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A preliminary proposal for urban and transportation planning in response to the Great East Japan Earthquake

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ABSTRACT

The purpose of this paper is to propose information of use in the reconstruction of urban transport and infrastructure in response to the Great East Japan Earthquake. In particular, knowledge of urban planning and transportation planning is summarized to help in drawing up physical plans.
From the viewpoint of reconstructing urban structure, it is necessary to create regional linkages to adjacent cities within a compact district connected by various transport modes. And, the redundancy in traffic function can be secured through a suitable division of roles between automobile traffic and public transportation. Besides, the following issues are discussed: 1) improvements aimed at a safe living environment, 2) examination of new intersections, and 3) sharing crossing space between people and cars. Moreover, introducing new technology in transport planning should also be considered to cope with the aging of society to come.

1. Introduction

The Great East Japan Earthquake has scarred Japan's mature society both physically and psychologically. The most important thing is how we cope with the errors caused by our overconfidence in technology and our underestimation of nature's fury. This paper focuses on reconstruction planning for urban transport and infrastructure in hoping for a rapid recovery in the disaster areas and surrounding region.

This paper aims in particular to support physical planning for reconstructing urban transport and infrastructure in terms of city and transportation planning. No reference is made, therefore, to social planning including community revitalization. Still, it is clear that both physical and social approaches should be considered when actually making a policy. Additionally, reconstruction planning must be based on an in-depth analysis of regional needs, on information gathered through field research and in collaboration with residents. For these reasons, the direction proposed in this paper should be understood as only one basic concept for the planning process.

The concepts toward sustainable city proposed in this paper have been discussed in city planning field for coping with the depopulation society in Japan. Some of the empirical evidence was revealed in existing city and academic researches. The paper was composed of the knowledge and revised the Japanese original paper in the issue of "Proposals to Aid Recovery and Rebirth Following the Great East Japan Earthquake" published by the International Association of Traffic and Safety Science [1].

2. Proposal for a resilient urban structure

2.1. Compact cities and depopulation

The need for compact cities has been discussed in the context of depopulation in Japan. Many municipality master plans adopt the compact city concept as an ideal urban structure for coping with suburban sprawl. The move toward compact cities as an urban planning strategy had already begun, with numerous measures implemented intending to revitalize central city areas or to make improvements to centers of consolidation and public transportation networks [2]. Looking at the facts on the ground, however, it would be difficult to suggest that such concentration is actually taking place. Because the population of Japan is expected to decline by approximately 32 million people over the next 40 years, the issue of how to wisely shrink widely sprawling urban areas is an urgent one from the viewpoint of city management.

Meanwhile, Japan's low birthrate and aging society influences reconstruction planning in the cities that suffered from the Great East Japan Earthquake. An appropriate urban structure is required to ensure sustainable growth in areas affected by the disaster. A key strategy for sustainable urban structure is the "connected compact city" that connects a safe regional core through a robust transportation network [3].

2.2. The connected compact city proposal

The connected compact city model incorporates two characteristics: intensive land use around centers of social and commercial activity and the networking of these core centers through multiple transportation modes. Land use covers various functions including commercial and residential districts, as long as the focal areas are within a certain

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distance. The multiple transportation modes include walking, bicycle, public transport, and automobiles.

A sample urban structure is shown in Fig. 1. Compactness refers not to overconcentration in a particular area but rather multipolar aggregation in appropriate districts. This structure leverages the appeal of regional resources, connecting area attractions through various modes of transport. One of the benefits of a connected compact city is that it ensures redundancy even if the part of the city suffers from a future disaster. At the same time, overall city resilience may be enhanced through restoration work conducted flexibly from other areas.

In general, the process of creating a compact city in the absence of disaster would take many long years, while reconstructing an area affected by disaster, despite the pain, offers the possibility of speedy integration. Local governments all over the country are looking to reconstruction of the region affected by the disaster as an opportunity to take the lead in tackling the compact city issue [4].

3. Integration of land use and transportation planning

3.1. Safe land use planning

Many places affected by the tsunami had experienced severe disasters several times in the past, and were repeatedly resettled after temporary withdrawals. In the current revival plan we should not repeat the past mistake of resettling in dangerous areas. Needless to say, any reconstruction plan must be based on preservation of safety, with residential areas on high ground protected from tsunami. In addition, flood areas must be considered natural land and used for parks and productive greenery or as industrial areas around fishing ports. A land-use cross-section is presented in Fig. 2. The speedy recovery of disaster areas can be achieved by combining the effective use of lowlands that suffered from the tsunami with safe high ground for residences.

3.2. Reproducing a hierarchical traffic system

Traffic systems are fundamentally hierarchical [5]. With regard to automobile traffic, the hierarchy has a gradual pyramidal structure from highways that improve traffic function to familiar community roads that provide an access function. As speed of movement falls, service flexibility increases such that the pyramidal structure tops out with the Shinkansen, which moves at high speed between cities, then moves down to community buses that move within a district, as in Fig. 3.

With overdependence on automobiles in recent years, the automobile became the only available transportation mode in many cities. The hierarchy of urban transport was destroyed, with through traffic entering even community roads and bus traffic forced to withdraw. The reconstruction of areas affected by the earthquake is an opportunity to reconstruct the collapsed hierarchy of urban transport. Since high-speed traffic routes can be used for urgent transport in times of emergency as well as in ordinary times, I would recommend that such routes by improved first.

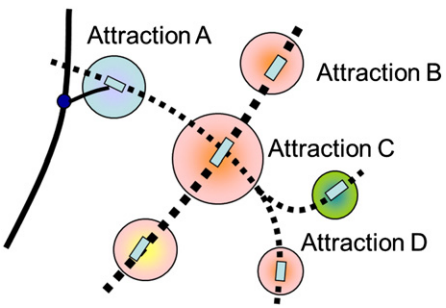

Fig. 1. Image of a connected compact city.

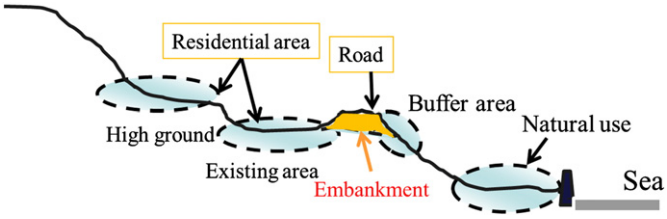

Fig. 2. Image of restoration land-use plan.

On the other hand, maintenance of the public transport network is also an important issue to address in light of the aging of society. Introducing punctual public transport that operates within concentrated areas near stations will serve as a key to the continued use of public transportation.

In other words, redundancy in traffic function can be secured through a suitable division of roles between automobile traffic and public transportation. Moreover, the construction of sufficiently wide escape routes for evacuees connecting high ground with low-lying areas can help ensure smoother evacuations and improve resilience after the disaster. According to this concept, the reconstruction of road network was proposed in reconstruction plan, one of which is seen in the Yamada Town Reconstruction Vision [6].

4. City planning around disaster areas

4.1. Infill development in areas where disaster victims are concentrated

Support for disaster victims is gradually shifting from moving them to temporary evacuation areas immediately after the earthquake to moving them to public housing. The next step should be toward securing their independence and local governments that have accepted disaster victims also need to move forward with town planning. If a city aims for the compact city model as a matter of urban policy, it becomes even more important to move proactively in areas where victims are concentrated. Disaster victims can be provided with a good living environment if local governments accept them where they are engaged in intensive capital investment. Moreover, if disaster victims are unable to secure sufficient vitality where they have relocated, it will be difficult for them to return to their native areas. By shifting to from victim protection to a sustainable city perspective, cities that have taken in disaster victims can expect town planning promotion to result in disaster victims residing for some time. It is important to build win–win relationships that benefit both disaster victims and the cities that take them in.

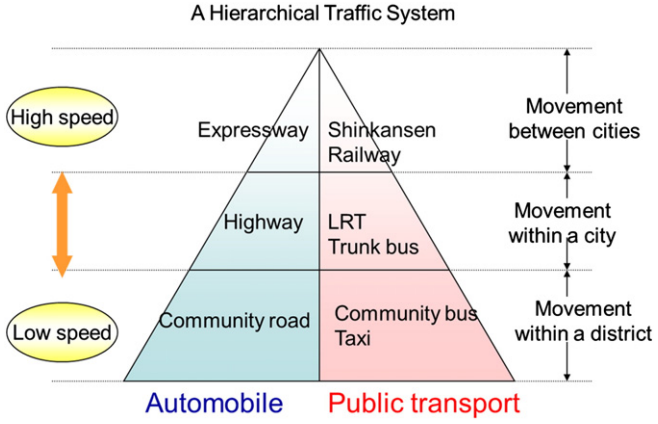

Fig. 3. A hierarchical traffic system.