Comparative Analysis on Land Use Management and Planning for Sustainable Recovery from Great East Japan Earthquake and Canterbury Earthquake

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ABSTRACT

After the Great East Japan Earthquake, the land use management for disaster mitigation has been considered more important than ever and recovery plans have been developed by combining civil engineering structures and land use management tools for sustainable development. While, New Zealand has been practiced land use management for disaster mitigation in the framework of urban and regional planning, and it faces emerging issues in the recovery after Canterbury Earthquake to redevelop sustainable cities and regions. The purpose of this paper is to clarify issues of land use management and planning to reduce disaster risk and build sustainable cities and regions in the process of recovery through comparative analysis of recovery cases after Great East Japan Earthquake and Canterbury Earthquake. Recovery process of disaster stricken areas by Great East Japan Earthquake and Canterbury Earthquake are studied from the perspective of land use management and planning.

Introduction

Although the experiences of disasters are tragedies, the recovery process can be the opportunities to build sustainable cities and regions. Land use management and planning are expected to be effective measures for natural disaster mitigation, however, civil engineering structures have dominated natural disaster prevention and reduction in Japan for long time. Now, after the Great East Japan Earthquake, the importance of land use management for disaster risk reduction has been raised in the recovery plan. While, New Zealand has been practiced land use management for disaster mitigation in the framework of urban and regional planning, and it faces emerging issues in the recovery after Canterbury Earthquake to redevelop sustainable cities and regions. In this paper, issues of land use management and planning to reduce future disaster risk and build the sustainable cities and regions in the process of recovery after disaster, are discussed through comparative analysis of the case of Tohoku, Japan and the case of Christchurch, New Zealand.

Land Use Policies of Christchurch after the Earthquake

Features of damages of Canterbury Earthquake were liquefaction, damages to old buildings and roads, rock fall or cliff collapse. Lands were classified into four categories, red, orange, green

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and white, according to the damage states. Red zone as shown in Figure 1 [1] is the area with serious damages. Lands designated as red zone were purchased by the national government. Although buyout is not compulsory, approximately 98% of residents agreed to move out and the lands were purchased by market price before the earthquake. Residents who lived in red zone were resettled individually by themselves.

In central city many historical buildings were damaged, and had to be repaired or rebuilt. Wide spread area was liquefied and lands with rock falls were designated as red zone and those lands were purchased by the national government. Due to the severe damages, the recovery plan of the central city was developed according to Canterbury Earthquake Recovery Act 2011, and lands in red zone were purchased by national government. Following the recovery plan which contains anchor projects to reconstruct town, the city of Canterbury revised the city plan including land use plan (zoning), according to which land use is regulated. Land use management for disaster risk reduction is basically implemented through ordinary planning process by the city plan. Revised city plan was developed based on the population forecast. Also, the land use plan is developed based on the policies to maintain the intensification in urban area and avoid unnecessary developments outside of urban area. Development of the city plan follows the scheme of planning as shown in Figure 2[2]. In planning system, the city plan has the linkage with transportation plan. Following the city plan, Christchurch Transport Strategic Plan has been develop to provide the better access to job, school or shopping to residents. The revised city plan is developed by risk based approach to regulate the use of land with high disaster risk with the consideration of multiple disaster risks according to Resource Management Act. The Earthquake became the opportunity for the city of Christchurch to take disaster risks into consideration in planning.

![Figure 1. Residential red zone in Christchurch](image1.png)

![Figure 2. Planning scheme of New Zealand](image2.png)

**Land Use Policies of Tohoku after the Earthquake and Tsunami**

In Japan, land use plan after disaster is determined by what to do with damaged lands, how many houses were damaged and where to rebuild them, where and how large available spaces are. The breadth of lands necessary to rebuild houses depends on the number of people who intend to rebuild their own houses or who intend to live in public housing.
Land use management policies and land use plan determined according to those factors after the Great East Japan Earthquake are categorized into two types. One is to regulate the use of tsunami stricken area entirely, and cities whose centers were heavily damaged and could not find spaces to relocate houses nearby choose this. City needs spaces as victims are relocated collectively by each community as shown in Figure 3 [3]. The other is to raise the ground level to rebuild houses with the partial use of tsunami stricken area as shown in Figure 4[4] and Figure 5[5], cities which find spaces to relocate houses near stricken areas. Most of the cases, relocation sites are mountain sides.

![Figure 3. Relocation of houses from disaster risk area](image)

![Figure 4. Damages of Natori City](image)

![Figure 5. Land use plan of Natori City](image)

Land use is planned based on the number of people who lost their houses and want to rebuild their houses in the city, and construction projects are planned according to the figure. The figure is estimated by resident survey, but the figure is not always accurate. For example, victims who evacuated to other cities than the city they lived at the time of disaster could request for living in public housings in both cities, which is a double count. Also, some victims change their minds from rebuilding their houses to living in public housing or to move to other towns.

The problems is that land use plan in the recovery is not developed based on the population forecast although the population of Japan turned to decrease and plans have to be considered of future population change. It is worried that an effective land use appears in the future due to the lack of future population.

Land use in the recovery plan is not linked to the city plan. The city plan also does not function
as tool to regulate land use. Legally valid land use regulation is land use district designated by Building Act, and city master plan and land use plan developed by the local governments do not have legal restrain.

Regarding transportation plan, repair and construction of trunk roads connecting and railroads and airport were centered after the disaster, but planning of public transportation network to connect the city internally have let out. In addition, that many of the affected cities have had difficulties providing convenient internal transportation network, it will be more inconvenient after relocating houses to the mountain sides.

Comparative Analysis

Land use planning and management after Canterbury Earthquake and the Great East Earthquake are compared and analyzed focusing on the following four points.

The first point is how lands to rebuild houses are reserved. In Japan, collective relocation is the central measure, damaged cities need spaces for it, so relocation policy affects the use of land. On the other hand, in Christchurch, relocation of victims in red zone is conducted individually. Second, the land use plan developed by the municipality after the Earthquake is not connected to ordinary planning system. In the recovery plan, first reconstruction projects are planned and land use plan is developed following the projects. On the other hand, after the Canterbury Earthquake, the national government, Christchurch Earthquake Recovery Agency, develops the Recovery Plan, and the City of Christchurch develops the city plan after that. In the city plan, land use plan which is zoning plays the main role to actually control the use of land. Third point is whether the land use plan is considered long term perspective or not. While the land use plan after the Great East Japan Earthquake does not reflect population forecast, one after the Canterbury Earthquake does.

The last point is the transportation plan. While the transportation plan is considered later than land plan in most of damaged cities, transportation plan and land use plan are developed almost simultaneously to reserve residents’ convenience.

Conclusions

While the land use planning and management after the Great East Japan is more project oriented, the one after the Canterbury Earthquake is more plan oriented with long term perspective. Each has advantages and disadvantages and can learn from each other for the better system.

References