Meguro Lab.

[Comprehensive Disaster Management by both Structural and Non-stractural Countermeasures]

Urban Earthquake Disaster Mitigation Engineering

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Department of Civil Engineering

Interfaculty Initiative in Information Studies

Implementation of earthquake safer built environment

Japan has entered a period of high seismic activity. Within next 30 to 50 years, magnitude 8 (M8) class earthquakes may happen 4, 5 times and M7 class earthquakes may strike Japan 40 to 50 times. Typical one with magnitude 7 is Tokyo Metropolitan inland earthquake and those with magnitude 8 are Tokai, To-Nankai and Nankai earthquakes along Nankai-Trough. The Central Disaster Prevention Council, Japan, estimated their damage in 2003 and 2005 and total damage reported was 200 trillion yen, including 2million collapsed/burnt buildings and houses. Based on the experiences of the 2011 Great East-Japan Earthquake disaster, the Council re-estimated the damage and reported over 220 trillion yen damage of collapsed/burnt buildings and houses by magnitude 9 gigantic earthquake along Nankai-Trough and 95 trillion yen damage by Tokyo Metropolitan inland earthquake. Total structural damage estimated was over 3 millions and over 300 thousand victims.

Can you protect your important persons and things, and yourself from these earthquakes? The most important point for disaster reduction is "How to increase the number of people who can imagine the real situation around them as time goes since the hazard attack". An appropriate countermeasures requires disaster imagination. Our research group has been studying method for implementation of disaster safer built environment by integrating structural and non-structural measures.
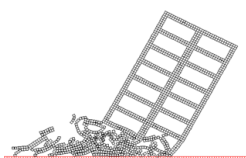
Hardware (Physical Analysis)

■ **Retrofitting for masonry structures**

Proposal of highly effective method which is easy and cheap for retrofitting masonry in the area where there are many earthquakes
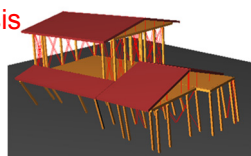
■ **Building Collapse Analysis**

Building collapse simulation using AEM which enables high-accurate analysis from continuum to non-continuum.

■ **Housing Collapse Diagnosis**

Development of seismic diagnosis method using vibration generator and DEM. Figure shows the housing collapse simulation by DEM.

■ **Furniture Overturning Analysis**

Furniture overturning simulation using EDEM. Difference in the layout of the room and furniture were analyzed.
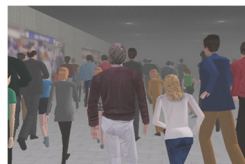
Software (Social Analysis)

■ **Social promotion system for masonry retrofitting**

Research for the system of promoting seismic retrofitting of unreinforced masonry houses

■ **Evacuation Behavior**

Analysis of human evacuation in underground city and buildings, based on walking characteristics and building designs.
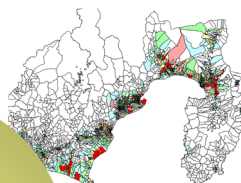
■ **Fire Spreading**

Damage caused by fire spreading was analyzed. Figure shows the situation 12 hours after the Great Kanto Earthquake.

■ **Countermeasure Effect Evaluation**

Research of adopting incentives for retrofitting vulnerable buildings. Effect of "Seismic Retrofitting Encouraging System", in case of Shizuoka prefecture, was evaluated.
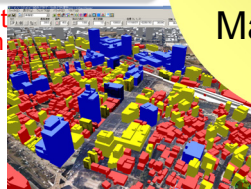
Towards Comprehensive Disaster Management

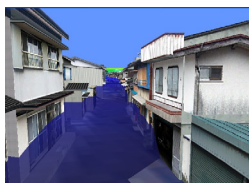### Disaster Information Archive

■ **Development and management of efficient disaster information system**

For contributing pre- and post event countermeasures including recovery, method for development and management of efficient hazard map is studied.

■ **Tsunami evacuation system**

Integrating Tsunami simulation and human evacuation simulation, tsunami evacuation system is made by which people can understand the risk of tsunami disaster and proper evacuation.

■ **Disaster lesson database**

Organize, accumulate, analyze and make use of the knowledge from the past disasters.

Disaster Information Collection and Dissemination

■ **VR (virtual reality) information terminal**

Create a 3D city in virtual reality and deliver information such as evacuation route.

■ **Next generation disaster management manual**

Damage estimation and disaster response navigation are shown by inputting earthquake information such as location of source, magnitude, and time of the quake .

■ **Meguro-method/maki**

A tool for improving disaster imagination. Create a story of your own by setting a situation around you during the disaster.