Returning to Origin of Architecture

Restoration and Renovation of Our Living Environment In Response to the 2011 Tohoku Earthquake Disaster (First-Stage Summary and Recommendations)

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Architectural Institute of Japan（AIJ）

1. Preface

Immediately after the 2011 Tohoku-Chiho Taiheiyo-Oki earthquake, the AIJ formed its disaster response headquarters, chaired by the AIJ President, Shigeru Sato (until May 31, 2011) and Akira Wada (from June 1, 2011). Since that time, the headquarters has been continuously working to help the rescue, response, recovery, restoration, and documentation of numerous cities and towns and people affected by this earthquake. A few sub-committees have been formed within the headquarters to expedite and promote such activities. One of them is the Sub-Committee on Research and Recommendations (whose chairman is Masayoshi Nakashima), with is duty to summarize the lessons that the AIJ shall take seriously and identify the according research needs to be explored by the AIJ. At the end of August 2011, the Sub-Committee submitted a six-page long report entitled “First-Stage Summary and Recommendations”. The contents of this report were discussed by the AIJ Board members, and it was approved on September 9, 2011 by the AIJ Board as the AIJ’s official recommendations. The document is to appear in October 2011 issue of the AIJ journal.

The description below is an excerpt of “First-Stage Summary and Recommendations”. Kaori Fujita, Associate Professor of University of Tokyo took the charge of this translation.

2. Excerpt of “First-Stage Summary and Recommendations”

2.1 Background

The Architectural Institute of Japan (AIJ) has attempted to document lessons learned from the 2011 Tohoku Earthquake Disaster in the form of this draft proposal. The proposal seeks not simply to reorganize the problems of existing disciplines, but to directly benefit the affected people and their daily lives. A further intention is to highlight “support for the lives of the people (through architecture)” as the basis for the activities of the AIJ. To meet these objectives, we have selected

the following five keywords for the proposal: “(Huge) Tsunami,” “(Disaster) Management,” “Metropolis,” “Nuclear Power Plant (Disaster),” and “(Documentation and) Inheritance.”

The huge “Tsunami” and consequent devastation in affected areas were the roots of this great earthquake disaster. The recovery and reconstruction of the cities and villages swept away by the tsunami and the preparations to fortify against future tsunamis that may occur if or when the Nankai (South Sea) Trough causes another great earthquake, as forecasted, are problems of great urgency. By virtue of the huge scale of the recent disaster, the post-earthquake disaster “Management” efforts have confronted many new and unexpected problems: the vast area of the damage, the huge numbers of victims, the long-term evacuation, and the chain reaction effect compounding the damage. These challenges force us to radically restructure the risk management regime for our “Metropolis.” In view of the highly accelerated concentration of urban functions and population, the vulnerability of the urban space to earthquakes is apparent. We have also been forced to recognize anew how seriously the risk of another huge earthquake and accompanying effects imperil Japan’s economy and industry, therefore our disaster risk verification is in need of a radical reexamination. Meanwhile, in view of the gravity of today’s global environmental issues, the “Nuclear power plant (disaster)” forces us to reconstruct our energy policy within a framework that harmonizes the environment and energy. On the one hand, this great disaster has again proved the importance of “inheriting” the lessons learned from past disasters in the form of precise documentation. Likewise, it has proved the importance of inheriting the history and culture of affected towns and architecture in order not only to reconstruct, but also to prevent future damage. In the actual process of reconstructing the earthquake-damaged regions and infrastructure, it will be crucial to recognize that our towns and industry will be constituted by a super-aging society with fewer children. This demands that we act upon a correct understanding of our country’s historical background.

In this draft primary proposal we reorganize the major lessons learned from this disaster in five categories corresponding to the five issues named above, propose “Investigation and Research as missions for the AIJ,” and specify actual investigation and research topics expected be instrumental in realizing the proposal.

2.2 Tsunami – Realize a disaster-mitigation town through cooperation in multiple disciplines –

(Summary of the lessons learned and proposal)

The huge tsunami has deprived us of many precious lives, along with foundations for daily life and the hopes of many people. To prevent recurrences of the tragic events we have recently lived through, it will be crucial to reconstruct the stricken area and thoroughly prepare against huge earthquakes of the future without delay. The problems must inevitably be tackled from both

structural (hardware) and planning (software) aspects in order to promote efficient reconstruction and future disaster mitigation. The structural (hardware) issue is to clarify and verify the mechanisms of building structures under tsunami load. The planning (software) issue is disaster management of buildings and local communities with respect to diverse topography, nature, and lifestyle.

(Actions)

① Construct a tsunami data collection system and analyze the collected data in order to quantify the destructive force of tsunamis.

② Systematize control measures for building structure safety against huge tsunamis, evaluate the structural performance of buildings under tsunami load based on the tsunami load resistance mechanism of building structures, clarify the process of water inundation into buildings, take measures against basement flooding, and develop recovery efforts in consideration of the equipment as well as the systems.

③ Construct a new structural performance verification system with which to assess the response and failure processes of building structures under maximum expected loads imposed by possible physical phenomena such as large-scale destruction of tectonic faults and huge tsunamis.

④ Research and develop design methods to mitigate urban and rural disasters by studying the topography, surface soil conditions, infrastructure, pre-earthquake urban structures, industry, land-use, and damage levels to both buildings and daily functions in the stricken area.

⑤ Research, develop, and systematize proposals for the reconstruction of cities and villages based on cooperation between citizens engaged in self-supported reconstruction and engineers, architects, and other professionals engaged in holistic disaster-mitigation designs for cities.

2.3 Management – Ensure the sound daily lives of people during the reconstruction –

(Summary of the lessons learned and proposal)

The huge scale of this disaster created many new challenges for immediate post-disaster measures: numerous victims, disruption of transportation, insufficient and inconsistent disaster information, lack of fuel to distribute supplies, and malfunctions of damaged (municipality, hospital, and welfare) public facilities. Housing guidelines to ensure quality of life in evacuation shelters and design guidelines for buildings fit for use as evacuation shelters need to be considered more carefully. The period spent in constructing temporary housing and the quality of life afforded by the housing need further improvement. Likewise, management support to ensure the living environment within temporary housing is crucial. There is a pressing need to prepare for the

future by fundamentally reconsidering the temporary housing and temporary facilities available, as well as strategies for the effective use of existing building stock.

(Actions)

① Investigete, extract problems, and propose countermeasures concerning the immediate post-disaster measures from a standpoint grounded in architectural expertise.

② Plan facilities for disaster-management centers, improve the living environments of evacuation shelters, and propose adequate architectural planning for evacuation shelters.

③ Establish a firm management and support system to ensure the living environment of victims during the whole process; from evacuation to reconstruction, in consideration of the effective use of existing building stock.

2.4 Metropolis – Maintain and continue the activity of the people in the huge metropolitan area –

(Summary of the lessons learned and proposal)

It will be essential to collect knowledge and take measures on disaster prevention and mitigation for the metropolitan area. In addition to reinforcing the sustainability of our country, this effort will support to the existence of other huge urban districts in the world endangered by similar seismic hazards. The earthquake damage needs to be investigated in detail and the necessary measures against earthquakes in large urban districts need to be thoroughly discussed to prepare for the future. The total collapse of buildings was very rare in the metropolitan area, as well as in Sendai City, but substantial damage to non-structural elements and equipment often made it difficult to sustain building functions. Worse still, disruptions of transportation, communication failures, and large-scale liquefaction have greatly affected the business activities and daily lives of people in the city. Academic contribution is essential to learn lessons from this experience, in order to maintaining and continuing urban life and urban functions together with dealing with the known problem of vulnerability in dense urban area.

(Actions)

① Investigate the vibration response of major buildings (super-high-rise buildings, disaster-prevention facilities, medical facilities, vibration-controlled structures), investigate actual building damage, and verify the precision of the structural performance estimations of our seismic designs.

② Secure the safety and security of people and maintain the functions of buildings and cities by developing an integral seismic performance verification system and effective seismic performance improvement technology, not only for building structures but also non-structural

elements and lifeline facilities.

③ Develop an immediate damage inspection system by monitoring the vibration response of building structures triggered by emergency earthquake reports. Enable immediate disaster management, decisions on whether to evacuate or not, and appropriate emergency announcements via public address infrastructures.

④ Precisely investigate the damage indigenous to large urban districts (people unable to reach their houses, traffic jams, disrupted communications, liquefied-reclaimed land by the bay). Investigate post-disaster behaviors and difficulties in the living environments of the residents of large scale-buildings such as high-rise multi-family housing complexes.

⑤ Develop a District Continuity Plan (DCP) and area management system based on the promotion of regional cooperation.

2.5 Nuclear Power Plant – Contribute to the energy problem from both sides, consumption and supply –

(Summary of the lessons learned and proposal)

This earthquake disaster has brought to light the enormous risk of nuclear power plants and the relationship between the areas consuming and supplying energy. In facing this serious situation, we must act swiftly by reconsidering how we can contribute to the energy crisis issue from an architectural standpoint while searching for ways to reduce the risk itself. From the energy consumption side, we must consider changes of lifestyles, appropriate responses to the natural environment (insulation, solar control, utilizing the wind flow etc.), compact urban development, and the introduction of energy-saving equipment/management. From the energy supply side, we must apply renewable energy and utilize unused energy in the city. Some of these measures have already advanced in the drive to solve issues of the global environment, but they will still need to be implemented more widely and seriously overall.

(Actions)

① The application of various measures to cope with energy supply shortages has brought about a transition in our lifestyles and environmental awareness. Analyze this transition and the process behind it, and efficiently use the knowledge gained for the future.

② Design buildings, regions, and towns that minimize energy consumption through strategies such as change in lifestyles, respond appropriately to natural environments, and compact regional development.

③ Design energy equipment, energy systems, and reconstruction plans for buildings, regions, and towns to enable efficient energy use, reduce environmental impact, secure energy supply, and apply and manage reliable energy-supply technology.

④ Extract problems and examine architectural measures to reduce and control radioactive contamination and secure the safety of nuclear power plant facilities.

2.6 Inheritance – Inherit both the experience and culture of the stricken area –

(Summary of the lessons learned and proposal)

The lessons from this experience need to be fully utilized to prepare for similar catastrophes and disaster-management efforts in the future. This can only be done by producing detailed documentation on the damage and post-disaster behavior and influences, while concurrently creating a system to share this knowledge. To reconstruct a healthy prosperous daily life, the regional history and culture also need to be remembered. To this end, we must carefully select what can be preserved and what can be reconstructed in the urban/rural environment in general and in each individual architecture. Many of the damaged historical buildings are endangered by the lack of specialized craftspeople with traditional skills to pass on. Measures to preserve the architectural culture of each region are crucial.

(Actions)

① Document various records on activities such as damage investigations, post-disaster management measures, and processes to reconstruct the stricken area.

② When designing and planning restoration and reconstruction projects, inherit the memory of the region. Research and investigations into methods for inheriting regional legacies and effective advice based on that research are important.

③ Investigate, research, and give advice on inheriting damaged historical architecture.