and urban planning, but also with experts in "soft" fields like welfare, education, and medicine. These experts need to connect and cooperate with one another, and support the creation of town and village reconstruction plans through coordination and teamwork. This point is important for avoiding confusion among residents, as they tend to see all "outside experts" as one in the same, making no distinction by field of expertise.

The third key relationship is that between outside experts and the government. When governments and outside experts connect and cooperate on plan formulation, they are able to create a win-win situation: the government gets to stay out of the process of consensus formation between citizens, and the outside experts get to see plans that they worked hard to form a consensus on reach a point of becoming achievable. For the plan itself, this process also increases the likelihood of achieving a balance between practicality, design, and economy. It is difficult to form relationships of trust in a short time immediately after a disaster. It is therefore important to cultivate these types of relationships before a disaster strikes.

**Lessons, Proposals**

- The urban planning challenges that are present before a disaster become expressed in even more dramatic form during post-disaster reconstruction, and they need to be addressed. However, if adequate management measures were not taken to address them during ordinary times, it becomes extremely difficult to deal with them after a disaster. Governments need to tackle their challenges and do serious work to solve such issues before they are faced with a disaster. If short-term efforts are made based on a medium to long-term vision, the situations that were envisioned to occur over the medium term may be realized all at once when a disaster strikes. This point applies not only to lower-tier local governments that have to deal with challenges on the front lines, but also to the national and prefectural governments that provide those local governments with "ammunition" in the form of systems and financial resources.
- Local governments have to be given some kind of incentives to use the opportunity presented by the disaster to solve their urban planning challenges. Without them, particularly if there is no change in the...
level of financial accountability expected of the local governments, either the citizens' opinions will be swallowed whole or a medley of vertically structured and horizontally structured projects will be undertaken, and the issues in place before the disaster will remain unresolved.

- It is important for lower-tier local governments to promote project and regulatory integration based on centralized space plans at the community level. When decision-making authority regarding plans, projects, and regulations is dispersed among different institutions, and there is a lack of adequate coordination, the result is the creation of spaces that are both inefficient and unappealing. Efforts must therefore be made to facilitate coordination or to centralize authority.

- Disaster resilience is the core criterion on which disaster reconstruction plans are evaluated. However, to ensure the long-term survival of towns and villages, plans must also be evaluated and judged based on comprehensive considerations of convenience, comfort, and other important factors.

- Regardless of the level of development of a draft plan, it is important for governments (and sometimes the head of government), from the very beginning and into the future, to continue the dialogue with citizens, to promote their active participation, and to collaborate with citizens on projects. The hope is that governments will have experience collaborating with citizens on a wide range of issues before a disaster situation arises.


Author: Michio UBAURA
Department of Architecture and Building Science, School of Engineering, Tohoku University
International Research Institute of Disaster Science, Tohoku University

3.2. Reconstruction Plan Case Studies

This paper reports on the current status of reconstruction plan formulation and reconstruction community development in individual communities, such as Otsuchi-cho and the former Ogatsu-cho, based on site surveys conducted in areas affected by the Great East Japan Earthquake.

Overview

Specific measures aimed at achieving reconstructive community development and the revitalization of communities are being developed in each of the neighborhoods in the disaster-affected municipalities based on overall reconstruction plans formulated at the municipal level. However, in individual neighborhoods facing their own particular sets of circumstances, there is a tendency to continuously rehash the same several issues that have posed problems in the formulation of an overall reconstruction plan, without making any progress toward a solution. Thus, now that two years have passed since the disaster, we are performing case studies, conducting assessments, and making proposals regarding the reconstruction plan formulation process in various neighborhoods.

Large percentages of the downtown districts of Pacific coastal municipalities in the Tohoku region were flooded by the tsunami. For example, 52% of downtown Otsuchi-cho, Iwate Prefecture was flooded, as was 65% of downtown Higashi-matsushima City, Miyagi Prefecture. Reconstruction in those areas is therefore being pursued in a context where more than half and sometimes nearly all of the infrastructure was lost (see Figure 3.4). Thus, to ensure greater safety from tsunami damage in the future, reconstruction plans in these areas involve areawide improvements, such as village relocation, the development of downtown setbacks, land elevation, and the construction of high embankments.

The progress made on the implementation of the reconstruction plans formulated in these affected regions varies based their the specific circumstances, but in many cases, progress seems to be taking more time in areas with city centers than in smaller villages. This is partially because larger numbers of residents means that more time is required to form a consensus around decisions, but it is also because it is easier to
reach a consensus in the implementation stage of the process in smaller villages. For example, since the relocation area needed for a smaller village is more limited, when choosing among the potential relocation destinations that will offer safety from future tsunamis, it is easy to make a decision to move to the destination that is closest to the village's current location.

However, while the formulation of plans regarding the relocation of small villages is proceeding quickly, inadequate attention is being paid to the issue of ensuring stable village livelihoods. Thus, the plans only meet the minimum necessary requirement of ensuring safety from tsunamis (see Figure 3.5).

On the other hand, in areas with city centers of a certain size and larger, and even in cases like the Machikata district of Otsuchi-cho, where the vast majority of the city center flooded (Figure 3.6), reconstruction of the existing downtown core is going to be achieved by raising the ground level to a height of about two meters, and there are plans to restore the city center functions (Figure 3.7).

The idea of raising the ground level by about two meters is based on a proposal by the Japan Society of Civil Engineers (JSCE), which indicated that "disaster reduction can be achieved in the face of level 1 tsunamis, which occur once every tens of decades to once every hundreds of decades, by building coastal preservation facilities such as seawalls, while it can be achieved in the face of a level 2 tsunami, which clearly exceeds a level 1 event, by incorporating additional organizational components, such as evacuation systems." To help
prevent homes from being washed away by a level 2 tsunami, the JSCE also indicates that "coastal seawalls and breakwaters alone will not be able to prevent a large tsunami inundation. From the perspective of the tsunami damage function, future community development in the form of coastal protective structures, protection redundancies, and relocation should be pursued with the goal of locating residential areas at an elevation of two meters or higher so that they will not flood." The results of a numerical tsunami simulation in Otsuchi-cho indicate that if the ground level is raised to about two meters, residential areas will be safe from tsunamis, as they have never flooded a height of more than two meters. This approach informed the study of reconstruction plans in most municipalities.

In locations of a certain size or larger, like Otsuchi-cho, the total area of the city center itself will be limited, but it will be possible to revitalize the area and restore the dynamism of the community by incorporating various urban functions, including residential functions, into that city center. However, in areas larger than a small village but smaller than a certain size, it will ultimately be impossible to revitalize the city center. A typical example of this is the downtown district (about 500 households) of the former Ogatsu-cho, where the Ogatsu Regional District Office (the former Ogatsu town hall) was located.

The vast majority of this district, as in Otsuchi-cho, was flooded. Unlike Otsuchi-cho, however, the numerical tsunami simulation results indicate that due to topographical factors, raising the elevation of the residential areas will not ensure that flooding will not occur above the two meter mark. Thus, a group relocation promotion project has been developed instead of a plan for rebuilding on the site of the former town (Figure 3.8). Initially, a public opinion survey indicated that many local residents wanted to rebuild the former city center, and very few people wanted to live in the relocation site after the group relocation plan was revealed.

That said, a certain percentage of people preferred not to return to the city center from the very start. Their workplaces were located in central Ishinomaki or in Kahoku-cho, and they had been commuting to those locations from Ogatsu. They used the disaster as an impetus for relocating to the towns where they work. As indicated in the Disaster Reconstruction Basic Plan for Ishinomaki City, the livelihood spaces, such as the fishing port and fishing industry facilities, as well as the gathering places, such as public facilities, the tourism sites, and the group relocation residential areas would all be established in different locations, and the schools, hospitals, shops, government offices, neighborhood police boxes, post offices, and other such facilities, which had been centrally located in the former city center, would be scattered around different areas. For citizens who initially planned to return and did not want to go to the group relocation site, the loss of these city center functions meant the loss of the original location's appeal. As a result, many residents, particularly those in occupations that benefit from greater population density, chose not to move to the inconvenient group relocation site. Ogatsu-cho is a town with a strong traditional arts culture. Had many of its residents had wanted to revitalize and live in the city center, which was a part of that traditional culture, or had procedures been adopted for the formulation of a reconstruction plan after a vision for reconstruction had been established, the number of returning residents may not have dropped so significantly.

Figure 3.8 Examples of the pre-relocation and post-relocation sites being considered as part of the Group Relocation Promotion Project (central Ogatsu-cho)

Figure 3.9 Ogatsu Area Reconstruction Development Guidelines (Ishinomaki City Disaster Reconstruction Basic Plan) http://www.city.ishinomaki.lg.jp/mpsdata/web/7742/04_dai4syou.pdf
So what should be done to revitalize central Ogatsu-cho? This requires another look at the suggestion made by the Japan Society of Civil Engineers, which was to achieve disaster reduction "by incorporating additional organizational components, such as evacuation systems" to prepare for a level 2 event. This is not to say that "tsunami safety can be assured because there has never been flooding higher than two meters in the residential areas." Situating the residential area such that it will flood to a height of more than two meters in the event of a tsunami is no more than one type of evacuation method that will help save people's lives by ensuring that their homes will not be swept away. If a high value is placed on revitalizing and living in the city center, residents cannot become overly particular about a single evacuation strategy. Instead, they will have to take a stance that is concerned less about buildings being washed away in a tsunami than about the development of evacuation routes and shelters, the development of evacuation guidance systems, and the use of some evacuation buildings, and they will also have to incorporate the many techniques for instilling an awareness of disaster preparedness at the community level.

Lessons

When formulating a reconstruction plan, it is important to strive to achieve a level of safety that will ensure that the similar levels of damage will not recur in future disasters. However, if attempts are made to ensure safety using uniform methods of dealing with large-scale natural disasters, which can cause damage on a scale that is only rarely experienced, the appearance of the rebuilt community may be completely changed, such that livelihoods in that area will not be reestablished and community residents will not progress in their recovery.

Recommendations

When studying reconstruction plans, it is important not only to ensure the safety of the people who will live in rebuilt communities, but also to ensure a certain quality of life there. To do this, the authorities must start by adopting strategies for avoiding damage from large-scale natural events, considering such factors as the local topography and ground quality, the structures of the buildings that are to be rebuilt, and the implementation of evacuation measures, but they must also adopt strategies for ensuring a certain quality of life in the rebuilt communities.

Author: Akihiko HOKUGO
Research Center for Urban Safety and Security, Kobe University
CHAPTER 4: SUPPORTING MUNICIPALITY FUNCTIONS

4.1. Logistical Support for Devastated Municipalities: Examples and Legal Reforms after the Great East Japan Earthquake

Centralization is of limited usefulness in the kind of situation-specific disaster response needed at the community level, but decentralized systems of responsibility at the municipal level can fail to function in major disasters that result in the loss of municipal functions. Many municipalities sustained operational failures in the Great East Japan Earthquake, though municipal function backup systems based largely on horizontal support between local governments proved somewhat effective. However, since this backup support was often implemented through a process of trial and error, there is a need for the more explicit institutionalization of systems, responsibilities, and financial resources based on lessons learned.

Overview

The Japanese Disaster Measures Basic Act and the national, prefectural, and municipal disaster management plans based thereon position municipal governments as the central players in disaster response efforts. This framework was intended to provide an appropriate structure that would enable a precision response well suited to the needs of the situation on the ground in disaster-affected areas in the event of a small to medium-scale disaster. However, given the massive scale of the calamity inflicted by the Great East Japan Earthquake, municipal workers and buildings themselves sustained catastrophic damage, and disaster response systems at the municipal level were rendered inoperable. In addition, the disaster response capabilities of municipalities had been substantively weakened by the shrinkage and elimination of basic local government functions through widespread municipal mergers that were pursued in Japan in the 2000s, and by the effects of human resource adjustments made in the wake of local government budget cuts.

Of course, this is not to say that the Disaster Measures Basic Act failed to envision support systems for cases in which municipal functions are lost. In fact, it contained stipulations regarding (1) backup support by prefectural governments, (2) horizontal support by other local governments, and (3) the role of volunteer citizen defense organizations. The latter two items were added in 1997 based on lessons learned from the Great Hanshin-Awaji Earthquake. Even in the Great East Japan Earthquake, attention was paid to horizontal support provided by other local governments, a spotlight was shined on the lateral coordination provided by the Union of Kansai Governments, and results were achieved not only by the emergency dispatch of police, fire, and medical personnel during the immediate response phase of the disaster, but also by the disaster assistance and provision of access to restoration and reconstruction engineers in the later stages. However, these support systems, responsibilities, and budget measures were not clearly stipulated in advance, and in many cases the various stakeholders involved worked on a trial-and-error basis. Support measures focused on the flow of goods and personnel into the affected areas, while no progress was made on the long-distance evacuation of victims to safe locations. Thus, investigations were conducted by the Central Disaster Management Council Committee for Policy Planning on Disaster Management on the systemic problems that were exposed by the Great East Japan Earthquake, and these led to revisions to the Disaster Measures Basic Act in July 2012.

This paper examines problems related to logistical support for municipal functions while focusing on the key points of the legal revisions, and extracts the most versatile lessons that can be applied to developing countries.
Revisions to the Disaster Measures Basic Act

**Strengthening Prefectural Responsibility**

The 2012 revisions to the Disaster Measures Basic Act strengthen the obligations of prefectures with regard to actively taking responsibility for collecting information from municipalities (Articles 51 and 53) and to playing a substitutive and supplemental role in disaster management measures overall. (Article 68). The original stipulations established the responsibilities of the prefectures with regard to "emergency measures," narrowly defined to include fire fighting and flood prevention measures, for example, while the 1947 Disaster Relief Act, which was the fundamental law with regard to victim support, stipulated the management responsibilities of the prefectures. However, the new law does not stop here; it once again stipulates the overall responsibility of prefectures to take overall "disaster management measures." This is likely due to the frequent complaints about the lack of prefectural functions that emerged after the Great East Japan Earthquake.

**Horizontal Support Between Local Governments**

With regard to horizontal support relationships between local governments, the revisions to the Disaster Measures Basic Act establish provisions for bilateral relationships wherein assistance is provided based on direct requests by affected municipalities. First, if a request for help is received from an affected municipality or prefecture, the receiving local government is obligated to agree to provide "emergency measures," but is not obligated to agree to provide "disaster management measures," which may or may not be provided at its own discretion (Articles 67 and 74). On the other hand, regardless of whether a request of support is made by an affected municipality, the law clarifies the coordination role that prefectural governments are to play in the provision of horizontal support (Article 72). It also regulates requests for support made to other prefectures by the prime minister, but does not obligate local governments receiving such requests to agree to them (Article 73-2). Thus, the revisions map out the scope of obligations and strengthen the coordination functions of higher-tier local governments more than they promote horizontal support.

This reflects the fact that both the advantages and disadvantages of horizontal support have been pointed out as lessons of the Great East Japan Earthquake. According to a survey of local governments conducted by the National Governors’ Association, horizontal support provided at the direct request of an affected municipality predominantly receives favorable reviews, and in several cases, direct requests are deliberately made to local governments that are located nearby or that have previous disaster experience. In such cases, the prefectural office receiving the request took the initiative in trying to meet the needs of the affected municipality, and in doing so, achieved results by forming partnership teams with other municipalities in the prefecture (Yamagata, Tochigi, Kanagawa, Ishikawa, Ehime, etc.). This highlights the importance of a centralized needs assessment and bold command.

On the other hand, horizontal support provided by remote locations without a direct request for such support received a mix of both positive and negative reviews. For example, horizontal coordination by the Union of Kansai Governments (Shiga, Kyoto, Osaka, Hyogo, Tottori, Wakayama, and Tokushima) received relatively positive reviews from both those providing and receiving support. However, in the case of a scheme by the Ministry of Internal Affairs and Communications and the National Association of Towns & Villages, some confusion was reported when remotely located municipalities that had received requests for support were perplexed by the urgent requests and petitioned the higher-tier local governments to provide some coordination services. Reactions from the affected local governments that received the support also indicated confusion regarding the arrival of individual and uncoordinated offers of horizontal support from far-away locations. There were also some municipalities that expected to receive support directly from the national government (knowing that it would have the financial resources to handle the situation).

Based on both these positive and negative reactions from affected areas and support providers with regard to horizontal support, the recent legal revisions can be viewed as stipulations that govern coordination and control based on the presence of a direct request from an affected local government, and as regulations regarding the scope of obligations of local governments that receive requests for support.

However, it is difficult to expect this kind of system design to function effectively in emergency situations where an affected local government has lost its ability to make direct requests for assistance. It is therefore
HORIZONTAL SUPPORT - CREATING BOTTOM-UP SYSTEMS

The municipal government that suffered the most severe loss of function in the Great East Japan Earthquake was Rikuzen-takata City in Iwate Prefecture. The flatland known as Takata-matsubara was destroyed by the tsunami, which caused the deaths of as many as 2,000 people, or 10% of the local population of 20,000, and left 200 people missing. This was second highest number of casualties, second only to Onagawa-cho in Miyagi Prefecture. The three-story city office was completely flooded, and one in three city workers (112 people) perished. Even in the midst of this devastating loss of local government function, the city had to continue working on the front lines of emergency relief operations pursuant to the Disaster Measures Basic Act, leaving city workers to experience the depths of despair and suffering. Horizontal support activities were developed by many other local governments wanting to help Rikuzen-takata. These support systems were largely activated through the mediation of the Iwate prefectural government office, but support was also boldly provided by the City of Nagoya through a direct two-party agreement. Apart from horizontal support provided at the expense of the national government, a significant boost to city workers came in the form of support provided by 29 people in 18 cities through the Japan Association of Young Mayors thanks to the strong ties of friendship between that association and the mayor of Rikuzen-takata.

According to people connected with the Ministry of Internal Affairs and Communications, the remarkable horizontal support provided by unaffected local governments after the Great East Japan Earthquake was not the result of a ministerial ordinance, but a development that the ministry only helped support later, after having received voluntary proposals from organizations like the National Association of Towns & Villages, with scheme confirmation and budget measures. The bottom-up structure of these arrangements is what made them distinctive.

Long-Distance Evacuation across Local Government Borders

It may have to be classified as a type of horizontal support by other local governments, but long-distance evacuation across the borders of affected local governments has become a point of debate. In a major disaster like the Great East Japan Earthquake, under conditions where lifelines have been disrupted, there is a lack of disaster relief in the form of food, clothing, shelter, and medical care, and there is a considerable risk of secondary disasters caused by, for example, continuing aftershocks, the long-distance evacuation of victims across the borders of local governments can be an even more effective emergency response measure than bringing relief supplies and personnel into the affected region. However, the revisions to the Disaster Measures Basic Act in 2012 do not go so far as to outline the active construction of systems for long-distance evacuation. Instead, they leave this to the management of the affected local governments, and only include passive control in the form of preliminary reporting and an obligation to discuss related plans with the prefectural government. That is, an affected municipality can discuss long-distance evacuation within the same prefecture with other municipalities, and the other municipalities are obliged to consent, but the affected municipality is required to issue a preliminary report to and to discuss the matter with the prefectural government (Article 86-2). Only in cases where the affected municipality experiences a complete loss of function can the prefecture take over the discussions on behalf of the municipality (Article 86-4). In long-distance evacuations across prefectural borders, the affected municipality must first discuss the situation with the prefecture, after which the issue must be discussed between the prefectures. The other prefecture that is approached for assistance is obliged to consent. In this case, a preliminary report must be issued to the prime minister (Article 86-3). In cases where the affected municipality experiences a complete loss of function, the prefecture can take over the discussion on behalf of the municipality (Article 86-5). If this system were to put the prefecture in a position to serve an efficient coordinating role, it could be expected to produce some useful results. However, there are concerns that in the event of the loss of function of a prefectural government, these troublesome procedures would instead become shackles. Thus, the advance preparation of agreements is essential (Article 8-2-12).
In this way, several layers of procedures related to the long-distance evacuation of victims have been laid out. By contrast, a rapid and flexible response is possible when it comes to disaster management measures in the form of the supply and shipment of goods, as relevant institutions can take steps without waiting for a request from an affected municipality or prefecture (Article 86-7) and can make requests to shipping companies that are designated public institutions (Article 86-9). It is unclear why the influx of goods across local government borders is promoted while the long-distance evacuation of disaster victims across borders has to be controlled.

In the Great East Japan Earthquake, many municipalities experienced tsunami inundations across the entirety of their territory, making it difficult to secure evacuation shelters and causing a scarcity of lots where temporary housing could be built. Nonetheless, little long-distance evacuation across municipal and prefectural borders took place. Evacuation shelters were erected under squalid conditions in flooded areas lacking infrastructure or access to food and water, and the transport of goods and poor medical care continued over several months until temporary housing was constructed. Somehow, these irrational conditions became normalized. This situation was an outcome of financial and other problems. Such irrationality is not overcome by the revisions to the Disaster Measures Basic Act, and discussions over additional reforms are still necessary.

**Disaster Management Measures and the Financial Burden**

**Complementary Relationship Between the National and Local Governments**

Although the institutional framework of the Disaster Measures Basic Act has been reformed, the inability to secure financial resources will make it impossible for measures to be implemented. Attention has been focused on the fact that the Great East Japan Earthquake occurred right in the middle of regional fiscal reductions brought about by the trend toward decentralization through the 2000s. Even if efforts are made to correct systems that concentrated the responsibilities for disaster response in the hands of municipalities by strengthening prefectural functions and establishing regulations to promote the acceptance of horizontal support and long-distance evacuation support from other local governments, there is no extra room in the local government finances, which were largely wiped out in the 2000s, for putting out other fires. In the process of responding to the Great East Japan Earthquake, there were repeated appeals by individual local governments asking for the national government to pay for all disaster management expenses. Between the affected local governments, there was a certain amount of hesitation in accepting horizontal support for fear of being billed for the expenses at a later date. There was also no small number of examples in which other local governments that had received requests for support only passively responded to those requests until they were certain that the costs would be borne by the national government. This passive approach may have been brought about by the lukewarm stipulations contained in the revisions to the Disaster Measures Basic Act, as noted above.

This suggests that the enactment of stable budgetary measures is essential in terms of having the foundations necessary for a rapid disaster response. There are several ways to approach the question of where these financial resources should come from. The welfare-state position, which emphasizes the national government’s responsibility for providing this funding, stands in contrast to the neoliberal position, which emphasizes the importance of the self-responsibility of affected local governments, achieved through fund reserves and bond issuance. Japanese law adopts aspects of both designs, as follows.

1. Emergency rescue and other emergency measures, disaster management measures:
   The Disaster Measures Basic Act stipulates that the agency implementing measures must generally do so using its own resources (Article 91), that the costs associated with horizontal support provided by other local governments are to be borne by the affected local government (Article 92), and that the national government may cover all or part of these expenses within the range of what is provided for by law and by its own budget.

2. Disaster relief in the form of food, clothing, and shelter for disaster victims:
   Prefectures are responsible for this pursuant to the Disaster Relief Act, but the proportion of expenses that they will be responsible for ranges from 50/100 to 10/100.

3. Restoration:
   Infrastructure restoration will be covered by local governments in a 10/90 ratio in accordance with such basic laws as the Act Concerning the Portion of Expenses for the Restoration of Public Civil Engineering
Facilities to be Paid by the National Government. Municipalities will pay for 50/100 to 10/100 of debris processing pursuant to the Waste Management Act.

4. Reconstruction land use plan projects:
Because Japan lacks a permanent basic law on reconstruction, reconstruction projects are undertaken based on urban planning legislation. Fixed rates for the share of expenses to be paid by local governments are established by law. For example, municipalities are responsible for 1/4 of the cost of disaster-related group relocation projects.

5. Victim support in the livelihood reconstruction phase:
Prefectures and municipalities are each responsible for 1/4 of condolence payments (the provision of ¥5 million for the death of a head of household), while the prefectures are responsible for 1/2 of livelihood reconstruction support funds provided to victims. In addition, local governments are also responsible for fixed portions of the support provided to agriculture, forestry, and fisheries businesses, as well as to small and medium-sized businesses pursuant to the Act Concerning Special Financial Support to Deal with Designated Disasters of Extreme Severity.

**Strong Reliance on National Funding**

As indicated above, Japanese disaster management expenses are shared between the national and local governments. Although there is some flexibility for increasing the portion paid by the national government depending on the scope of the disaster, this system aims to promote a certain level of self-reliance on the part of the local governments, thereby preventing moral hazard and encouraging independent disaster preparedness efforts.

However, there are limits to this kind of system design. A flexible structure that assigns responsibility for disaster management to municipalities while leaving some room for negotiation with the national government over finances could potentially cause some local governments to curtail their disaster management expenses based on skepticism over how much of the financial burden will be covered by the national government. Or, similarly, it could create some friction in disaster response efforts, as local governments might use delays in disaster management implementation as a bargaining chip for extracting an increased financial commitment by the national government. In reality, governance conflicts have already been seen in the disaster management measures and restoration and reconstruction efforts following the Great East Japan Earthquake. Since the disaster struck, efforts have been made to keep disaster management expenses down, and strong appeals have been made for the national government to carry the entire financial burden.

As a result, an increased share of the financial responsibility has been assigned to the national government in the form of special measures, as follows. National government measures have been established to allow 100% of the prefectural government’s share of expenses under the Disaster Relief Act to be raised through bond issuance, and 95% of the redemption of principal and interest to be covered by the local government tax allocation. In debris processing as well, measures have been adopted permitting bond issuance to be used to raise the funds needed by municipalities, and to allow all of the redemption of principal and interest to be covered by local government tax allocation. In the area of livelihood reconstruction, local government tax allocation measures have been adopted for up to 70% of the portion of condolence payments to be paid by the prefectures and municipalities, and the prefectures' portion of livelihood reconstruction support is being covered by an increase in the national government's share of the burden along with bond issues. Some local government tax allocation measures have also been adopted to make up for local tax reduction measures. Even in the area of industrial support measures, consideration is being given to the idea of covering the prefecture's share of subsidies to groups of small and medium-sized businesses through subsidized interest payments by the Organization for Small and Medium Enterprises and Regional Innovation. The Special Reconstruction Zone Act adopted in November 2011 guaranteed that the national government would cover the costs of the reconstruction and community development projects that have received the most attention (group relocation to high ground and land readjustment projects), and turned attention toward housing support resources related to the Reconstruction Fund.

In this way, there have been efforts to increase the national government's total share of disaster management expenses following the Great East Japan Earthquake, but this has come with several problems. For example, several months after the earthquake were wasted on these kinds of financial negotiations, and increases in the share of national government responsibility has meant limiting the households that are...
eligible for support. Clear systems need to be constructed under ordinary, non-emergency conditions that match the responsibilities for disaster management with the appropriate financial resources.

Conclusions

In this paper, I have outlined the backup support systems that were mobilized to help municipalities that became fully inoperable after the Great East Japan Earthquake, and have discussed the various problems entailed. The government is developing detailed disaster management plans and manuals that place the central responsibility for Japanese disaster management in the hands of the municipalities, but this kind of governance structure, though suitable for a response to a small or medium-scale disaster, is not sufficiently developed for dealing with a massive disaster that involves the complete loss of municipal functions in some locations. Based on the lessons learned from the Great East Japan Earthquake, revisions were made to the Disaster Measures Basic Act in July 2012, but several institutional reform issues still remain. That is, the revisions reconfirmed the obligations of prefectures for collecting their own information and providing supplemental disaster response efforts, and clarified the prefecture's command and control role in promoting and coordinating horizontal support and long-distance evacuation across local government borders. In reality, however, prefectures have little choice but to rely on partnerships with municipalities within and beyond their borders for the mobilization of personnel and supplies, and for the coordination of long-distance evacuation efforts. The recent reforms did not adequately clarify the institutional frameworks for these activities, leaving many to be dealt with through individual agreements between local governments. This lukewarm legislative response may be an outcome of Japan's difficult financial situation. In the future, clarification of disaster response responsibilities following a large-scale disaster and the clear institutionalization of the funding sources needed to fulfill those responsibilities are going to be issues that will require further institutional reform. Joint regional-scale disaster drills organized at the community level should be held regularly to help increase the practical effectiveness of these systems.

Lessons

- In designing disaster management governance, the decentralization of specific disaster response measures to municipalities, or to the even smaller level of local communities, is important. At the same time, however, it is also important to prepare for large-scale disasters that might result in the complete loss of municipal functions, and to institutionalize backup support systems that can be implemented by higher-tier local governments or nearby local governments, such as systems for information gathering, horizontal support, and long-distance evacuation.
- To ensure that the backup support systems for affected municipalities are effective, it is important not only to clarify the responsibilities for disaster response, but also to institutionalize the funding sources that will be used for fulfilling those responsibilities. In a disaster situation where rapid response is required, there is no time to conduct financial negotiations.
- Backup support systems for affected local governments have to accommodate not only the shipment of supplies and personnel to the affected areas, but also the long-distance evacuation of disaster victims out of the affected areas. It does not make any sense to virtually neglect disaster victims for long periods of time by managing evacuation shelters and temporary housing units under squalid conditions in disaster zones where lifelines have been disrupted, there is a lack of access to food and water, and security structures have been destroyed.
- It is important to create systems for conducting long-distance evacuations under non-emergency conditions; simple support agreements between local governments are insufficient for this purpose. Plans should be made to improve the elementary schools and other public facilities and medical facilities that are often designated by local governments as evacuation shelters. Also, one-on-one tie-ups should be created between evacuation shelters through the development of a manual that can be used by partner local governments, and greater efforts should be made to conduct regional evacuation drills.

Proposals

In disaster management governance, there is always debate over centralization versus decentralization. Under Japan's Disaster Measures Basic Act, the responsibility for disaster response is more heavily weighted toward municipalities. However, this is less a matter of local government decentralization, than of administrative "deconcentration" restrained in the reporting responsibilities in the vertical structure...
controlled by the central government, also known as a bottom-up version of centralized administration. Nonetheless, this kind of vertical administrative control has changed and weakened under the influence of the regional decentralization that occurred in the 2000s, the financial constraints affecting the situation at the local level, and the widespread mergers of municipalities that have taken place. When met with the massive disaster presented by the Great East Japan Earthquake, the result was a complete loss of function.

In the context of increased security measures having been adopted worldwide since the terrorist attacks on the US on September 11, 2011, the trend has been moving toward greater centralization. By contrast, however, the problem of the alienation of the smallest community units at the local level has been identified, and neither centralization nor decentralization seems to be having any effect in this regard. Since international development organizations led the way in radical local decentralization in the developing nations in the 2000s, the sense of distance between central governments and local communities has been growing. To overcome this friction between disaster management centralization and local government decentralization, efforts are being made by central governments in various regions to make direct connections with people at the community level through their vertical control systems, without the mediation of local governments. However, this type of government-initiated community-level disaster management organization is not producing results.

The horizontal support between local governments that was seen in the Great East Japan Earthquake may suggest a way to overcome the contradictions between centralization and decentralization. As upper-tier local governments provide complementary support to affected local governments and reconnect the broken synapses in the centralized system of vertical information sharing and reporting, nearby local governments with whom those local governments have partnerships form horizontal networks that can accept long-distance evacuees and prioritize disaster relief. Of course, horizontal support in the Great East Japan Earthquake was not the complete success story that it was made out to be. Behind the scenes of the successful cases, like the strong organization by the Union of Kansai Governments and the active participation in agreements by some local governments, there was a sense of pessimism that emphasized budget allocations and the burden on personnel. However, if we continue to make efforts to strengthen relationships between local governments by building reciprocal partnerships in which both parties commit to promoting bilateral support, and by making efforts to conduct joint disaster drills between long-distance evacuation shelter partners, all while overcoming the financial problems that pessimists are concerned about, it will become feasible to create systems for horizontal support and long-distance evacuation.

Key References Cited


- Ministry of Internal Affairs and Communications (MIAC), "Dispatch of National Government Officials to Affected Local Governments (as of September 24, 2012)," MIAC website.

- Ministry of Internal Affairs and Communications (MIAC), "Dispatch of Local Government Officials to Local Public Organizations Affected by the Great East Japan Earthquake (March 11 to 31, 2011)," MIAC website.

- Ministry of Internal Affairs and Communications (MIAC), "Overview of the Survey on the Dispatch of Local Government Officials to Local Public Organizations Affected by the Great East Japan Earthquake (as of April 16, 2012)," MIAC website.

Author: Yuka KANEKO
Graduate School of International Cooperation Studies, Kobe University
4.2. Support for Recovery Plan Formulation by Outside Experts: The Case of Ishinomaki

The support of outside experts in recovery plan formulation plays an important role in terms of garnering public opinion, improving the quality of plan design, and coordinating related projects. However, that support has to be provided in a way that is organized and supervised in close cooperation with municipal governments. Also, the keys to ensuring the prompt formulation of high quality recovery plans include not only strategies for the involvement of outside experts, but also the adoption of systems for implementing relevant projects.

Overview

There are three major types of roles that can be played by outside experts in recovery plan formulation: roles in garnering public opinion, improving the quality of the plan and its design, and coordinating various projects. I will begin by introducing the support system used in Ishinomaki City, and then will present information on how each of these roles should be played.

Support Systems in Ishinomaki

FY 2011 Systems

In June 2011, after the Great East Japan Earthquake, the City Bureau of the Ministry of Land, Infrastructure, and Transport began a Survey of Urban Recovery Patterns for supporting substantive recovery plan formulation on the behalf of the affected local governments. In doing this, support for recovery plan formulation was provided through the establishment of work management committees within each of the affected city halls, the involvement of outside experts, and the dispatch of officials from the City Bureau. The outside experts that were involved in Ishinomaki included Takayuki Kishii (professor of urban planning at Nihon University), Keiji Kitahara (professor of community development and urban planning at Hirosaki University), Masaharu Osawa (associate professor of urban planning at Nihon University), and Katsuya Hirano (associate professor of civil engineering and urban design at Tohoku University). These experts worked in tandem with the Ishinomaki City Construction Department on the painstaking investigation of a recovery plan for infrastructure facilities until March 2012. This work management committee, as the name implies, was a genuine working committee, unlike the concept implied by the "committee method."

Meanwhile, the recovery plan itself could not be limited only to infrastructure facilities, but had to be a comprehensive plan that more broadly incorporated industrial policy, education policy, and welfare policy. Ishinomaki City established a citizens' investigation committee comprised of various professionals and citizen representatives under the leadership of the City Recovery Management Office to work on the formulation of a basic recovery plan. In June 2011, a comprehensive exchange agreement was concluded between Tohoku University and Ishinomaki City, and a steering committee formed by the City Recovery Management Office, relevant city departments, and Tohoku University engaged in practical discussions around the creation of a draft plan that would be presented to the citizens' investigation committee. The participating outside experts from Tohoku University consisted of Yasuaki Onoda (professor of architectural design), Michio Ubaura (associate professor of urban planning), Katsuya Hirano (associate professor of civil engineering and urban design), and Kentaro Imai (associate professor of tsunami disaster management).

In addition, several organizations went into individual fishing villages in the peninsular regions (in Ishinomaki, these include the Oshika Peninsula and Ogatsu Peninsula) to provide support with recovery plan formulation. The Japan Institute of Architects (JIA) went into the former Kitakami-machi, the Ogatsu Studio within the Tohoku University Graduate School program of Architecture and Building Science (a support team comprised of an instructor, a non-full-time lecturer, and students) went into the former Ogatsu-cho, and ArchAid (a recovery support network comprised of architects) went into the former Oshika-cho and the peninsular areas of former Ishinomaki City to provide support.

FY 2012 Systems

December 2011, Ishinomaki City formulated its Basic Disaster Recovery Plan, finally reaching the stage at which it could make concrete progress on individual reconstruction projects. To facilitate this, Ishinomaki City
Hall established a Reconstruction Department, which combined what had been its General Policy Department with its Infrastructure Development Department. In conjunction with this, and building on the progress made in FY 2011, in FY 2012, the city launched the Ishinomaki City Recovery and Community Development Council to serve as an internal investigatory body headed by Nihon University Professor Takayuki Kishii (Figure 4.1). This council also was not a committee in the sense of the so-called "committee method," but a practical-minded working body that conducted substantive investigations, shared information, coordinated projects, and managed project progress. To facilitate information sharing and project coordination within Ishinomaki City, this council was comprised of relevant departments from the national government (Reconstruction Agency, Kitakamigawa-Karyu River Office), prefectural government (Tobu Public Work Office), and city government, as well as consultants hired on a contract basis, and other outside professionals.

Under this council, several working groups (WG) were established: the Downtown WG, which primarily handled projects in the downtown areas of the former Ishinomaki City, the Peninsula WG, which primarily handled projects in the peninsular areas, the Public Housing WG, which handled recovery-oriented public housing projects, and the Disaster Management Plan WG, which dealt with disaster management planning. Each of these conducted substantive investigations and diligently promoted information sharing. The JIA, Ogatsu Studio, and ArchiAid, which provided support in the peninsular regions, participated as members of both the Peninsula WG and the overall council. Even today, investigations are being conducted by the council, as the integrated embodiment of the various organizations and systems adopted in FY 2011.
One of the challenges facing this council is the fact that, due to the diverse array of coordinators involved in various projects, the number of council participants has increased, making it difficult to engage in practical discussions (Figure 4.2). To address this, the WGs have been engaging in practical discussions by increasing their individual meetings, while full council meetings focus more on information sharing.

Tohoku University launched the International Research Institute of Disaster Science in April 2012, and in recognition of the importance of this kind of practical support and disaster management research, established the field of disaster reconstruction design and management within the institute. Since November 2012, two battle-ready assistant professors have been added as practitioners, not researchers, to this field, and support has been strengthened with the provision of practical, concrete design proposals to the city.

**Role in Garnering Public Opinion**

*Issues Related to Experts’ Fields of Expertise*

As mentioned above, garnering public opinion has been done by outside experts in Ishinomaki, particularly in the peninsular areas. The JIA has been working in the Kitakami area, the Ogatsu Studio in the Ogatsu area, and ArchiAid in the Oshika area and peninsular areas of former Ishinomaki City, to support recovery plan formulation while working with the city and its hired consultants to garner public opinion. It goes without saying that the presence of a third party is effective in garnering public opinion and forming a consensus. Outside experts take a neutral position between the citizens and the local government, serving as a lubricant in consensus formation regarding recovery plans.

However, architects in Japan, as a professional group, differ somewhat from other professional architects (based on an international standard) who are both architects and engineers of structures like houses and buildings. For this reason, because infrastructure facilities are outside the scope of their expertise, they are somewhat lacking in knowledge about such matters, and some friction emerged between the architects and the consultants who were hired to plan and design the infrastructure facilities required for current reconstruction projects. However, some civil engineers who were members of the Peninsula WG stepped in to help mediate between the two sides. In Japan, it has always been important for civil engineers who specialize in infrastructure facilities to participate as outside experts in efforts to garner public opinion, but the reality is that in Japan, there are few civil engineers who can actively engage in such efforts.

In Ishinomaki, it must be noted that the participation of architects in hearings for garnering public opinion was done at the institutional, not the individual level. As mentioned above, various organizations participated in the efforts conducted in the various regions of Ishinomaki, in Kitakami, Ogatsu, and Oshika. Thus, it was easy to bring everyone together and engage in controlled efforts to garner public opinion in each fishing village with regard to issues that, from the perspective of fairness on the city’s part, had to be applied to everyone (such as post-recovery disaster management standards and development standards).

**The Situation and Challenges in Other Areas**

In this major disaster, because of their good intentions and desire to support recovery efforts, many experts in the fields of architecture and civil engineering participated in support efforts in the affected region. However, that support came largely from individuals rather than organizations. In many other municipalities, workshops for citizens were conducted by outside experts and various plans were proposed without any involvement of local municipal governments. However, there was apparently some friction between these plans and the recovery plans of those municipalities, resulting in the emergence of opposition movements by citizens against the municipal plans. Disaster recovery is an urgent matter, and if feasible plans are not promoted in cooperation with local governments, there is no need to participate in efforts to garner public opinion, no matter how much goodwill exists. It will produce lingering problems with regard to the ethics of experts. It is extremely important to create a system in which strong ties are maintained with the city and that outside experts are involved in garnering public opinion.

There is also no shortage of experts who will work with citizens to develop proposals without an understanding of recovery project systems, and thus end up producing plans that look better on paper than they actually are. Experts must keep in mind that what disaster-stricken areas need is not fabricated ideals, but real, tangible recovery.
The emergence of confusion as a result of support provided by experts may indicate a need to spend more time studying volunteer control. Based on lessons learned from the Great Hanshin-Awaji Earthquake regarding the arrival of volunteers to disaster-stricken areas, the social welfare councils in each municipality were tasked with supervising individual volunteers and coordinating them so that they would not become unevenly assigned to various work areas. In this disaster, the Ishinomaki Volunteer Center served as coordinator between volunteer organizations, ensuring the success of efforts to coordinate the distribution of relief supplies and services. This proved so successful that it came to be called the "Ishinomaki method." It has been said that in Ishinomaki, the coordination of individual volunteers as well as the coordination between volunteer groups facilitated a relatively smooth provision of support.

Because a comprehensive exchange agreement was concluded between Tohoku University and Ishinomaki City Hall in the early stages with regard to the involvement of outside experts, and because institutional support was provided by a well known organization, a certain sense of territoriality emerged. As a result, there were no cases of experts randomly getting involved in garnering public opinion. Instead, the garnering of public opinion was done under controlled conditions, with city hall and the citizens working together. However, it is important not to rely on the emergence of casual, implicit coordination structures, but to create systems in which the kind of coordination that came to be known among volunteer groups as the "Ishinomaki method" can be deliberately and explicitly implemented.

Role in Improving Plan and Design Quality

Forward-Looking Community Development and Rapid Recovery

While rapid recovery is very important, plans for infrastructure that is to be developed as part of a region's reconstruction projects are also extremely important insofar as they have to be established based not only on a vision for the community's future, but also on the basis of their sustainability under conditions of population decline. Several cases were found in which staff on the government side, including local government workers and consultants, focused too heavily on quickly completing the immediate work right in front of them. This is likely because they were interacting with victims living in temporary housing. When hasty planning and design precludes sustainability, priorities are being placed in the wrong order. To improve sustainability, it is important to maximize convenience and appeal.

Because of the hard ground found in areas with sawtooth coastlines, the amount of earth required to enable relocation to higher ground often determines the total construction time needed until completion. In many cases, the time taken to come up with a careful design can be recaptured in the form of shorter construction periods. Also, a smaller volume of earth moved generally means that a design is going to be more environmentally friendly. It is very important in terms of improving the appeal of a community that adequate time be taken to develop a well conceptualized design that reduces the earthmoving required.

Achieving a balance between promoting rapid recovery and maintaining a community's sustainability requires difficult decisions to be made, but outside experts, in their role as third parties, should be able to make relatively objective decisions. Because they are not local residents, consultants also should be able to take the same kind of third-party stance as outside experts, but because government agencies overwhelmingly take the initiative in Japan for planning and design contracts, the third-party perspective of a consultant may be difficult to utilize effectively.

Lack of Planners, Engineers

Many of the current recovery projects being pursued cover a wide area and typically involve the reorganization and relocation of towns, with relocation to higher ground being a common approach. This clearly involves a level of difficulty that is distinct from a type of recovery planning that is more mechanical in nature, that is, the recovery of a town in its original location, on the same scale. Talented planners must be involved. Also, because recovery is being pursued under conditions of population decline, it is essential to design a high quality infrastructure in such a way that it highlights and maximizes the appeal of the community. In other words, this situation is really putting the capabilities of Japanese planners and engineers to the test.

That said, the development of infrastructure in Japan cannot escape the systems that were established for the development of mass infrastructure during the high-growth period. During that period, the state...
required the recovery of the quality and appeal of Japan’s infrastructure and rapid development using standard designs. For this reason, governments and consultants that were adept at working mechanically based on standard designs have not spent much time on the kinds of designs that really draw out a community’s unique appeal. Under conditions of population decline, there are not many engineers capable of producing high quality designs for improving sustainability, and it would be difficult to argue that enough of them have come into the affected region. This is a major issue that needs to be addressed going forward.

Community development under conditions of population decline has only just begun, and many planners, engineers, and governments, unable to escape the large-scale development paradigm, do not understand the need for implementing appropriate “smart shrink” solutions (smart solutions implemented on a small scale). This, too, poses a challenge.

Planning and design service contracts in Japan provide little incentive for bid-winning consultants to improve the quality of their designs. If the amount of work involved increases as the result of a customer’s request, the contract price can be increased, but there is no framework for authorizing price increases for quality improvements. This means that the consultant's management team often only uses engineers and planners to perform the minimum necessary amount of work, impeding any effort to spend the necessary time and money on personnel to come up with a well-crafted, high-quality design. Technological competition exists during the competition for contracts, but there is clearly no incentive for improving quality once a contract has been awarded. This was one of the issues to be addressed in the improvement of Japan’s technological capabilities, but little improvement has been made, and we continue to move forward on recovery projects while facing the same challenges.

To execute high quality, sustainable designs under these conditions, the involvement of outside experts is of critical importance. Efforts to improve plan and design quality and to improve sustainability are being undertaken in all regions under the guidance of outside experts. In Ishinomaki, concrete design proposals are being provided by Tohoku University and the city has created its own site design guidelines based on guidelines issued by the Ministry of Land, Infrastructure, and Transport with regard to the site design of higher ground relocation areas.

Role in Project Coordination

Japan’s Public Works System

First let me provide an overview of the development and management of Japan’s infrastructure, which is so important in recovery plan support. All infrastructure development and management in Japan is conducted based on legislation. This legislation contains basic stipulations regarding such matters as the infrastructure managers, the party responsible for costs associated with development and maintenance, and the definition (scope) of projects. The national government directly manages and develops nationally important infrastructure, while locally important infrastructure is managed by prefectural governments, and other infrastructure is managed by municipal governments.

Because the relevant legislation has provisions stipulating that certain types of infrastructure are to be managed by various agencies, for example, that roads and rivers are to be managed by the Ministry of Land, Infrastructure, and Transport and that farm roads are to be managed by the Ministry of Agriculture, Forestry and Fisheries, and provisions stipulating that the national government has management authority over national funds (subsidies) provided to cover expenses, the national government maintains a certain amount of influence over infrastructure that is managed and developed by prefectures and municipalities.

Reconstruction Project System

In consideration of the local financial situation, the national government raised its subsidy rate for reconstruction projects following the Great East Japan Earthquake, and added the share to be borne by the local governments to their local government tax allocations, effectively ensuring that many reconstruction projects were fully funded by the national government. The Reconstruction Agency that was established on February 10, 2012 is the central agency in charge of those budget allocations. This means that budget negotiations over reconstruction projects may be subject to various criticisms, but a system has been created to ensure that the budget is centrally managed and easy to implement.
On the other hand, management authority has not been centralized. Because the formulation of recovery plans is unequivocally the responsibility of municipal authorities, the affected municipalities are having to move forward on reconstruction projects while engaging in massive project coordination. This is because much of the key infrastructure in municipalities is managed by the prefecture or national government, leaving the municipal government without the decision-making authority over relevant projects. The managers in charge of projects involving coastal levees, as the region’s core tsunami prevention facilities, are wide ranging. The authorities that manage coastal areas belong to several ministries, such as the ministries in charge of construction, transportation (industrial ports), fishing ports, agriculture, and forestry, and they refer to the coasts they manage as construction coasts, transportation coasts, fishing port coasts, agriculture coasts, and forestry coasts. A fishing port coast and construction coast located next to one another are both managed by the prefectural governor, but because of differences in the ministries with jurisdiction over their systems, and thus differences in the prefectural departments in charge of related decision-making, there are different offices responsible for project coordination.

**Role of Outside Experts in Project Coordination**

As mentioned above, the current recovery effort is distinctive in that recovery projects managed by many different authorities have to coordinated and implemented simultaneously. If each project moves forward independently, the overall result will not reflect good planning. An overarching design for a community's systems is essential. Project coordination during normal times largely consists of construction schedule and location coordination, but in the current recovery effort, a more essential form of coordination is required. For example, while a recovery plan in one affected area could involve creating disaster management facilities such as river embankments and coastal seawalls, and developing land use plans for low-lying areas damaged by the tsunami, another possible plan would be to restrict the use of low-lying areas through land use regulations and to promote recovery primarily in higher ground relocation areas without creating any new disaster management facilities in the low-lying areas. It is difficult for the municipalities that have land use authority and the disaster management project managers to decide on their own whether to choose one of these options or to explore some alternative solution. This is because they cannot propose a possible solution without conducting investigations of issues that include elements that fall outside the scope of their authority. There is therefore a tendency for agencies to move forward on recovery projects that require a quick response by staying within the scope of their authority. To prevent this, it is important to promote appropriate information sharing between project managers, of course, but it is also valuable to get input from outside experts who can provide advice from an objective, third-party perspective on the basic direction that comprehensive recovery plans should take.

In Ishinomaki, the above-mentioned Ishinomaki City Recovery and Community Development Council played a role in the complex process of coordinating the various project managers by discussing these kinds of issues, presenting guidelines to the various project managers, and asking them to check into these issues themselves.

**Lessons**

- Getting outside experts involved in efforts to garner public opinion is effective in promoting recovery projects. However, in this case, when such activities were undertaken without any coordination with the municipal authorities who were unequivocally responsible for the reconstruction projects, a situation arose in which a movement developed in opposition to the city’s plans. This kind of situation cannot be tolerated, even if it was one that started with good intentions. Outside experts, as professionals in their fields, must be held to a higher standard of ethics. They must be subject to ethics education and some form of regulation.
- Under circumstances where the involvement of outside experts is coordinated and supervised, as is the case with volunteer organizations, they should definitely be involved and systems should be created to facilitate their participation.
- If the technological skill level of all engineers and planners is not improved, it will be difficult to implement recovery plans quickly and accurately. If authorities do not adequately disseminate and systematize approaches to physical infrastructure that deviate from standard designs, and approaches for cultivating new design technologies in an age of population decline, similar types of confusion will not be avoided in future reconstruction projects. It is particularly important to promote more advanced technological competition and engineer education. Recovery from a major disaster is a national effort,
and the capabilities of Japanese engineers in the fields of civil engineering, architecture, and urban planning are certainly being tested by this disaster.

- A system that appropriately promotes social capital development during ordinary times may have different requirements than a system for promoting social capital development after a major disaster. Infrastructure development after the Great Hanshin-Awaji Earthquake, with the exception of some land readjustment projects, fundamentally consisted of restoration projects conducted in the same location, on the same scale as existed prior to the disaster. In such cases, there was little confusion caused by the use of systems that had already been put into place during ordinary times. After the Great East Japan Earthquake, however, many of the affected local governments had to reconfigure their spaces and structures in conjunction with the relocation of their towns. These cases required a more essential form of coordination between projects for which the systems established for ordinary times proved inadequate. For this reason, many government workers have been involved in project coordination, and many outside experts have played roles as intermediaries, but a greater degree of centralization in management authority (authority to implement projects) from the outset might have reduced the amount of coordination work needed. We should remember that the Imperial Capital Reconstruction Department established after the Great Kanto Earthquake had the authority to implement projects involving the infrastructure in Tokyo under the direct supervision of the national government, and worked in concert with (what was then) Tokyo City to form a two-pronged system for pursuing reconstruction projects.

Proposals

Create an Environment Suited to the Participation of Outside Experts

The appropriate involvement of outside experts in recovery projects is extremely important for both governments and citizens as they can promote consensus formation from a neutral perspective. However, if their involvement is not appropriately supervised and coordinated, much like the intake of volunteers and relief supplies, they can actually end up impeding the process of consensus formation. Such systems should not be adopted after a disaster strikes. Rather, during ordinary times, local governments should prepare for disasters by forming relationships of trust with outside experts who should be invited to serve as advisors and to be involved in the urban planning process in individual communities. It will also be effective for the national government to play a central role in concluding agreements with various countries and international organizations that can provide support through the dispatch of experts in emergency situations. Inviting outside experts to suddenly get involved after a disaster strikes makes it difficult for them to play a leadership role. In such cases, an organization is needed that can, at a minimum, coordinate the involvement of those experts.

Cultivate Japanese Engineers and Planners

It is no exaggeration to say that the technological skill level of native Japanese engineers and planners in promoting recovery projects in cooperation with affected citizens will determine the success or failure of recovery projects. The larger the magnitude of the disaster, the more our own native planners and engineers will be mobilized and the more their skills will be tested. Thus, naturally, we need to be working on a regular basis to bolster the technical education we provide to our engineers and planners. To prepare for the future, we must place priority on communication skills, which are needed all over the world for exploring plan proposals with local citizens, and on high quality planning and design skills.

Prepare Project Structures for Disaster Recovery

During ordinary times, the organizational structures needed for bolstering the infrastructure to achieve national development are different from those needed for conducting recovery projects, particularly in the case of tsunami recovery. After a tsunami or other calamity, when disaster recovery is undertaken in such a way that disaster management projects are simultaneously undertaken with efforts to reexamine the infrastructure (like roads and railroads) and urban land use plans, project coordination can be facilitated by the legal system preparations that concentrate project implementation authority and budget allocation authority in only two parties, the national government and the basic local government agency. Even in such cases, outside experts have an important role to play in terms of providing planning advice from a third-party perspective.
Key References Cited


Author: Katsuya HIRANO
International Research Institute of Disaster Science, Tohoku University
CHAPTER 5:
SHELTER

5.1. Housing Reconstruction and Community Development

This paper discusses the policies, problems, and future issues to be addressed with regard to housing reconstruction following the Great East Japan Earthquake, the construction and occupancy of temporary housing, the future provision of permanent housing, and community development efforts, including group relocation to high ground.

Overview

Background

It has been almost two years since the Great East Japan Earthquake. Tragically, this disaster resulted in 15,879 deaths, 7,712 missing persons, and 2,303 related deaths after the quake (Reconstruction Agency, January 10, 2013). Of the related deaths, 1,121 (49%) were deaths of residents of Fukushima Prefecture.

There are 320,000 victims living in evacuation shelters and temporary housing facilities. More than 70,000 evacuees left their home prefectures, but the vast majority of those (62,000) evacuated from Fukushima Prefecture.

The government prepared a reconstruction budget of ¥19 trillion to be spent over five years, but at least ¥2.4 trillion of that has gone to projects outside of the affected areas, making it hard to claim that the funds have been used appropriately for the reconstruction of the affected region. The new administration plans to increase the reconstruction budget to ¥25 trillion over five years, but it remains to be seen whether those funds will be appropriately allocated.

There are currently many people living in temporary housing in the affected areas. At this stage, it is important to ensure a humane living environment at the temporary housing facilities, and to establish projections regarding the next stage - transition to permanent housing.

Emergency Temporary Housing

Emergency temporary housing is provided through new supplies of housing and the use of existing housing inventory. New supplies of housing include prefabricated (prefab) housing and wood-frame temporary housing, while the use of existing housing is achieved in the form of sublet temporary housing, where private rental housing is rented to victims, and the temporary use of public housing, such as publicly owned housing and housing for public employees.

About 53,000 units of emergency temporary housing have been built, but many of these are prefab structures (as of October 2012).

The floor area of a temporary housing unit is up to a maximum of nine tsubo (29.7 m²) for a household of three people. Construction of these units began within 20 days after the quake so that they could be provided quickly. However, in many cases, it took more than a month before construction was even started. The units are generally expected to be used for two years, but occupants can extend their stay one year at a time. Current residents have extended their stay to a third year.

Initially, temporary housing construction was pursued too hastily, causing frequent cases of construction defects and calls for the national government to step in with response measures. However, a more fundamental problem was the poor quality of the steel-frame prefab housing units in terms of heat and sound insulation. During the summer, there were many cases of heat stroke, and measures to keep out the...
cold were likewise inadequate. For these reasons, some additional work had to be done after move-in, such as the installation of insulation materials and work to replace bathtubs with self-heating bathtubs.

The temporary housing construction cost is reported to have averaged ¥6 million per unit, but with the inclusion of later add-on work, the final cost may be as high as ¥7 million to ¥8 million per unit. After the Great Hanshin-Awaji Earthquake, 480,000 temporary housing units were built, with an all-inclusive cost of ¥4 million per unit.

Small unit size (floor area) has also been a problem in the Tohoku region. Many of the disaster victims were members of large families who had been living in large houses on large plots of land. A large family cannot live in a space of less than 30 m². However, splitting up families and having them live in separate residences causes major disruptions to everyday living.

There are also problems in terms of the location of temporary housing complexes, related living facilities, and issues surrounding community. In the affected region, there was not a single large area available for housing. With the land having been flooded and hazards related to tsunamis and radiation looming, the temporary housing was built in fairly remote locations. Since there were many people wanting to move into the temporary housing in the beginning, residents were selected by lottery. Elderly disaster victims who move into housing complexes where they do not know anyone and which are inconveniently located far from their old neighborhoods are having problems with everyday tasks, such as shopping and going to the doctor.

Evacuees from the nuclear accident are living in temporary housing in Fukushima or Aizu, far from the coastal areas, or are living in housing outside of the prefecture. Many complaints can therefore be heard from such residents regarding differences in the climate and natural features.

Various living problems associated with temporary housing caused serious problems after the Great Hanshin-Awaji Earthquake, including 233 so-called "solitary deaths," or people who died while alone. This experience has surely been conveyed to those managing the current disaster, but there have already been 54 solitary deaths across the three most heavily affected prefectures.

The way that temporary housing complexes are built can have a major impact on the creation of community among disaster victims. Community-style temporary housing complexes in Heita, Kameishi City, which were built under the guidance of a group at the University of Tokyo include installations of various service facilities and semi-outdoor spaces facing one another between the housing structures. Victims in these complexes can be seen spending time with one another. Also, the common areas designed by the architects are managed autonomously by the residents, who undertake various improvement initiatives. However, such progressive housing examples are few in number.

**Wood-Frame Temporary Housing**

In terms of the new supplies of temporary housing, significant progress has been made in the creation of non-prefab housing, largely in the form of wood-frame structures.

**Sumita-cho**

Sumita-cho in Iwate Prefecture sustained very little damage, but quickly built about 100 wood-frame temporary housing units for nearby disaster victims. With about 30 m² per unit, these homes have excellent heat and sound insulation, and were built at a construction cost of ¥2.5 million per unit. This housing was planned and designed by Sumita Housing Industry Corporation, a semi-governmental organization established as an initiative of the mayor of Sumita-cho. Sumita-cho developed community support activities using its local Kesen cedar and constructed public housing for Kizukuri-machi. Coincidentally, one week before the quake, the town had been working on the design of wood-frame temporary housing. Thus, they were able to quickly build housing for victims in Rikuzen-takata and Ofunato. Initially, the prefecture did not approve the structures as they did not meet standards, but the town built the houses with its own resources. Local wood was used for the construction materials and a local construction company quickly completed the construction work.
Wood-Frame Temporary Housing in Fukushima Prefecture

In Fukushima Prefecture, a nationwide call was put out for the housing units needed that exceeded the supplies of prefab housing units available, and about 6,000 wood-frame temporary housing structures were built. Wood-frame temporary housing construction was a relatively small scale project in Fukushima Prefecture and included several types of housing that went beyond the typical Japanese-style of wood-frame construction, such as log homes and 2-by-4 structures.

The homes were about 30 m2 in size, with some as large as 60 m2 including a loft area, and were outfitted with tatami mats and shoji screens. According to the designers, particular attention was paid to livability because the homes were built for the purpose of housing nuclear accident victims, who would likely be living in the houses for a long time.

Wood-frame temporary housing units in Fukushima Prefecture were not rented using a lease format, but were purchased by the prefecture. This meant that the periods of use could be flexibly determined, and made several post-use options available other than destruction, including the possibility of reuse or sale.

In Iwate Prefecture, 2,500 wood-frame structures were built, while 250 units were built in Miyagi Prefecture.

Sublet Temporary Housing

A new policy following this disaster was the introduction of rented (sublet) temporary housing which, unlike new installations of temporary housing units, involves the rental of existing private rental housing units that are then offered to disaster victims as temporary housing. This framework involves the conclusion of a contract between three parties, the prefecture, the rental housing owner, and the disaster victim, wherein the prefecture rents the home and pays rent using national government funds to the homeowner.

Because sublet temporary housing is not temporarily constructed, and consists of apartments designed for long-term occupancy, they offer excellent livability conditions and allow victims to choose their own furnishings. This option is therefore more popular than ordinary temporary housing, where residents are chosen by lottery and thus do not always know where they will be located. At the peak, more than 67,000 such units were made available to victims (as of August 2012). As a result, the initial 70,000 prefab temporary housing units was able to be reduced to 53,000 units.

However, sublet temporary housing presents several challenges. First, because private rental housing units are concentrated in the urban parts of Sendai City, they can end up promoting the relocation of victims to places far from their original homes. In Sendai, sublet temporary housing accounts for about 80% of emergency temporary housing. That is, there were 1,455 prefab housing units, 8,379 sublet temporary housing units, and 493 units of public employee housing, for a total of 10,327 units (as of October 2011). Of the households in sublet temporary housing units, 2,126 were living outside of the Sendai City before the earthquake struck (as of August 2011).

Second, sublet temporary housing is scattered throughout the city, but the locations cannot be marked as such because of concerns over personal privacy protection. This means that support organizations do not know where victims are, making it difficult for them to efficiently deliver support services. Likewise, the victims occupying these homes are anxious that they might be slipping through the cracks of the support network, and tend to feel isolated because they aren’t as aware of the presence of fellow victims.

Third, several prefectoral governments in western Japan preferred to pursue efforts to house victims in vacant public housing units, and did not adopt the sublet temporary housing framework. Since the framework of the sublet temporary housing system requires a contract to be concluded between three parties, the prefecture, rental housing owner, and disaster victim, wherein the prefecture uses national government funds to pay rent to homeowners, the prefecture has to implement the system in order for rents to be paid. The use of vacant public housing units to meet the needs of disaster victims may seem like a good option, but that is not always the case. Prefectural residents who are waiting for public housing openings may feel that the provision of housing to victims compromises their own opportunities for housing, and this can create its own problems.
With the sublet temporary housing program, the prefectural government uses national funding to rent housing and provide it to housing victims. As is the case with prefab housing, victims are provided with a material good (housing). However, the provision of temporary housing can be achieved through cash grants, according to Article 23-2 of the Disaster Relief Act. If this provision is accurately applied, direct payments of rent to occupants is allowed. If this is the case, there is no reason for victims to use vacant public housing units.

Fourth, someone who lived in a multi-family rental housing complex before the earthquake would be able to move into sublet temporary housing if their entire housing complex sustains damage, even if their own unit remains undamaged, suddenly giving them access to housing whose rent is free. Meanwhile, nearby residents would naturally be paying their rent as usual. This means that people categorized as victims, even though they sustained no direct damage and thus were essentially in the same position as other non-victim residents, would be able to live rent free. Clearly this is unfair.

**Securing Permanent Housing**

Permanent housing consists of disaster public housing and housing rebuilt independently by victims.

**Disaster Public Housing**

Constructions plans for disaster public housing are currently calling for the construction of 5,539 units in Iwate Prefecture, 3,956 units in Miyagi Prefecture, and 1,300 units in Fukushima Prefecture. However, construction has only begun on 539 units in Iwate, 654 units in Miyagi, and 58 units in Fukushima, together accounting for less than 10% of the planned number (figures obtained from the websites of each prefecture).

Disaster public housing is the most reliable housing option for victims who lost their homes. Occupancy of ordinary public housing is subject to income limits and other restrictions, but anyone who lost their homes in the disaster and are unable to rebuild on their own are eligible to apply for disaster public housing. (However, the period of occupancy is three years. After that, persons with excess income are required to vacate.) In this case, disaster victims who were left unable to occupy their own homes due to the nuclear plant accident also were qualified occupants.

Thus, disaster public housing provides a kind of safety net for disaster victims, but it is important for them to understand that it this is not the best option and that it comes with certain qualifications.

First, public housing is not always well suited to the lifestyles of disaster victims. In many cases, public housing units are built according to a uniform design to which occupants have to adapt their lives. The floor area of units is usually less than 60m², and residents cannot reconfigure the rooms or replace the furnishings with items of their own choosing. They do not have any space for a guest room, nor any land for flower or vegetable gardening. The location of the housing complex to which people are assigned is also determined by lottery. It is important to remember that for people used to living in areas with wide open spaces like farming villages, fishing villages, and rural towns, being moved into public housing can feel like being forced to live in a situation that feels completely foreign to them.

Second, the government authorities supplying public housing must take management issues into consideration. National funding is available at the time of construction and a great deal of energy is put into the construction process, but ongoing management of a facility places a significant burden on a local government. Ishinomaki City had 1,700 public housing units before the earthquake, but its reconstruction plan called for the construction of as many as 4,000 units. Minamisanriku-cho was slated to build 1,000 units while Ofunato City was slated to build 900, large numbers for both local governments. When elderly disaster victims who have moved into public housing ultimately die, large numbers of units will remain vacant if there are no new tenants to fill them. A carefully crafted plan is needed that looks head to the time when local governments are left holding vacant public housing units scattered across a wide area.

**Independent Reconstruction**

Another option for housing reconstruction is to rebuild one’s home independently. It goes without saying that disaster victims would like to secure the same type of housing they had before the disaster. Given this, housing reconstruction policies must be based on providing support to those who choose to rebuild their homes on their own. In reality, however, it is not easy for disaster victims to rebuild independently.
According to a survey conducted among temporary housing residents in Kameishi City, the number of respondents indicating that they were going to rebuild their own homes decreased dramatically in 2012 from 2011, while the number of people hoping to move into public housing increased.

The impediments to independent reconstruction include, first, a lack of capital for home construction, and second, issues related to the soil, such as soil degradation (subsidence), future tsunami risks, and radiation contamination. In the former case, financial support systems for independent reconstruction are essential. Meanwhile, community development planning plays a major role in the latter case. Still, even in these situations, capital support is essential.

The system through which financial support for independent reconstruction is provided is the Act on Support for Reconstructing the Livelihoods of Disaster Victims. When a home is totally destroyed, a maximum of ¥3 million can be used for housing reconstruction. However, ¥3 million is not nearly enough to rebuild a home, and owners of homes that are half destroyed are not eligible for any support. Also, the problem remains that this support is available to victims of natural disasters, and thus not to victims who lost their homes as a result of the nuclear accident.

In the case of the Great East Japan Earthquake, a total of ¥248.2 billion in basic support funding has thus far been paid to 183,264 households (as of the end of October 2012). However, no real progress has been made toward reconstructing homes using those funds, and there are significant regional differences in the dispersement levels, with the heaviest-hit coastal areas having received little funding (Asahi Shimbun, January 7, 2013). In addition, the government now has plans to promote inflation and a policy to raise prices, which will mean that victims will face rising housing reconstruction costs.

**Community Development**

Housing access is closely related to community development of the affected areas. In the areas affected by the tsunami or nuclear accident, people are unable to rebuild their homes on their previous lots. Reconstruction-oriented community development is promoted through a system wherein prefectures make assumptions regarding tsunami inundation, and municipalities then formulate community development plans based on those assumptions, and establish non-residential land use guidelines for areas vulnerable to tsunami inundation. Citizens designated as living in non-residential areas are encouraged to move to higher ground through group relocation projects.

However, disaster victims cannot easily agree to the relocation measures suggested by these land use policies. Significant problems remain in terms of preferences regarding where they want to live, the ability to secure employment, and the victims’ use of their own housing reconstruction funds. Land prices in the target relocation areas, such as the Sendai Plain, are high, putting housing construction in those areas out of reach for many. Also, in the areas not designated as destinations for group relocation, reconstruction grants cannot be used for raising sunken land, making it impossible for residents to build safe homes there. The project costs involved in community development infrastructure construction are covered by reconstruction grants, but individual victims have to come up with their own funding for housing reconstruction.

Many people are concerned about the impact that the construction of massive seawalls will have on their everyday lives, commercial ventures, and tourism. Also, community development projects can take, on the early end, as many as three years until completion, with some projects lasting as long as five or seven years. It is feared that people who are unable to secure employment or earn an income during that time, and who are thus unable to make a living, will leave the area before the projects are complete.

**Lessons**

Some are saying that reconstruction from the Great East Japan Earthquake is lagging, but it is meaningless to make simple comparisons with past disasters. This was a colossal disaster that combined a massive one-in-one-thousand-year tsunami event with the first-ever combined earthquake and nuclear power plant disaster. Because of the difficulties involved in meeting our reconstruction goals, it is useless to debate the amount of time it should take to reach them.

Earlier is better when it comes to reconstruction, but even more important is the goal is of helping disaster victims rebuild their lives in a meaningful way.
Reconstruction projects place the highest priority on the livelihood reconstruction of victims, and the revitalization of the national economy as a whole has to be dealt with separately from this. Reconstruction funds have to be invested in a way that focuses on rebuilding victims’ livelihoods.

The supply of emergency temporary housing is urgently needed, but even more important is the need to ensure quality of life. It is not enough to do things quickly; past experience has taught that better housing must be supplied. This is extremely important in terms of preventing extreme distress among disaster victims during the long reconstruction process, and thus preventing secondary damage.

After the Great Hanshin-Awaji Earthquake, temporary housing was used for five years, but it is highly likely that it will be used for an even longer period this time, given the time that residents of the radiation-affected areas will be required to stay away from their homes. To ensure a certain level of quality of life, new, additional measures need to be investigated.

The low livability performance of prefab temporary housing has been pointed out in the past, and we have experience in improving these structures. The fact that low-livability temporary housing was nonetheless supplied to affected areas indicates that there is a major deficiency in our current system of supplying emergency temporary housing.

Wood-frame temporary housing units offer good livability in terms of heat and sound insulation, excellent versatility and flexibility, and benefits in terms of relocation and reuse. Also, because wood-frame temporary housing is made using local materials by local construction companies, they are less expensive and promote the revitalization of local industry. This is important experience that should be put to use in future disasters.

Until now, all Japanese prefectures have concluded agreements with prefab home construction companies and have exclusively supplied steel-frame prefab housing, but an emphasis must be placed on the introduction of wood-frame temporary housing in future disaster response efforts. The National Association of Wood-Frame Construction Companies has concluded disaster management agreements with six prefectures, and is asking 16 others to consider similar arrangements.

The imbalance in rents between sublet temporary housing occupants and other occupants is due to the lack of a general rent subsidy system for private rental housing. This kind of problem could be avoided if a rent subsidy system were put into place for all residents of private rental housing whose income is at the level of that of public rental housing residents. A rent subsidy system for low-income earners needs to be introduced as a general policy, not just for disaster victims.

Sublet temporary housing is expected to play an important role in the event of a future Nankai earthquake or earthquake directly beneath the capital region, but chaos is expected to continue under the current conditions, and the system needs urgent improvements.

After the Great Hanshin-Awaji Earthquake, the government supplied 38,000 units of disaster public housing. These were multi-family housing complexes of five stories or more that were made of reinforced concrete, highly resistant to disasters, and fully furnished. Rents were low for low-income earners, with the lowest at ¥6,300/month, but the greatest problem was that existing human relations were severed, isolating the occupants from their former networks. The reason for this, speaking in the extreme, is that much of the disaster public housing was built in the outskirts, separated from the affected areas, and since occupancy was determined by lottery, previous communities were destroyed. As a result, solitary deaths at temporary housing and disaster public housing facilities has risen as high as 1,011 people over 18 years. Efforts had been made by lifestyle support officials to keep an eye on people as best as possible, but those efforts are of limited effect. Even today, 50 to 60 solitary deaths occur each year.

In the aftermath of the Great East Japan Earthquake, disaster public housing needs to be planned and designed in such a way as to prevent these kinds of problems. We need to build on the experiences of Sumita-cho, where wood-frame municipal housing was built in large quantities, and the experiences of the Niigata Earthquake, after which wood-frame public housing was built in the form of duplexes and detached houses. The public housing plans of the various prefectures include plenty of small-scale and wood-frame housing, but they also include seven-story structures with 10 to 100 units or more. In these latter cases, particular care must be taken.
On the other hand, it is also important to supply a variety of services, including nursing care services, to senior citizens. In multi-family housing complexes where people cannot expect help from large families or fellow members of their community, these kinds of services have to be provided by public agencies. To do this, plans can be made to install facilities in such a way as to accommodate multi-family living situations. However, careful research must be conducted on how to ensure that these services are well suited to victims’ lifestyles.

The new administration is urgently promoting projects in the name of accelerating reconstruction, but there is a significant shortage of manpower at the municipal level. If construction projects are too hurriedly ordered, and mass projects are undertaken without spending time ascertaining the needs of victims and local communities, gaps may emerge between the housing built and the lifestyles of the victims/occupants, potentially creating new problems.

To make up for inadequacies in the support systems for the livelihood reconstruction of disaster victims, prefectures have, in the past, made efforts to use their own budgets to increase the support funds given to victims, much to their appreciation. The maximum amount of support funding provided was ¥7.7 billion after the Noto Peninsula Earthquake (Ishikawa Prefecture) and ¥6.5 billion after the Chuetsu Offshore Earthquake (Niigata Prefecture).

In the Great East Japan Earthquake, efforts to accumulate support funding can hardly be described as vigorous, but Iwate Prefecture is providing ¥1 million in additional funding, a housing damage restoration expense subsidy of ¥2 million, and a loan interest subsidy of ¥1.35 million. In addition, the prefecture’s own housing subsidy of ¥1.3 million is being supplemented with a contribution of ¥1.52 million and the national government’s support grant of ¥3 million, for a total of ¥10.17 million. However, the effects of these support policies are not altogether clear.

There is a time lag between community development and the livelihood problems of victims, but livelihood problems fall outside of the range of factors that are taken into account by community development projects. For victims, however, these are integrated problems, and comprehensive reconstruction measures have to be taken that address all aspects of livelihood reconstruction. This requires adequate investments of capital, revisions to the Act on Support for Reconstructing the Livelihoods of Disaster Victims, and increases in the frameworks for and amounts of support funding.

To promote community development, manpower support is needed for consensus formation and project promotion. The government is increasing its ¥19 trillion reconstruction budget for the 5-year intensive reconstruction period, to ¥25 trillion. However, securing a large budget does not automatically mean that reconstruction will be advanced. Naturally, the reconstruction budget should not be appropriated to other purposes. Local governments in the affected areas are going to be very hard pressed to implement projects, and they will require manpower support so that they will be able to keep a watchful eye on the overall status of the livelihood reconstruction of victims. On the other hand, increases in the costs of housing construction can be expected given the government’s policy aimed at increasing consumer prices by 2%, and this will make financial assistance necessary.

**Proposals**

- Reconstruction policies are primarily geared toward the livelihood reconstruction of victims, and the reconstruction budget must be invested in efforts that focus on this priority.
- The supply of temporary housing and the expectation of permanent housing are absolutely essential to the livelihood reconstruction of victims, and such programs must be quickly proposed.
- In the reconstruction of emergency temporary housing, we must learn from past experience and adopt methods that allow us to supply housing that is compatible with the climate, natural features, and lifestyles of the affected communities.
- To prevent the emergence of an imbalance in rents between sublet temporary housing occupants and other occupants, a rent subsidy system must be implemented for occupants of private rental housing.
- A temporary housing system that utilizes private rental housing is expected to play an important role in future disasters, and must be urgently developed.
Disaster public housing is an important safety net policy for disaster victims, but because of its disadvantages, emphasis must be placed on policies for providing funding support to victims for independent reconstruction.

When providing for the construction of disaster public housing, structures must be planned and designed in such a way that living spaces are secured without destroying the disaster victims’ previous communities.

Author: Yoshimitsu SHIOZAKI
College of Policy Science, Ritsumeikan University (Kobe University)

5.2. Reconstruction Public Housing: The Case of Shichigahama-machi in Miyagi Prefecture

In reconstruction after a major disaster, projects aimed at providing victims with a stable living environment are given the highest priority. The actual process involves moving them from immediate post-disaster shelters, to temporary housing, and then to permanent homes (independent reconstruction, disaster public housing, or other options). In the development of these housing options, it is important to consider not only the ways that outside experts can be involved, but also the systems used for project implementation.

Overview

Development of Disaster Reconstruction Public Housing

This paper reports on the current status of and issues related to the development of disaster reconstruction public housing, with particular focus on the conditions being faced by small local governments, where it is relatively easy to get a sense of the overall situation.

The Disaster Public Housing Framework

Number of Developments

Disaster reconstruction public housing (hereafter "reconstruction housing") are housing complexes in which disaster victims who have moved out of temporary housing can begin their new lives. After the recent Great East Japan Earthquake, plans were made to develop about 5,000 units in Iwate Prefecture, 15,000 units in Miyagi Prefecture, and 5,000 units in Fukushima Prefecture, for a total of 25,000 units. In Iwate Prefecture, there will be 3,231 units of prefectural housing, and 2,370 units of municipal housing, such that the number of units to be directly developed by the prefecture is higher than that of the municipalities. On the other hand, Miyagi Prefecture does not have any plans to develop prefectural housing. All public housing there will be managed by the municipalities, but the prefecture will handle the design and construction of some of the units in an effort to reduce the municipal burden. Both Iwate and Miyagi plan to have their public housing completed by FY 2015, but finishing this enormous amount of public housing within such a short time frame is going to be very difficult.

Management

Reconstruction housing has to be built in large quantities, very quickly, but the need for this housing tends to taper as reconstruction progresses and residents age. Thus, the supply and management of this housing requires proper handling. Also, since many of the most vulnerable individuals tend to live in these units, attention must be paid to efforts to prevent solitary deaths.

To be vigilant about creating structures that will prevent residents from becoming isolated, and to ensure at the beginning of the process that supplies will be available in a short time frame, flexibility in land acquisition, the standardization of parts and materials, and designs that are compatible with construction methods are all necessary. At the end of the process, by contrast, a management plan that integrates the new housing with the existing inventory of public housing will also be needed. For the sake of appropriate community management, and to ensure that local governments are not left with excess inventory, exit strategies that account for unit dismantling or reuse will be important (Figure 5.1).
Case Study: Shichigahama-machi, Miyagi Prefecture

Town Overview

As indicated above, the development of reconstruction housing is difficult. It is difficult to assess the overall situation at present, while development is still in progress. Thus, in this paper, I will present the issues by looking at the case of Shichigahama-machi in Miyagi Prefecture, a location where the development of reconstruction housing is progressing comparatively smoothly.

Shichigahama-machi is a small town with a population of about 20,000. Neatly settled in a circular area with a diameter of about 5 km, it is located about 15 km from central Sendai, the nearest large city, and has a lot of remaining natural resources. In the latest tsunami, 46% of the town was flooded, and 1,323 homes were completely or half destroyed.

Number of Units to be Developed

The number of housing units to be developed as of February 2013 was 222, which accounts for about 3% of the 6,540 total households in the town (as of the resident registry on January 1, 2010). This figure is very conservative as compared with the 6.9% in Ishinomaki City, which has established a development target of 4,000 units.

The homes are to be developed in the five areas that sustained the greatest damage, and the numbers to be built in each are indicated below. In Shobuda, where the damage was greatest, more than 100 homes are being built, but in other regions, the numbers are being kept to a more reasonable level.

Table 5.1 Planned number of units in Shichigahama-machi (January 2013)

<table>
<thead>
<tr>
<th>Planned construction sites</th>
<th>Size/No. of units</th>
<th>1 person</th>
<th>2-4 people</th>
<th>4-6 people</th>
<th>7+people</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1LDK</td>
<td>2LDK</td>
<td>3LDK</td>
<td>4LDK</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Matogahama</td>
<td>17</td>
<td>10</td>
<td>5</td>
<td>0</td>
<td>52</td>
</tr>
<tr>
<td>2</td>
<td>Shobuda</td>
<td>26</td>
<td>65</td>
<td>1</td>
<td>1</td>
<td>105</td>
</tr>
<tr>
<td>3</td>
<td>Hanakadahama</td>
<td>55</td>
<td>13</td>
<td>1</td>
<td>1</td>
<td>88</td>
</tr>
<tr>
<td>4</td>
<td>Yosugahama</td>
<td>6</td>
<td>14</td>
<td>5</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>89</td>
<td>112</td>
<td>5</td>
<td>2</td>
<td>222</td>
</tr>
</tbody>
</table>

Housing Preference Survey

The number of planned reconstruction housing units was calculated based on the results of a housing preference survey conducted among disaster victims. In Shichigahama-machi, surveys were conducted twice, first in July 2011 and again in February 2012. The nearly one-third of disaster victims who indicated a desire for reconstruction housing in the beginning had shrunk to less than one-fourth of victims by the second survey. Between the first and second surveys, interactive information sessions carefully explaining the differences between the existing systems, such as independent reconstruction, group relocation, and reconstruction housing, had been held on a large scale, and it is likely that the number of disaster public housing units needed fell as a result of those explanations. The significance of such inducements is quite large given the difficulties involved in managing the public housing stock, as mentioned above.

On the other hand, these inducements also end up ensuring that those who want to be in reconstruction public housing are those for whom such housing is essential. Figure 5.3 gives a breakdown of those in Shichigahama-machi who indicated on the second living preference survey that they wanted to live in reconstruction housing. Most are in their 70s or older, living in households that have to take issues of accessibility into strong consideration. This highlights one aspect of the problem. That is, when planning reconstruction housing, it is important to think about how support is going to be incorporated for the vulnerable individuals who are expected to live in these complexes in large numbers. Nonetheless, since the authorities have to have a flexible exit strategy for dealing with changing needs, it is not really appropriate to
create a rigidly fixed plan. While establishing a master plan for the overall situation, we need to develop a plan that can satisfy both current and future needs.

**Development Process**

**Process Overview (Figure 5.4)**

The process for the development of reconstruction housing, with all its complex characteristics, has to be carefully managed. First, when conducting the housing preference survey among the most vulnerable disaster victims, it is important to provide careful explanations beforehand in order to extract appropriate information about victims' needs. Based on the needs identified, authorities need to reposition people within their previous communities, in housing built on an appropriate scale.

The housing design needs to take into consideration the creation of spaces in such a way that senior citizens who require support, who account for many of those who want to live in reconstruction housing, are not left isolated and alone. To accommodate this need, the town government selected a designer based on submitted proposals, with the aim of improving the quality of life in these living spaces.

Ordinarily, affected local governments are so busy working on various tasks and are so short on manpower that they tend not to use time-consuming bid-solicitation methods of vendor selection. In this case, however, various methods for improving the efficiency of processes that straddle the design and construction tasks have been explored, including design-build schemes, the construction management (CM) method, and bundling options. In Shichigahama-machi, it seemed possible to expect that a well crafted plan could be entrusted to an excellent designer because the number of units to be developed was already constrained by the above methods, and because the reconstruction housing complexes were being positioned as core elements of new community development in their respective neighborhoods.

**Designer Selection**

However, the burden imposed on the affected local government by the selection of a designer through a bid process was not insignificant. For this reason, the town enlisted the assistance of outside partners (a university research lab) for support with this process. The town did not request separate proposals for each of the five sites where housing was needed, but solicited bids for two major types of construction, wood-frame structures and reinforced concrete. While considering the submissions, the reviewers assigned the
best bidders to the five target neighborhoods. Using this method, the local government was able to select designers for all five neighborhoods with a single bid solicitation.

Control over Design Tasks

The reconstruction process is a difficult one that involves a complicated mix of public contracting activities. Even after a designer is selected, the local government has to appropriately manage each agent. In Shichigahama-machi, the town government handled everything up to the proposal. By relying on the support of Miyagi Prefecture in the actual ordering of the design and construction, the town has been able to avoid the complicated work of compiling drawings and specifications at the appropriate cost and performance levels while engaging in negotiations with multiple designers, and to avoid the contracting and management of the builders. On the other hand, by sponsoring meetings with the various designers, the town has been able to facilitate information sharing among them and to convey the town’s goals to them. Appropriate process management that includes sharing roles with higher tier local governments and holding joint meetings to promote efficient management makes it possible to meet the difficult need for securing an appropriate quantity of good quality social capital in a short period of time.

Reflection of Citizens’ Requests

The importance of getting feedback from citizens also applies to the design process of reconstruction housing. In fact, it may be even more important since most of the prospective occupants are currently being forced to live in the challenging conditions presented by temporary housing. Under these conditions, it is of considerable significance in terms of preventing a decline in the quality of life and the loss of any sense of community, to be holding workshops in the early stages where projections for new housing options are presented. Even in the ordering of the current design, each designer was obligated to hold a workshop with residents. Although this began with an attempt to get feedback from residents about their needs, it turned into a wide-ranging discussion of such issues as the management methods for the new spaces being created and the formation of new communities.

Figure 5.5 Designer selection

Figure 5.6 Town-sponsored joint meeting of designers

Figure 5.7 Workshops for prospective occupants

Figure 5.8 Winning wood-frame design proposal (Norm Null Office) A segmented spatial composition and a street lined with familiar wood-frame houses help ensure that disaster victim households will not become isolated.

Figure 5.9 Winning reinforced concrete design proposal (Atelier Hitoshi Abe). Fosters a sense of community through a unit structure that includes access to a common living space, and incorporates an exit strategy as units can be converted for group home use.
Lessons

Reconstruction housing conditions in Shichigahama-machi are exceptional cases in the overall context of disaster reconstruction, and do not suggest that other local governments are also capable of wholly managing their situations. What these cases have in common is that they concluded contracts with talented experts in the relatively early stages, and in doing so, were able to capitalize on their skills by transferring some degree of authority to them.

Their ability to make good use of these wise agents was an outcome of the fact that the garnering of public opinion by the local governments had been easily done through the appropriate sharing of information with residents. When some degree of trust can be established between citizens and the local government, appropriate solutions can be selected based on the individual needs of victims rather than being bound up more than necessary by the perceived need for equality in housing support for victims. This will undoubtedly create a richer post-reconstruction environment for everyone.

Key References Cited


Author: Yasuaki ONODA
Graduate School of Engineering, Tohoku University
International Research Institute of Disaster Science, Tohoku University

5.3. Wooden Temporary Housing in Fukushima Prefecture: Focusing on Log Construction

Disaster victims and evacuees in Fukushima Prefecture are still facing housing instability and an uncertain future due to the impact of the Great East Japan Earthquake (hereafter, “the Tohoku earthquake”) and subsequent nuclear accident, and are still living in nonpermanent homes, such as temporary housing and rental housing. With requests for supplies of temporary housing at levels never before seen in the three most severely affected prefectures in the Tohoku region, it clearly was not going to be possible to produce all of the housing deemed necessary by the national government in a short period of time through contracts with the Japan Prefabricated Construction Suppliers and Manufacturers Association. In Fukushima Prefecture, the number of temporary housing units to be supplied by local construction companies was increased, as efforts were made to make up for the expected shortfall.

Introduction

Through a request for proposals issued within Fukushima Prefecture, about 6,000 units of temporary housing primarily consisting of wooden structures were built. Amidst the uncertainty following the Great East Japan Earthquake and subsequent nuclear accident, attention had to be paid to the provision of temporary housing both in terms of securing physical infrastructure to protect the lives of disaster victims and evacuees, and in terms of creating a livable environment for those living in temporary housing complexes and producing orders for local construction companies. Here I discuss the wooden temporary housing effort with a focus on the approximately 600 log construction-style temporary homes built through a joint venture between the Japan Log House Association, Haryu Wood Studio, and the Tomoyoshi Urabe Laboratory in the College of Engineering at Nihon University.
Overview of the Emergency Temporary Housing Supply Plan in Fukushima Prefecture

After the Tohoku Earthquake, in part as a result of the evacuations necessitated by the nuclear accident, a decision was made to supply 14,000 of the 20,000 homes initially estimated to be necessary through supplies of temporary housing. Temporary housing was quickly installed by the Japan Prefabricated Construction Suppliers and Manufacturers Association (JPCSMA) based on an emergency disaster response agreement. However, due to the multiple requests for temporary housing from affected regions in other prefectures, the JPCSMA was only expected to be able to provide up to 10,000 temporary housing units in Fukushima Prefecture. During the same period, construction companies in Fukushima submitted petitions to the prefecture asking that they be allowed to participate in the temporary housing construction process. In response, Fukushima Prefecture issued a request for proposals inviting local companies to bid on the construction of 4,000 homes about one month after the Tohoku Earthquake. Later, given increasing requests for housing from municipalities in the nuclear evacuation zone, the prefecture ultimately ended up supplying as many as about 16,000 temporary housing units.

Requesting Proposals for Temporary Housing

Requests for proposals were issued to construction companies with bases of operation in Fukushima Prefecture to promote the early supply of emergency temporary housing and to promote the use of locally made materials by local companies. The first call for proposals was made for 4,000 units in April 2011 and a second was made for 2,000 units in July of the same year. Twelve companies were selected in the first round, and 15 companies in the second. In the end, approximately 6,000 primarily wooden temporary homes were built by local construction companies. It is worth noting that the proposals were comprehensively reviewed by scholars and other experts based on such evaluation criteria as supply capacity, sales price, housing performance, employment of local (in prefecture) disaster victims, use of locally made (in prefecture) materials, demolition and reassembly methods, housing plans, and model complex plans (including community considerations, for example). Several types of temporary housing different from the conventional model emerged, and a structure was established for placing orders with local construction companies.

Characteristics of Wooden Temporary Housing Built Through the Proposal Process

Construction Systems

A review of the construction systems proposed reveals a tendency for the managing construction company in charge of overall project management to be relatively closely located to the construction site. The use of locally made materials by local companies, which is one goal of the public proposal process, was pursued for each housing type, but since construction in each region was concentrated within the same time frame, it was difficult for some of the housing types to be constructed only by local companies. Thus, a system for accepting support from companies outside the prefecture was adopted.

Construction Periods

While the call for proposals made within the prefecture indicated a completion period of 30 days from the site inspection, the actual amount of time needed for the construction of wooden temporary housing was about 30 to 40 days. With the prefecture’s established time frame of 30 days being too tight, a goal of about 40 days was established. This means that the construction period for wooden temporary housing was about 1.5 times that needed for prefab temporary housing built during the same period, even though the construction company was located relatively close to the construction site. On the other hand, as construction companies accumulated experience over the course of building many units, they became more familiar with the construction process and were able to make adjustments to their systems that allowed.
them to start building units more quickly. For example, by changing the design of log construction homes (that is, simplifying the floor plans) based on their experience in the first call for proposals, companies were able to improve their plans and cut their production periods down to 24 days.

**Site Characteristics (Owners, Types, Area)**

Because public lands owned by municipalities were divided up for the construction of prefab temporary housing when construction began immediately after the Tohoku Earthquake, there was a shortage of public land available when it came time for the construction of wooden temporary housing through a call for proposals within the prefecture. Meanwhile, there was an abundance of privately owned land, especially small privately owned lots. Also, the types of lots readily available were the same types used for housing complexes by the JPCSMA, such as "athletic fields," "sites of demolished buildings," and "industrial parks," while wooden temporary housing was unique in that it could be constructed in "fallow fields," "existing facility sites," and "rice fields."

**Practical Experience Building Log Construction Temporary Housing**

What became apparent through the practice of constructing log constructed temporary homes was that in addition to meeting the prefecture's established goals in terms of the number of housing units needed per lot, these homes (1) could promote communication among residents by being arranged not just for efficiency, but for the inclusion of amenities like communal gardens, and (2) allowed for the creation of inviting outdoor spaces, as they were surrounded by the exterior wooden walls unique to log homes. Also, the homes (3) could take advantage of the existing surroundings and objects (could be positioned in relation to benches, trees, walking paths, and existing parking lots), and (4) were built with protruding windows and decks on the south side, to prevent the creation of monotonous, continuous north-facing entryways. The latter feature was intended to achieve the effect of promoting communication by making the entryways face one another, as was recommended by the prefecture during the construction process.

When there was multi-party collaboration on a site for the above-mentioned applications, sites were arranged such that the work lines during construction would not overlap and areas for each organization were set up to ensure equal access to communal facilities and the site periphery. They were arranged to achieve a sense of integration within each area, taking advantage of the specific properties of each housing type, while ensuring a sense of cohesiveness within the entire project site.

There were a total of four types of buildings with consecutive units: two types each of duplexes and fourplexes. By combining 1K (20m2), 2DK (30 m2), and 2LDK (40 m2) units in a given building, builders aimed to create a layout that combined block planning with measures to enable different types of residents to interact with one another. That said, building types were prepared to accommodate the predetermined ratio of units of each housing type. Also, the walls between all the various types of units were made using log shells with openings sandwiched between plaster boards so that the units could one day be merged, either two units into one or four units into one.
Future Demolition and Reuse

Efforts are now underway to demolish wooden temporary housing and reassemble it elsewhere. If we look at wooden temporary housing construction methods from the perspective of demolition, reassembly, and reuse, there are many strategies for improving on-site workability and for facilitating demolition and reassembly. For example, the conventional + wood panel method incorporates the efficiency of prefab temporary housing into wooden housing through the independent factory production of wood panels sprayed with urethane-based heat insulating materials. Once the decision is made to use these homes for permanent housing, this approach would make it possible to improve the texture by layering the finished surfaces. The traditional Itakura method of construction, which involves dropping wood planks between columns, is the most wood-consuming method. Structures made using this method can be used as is as reconstruction housing. Because this is a drop-in method, this type of construction allows for easy demolition and reassembly. The log construction method facilitates demolition and reassembly elsewhere by way of its specific characteristics and the fact that the logs used for the structure are also used for the exterior walls, interior walls, and insulation materials (this was helpful in this widespread disaster, given the shortage of conventional construction materials). Insofar as this method requires relatively fewer parts and components at the time of construction, it is recognized as one that takes issues of temporary housing reuse into consideration from the very beginning (one building is already being tested for demolition and reassembly elsewhere). These homes can also be placed in semi-fire zones after they are repurposed.

The conventional wood-frame construction method accounts for the highest proportion of temporary housing in this disaster, and it is a method that is regularly used by local construction companies. That said, since each of the materials used is fastened into place, it is the most inconvenient in terms of demolition and reuse. The question of which fastening methods were used for the interior walls, ceiling, floor, and exterior walls is an important factor with regard to the issue of reuse.

Figure 5.12 Sample layout of a log construction temporary housing complex (use of a park)

Figure 5.13 Examples of wooden temporary housing construction methods

Figure 5.14 Materials from log construction temporary homes being moved for relocation and reassembly after demolition
Conclusion

- This was the first attempt to build temporary housing through a prefecture-managed public call for proposals with a short turnaround under disaster conditions, and there were concerns regarding a shortage of experts and engineers. However, the local government (primarily the prefecture), university scholars, and various organizations and associations in the construction industry, because they had worked together in the past, were able to work well together under emergency conditions.

- In the current temporary housing construction project, which primarily involved wooden housing and was based on a public call for proposals, temporary housing was constructed under conditions in which each organization was trying to figure out the best construction systems and materials under the circumstances. Thus, challenges arose with regard to instability in the supply of materials and delays in construction times.

- Future disaster management efforts will largely focus on the early development and supply of housing, but the efforts made to construct wooden temporary housing after the recent disaster show that, based on the later reactions of residents, disaster challenges cannot be met by the conventional supply of stable and efficient temporary housing from the JPCSMA alone. Authorities must examine ways to bolster primary evacuation shelters and to improve the usage of rental housing, and must also investigate their overall approach to the supply of temporary housing.

- Two years have passed since the Tohoku Earthquake and policies are being developed for the construction of disaster public housing comprised of reinforced concrete multi-family housing complexes. When it comes to the development of mid-term housing solutions, including so-called "temporary towns," however, alternative options must also be examined. For example, there is the option of repurposing and reusing wooden temporary housing, depending on its concrete foundations, layout, and location, by changing some of the specifications so that it can be used in semi-fire zones. Among the types of wooden housing options available, log construction homes can be built in relatively large numbers, offer the highest rates of reuse, and are easily adaptable.

Figure 5.15 Fukushima Temporary Housing, Reconstruction, and Community Development Council (participants include prefectural officials, university scholars, the JIA, construction industry association representatives, and others)

Key References


Haganuma, Sei, Takashi Nameda, Tomoyoshi Urabe, et al., Wooden Temporary Housing Group: Architecture from 3.11, December 2011.


Endnotes

1 In this paper, "prefab temporary housing" refers to temporary housing built in an assembled house style or a unit house style based on the standards of the JPCSMA.

Author: Tomoyoshi URABE
College of Engineering, Nihon University
6.1. The Development and Significance of Efforts to Preserve Historical Records and Disaster Materials After Major Disasters

There are three important points when it comes to the preservation of affected community historical records and materials related to massive disasters (disaster materials) following large-scale natural disasters: (1) the preservation of historical records for disaster research, (2) the formation of disaster-resistant community cultures through the transmission of disaster memories to future generations, and (3) the formation of community reconstruction processes rooted in local history and based on the initiative taken by local citizens. This paper discusses items (2) and (3) by looking at efforts made by experts and local residents from the time of the Great Hanshin-Awaji Earthquake to the time of the Great East Japan Earthquake.

Overview

Introduction

This paper outlines methods for preserving historical records and disaster materials in times of disaster that have been developed since the 1995 Great Hanshin-Awaji Earthquake and after the Great East Japan Earthquake and discusses the significance of these activities in contemporary Japanese society. Specifically, it focuses on the following three points:

1. The question of what types of local historical records should be preserved after large-scale natural disasters, and by whom in the affected regions they should be preserved.
2. The historical attributes of local communities in Japan and the attributes of the local historical records that remain there, insofar as they contribute to an understanding of the significance of historical record preservation after large-scale natural disasters.
3. The significance of the preservation of community historical records in societies that experience frequent large-scale natural disasters.

Section 1: Affected Community Historical Records and Disaster Materials: The Preservation of Two Types of Historical Records

There are two types of historical records to be preserved when a major disaster strikes. After the recent Great East Japan Earthquake, old historical documents and books, as well as family memorabilia and historical records related to the community, were carefully collected from the tsunami debris. These are historical records that shed light on the history of the affected communities, and thus are referred to as "affected community historical records" (Figure 6.1 and Figure 6.2). In addition, there are various materials that convey information about major disasters to future generations, and these are generally referred to as "disaster materials," or in the case of a major earthquake, "earthquake materials" (Figure 6.3). Efforts to preserve historical records tend to focus on the preservation of affected community historical records, but it is important to preserve both these and disaster materials as well.
These two types of historical records are viewed as local historic properties by community members. Let us consider the example of the Honma family storehouse in Ishinomaki City in Miyagi Prefecture, an area affected by the Great East Japan Earthquake.

This storehouse, which survived both the massive earthquake and tsunami, was built in 1897 (see page 94). Tens of thousands of old documents have been housed there since the Edo period. Thanks to the efforts of the owner (Honma-san), the fundraising activities of the Ishinomaki Wakamiya-Maru Castaway Society and the Ishinomaki Sengokubune Association, and support from the Miyagi Shiryō Network, this storehouse was saved from demolition and is slated instead for renovation. Appeals for funds to save the structure suggested that "the strength of this storehouse, which was left standing in the middle of a sea of debris, might serve as a cornerstone for the reconstruction of disaster-stricken Ishinomaki" and referenced "the importance of maintaining the light of hope in our hearts." The local people feel that the storehouse, which conveys to future generations the histories of individuals who lived in Ishinomaki as well as memories of great disasters, is a local historic property that will sustain the people who remain in the disaster-affected area.

This concept of local historic properties became popular after the Great Hanshin-Awaji Earthquake. In 2004, the Cabinet formed the Committee for Protecting Cultural Heritage Properties and Communities from Disasters. In its report, the committee suggested that the local historical properties are the core of a community; that community members must recognize the need to pass them on to future generations and that without vital communities that are capable of leaving their own historic properties for others, society as a whole will be unable to adapt to disasters. This report was groundbreaking in that it expanded the range of historic properties to include not only items designated by the government as significant cultural properties, but also historic properties with specific relevance to local communities. An appeal by the commissioner of the Agency of Cultural Affairs regarding the preservation of local cultural properties after the Great East Japan Earthquake highlighted the importance of activities aimed at rescuing even non-designated cultural artifacts.

Thus, approaches to local historic properties always assume that local residents will play a role in preservation activities. This kind of thinking first emerged in the context of efforts primarily undertaken by experts in history and culture who were preserving community historical records after the Great Hanshin-Awaji Earthquake, and became more firmly established in the context of later efforts. The effort to preserve historical records of the "Shiryo Networks" formed after the Great Hanshin-Awaji Earthquake proceeded smoothly thanks to the data provided by local governments and the cooperation of local residents and local historians with a strong interest in community history and culture (Figure 6.4).

"Shiryo Networks" are organizations that preserve historical records after disasters, and since the Great Hanshin-Awaji Earthquake, they have been formed by experts in history and culture, including university professors, graduate students, curators, local government archivists, and cultural property restorers, working in concert with local residents who have an interest in the history and culture of their communities. These organizations have spread throughout Japan. As shown in Figure 6.5, these groups are not formed only after disasters strike, but also before for the purpose of taking preventive measures. Today, there are about 20 organizations operating at the prefectural level throughout Japan. These organizations have also been playing a major role in the preservation of community historical records since the Great East Japan
Earthquake. After the recent disaster, the organizations in each prefecture, centered around Shiryo Net in Kobe, began working together to provide support (Figure 6.5).

**Figure 6.4 Preserving materials from destroyed homes, conducting surveys with community researchers**

**Figure 6.5 Active Organizations for the Preservation of Historical Records (Shiryo Networks)**

**Section 2: Why Are Such Efforts Necessary When Disasters Occur in Japan?**

There are five reasons for undertaking these kinds of efforts when large-scale disasters strike. First, Japanese society is unique insofar as premodern historical records are still held by local communities. A model of Japanese local communities would consist of a multilayered structure comprised of six levels: (1) prefectures, (2) municipalities, (3) Showa period local governments, (4) Meiji period local governments, (5) Edo period towns and villages, and (6) villages (Figure 6.6).

In modern Japan, local government mergers have been conducted three times, in the Meiji, Showa, and Heisei periods. When these mergers took place, the communities that had been in place since the Edo period were not dismantled. Rather, the existing frameworks were used as the bases of contemporary local government administration. Community historical records are not collected by local governments, but by individual multilayered communities, where they are kept in a variety of formats. The total volume of records available is unclear, but there are at least 10 billion records from the premodern period alone. Many of these are still kept in people's homes, even today. In times of disaster, these are the basic conditions under which community historical records are preserved. If we think about history at the community level since the start of the modern period, we realize that this situation with regard to historical records is hardly unique to Japan; it is a common situation all over the world. In this regard, Japan's efforts to preserve community historical records have some universal applicability.

**Figure 6.6 Japan's multilayered local communities**

*There are at least 10 billion historical records from the premodern period (until 1867).*
Second, the survival of these kinds of community historical records is threatened in the context of ongoing industrialization, the migration of populations to cities, and Japanese population decline. About 150 years ago, at the end of the Edo period (1603-1867) and before industrialization, the Japanese population in rural areas was about 30 million. Up until the 1980s, the population in those areas was about the same, still at around 30 million. Today, as the society continues to age, this kind of rural population cannot be maintained. Japanese rural communities have been struggling to survive since the Edo period, and as villages become increasingly deserted, historical records are disappearing.

Third, the high economic growth that took place after the 1960s resulted in major changes in Japanese lifestyles and culture. For example, cooking was no longer done with wood, and cows were no longer used for farming and transportation. Memories of the past which had been so carefully preserved lost their meaning in everyday life and were no longer passed down to younger generations. This is one major reason for the loss of community historical records. However, the threats facing local communities today are widely shared throughout Japan. To sustain local communities, the value of the history and culture of those communities needs to be reexamined. This is one of the basic premises for promoting the preservation of community historical records.

Fourth, many large earthquakes and floods have occurred in Japan since the Great Hanshin-Awaji Earthquake, and the preservation of community historical records has been highlighted as an urgent issue within that context. In the 47 years from the time of the 1948 Fukui Earthquake, and the devastating effects it wrought on the city of Fukui, until the 1995 Great Hanshin-Awaji Earthquake, no large-scale earthquakes occurred in a Japanese urban center. By contrast, large earthquakes have occurred in various locations about every two years since 1995, with the massive Great East Japan Earthquake having struck in 2011. This means that when major transformations in Japanese society are achieved as a result of high economic growth, the culture has not been formed in a way that allows for earthquakes and other disasters. Also, over the past 10 or so years, large floods have occurred more frequently as a result of the impact of global warming. There are several cases in which storehouses dating from the Edo period are now experiencing flooding for the first time. Thus, up until now there has not been a great deal of research on the preservation of community historical records after disasters in Japan. The Great Hanshin-Awaji Earthquake provided the initial impetus for such efforts.

Fifth, given the mergers of local governments (Heisei mergers) that have taken place since 1999, new systems to preserve historical records suitable for large-scale local governments are needed. However, since such systems have not yet been developed, community historical records are being lost.

Lessons

Section 3: Lessons from Japan: The Significance of Preserving Community Historical Records after Disasters

Finally, I would like to discuss the significance of preserving community historical records after a disaster strikes. First, preservation is significant in terms of disaster preparedness. The preservation and study of community historical records provide basic materials for the scientific study of earthquakes in Japan, where earthquake disasters have occurred many times over the course of history. They provide basic materials for studying the history of disasters so that improvements can be made in disaster preparedness.

Second, preservation is significant in terms of disaster mitigation. Local residents who pass down disaster memories from the past to the future in local communities facilitate the formation of a local culture that is highly resilient to disasters (a disaster culture). For example, passing down lessons about tsunami hazards (and the need to evacuate quickly) as a matter of community history is important for mitigating disasters. The historical transmission of disaster memories is part of a community’s culture. Lessons such as building structures in disaster-prone locations and reminders about the importance of maintaining supplies of water at evacuation sites are extremely important for disaster mitigation.

Third, preservation is significant in terms of reconstruction. Local historic properties serve as monuments that encourage disaster victims during the process of reconstruction, and provide basic materials that residents can use as they think about what kinds of communities they want to create. Without the accumulation of history and culture to promote a deeper understanding of the local community as it has evolved from the past into the present using local historic properties, it will be impossible to reconstruct
disaster-resistant local communities or to create a strong disaster culture. When a disaster strikes, it is also important to develop a diverse, multilayered community culture that can be sustained into the future, and to thereby promote the mature development of civic society.

**Recommendations for Developing Countries**

Through our ongoing efforts at preserving preservation of community historical records from the time of the Great Hanshin-Awaji Earthquake to the Great East Japan Earthquake, we have learned from the affected communities the importance of history and culture in conveying the histories of diverse, disaster-resilient communities to future generations. The following three suggestions can therefore be made to developing countries.

1. Developing countries are undergoing major social changes as a result of industrialization, and changes in everyday culture are progressing rapidly. Given this, it is becoming increasingly important to create disaster-resistant cultures, and to undertake activities to preserve local historical properties, as these will form the basis for the reconstruction of communities in the aftermath of a major disaster, as well as the basis for history and culture at the community level.

2. It is important to have regular systems in place for maintaining various community historical records and intangible properties, such as oral traditions, which form the foundations of a community's history and culture. These systems will simultaneously form the basis for efforts aimed at preserving local historic properties in the event of a large-scale natural disaster. In communities that have already experienced such a disaster, these systems will also form the framework for conveying those experiences to future generations within the context of local history.

3. Human resource development is important for the formation of these systems. Systematic efforts should be made to promote the development of community-level leaders who, in addition to having a sound understanding of the community's historical culture, also have the ability to conduct basic activities aimed at the preservation of historical records.

**Key References Cited**

Okumura, Hiroshi, Major Earthquakes and the Preservation of Historical Records: From the Great Hanshin-Awaji Earthquake to the Great East Japan Earthquake, Yoshikawa Kobunkan, February 2012.

Kobe and Heike in History, December 1999, Shiryo Net, ed. Okumura, Hiroshi and nine other authors, Kobe Shimbun Press Center, pp. 218-42.


**Author: Hiroshi OKUMURA**
Graduate School of Humanities, Kobe University
6.2. The Preservation and Collection of Disaster Materials

Starting immediately after the Great Hanshin-Awaji Earthquake, volunteers, libraries, and local governments all began collecting and preserving materials about this (earthquake) disaster. Hyogo Prefecture included these activities in its reconstruction plan and engaged in a comprehensive collection effort starting with primary sources. A large-scale materials survey project was conducted by the prefecture, and today those materials are stored at the Disaster Reduction and Human Renovation Institution.

Overview

Introduction

The Great Hanshin-Awaji Earthquake was an devastating disaster for Japan in terms of both the damage it caused and the problems it raised related to the preservation of materials. Emergency preservation activities aimed at saving disaster-related and historical records from the disaster period began right away, and the collection and preservation of the disaster records and materials was conducted by a wide range of people, including volunteers, libraries, and local governments.

In large-scale disasters, materials on the disaster itself (disaster materials, earthquake materials) are fundamental resources when it comes to accurately understanding the disaster and communicating what is known to other regions and future generations; they are absolutely essential for preparing for the next disaster.

In the Great Hanshin-Awaji Earthquake, the information referred to as "earthquake materials" was not limited only to materials and records related to conventional disaster data on earthquakes and tsunamis, such as the disaster scope and damage caused, but also included information on the progress made by victims toward livelihood restoration and reconstruction and the support activities conducted by volunteers. Local people did not have any experience in this kind of large-scale effort to preserve materials even as the event itself was unfolding, and the disclosure and use of the information gathered had to be coordinated due to issues related to the protection of personal privacy. This paper presents an overview of the efforts made to collect and preserve disaster materials in Hyogo Prefecture, which began at the time of the Great Hanshin-Awaji Earthquake, and makes proposals for handling future disasters.

Earthquake Materials Preservation Activities by Hyogo Prefecture

In the Great Hanshin-Awaji Earthquake Reconstruction Plan (Hyogo Phoenix Plan, formulated July 1995), the "collection and organization of disaster and reconstruction materials and records" was established as a policy for achieving the basic goal of "developing cities that are disaster resilient and that make residents feel safe and secure." In October 1995, this project was named the Earthquake Reconstruction Materials and Records (hereafter, "Earthquake Materials") Collection Project, and was entrusted to the 21st Century Hyogo Creation Association (hereafter, the "21-CHCA"). The 21-CHCA printed fliers and spread the word widely asking prefectural residents to submit their materials.

According to the fliers, the materials being collected were "not only books and pamphlets, but also the large quantity of ordinary materials and records that people had access to, including personal memos and records of personal experiences, leaflets and fliers distributed in neighborhoods, wall posters and notes distributed at evacuation shelters, and the notes and memos recorded at town meetings." The content was categorized into materials reflecting (1) actual conditions in the current earthquake, (2) earthquake damage, (3) earthquake response, (4) the everyday lives of earthquake victims, and (5) the process of developing reconstruction plans and projects. Examples of the materials to be collected included (1) printed information, (2) images, and (3) voice recordings. Specific examples of each type of material were provided as follows. Printed information might include (1) all relevant books and materials (photos, newspapers, newsletters, maps, etc.), (2) private leaflets, fliers, wall posters, internal company memos, mini-newsletters, volunteer information and diaries, records of personal experiences, written descriptions of impressions, and memos, (3) expert research records (research reports, survey reports, policy proposals, (4) lecture notes, seminar and symposium materials, and (5) statistical data (produced by various local governments). Images might include (1) TV images, media photos, videos, 8 mm film, and other photos, and (2) electronic materials on CD-ROM or other media, and microfilm. Voice recordings might include audio tapes, for example.
The format of the materials listed here could be in any media format in use at the time. By including information on the "(4) the everyday lives of earthquake victims," the scope of materials collected was expanded not only to include those related to the earthquake, but also those related to the reconstruction of the lives of people living in the affected areas. In Hyogo Prefecture, all of the information generated related to the earthquake was considered to be "earthquake-related records and materials," and the collection of items began with what would be called primary materials, including materials before they had been analyzed and processed into reports. Experts in materials collection were hired to do the actual collecting, and items were collected even as surveys were conducted in the affected areas regarding what kinds of items should be preserved.

**Large-Scale Materials Survey Project in Hyogo Prefecture**

In April 1998, the Earthquake Materials Collection Project that had been conducted by Hyogo Prefecture was taken over by the Great Hanshin-Awaji Earthquake Memorial Association (hereafter, the "Memorial Association"), which was established by 10 cities and 10 towns (at the time) that had been affected by the earthquake. From June 2000 to March 2002, a large materials survey project was undertaken using an emergency local employment grant from the Ministry of Health, Labour and Welfare. The approximately two-year survey period was divided into four quarters, and about 100 people were mobilized during each quarter, for a total of 440 people.

This had to be conducted as a "survey project" rather than a materials collection project because the materials were still currently in use by the Memorial Association, making it difficult to collect materials without running up against privacy concerns. Thus, by focusing on ascertaining information on the location of materials and on referring to easily accessible materials as "earthquake materials," researchers made the owners of the materials aware of their importance and opened the doors toward materials preservation.

In this survey project, numbers were assigned to the survey locations, and materials were organized by survey location in accordance with the "source principle." During the survey, surveyors not only collected information on the materials themselves, but also collected metadata, or information on the survey site and origins of the materials.

The survey targets were divided up into the following categories: (1) individuals (excluding those in evacuation shelters, temporary housing, and reconstruction public housing), (2) reconstruction public housing, (3) volunteer and other support groups, religious groups, (4) community development associations, community organizations, (5) workplaces (companies), (6) labor unions, private organizations, (7) education and research institutions (including nursery schools), (8) mass media, (9) governmental and semi-governmental agencies, (10) evacuation shelters (including resident associations), and (11) temporary housing (including temporary resident associations).

In this survey project, an inventory was created at the same time the survey collection was performed. To facilitate the organization of materials by numerous inexperienced surveyors, the decision was made to, if possible, create a single survey form for the smallest unit of items being surveyed. As a result, a large volume of about 160,000 survey forms were created for items that included 149,427 paper materials. These
materials were moved to the resource room of the Disaster Reduction and Human Renovation Institution when it opened.

**Public Disclosure of Disaster Materials**

Disaster materials were primarily collected on the premise of the notion that they would be made available for public use. Those who provided the materials, however, had significant concerns regarding what standards would be used to protect materials containing personal information. To help the owners feel more comfortable with sharing their materials, standards had to be drawn up that explicitly stated the privacy protection and consideration protocols to be followed, and efforts had to be made to increase people’s sense of trust in those who were collecting the materials. The Memorial Association formulated Guidelines for the Handling of Materials by the Great Hanshin-Awaji Earthquake Memorial Association at the start of this large-scale survey.

Those guidelines noted that the items were ultimately being collected on the basis of the principle of “public disclosure.” The association observed the information disclosure ordinances of local governments like Hyogo Prefecture and Kobe City, which limit the information that can be disclosed, and asked for the right to request disclosure of their own information from the owners of the material. To conduct the survey in accordance with the purpose for which it was intended, an expert committee was established to deal with concerns about opening doors to specific uses and complaints about the handling of materials or restrictions related to their use.

The Great Hanshin-Awaji Earthquake Disaster Reduction and Human Renovation Institution (DRHRI) opened in August 2002, and materials that had been collected since October 1995 were moved to that facility’s resource room. The DRHRI drafted disclosure standards addressing public disclosure issues and formulated standards for the use of materials held in the resource room. These standards were distinctive insofar as they were based on the “principle of disclosure,” establishing a “right for users to know” the information contained in the resources. To achieve this “principle of disclosure,” the facility did not adhere to uniform disclosure standards, as is the conventional approach, but instead established different rules of disclosure for online use versus disclosure on site at the DRHRI. To ensure an adequate response in the face of complaints or errors in judgment, an expert committee was formed to address problems in which the involvement of the DRHRI director was deemed necessary.

**Government Documents Related to the Earthquake**

Under the Earthquake Materials Collection Project conducted by the Memorial Committee, it was not possible to directly collect or preserve government documents related to the earthquake, as the management of government documents is the responsibility of the national or local government that created them. However, inspired by the need for government documents related to the earthquake, a path toward preservation was opened up for Hyogo Prefecture and Kobe City.

To compile records on the Great Hanshin-Awaji Earthquake created by the cities of Amagasaki and Nishinomiya, a request was made to those city governments in April 1995 asking them to preserve their government documents. In Itami City as well, a survey of earthquake-related documents was conducted in October 1998, and this effort was continued by the General Affairs Section.

In this way, some local governments in the affected area were given special consideration in the preservation of earthquake-related government documents, but these considerations did not extend to every local government. Also, the preservation of documents did not extend to the level of the national government.

**Lessons**

- Disaster-related materials are essential resources for the examination of conditions in a disaster-stricken area and their progress toward restoration and reconstruction, across the boundaries of place and time.
- The preservation of disaster-related materials involves the collection and preservation of government-related documents as well as private documents prepared by citizens.
- It is important for basic laws on disaster reconstruction or basic disaster reconstruction plans to incorporate stipulations regarding the preservation and collection of disaster-related materials.
The collection, preservation, study, and use of disaster-related materials are long-term activities, and consideration must be given to such factors as the systems, budgets, and personnel that will be needed to facilitate these activities.

The use of disaster-related materials requires partnerships with institutions that can analyze those materials and institutions that preserve the materials of the national and local governments.

**Recommendations**

Based on the lessons learned from the Great Hanshin-Awaji Earthquake, the first principle of the Seven Principles of Reconstruction issued by the Great East Japan Earthquake Reconstruction Design Council was "to leave disaster records in perpetuity" for future generations, and activities to do just that have already begun.

Today, a great deal of discussion is focused on the creation of digital archives, but it is most important to collect and preserve the wide range of genuine primary materials that show how the actual process of restoration and reconstruction has unfolded in the affected regions. When collecting materials, it is important to give adequate consideration to the fact that those materials are still in current use, and to simultaneously record metadata and background information on them.

It is important to look beyond conventional document management systems when it comes to the preservation of earthquake-related government documents. Adequate consideration must be given not only to the examination of project results, but also to the examination of various decision-making processes.

The collection and preservation of materials are long-term processes, and appropriate systems should be created for the training of personnel so that the content of those materials can be put to good use.

**References**


**Author:** Kazuko SASAKI
Office of Promoting Regional Partnership, Kobe University

**6.3. Historical Record Rescue Activities of the Miyagi Shiryo Network**

"Pre-Disaster Activities and Response to the Great East Japan Earthquake"

The Miyagi Shiryo Network first began conducting activities in response to an earthquake that struck Miyazaki Prefecture in 2003. With large earthquakes occurring about every 40 years in Miyagi, efforts are being made to locate and archive historical records before the next disaster strikes. Those activities, and the networks created by community members and government officials in the course of conducting them, have proven very significant in responding to the Great East Japan Earthquake. In developing countries as well, it is important to promote pre-disaster preservation efforts based on the specific circumstances of individual communities.

**Introduction**

This paper discusses the effects of and challenges involved in activities to rescue and preserve the many cultural properties and historical records that were left remaining in the communities devastated by the Great East Japan Earthquake from the perspective of the Miyagi Network for Preserving Historical Materials (Miyagi Shiryo Net), in which I am directly involved. In terms of the overall rescue activities of cultural heritage properties following the Great East Japan Earthquake, many different activities have been
developed by various institutions and organizations, including the Cultural Property Rescue Program conducted by the Committee for the Rescue of Cultural Properties Affected by the Tohoku Earthquake organized by the Agency of Cultural Affairs. See the report issued by that committee for information about its overall activities (Rescue Committee, 2012).

History of Activities: Historical Records and Disasters: Activities in the Miyagi Region

Large Volumes of Historical Records Kept by Japanese Local Communities: Background and Current Status

Innumerable historical records are held in Japanese local communities, including old documents, antique works of art, implements (folk craft articles) used in the agriculture, fishing, and forestry industries, as well as those used in securing food, clothing, and shelter. These are symbols of the lives people lead in the unique historical environments of various regions. Their disappearance is the disappearance of the history of those communities.

The quality and quantity of old documents created during Japan’s Edo period, from the 16th to the 19th century, is far and away greater than those of records from the same period kept in other countries. As many as 600,000 old documents in Miyagi Prefecture were photographed by the Miyagi Shiryo Net from 2003 to 2012, but there are still large volumes of old documents that remain to be surveyed and discovered in Miyagi Prefecture alone. Photos have only been taken of about 10% of the total volume.

The large volume of printed materials is an outcome of Japan’s particular history. In the Edo period, the ruling daimyo (military lords) formed towns around their homes (castles) where their vassals lived. The towns were home not only to samurai warriors, but also to the professionals and merchants who supported the lives of the samurai. The daimyo ruled domains located far from their own homes through towns and villages in those domains. Documents prepared using ink on Japanese paper (washi) were created in large volumes to serve as a means of communication between the rulers and the people in their communities, covering such issues as taxation and levies on work.

On the other hand, for the people who were ruled, documents were more than just a means of control; they were used as a means of improving their own lives. Documents prepared using washi and ink were created in large quantities, and were used for economic activities, production technology records, literary works, drawings, and ukiyoe woodblock prints, as well as for writing down ideas, facilitating self-expression. In addition, people systematically preserved these records and recognized that they should be handed down, so future generations, so organizational frameworks were created for this purpose. In families with long histories in a community, many storehouses built for the preservation of documents, known as “bunkogura,” have been passed down.

Today, the vast majority of these historical records are passed down by the descendants of those old families, who can trace their roots back to the Edo period, or by organizations, such as town council-type organizations, approximately the size of a Meiji period village, which were established through the mergers of Edo period villages under national policies enacted at the end of the 19th century. The management and succession of these documents is largely handled at the discretion of their owners. Of course, there are public collections (archives) in Japan, held by museums and other facilities, and owners can also entrust their materials to such organizations. However, there are relatively few public facilities as compared with the number of historical records kept in local communities. Thus, historical records in Japanese local communities are at risk of disappearing if there is a change in the attitudes of their owners or in the circumstances relating to their storage. Specifically, there may be a change of ownership, an owner may move to a city as a result of rural out-migration, or, in combination with these problems, the community organizations in which the owner was once involved may fall into decline or disappear altogether.

These kinds of problems occur unnoticed during ordinary times, but are further accelerated in the aftermath of a major disaster. Disasters cause widespread problems in terms of the ability to successfully hand down records, as the historical materials themselves may have been damaged by the disaster or their storage locations may be demolished in the recovery and reconstruction process. As a result, large volumes of local historical records end up being lost.
**Efforts to Protect Community Historical Records from Damage in Miyagi Prefecture**

Activities to rescue damaged historical records conducted after the 1995 Great Hanshin-Awaji Earthquake were the impetus for deliberate efforts to address the problem of the mass disappearance of historical records following disasters in Japan (Okumura, 2011).

In the Miyagi area, the specific trigger of the organizational response to the risk of disaster-related losses of historical records was the rescue of damaged historical records following a series of earthquakes that occurred in northern Miyagi Prefecture on July 26, 2003 (Hirakawa, 2005). Approximately, 200,000 historical records were rescued from the five towns affected by that disaster. These included 100,000 records from the family of Yonosuke Saito, the second-largest landowner in prewar Japan, which were donated to Tohoku University.

That said, however, basic information about the community’s historical records had not been compiled at that time. As a result, rescue efforts were not taken in time to save many other historical records, which were lost. In 2003, predictions indicated that an offshore Miyagi Prefecture earthquake, a type that occurs in approximately 40-year cycles, would occur within 30 years. Thus, a decision was made to prepare in advance for a future disaster and to continue efforts to preserve local historical records (Hirakawa, 2005).

In Miyagi, the Miyagi Shiryo Net was launched to facilitate the coordinated activities of interested parties. Since 2004, this organization has been working in partnership with governments, owners, and other local residents involved in community history clubs to promote the preservation of historical records kept in the community. In 2007, the organization attained non-profit status in Japan. When the Iwate-Miyagi Nairiku Earthquake struck on June 14, 2008, the network began collecting information that very same day and was able to start rescuing damaged historical records from the affected areas two weeks later.

**Methods in Miyagi: Locate and Photo Archive All Records**

Preservation activities are conducted using two main methods (Miyagi Shiryo Net, 2008). The first method is to conduct research aimed at determining how many historical records have been saved in a given community, either at the level of the municipal government or at the level of the administrative districts within municipalities. After creating a primary list from the various related sources and getting an overview of the situation, researchers cooperate with government agencies and residents in the target areas to confirm the local situation and get more detailed information on the whereabouts of various records. People are mobilized and surveys are conducted all at once in the short period of a single day. Since the cultural properties preservation offices of local governments often lack personnel and financial resources, it is difficult for them to adequately manage non-designated cultural properties. Given this, a survey method that can be undertaken in a short period helps reduce the burden on local authorities. As of 2003, before the Tohoku disaster, provisional lists had been created in 61 of the 73 local governments in Miyagi Prefecture. Also, location confirmation surveys had been conducted among 415 families and organizations in the prefecture.

The other method is to take pictures of all of the old documents saved by particular families and organizations. When large sets of documents are found, it is highly likely that they will include information not only about the owner’s ancestors, but also about the history of the community as a whole. This type of activity is distinctive in that it is not collecting materials based on a particular research topic, but aims fundamentally to archive all historical records that have been saved. The purpose is to create records that will allow people in the future to study all of the historical records. In Miyagi, 52 individual surveys had been conducted, and about 350,000 digital images had been collected.

**Historical Record Rescue After the Great East Japan Earthquake**

The Kawauchi-Kita Arts and Letters/Law Joint Building at Tohoku University in Sendai City, which houses the secretariat of Miyagi Shiryo Net, was also damaged by the earthquake on March 11, 2011. The functions of the secretariat were restored on March 15 using another facility on campus, and it is still active today. The following presents an overview of the network's activities since the earthquake.
Gathering Damage Information

In the month after the disaster, rescue activities could not be conducted in the affected areas because of damage to the transportation network and a shortage of gasoline. Activities during that time thus primarily consisted of information gathering. Owners, other interested local residents, and government officials with whom researchers had become acquainted during their pre-disaster preservation activities served as sources of information. The networks built up over the eight years prior to the disaster functioned effectively for this purpose. Miyagi Shiryo Net put out calls for the preservation of damaged historical records through various media outlets, including TV news ticker subtitles and in the lifestyle pages of newspapers. As a result, by the end of March, we had collected information on more than 500 damaged historical records.

What was particularly remarkable in this disaster was the tsunami damage sustained along the coast; our activities there definitely became the core of our efforts. Based on aerial photos published online in mid-March, we created our own tsunami inundation map1, and combined it with the above-mentioned location information to create an order of priority for on-the-ground activities.

Temporary Shipments Out of Affected Areas

On April 3, 2011, Miyagi Shiryo Net conducted its first survey of the damage situation in the tsunami-affected area of Ishinomaki City, Miyagi Prefecture. On April 8, at the home of Eiichi Homma in Kadonowaki-cho, Ishinomaki City, the first rescue of historical records from a tsunami-affected area was conducted (Figure 6.9). As of February 15, 2013, 90 sets of historical records had been temporarily shipped out of the area. Of these, 67 were shipped to Sendai City and are still undergoing emergency processing (Figure 6.10).

Of the 67 sets undergoing emergency processing, as many as 50, or about 80%, were from owners living in tsunami-affected areas. Even now, in 2013, nearly two years after the disaster, shipments from the tsunami-affected areas are still underway, though now on a smaller scale.

There was a lot of damage to inland buildings in Miyagi Prefecture, particularly in the northern areas, though this tends to be overshadowed by the tsunami damage. In Japan, when buildings damaged by an earthquake are demolished, there are systems in place for paying for all of the associated costs using public funds, by specific deadlines. In each region, the technologies for maintaining and repairing traditional Japanese structures have already been lost, and demolition is performed in one fell swoop when buildings are damaged. Shipments from these buildings are also ongoing.

Figure 6.9 Rescue activities at the home of Eiichi Homma in Ishinomaki City, Miyagi Prefecture (February 8, 2011 / Photo: Shuichi Saito)
Most of the historical records shipped out consist of documents and other papers, including 33 sets of old documents from the Edo period and 25 sets of modern documents created since the Meiji period. The total number of documents alone is about 50,500.

In most cases, old documents, works of art, and folk craft articles were all kept together in storage facilities, such as the storehouses of local owners. It was impossible to sort or determine the value of cultural properties on site, so we rescued a wide range of materials at the request of the owners. We also rescued reproductions of cultural properties, such as copies and photos of old documents collected by local old document reading clubs, as well as rubbings of medieval stone cultural properties. Some of these items reflected originals that were lost in the disaster, and were the one and only record of those items’ existence.

**Emergency Processing of Damaged Documents**

As is well known, the most remarkable aspect of this disaster was the tsunami damage. Materials were damaged due to contact with seawater, sand, sludge, and other substances brought in with the waves. To address this problem, universities and research institutions with expertise in preservation and repair shared emergency processing techniques that could even be performed by ordinary volunteers. Emergency processing work is still underway in Sendai City.

In April 2011, the Nara National Research Institute for Cultural Properties, which excavates ruins related to the ancient capital of Nara from Japan’s Nara period (8th to 10th century), demonstrated how drying techniques could be used for all documents.
damaged by the tsunami.2 Miyagi Shiryo Net shipped old documents from the Kimura family in Onagawa-cho, Miyagi Prefecture and other items that were damaged in large quantities to Nara Prefecture, where they underwent emergency processing by various organizations.

The shipment of historical records from the affected regions and the emergency processing conducted in Sendai City were done with the help of volunteers all over Japan. More than 800 volunteers lent their support to these efforts. The series of tasks involved in cleaning off stuck-on sand and sludge, rinsing items to remove salt, and then drying them out are not tasks that involve a great deal of strength. These are volunteer activities that can be performed by women and senior citizens.

One volunteer said that while they wanted to participate in activities to support the affected regions, the removal of debris or mud would be too physically strenuous for them to undertake. The rescue of cultural properties may become an important category of support activities that can be conducted for affected regions after disasters in Japan, as has clearly been shown to be the case through the experience of the Great East Japan Earthquake.

Taking Photos of Historical Records after Emergency Processing

Miyagi Shiryo Net is taking photos of damaged historical records that have already gone through emergency processing in the order indicated in the photography manual3 it created in 2009. As of February 15, 2013, about 150,000 digital images had been taken of 22 collections. The data is offered to the record owners and is shared with relevant organizations, with the permission of the owners.

Only 10 of 64 collections of materials have been completely processed and returned to their owners. With 10 sets having been completed in the two years since the quake, a simple calculation suggests that it will take another 12 years to finish processing the items that are currently in storage alone.

KIMURA FAMILY DOCUMENTS WASH ASHORE - ONAGAWA-CHO, MIYAGI PREFECTURE

The Kimura family of Onagawa-cho, Miyagi Prefecture is an old family whose members once served as okimoiri, the hereditary village headmen who were in charge of the administration of villages in the Sendai domain during the Edo period, the area of present-day Onagawa-cho. Old documents designated as cultural properties of Onagawa-cho were stored in three separate tea chests in this family's storehouse.

The Yokoura neighborhood of Onagawa-cho, where the Kimura family home was located, was destroyed by the tsunami on March 11, and the family tea chests were washed away. However, about one month after the disaster, on April 27, one of those chests was discovered in the Tsukahama neighborhood of Onagawa-cho, on the opposite shore of the inlet. Some disaster victims who had been cleaning up around their own tsunami-damaged home found the tea chest and delivered it to the Onagawa-cho town office. The town office had been relocated to higher ground due to the tsunami damage, but the town cultural properties officials, though busy with the process of dealing with evacuees, took care of the emergency processing of the chest. Miyagi Shiryo Net retrieved the historical materials from Onagawa-cho at the request of the town office on May 12. Though two months had passed since the tsunami, the historical materials were still nearly completely drenched (Figure 6.11). On May 13, they were sent to the Nara National Research Institute for Cultural Properties. In August, after the documents had successfully undergone a drying process, they underwent additional emergency processing by volunteers to remove the salt content. Today, repairs are still being performed by experts.

The Kimura family documents were able to be rescued primarily because of, first, the actions of the victims who discovered them, and second, the fact that the town officials, whose own workplace and homes had been damaged, had the right attitude toward preservation. Even in the challenging conditions immediately
after the earthquake, the local people took action to protect their own valuable documents. One owner wrote an opinion article in a local newspaper dated December 3, 2011, saying "Having lost my parents in the tsunami, as well as my home and all of my possessions, I was able to see some hope in the survival of these old documents."  

STOREHOUSE BECOMES SYMBOL OF RECONSTRUCTION: EIICHI HOMMA FAMILY, ISHINOMAKI CITY, MIYAGI PREFECTURE

The home of Eiichi Homma, a downtown landmark in Ishinomaki City, Miyagi Prefecture, was located at the base of Mt. Hiyori. The main building and other major structures were destroyed by the tsunami. In the midst of this devastation, a two-story storehouse built in 1897, which held old documents and other historical records, avoided destruction even though the surrounding homes were completely washed away. The floodwater stopped at the first floor, such that the old documents stored on the second floor and documents related to the community’s history that had been collected by a local community history club and stored by the Homma family, were spared from the floodwaters. About 50 cardboard boxes of materials were temporarily shipped to the Tohoku History Museum on April 8, 2011 (Figure 6.10).

The storehouse itself, on the other hand, was initially going to be demolished because of the tsunami damage it sustained. However, seeing some historical value in a storehouse that survived the tsunami, Homma decided to explore the possibility of preserving it. A survey conducted on April 12 by a team led by Fukushima’s leading architect Toshiro Sato revealed that there was no major structural damage to the building, and that it could be maintained with a minimal amount of repairs. Based on this assessment, Homma proceeded with the emergency processing and decided to preserve rather than demolish the structure.

The funds needed for the repairs were raised primarily through the fundraising activities of the Ishinomaki Wakamiya-Maru Castaway Society, the local history club of which Homma is a member, and the Ishinomaki Sengokubune Association. An information meeting was held at the site on September 24, 2011 to promote a better understanding of the significance of preserving storehouses (Figure 6.13). Donations of more than ¥3 million were received, and the repair work started on March 1, 2012.5 The building is serving as a sign of hope for the reconstruction process; it has even inspired the creation of a logo for the local town association. Investigations are underway regarding the use of the structure as a facility that will convey the local history and memories of the disaster.

The Homma family, for example, had been conducting regular repairs, such as repairs to its storehouse following the Iwate-Miyagi Nairiku Earthquake of June 2008. The family had disclosed the ancient documents it owned and had planned to promote their use as historical properties of the community (Saito, Ishinomaki Sengokubune Association, 2006).

The driving force behind the efforts to help save the Homma family’s historical records and storehouse was the owner’s appreciation of their ancestors’ old records, and the passion of local community history groups and residents who worked with them to continue uncovering pieces of local history.
Results and Challenges: Preparing for the Next Disaster

The Significance of Creating Pre-Disaster Digital Archives

It is unclear just how many community historical records were lost in the recent earthquake. Some old documents that had been kept in Ogatsu-cho and Kitakami-machi in Ishinomaki City give an idea of what might have been lost in Miyagi Prefecture. At the home of the Naganuma family in Ogatsu-cho, Ishinomaki City, which we visited on April 4, 2011, about 12,000 old documents along with the storehouse in which they were stored, had disappeared without a trace, having been completely washed away by the tsunami. Of the 18 sets of old documents that had been stored in this community, 10 sets of originals were destroyed by the tsunami.

However, these old documents had all been recorded as digital images between 2001 and 2005 as part of a project implemented by the Kitakami-machi town historian and through surveys conducted by Miyagi Shiryo Net. Data stored at the Kitakami District Office in Ishinomaki City also disappeared when the office building was destroyed by the tsunami, but we still have copies of those documents, which had been stored with the various people involved, including myself. About 30,000 old documents destroyed by the tsunami were saved as images in more than 70,000 electronic files in Karoji. This is the most tragic evidence of the need for the pre-disaster preservation activities (Hirakawa, 2005) that were undertaken in the Miyagi region before the disaster.

Those who participated in archiving the history of Kitakami-machi included researchers, government officials from the local government office, and community residents. I want to emphasize that citizen participation in this process ultimately helped ensure that the contents of old documents were saved from the disaster. Based on the experience in Miyagi, steps must urgently be taken in other regions to quickly archive historical records using organizations and methods that can accommodate the participation of ordinary citizens.

We are asking institutions with expertise in information technologies to help us with the long-term preservation of digital versions of old documents that have thus far been collected, including copies of original records that were lost in the disaster. Steps must be taken to investigate the creation of a framework that combines on-site data collection with long-term preservation by public institutions and systems. Not only is this issue relevant to cultural property data, but raises the important question of how to go about saving all human records and memories, since we have (had no choice but to) come to rely on digital data for all of the records we keep.

The Importance of Networks in Supporting Historical Record Owners

The networks that Miyagi Shiryo Net had developed before the disaster proved to be extremely important when it came to the rescue of damaged historical records on which it directly performed emergency processing. Of the 67 sets of documents that Miyagi Shiryo Net handled, 37 were rescued based on communications from record owners, local community historians, and local government officials that had been involved in preservation activities before the earthquake.

In Miyagi Prefecture, government organizations that had been continuously preserving historical records since before the earthquake, such as the Sendai City Museum (Kurihara, 2011), the office of the city historian in Iwanuma City (Takahashi, 2012), the Murata History Museum, and the Shiroishi Museum Construction Preparation Office, voluntarily stepped in to take prompt action. More than anything, this highlighted the importance of building close relationships with record owners and community members during ordinary times so that effective steps can be taken when there is a need for emergency response. In other words, if there are no permanent systems in place for the coherent preservation of a community’s historical records, damaged historical records held in private collections are at high risk of not being rescued, and ultimately of disappearing. In preparation for the next disaster, the owners of records, local residents, government officials, and experts in each region must work together to create the organizational structures needed for preservation activities.

In Ishinomaki City, the network that had sustained local owners over many years was the driving force behind the initial response when disaster struck. That said, my understanding of the situation even before the earthquake is that these kinds of connections are facing the challenges of aging and a lack of successors.
In some communities, these kinds of activities have been eliminated entirely. In fact, these problems are shared by communities all throughout Japan (Tani, 2009). From this perspective as well, it is essential to deepen the discussion around how to develop frameworks for preserving and passing down these most fundamental and important historical records at the community level.

Need to Share the Information Contained in Historical Records

The items being referred to here as Japanese "historical records" cover a wide spectrum, including old documents and antique works of art, farm and fishing implements, furnishings and other household articles, and clothing. In Japanese local communities, these items are often kept all together in private homes, and often in storehouses or other traditional structures that have historical value of their own. What is important is that they are all preserved together as a unit. That said, it is difficult for a single researcher or organization to maintain all of these different types of objects, each of which must be handled differently. It is therefore essential to share location information and to use it to form mutual partnerships. To prepare for the next disaster, we must work in partnership with local communities on an everyday basis to investigate interdisciplinary information-sharing frameworks among experts involved in the preservation of cultural properties and historical heritage properties.

Recommendations for Developing Countries

We know about the locations where community documents are kept in developing countries from research conducted by Japanese research institutions over many years in China and Southeast Asia (Toyota Foundation, 2009). As conditions in each region change, along with social changes such as economic development and increasing tourism, historical records are not being recognized as cultural properties, and thus are being scattered and lost.

In the 1950s to the 1960s, the culture and social order in Japan changed dramatically as economic development progressed, and documents and other artifacts with historical value were lost. It is likely that the above-mentioned Asian countries will undergo a similar experience as their economic development continues. One of the problems that needs to be addressed before a disaster strikes is how to deal with the scattering and loss of historical records even under everyday conditions. I therefore propose the following steps for addressing the handling of historical heritage properties that are held in communities in developing countries.

Develop a common understanding about community documents and other artifacts that show how people lived in the past, and their value as historical heritage properties

The documents, implements, structures, and other artifacts that remain in a community are often kept without any recognition of their significance as historical heritage properties. Unless they come to be viewed as items that require protection, no action will be taken to protect them from disasters, and discussing the issue will prove meaningless.

In developing countries, feelings of affinity for records left behind by one’s ancestors are thought to be relatively weak as compared with Japan due to the influence of changing dynasties and experiences of colonial rule. Ideally, some shared recognition of the importance of such artifacts would be attainable through bilateral exchange between communities and experts. Practically speaking, however, efforts must be made to instill in local residents a sense of the value that a community’s old documents and artifacts have as cultural properties and historical heritage properties, and this requires the support of experts in developing countries who are researching their own national history and researchers in Japan and other developed countries who are also conducting research on nations around the globe.

Promote activities to locate and archive community documents and artifacts that constitute historical heritage properties before a disaster strikes

In developing countries, as in Japan, those who are familiar with the locations of old objects at the community level tend to be the owners of those items and other local elders and residents. Government officials and researchers must work together in cooperation with such individuals to identify the locations of unconfirmed historical records. This involves gathering data, of course, and a common understanding of old documents and artifacts as historical heritage properties that tell people something about where they came from.
from can be expected to be instilled in those local residents who participate in the information gathering process.

At the same time, steps must be taken to prepare for the possible loss of original historical records by creating electronic copies of those items through digital photography. The methods used in Japan may not be applicable to developing countries, due to the need for access to electricity, but if minimal rules are established for taking pictures of cultural properties, it is easier to get ordinary residents involved in taking photos using a digital camera than it is to get them to decipher documents. Cultivating experts and developing techniques and organizations that facilitate the participation of both experts and residents alike is essential to the preservation of a community's historical records, whether for disaster preparation or other purposes.

In the emergency processing of documents that was undertaken following the 2004 Indian Ocean Earthquake, Japanese and Indonesian experts enlisted the help of local residents (Sakamoto, 2009). After getting both domestic and international experts involved, efforts should also be made to get local citizens involved in the pre-disaster, preparedness efforts to locate and archive affected materials. If possible, it would be beneficial if this could be done in such a way as to create jobs in the community.

Conclusions

"We lost everything in the tsunami; it was only thanks to the professor's work that we at least have photos of our old documents. It's a good think that the items were carefully surveyed before this happened. Thank you."

This message was conveyed to me during the first damage survey Miyagi Shiryo Net conducted after the disaster on April 4, 2011, by an owner in Ishinomaki, Miyagi Prefecture who had lost all of her historical materials in the tsunami. More than anything, the disaster preparedness efforts related to historical records and the disaster response activities were undertaken for the owners of historical records and their communities. As we continue to respond to the Great East Japan Earthquake, I hope that we will continue to put the lessons from this current disaster to use in developing new disaster management measures that will help us prepare for the next crisis.

Endnotes

1. Tohoku University Disaster Management Tsunami Inundation Map http://www.cneas.tohoku.ac.jp/labs/rdpm/database/tsunamimap/map_index/index.htm

4. "Old documents and diaries restored at the Nara Research Institute, supports affected areas with a massive dryer, Great East Japan Earthquake," Asahi Shimbun, April 21, 2011, morning edition, p. 34.


7. About the repair work being done on the Homma family storehouse http://www.hanadataz.jp/k/001/00/Homma00.htm

References

Hirakawa, Arata (2005), "Disaster Preparedness Measures Shift from Post-Disaster Preservation to Pre-Disaster Planning," Rekishi Hyoron, 666.


Miyagi Network for Preserving Historical Materials (Miyagi Shiryo Net, 2007), Research Report from the Project on Measures to Protect Cultural Properties from Disasters: Project Conducted on Behalf of the Agency of Cultural Affairs from 2005 to 2006

Okumura, Hiroshi (2011), Major Disasters and the Preservation of Historical Records, Yoshikawa Kobunkan.


Sato, Daisuke (2008), "Historical Record Preservation Activities After the Iwate-Miyagi Nairiku Earthquake: How Would We Respond to a Second Disaster?" Disasters and Materials, 3.
Takahashi, Yoichi (2012), "Historical Record Preservation Activities and Local Governments: An Example of Disaster Response in Iwanuma City, Miyagi Prefecture," Rekishigaku Kenkyû, 890.


Toyota Foundation (2009), "The Search for Traditional Documents in Asia," JOINT, No. 2.

Author: Daisuke SATO
International Research Institute of Disaster Science, Tohoku University
Director of Miyagi Shiryo Net
CHAPTER 7 : BUSINESS CONTINUITY PLAN

7.1. Business Continuity Plan (BCP) of Companies and Public Organizations

The Great East Japan Earthquake (GEJE) caused Japanese companies and public organizations to face the stoppage of supply chains and the lack of electricity, fuel, etc. as well as the serious damage of the tsunami and strong earthquake motion. Considering risk of large earthquakes in the future, spread of Business Continuity Plan (BCP) is indispensable in Japan. There were examples of successful correspondence at the time of the GEJE utilizing their BCP including examples of small and medium companies. BCP from now should include a standpoint of alternate strategy and supply chain management more explicitly.

RECOVERY PROCESS

Diffusion Status of BCPs before and after the GEJE in Japan

Business Continuity Plan (BCP) is formulated by companies and public organizations (hereinafter collectively referred to as “organizations”) to secure the continuity of their critical operations even if they have serious damage by disasters and accidents. Organizations recognize the permissible limit of recovery time, and make efforts to recover the operation degree before the limit. Additionally, even shortly after a disaster or an accident, the organizations make efforts to keep the operational degree above the permissible level (Figure 7.1).

Important articles of Business Continuity are as follows;

- Clarifying the chain of command of an organization including substitution of top executives and key persons and securing alternative human resources.
- Securing the functions of the head office and other key sites including preparing substitution sites.

Figure 7.1 Concept of Business Continuity
Cabinet Office of Japan (2009)
The Great East Japan Earthquake 2011

BUSINESS CONTINUITY PLAN

- Transmitting necessary information outside quickly and information sharing with stakeholders.
- Backing up important information and information systems.
- By the measures above, recovering supply of the important products or services before Recovery Time Objectives (RTO).

According to the “Survey on the Situation of Companies in Business Continuity” by the Cabinet Office, the diffusion ratio of BCP of Japanese companies has risen gradually. In FY2011, 45.8% of large-sized companies completed formulating BCPs, compared to 27.6% in FY2009 (Figure 7.2). The GEJE is considered a factor of the increase from FY2009 (cf. Cabinet Office (2012)).

As for medium-sized companies, the diffusion ratio in FY2011 was still 20.8% (Figure 7.3). However, it deserves attention that the ratio of companies which “do not know BCP” decreased rapidly from 45.3% (FY2009) to 13.3%.

Influence on Businesses Continuity in the Damaged Areas

In the GEJE many organizations face the difficult of their business/operation continuity.

As for head office of business or operation, main building of Fukushima prefecture which was low seismic resistance turned to be unusable for the disaster response headquarters. Thirteen municipal governments had to move their head offices to other buildings. There were also innumerable companies whose head offices suffered and were not usable.

As for the personnel, not a few organizations lost their top executives or key persons. The mayor of Otsuchi town of Iwate prefecture was killed by the tsunami. Besides, many cases were reported that a president of a company was far from one’s head office at the occurrence of the GEJE and could not command the initial response.

In addition, many organizations faced the disruption of supply of necessary raw material, parts and utilities for their critical business and operations.

Tohoku Economic Foundation (consisting of approximately 900 member companies in 6 prefectures of Tohoku District) conducted “the Questionnaire Survey on the Effect of the GEJE” during July 5-15, 2011 and received 245 answers (64 from manufacturers, 181 from non-manufacturers.) The response rate was 36.3%. 73.4% of manufacturers and 74.0% of non-manufacturers responded that there was some damage to their buildings or facilities. Additionally, 51.6% of manufacturers and 53.6% of non-manufacturers responded that they had indirect damage (Figure 7.4).
As to the details of the indirect damage, 42.2% of manufacturers noted an “increase of cost by the change of logistics network”, 29.7% noted a “decrease of production by disruption of supply chain,” and 20.3% noted a “price increase of fuel and raw materials.” For non-manufacturers, 22.1% cited a “decrease of sales by voluntary restraint of consumption,” and 16.8% cited a “price increase of fuel and raw materials.”

**Influence on Major Businesses Nationwide**

About one month after the earthquake, on April 8-15, the Ministry of Economy, Trade, and Industry (METI) conducted its “Emergency survey on the actual status of industries after the GEJE” directed at 80 major companies (55 in manufacturing and 25 in retailing/service). Of the manufacturing businesses, 64% (raw material producers 67%, processors 58%) had already restored their production bases which sustained damaged; 26% (raw material producers 20%, processors 38%) estimated that they would be restored by the middle of July.

Regarding the reasons for difficulty in obtaining raw materials and parts/components (multiple answers), 88% of raw materials producers cited “damage to the suppliers we procure from” and 42% cited “damage to the suppliers supplying the companies we procure from,” while 82% and 91% respectively of the processors cited these reasons. These indicate that the processors were strongly impacted from two levels up the supply chain.

METI also conducted the “Second emergency survey on the actual status of industries after the GEJE” during June 14 - July 1, surveying 123 major enterprises (65 manufacturing, 58 retailing and service). This represents a period of three and a half months after the GEJE. In this survey, out of 91 production bases of manufacturing companies that received direct damage, 93% had already been restored by this time. In the first survey in April, 90% thought they would be restored by middle of July and it indicated that recovery had been accomplished a little quicker than expected. Regarding production levels, 80% had regained or surpassed pre-earthquake levels.

Looking at the procurement of raw materials and parts/components, the second survey found that compared to the first survey in April, the proportion of the companies of raw materials producers responding that there were no alternate suppliers fell from 12% to zero, while from 48% to 18% for processors. The processors, which have a longer supply chain upstream, were indeed more strongly affected by indirect damage from the GEJE, but their recovery had made progress during the intervening three months.

In general, the damaged companies recovered more quickly than they had expected just after the earthquake. A reason for this seems to be that the original forecasts strove for certainty and therefore made slightly longer predictions, but many assume that Japanese companies’ “ability of production-field” achieved early recovery. This ability would include the dedicated recovery efforts of company’s staff in the field and contractors working around the clock, with their practical knowledge/skill and their sense of responsibility.

**Disruption of Supply and Organizations’ Response**

In the GEJE, if the damage of organizations was within a range where recovery was somehow possible on site, the organizations, in general, set out restoration works as soon as possible. On the other hand, when organizations found it difficult to recover the present bases for the time being, most of them seemed to start considering new bases after they were struck, except the few exception of holding plans to secure substitution bases in advance.

Meanwhile, as mentioned above, there were also many organizations which were not struck directly but faced the disruption of supply of essential raw materials and parts. Their response seemed to be these three approaches: (A) assisting their damaged suppliers to recover; (B) acquiring alternate sources of procurement for the unobtainable raw materials and parts; and (C) redrawing specifications so that the unobtainable raw materials and parts need not be used. From these, the companies seemed to choose one or several options that would solve the problems earliest.

Approach (A) was the most basic. However, it was not useful when early recovery was not expected, such as in the area struck by the tsunami. Approach (B) should be difficult when the needed raw materials or parts had been specially ordered to a single supplier. As for (C), it was said that, during normal operations, objections to changing specifications were common from the production floor, but when faced by a sudden disruption of supply, the production floor and customers alike became more amenable to such changes.
Grasp of Supply Chain Upstream

There were probably many organizations who had not sufficiently grasped the location of producers higher up on their supply chain. Especially, some of them might have multiple suppliers only to find that they were relying on the same supplier two or three levels up the chain. This type is called “diamond-shaped” supply chain. In comparison with this, more common is inverted pyramid style of supply chain, which it branches off into large number of suppliers upstream.

However, the problem of a diamond-shaped supply chain is not a new one; it also appeared following the 1999 Chi-Chi Earthquake in Taiwan, when semiconductor plants were damaged. Though a maker procured from multiple semiconductor suppliers, they all consigned their production to Taiwanese companies that suffered from the earthquake, and faced disruption of supply simultaneously. This has been cited frequently as an example of the need for supply chain management and BCP/BCM. (BCM: Business Continuity Management. BCM includes formulating, maintaining and revision of BCP and also contains education, exercise, audit, etc. in order to improve the business continuity ability.)

No doubt in the future Japanese organizations will make greater efforts to know about suppliers two or more levels upstream on the supply chain. However, the efforts will need not only considerable cost and labor, but also the cooperation of their suppliers by offering exact information about their suppliers upstream. It will not be easy to undertake these continuously and effectively.

LESSONS

Basic Requirement for Business Continuity

Based on the lessons of the GEJE, following basic requirements seem to be necessary for the organizations’ business continuity.

- **Securing Earthquake Resistance of Buildings and Facilities**
  Important factors for realizing business continuity in a time of earthquake include Earthquake-resistant design, anti-seismic reinforcement and base isolation of buildings/structures, and earthquake-resistant mounting of facilities. One of the reasons that the damage to buildings and structures by the GEJE was fewer than those by former large earthquakes seemed to be the effect of these quake-resistance measures.

- **Securing Transport Infrastructure and Essential Utilities**
  In the GEJE, highways and the bullet trains (“Shinkansen”) showed the effectiveness of earthquake-resistant works. While the damage to ports was extensive in general, the advantage of earthquake-resistant quays was confirmed. As for the utilities such as electricity, telecommunications, water supply and swage, the nation-wide recovery support system was realized from an early stage and worked well, in addition to the effect of introducing earthquake-resistant technology in advance. Still, recovery works of utilities did not make the desired progress because the affected area was so vast, restoration of roads took time, and tsunami warnings continued from continuous aftershocks.

- **Preparations for Bases, Persons and Suppliers Using the Substitute Strategy**
  Considering the actual state of the GEJE, it seems very difficult for organizations to get all of the necessary resources for their important activities on site when they are in an area that suffered severe damage from huge disasters. Therefore, a “substitute strategy” to secure alternative resources must be useful. This strategy is a basic method of BCM. A substitute strategy on the aspect of the business base means having an alternate base(s) when a base used in ordinary times is not usable. On the aspect of personnel, a substitution strategy means securing persons who can act as alternates for a president and key persons. For example, clarification of a deputy and delegation of authority are effective. On the aspect of goods and materials, a substitute strategy means securing alternate suppliers to prepare for the stoppage of supply of such resources as raw materials and parts.
Means to Secure Alternate Bases

While securing an alternate base is effective as mentioned above, it is not easy for an organization which usually has finance restrictions to prepare this on the same level of facilities and functions as the base used in ordinary times. However, an alternate base can still be effective even they are not equal to the usual base. The examples below are methods that have been found from past experiences with disasters, and they also showed their usefulness in the GEJE.

- **Alternate Communication Bases**
  The first method is that a company designates an “alternate communications base” in some location where it can communicate with employees and important business contacts. It is even useful to use the president’s home. The location should be one where the same hazard will not cause damage simultaneously as to the original base. The company should provide the place and contact information to business partners and other important parties. The base may be used as a place to keep backup files of important information, blueprints and other documentation.
  When the usual base becomes unavailable by a disaster, the alternate communication base would be the company’s site to confirm the safety of employees and open communications with important contacts, while the organization would start searching for alternate bases to be used for overall important business.
  This method would be effective for construction companies, for example, engaged in recovery works just after a disaster. Even when their head offices are not usable, construction companies may begin recovery works on damaged sites if they can secure their subcontractors with workforce and suppliers of raw materials and machinery.
  In the “Approval System of Constructors’ Business Continuity Ability at the Time of the Disaster” that the Kanto Regional Development Bureau has carried out since 2009, it is essential for an applicant to prepare for an alternate communication base.

- **Having a Plan to Set up an Alternate Base and Exercises**
  The second method is that a company with one production base for an important product decides clearly on a location for an alternate production base, plans how to set up facilities in the base deliberately, and carries out virtual exercises for setting up the base a number of times. This method seems to be effective for a manufacturing base using very expensive facilities, and therefore the cost of preparing second bases would be very high. Their profitability would be not enough if they had to produce same product at two bases.
  The successful example of Fujitsu Group during the GEJE has been published. A factory of a group company in Fukushima prefecture which was producing desktop PCs sustained severe damage and was unable to operate. The group set the substitute strategy in operation quickly: they built up the alternate production line in a factory of another group company in Shimane prefecture, where laptop PCs were produced at ordinary times. According to the website of Fujitsu Ltd., their exercises before the GEJE numbered more than 40 times, including disaster simulation drills, tabletop read-through exercises and integrated exercises.

- **Cooperation with a Company in the Same Industry in a Distant Place**
  The third method is cooperation with companies of the same industry in distant places where a disaster will not strike both companies simultaneously. One of the typical shapes is to conclude a “mutual cooperation agreement in a time of disaster” and to help each other as a sort of an alternate base. When early recovery of own business base is unavailable, this method makes it possible for a company to utilize its technology and knowhow in association with the other company, to maintain its relations with important customers, and to keep its workers be employed to some extent.
  An actual case is that companies of Electroplating Association of Kanagawa prefecture and Niigata prefecture signed a mutual cooperation agreement for alternate production in April 2011. As it is essential that the two parties have strong mutual trust, there are regretfully few practical examples of this approach until now. Efforts to seek a mediating role for governmental or economic organizations could be expected.
  In addition, a similar approach can be found in the examples responding to the GEJE. Oil Plant Natori Co. Ltd. in Miyagi prefecture, which performed treatment of waste oil and liquid, sustained serious damage. Its two processing plants were destroyed from the tsunami simultaneously. However, it was able to recover processing in a short period of time by the cooperation of companies of the same trade in other
prefectures based on its BCP. In ordinary times, Natori subcontracted the processing to a part of them and planned to build mutual support relationship with them. Another example was Suzuki Kogyo Co. Ltd. in Miyagi prefecture that performed treatment of waste from hospitals, sludge from water/sewage plants. Its processing facility was damaged seriously by tsunami, and it requested processing to another company of the same trade in neighboring prefecture based on its BCP, and was able to continue its business. These two good examples were awarded in 2012 by the Business Continuity Advancement Organization, non-profit organization acting for the diffusion of BCM.

**Improving the Supply Chain**

In June 2011, METI’s Industrial Competitiveness Subcommittee of the Industrial Structure Council released a report entitled “Problems and Responses regarding Japan’s Industrial Competitiveness after the GEJE – Moving beyond a Crisis of Unprecedented Hollowing Out.” This report covered the vulnerability of the supply chain of the manufacturing industry, and it raised the following five directions as measures for strengthening its position:

- Moving forward with the use of multiple and dispersed production bases for critical parts and materials, and making possible alternate production on a company’s other production lines.
- Promoting restructuring and use of joint businesses to advance the decentralization of production bases on a nationwide level.
- Stimulating the formulation of a system of alternate supply by concluding contracts with multiple suppliers and similar methods in case of disaster.
- Organizing and commonalizing specifications and parts in a balanced manner and ensuring the substitutability of non-critical parts and materials. At the same time, integrating upstream and downstream industries to promote the development and introduction of new parts and materials. Thereby, ensuring domestic predominance in items that cannot easily be switched to overseas orders.
- Reorganization of BCP to address the entire supply chain, including clients

**Countermeasures of Finished Product Manufactures**

Based on the measures of the METI above, the author believe that finished product manufacturers need to make a management decision to change their sense of values so as to give more emphasis to the stable supply, even though it means sacrifice in terms of procurement cost and product differentiation. Specifically, they should consider the following four points.

- **Setting Specifications**
  In setting specifications, narrow down the parts and materials that take a role of strategic differentiation. For those parts and materials, seek to have suppliers secure alternate supply bases, or strengthen their BCM if the alternate base is very difficult to have.
- **Alternate Procurement**
  For other parts and materials, introduce and thoroughly apply rules which emphasize the possibility of alternate procurement. In this regard, set forth these clearly as the policy of top management in order to settle them in the production field.
- **Part Development with an Subcontractor**
  Reconsider parts development performed only in cooperation with a single specific subcontractor, keeping in mind the risk of the stoppage of supply.
- **Support for subcontractors**
  When requesting subcontractors to secure their own substitute bases and/or strengthen their BCM, do not try to make the costs involved solely the burden of subcontractors; provide whatever support you can.

**Survival Measures of Subcontractors**

On the other hand, subcontractors have to consider how to survive when their supply chain is discontinued. Following four points would be pointed out:
Improving BCM
Be ready for a growing number of inquiries from customers to ensure their business continuity ability and request formulation of a BCP. Work on improving own BCM positively.

Securing Upstream Supply Chain
Grasp the risk of the supply chain further upstream, and request procurement sources to make more efforts toward stable supplies.

Considering Market Share
Subcontractors which have a larger market share seem to receive stronger requests to improve their business continuity ability and, on the other hand, have greater probability of receiving support from the customers for realizing it. Discuss support and mutual cooperation with customers deliberately.

Supply to Other Chain
Although it would not be easy way, try to consider strategies for survival by directing the supplies of products to other chains if the supply chain is disrupted at some point down-stream.

The Roles of Central & Local Governments
Japanese central and local governments should also play roles as follows, to improve the supply chains and enhance BCM.

- It is necessary to enhance disaster reduction measures, including earthquake-proof works, as well as to spread BCP/BCM that includes supply chain management.
- Based on the experience of the GEJE, the governments should emphasize the necessity of a “substitute strategy” in the BCP/BCM, in order to overcome situations when on-the-spot recovery is difficult.
- The governments should expand the estimation of damage by major disasters. Present estimation of damage does not include damage to the communication method such as mobile phones, mobile e-mail and the Internet, as well as shortage of gasoline, light diesel oil and other fuels.
- It will be effective for the governments to put together a package of easing of regulations in the time of disaster for organizations’ smooth business continuity.
- When governments select important operations of their BCPs, procedures of the necessary permissions and authorizations should be included for smooth recovery of economic activities. These are, for example, those of controlling dangerous materials, securing hygiene and preventing fire.
- Local authorities and public organizations should be more positive about holding a BCP and improving their BCM. In addition, existing BCPs of central and local governments are insufficient in terms of securing substitution sites, range of the hazard to assume, conducting exercises and seeking continuous improvement. They should be enhanced.

Japan’s business sectors and governments should be aware that foreign countries are apprehensive about the possibility of future large-scale earthquakes in Japan, and must show the status that countermeasures such as BCM are undertaken to control the effects of supply chain disruption.

Recommendations
To restore the living of the victims and economy of affected areas are very important policies, as well as to save lives after the occurrence of the disaster and to mitigate the damage beforehand. If restoration of the economic activities is realized earlier in the stricken area, it leads to securing of employment. The courses of independence of living of sufferers would be found easier. However, effectiveness of encouraging restoration of economy is limited only by subsequent correspondence of the governments. The governments should lead the companies to prepare the damage of disasters in ordinary times. The effective methods for this should be promotion of the disaster mitigation measures and BCM to the companies.

Besides, in the aspect of industrial structure and location of enterprises, division of production and specialization has progressed nationwide and internationally in pursuit of price competitiveness and technical competitiveness. Supply chains have been long and complicated throughout developed and developing countries. Therefore when production of a certain factory is disrupted, the influence spills over quickly and widely all over the country and internationally.

In the GEJE, the only one production bases of specific part of automobiles such as microcomputers suffered a great deal of damage. As a result, with the considerable time lag, the production of factories in the...
North America, Asia and Europe which received supply of these parts was decreased or delayed to a large extent. In addition, by the Thailand’s Great Food occurred in 2011, stoppage of the supply of the part from the damaged factory strongly affected the production and sales of many other countries including Japan.

Based on these experiences, the degree of business continuity risk of the country or region becomes the important determinant when a company examines the location of the business base. Therefore, it is necessary for local and central governments aiming at attracting industries to show not only disaster mitigation policies in the region, but also the business continuity ability of the company in charge of providing materials and parts, distribution, utility and so on. In addition, the operational continuity ability of the government organization is also necessary as a prerequisite.

Based on these recognitions, the author recommends the following items for the foreign countries including the developing country.

- To recognize the consequence of economic damage by the stoppage of the company activity, as well as human and physical direct damage by disasters, accidents etc.
- One of the important measures against the economic damage is introduction of BCM. To understand that BCM has a merit to be effective commonly to various kinds of disasters and accidents.
- To spread the recognition that the company which raised its business continuity ability has an advantage in even ordinary times to get business contracts with the customers who emphasize stable supply.
- For attracting factories and offices, to take measures to decrease the business continuity risk for local companies. It is effective not only when a disaster occurs, but also when a company evaluates the location of new business site in ordinary times.
- Considering that a disaster may cause damage that is more than assumption beforehand, to recommend to companies that their BCP/BCM include a substitute strategy including substitute bases.
- The local governments and local business community should understand that each company with its supply chain requires the substitute suppliers in the region that do not suffer from the same disaster at the same time, and support the securing of these suppliers.
- To improve the introduction of BCP/BCM to the governmental organizations positively, because it is demanded for sufficient rescue activities and business continuity of private sector at the time of great disasters.
- To promote upbringing of human resources who can manage and improve BCM properly. This is an urgent need in Japan, and it should also be an essential in other countries.

**KEY REFERENCES**


**Hiroaki MARUYA**

Chief Executive Researcher, Policy Research Institute, Ministry on Land, Infrastructure, Transport and Tourism

Vice-chairman, Business Continuity Advancement Organization, Japan
## ANNEX

**Meetings and Consultations**

### <Schedule>

<table>
<thead>
<tr>
<th>EVENT / ACTIVITY</th>
<th>OBJECTIVE</th>
<th>DATE &amp; VENUE</th>
</tr>
</thead>
</table>
| 1. First Coordination Meeting | • To brainstorm on case study topics  
• Identification of appropriate authors  
• Terms of Reference | Date: 6 July 2012  
Venue: Tohoku  
Lead: IRP, IRIDeS |
| 2. Second Coordination Meeting (The GEJE Watcher) | • Interim report  
• Draw comments and feedback | Date: 13 Sept. 2012  
Venue: Tohoku  
Lead: IRP, IRIDeS |
| 3. 4th Expert Group Meeting | • Presentation of case studies with international experts  
• Discussion on messages to further inform post 2015 Global DRR Framework | Date: 21 Jan 2013  
Venue: Kobe  
Lead: CAO, IRP, ADRC |
| 4. International Recovery Forum | • Presentation of draft summaries  
• Draw comments and feedback | Date: Jan 22, 2013  
Venue: Kobe  
Lead: IRP |
| 5. National Consultation | • To present the case studies to national government ministries and local governments  
• To validate findings | Date: 1 March 2013  
Venue: Tohoku  
Lead: IRP, CAO, ADRC |
| 6. Consolidation and Analysis | • Analysis of Tohoku recovery, comparison with Hanshin-Awaji Earthquake  
• Comparison and analysis of Knowledge Notes and other recent reports  
• Key massages for the Post-2015 Framework for DRR | Date: March 2013 |
| 7. 5th Expert Group Meeting (as a Side Event of GP13) | • To showcase lessons from Tohoku experience  
• To launch the case studies | Date: 21-23 May 2013  
Venue: Geneva  
Lead: CAO, IRP, ADRC |