

Prediction of malfunction in healthcare facilities in case of earthquakes



Environmental Planning, 2nd year

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Introduction and Purpose of research

The research is about the mitigation of healthcare facilities in the event of earthquakes. Much research has been conducted with regards to this subject. Some of them focused on assessing the facilities before the occurrence of a disaster, while others focused on the transportation of injuries to receive treatment. The general purpose of the research is saving human life. The centre of attention will be toward the response of a healthcare facility during and after experiencing an earthquake. The result of the present work can be used to strengthen the response of hospitals as well as the dispatching of injuries during the earthquake.

Framework

In the last two years I focused on finding the vulnerabilities of hospitals which created malfunction and therefore reduced the quality and the speed of treating the patients. I studied many cases around the world, Algeria, Iran, Japan, Taiwan, Turkey, USA and others. The problems can be classified as *a) structural problems, b) lifeline and medical problems* and *c) management problems*. Strengthening structures was found to be the topic of interest of many researchers. Also lifelines and specifically water and gas supply are the topics that are considered in many studies. Among the same category, lifelines, emergency electric power, was not considered at least in any of the studies that we investigated. Electricity was the cause of service interruption in many cases around the world including Japan and even in recent earthquakes. Usually emergency power generators are being used in the case of emergency; these engines depend on water for their cooling systems and on oil to function. In many cases the generators could not be used because of damage to water pipelines and the limited amount of stored oil. Besides that, during their functioning they consume large amounts of water, pollute the environment, cause the facility extra expenses especially when the cost of oil is getting very high among other effects. To strengthen the response of electric power we proposed the use of a solar system. The study was a comparison between using both systems in the case of an emergency. We considered the case of Kanazawa University Hospital as it is a very large facility and it is located in a very low radiance area. The result showed that it is beneficial to use such technology. The other problem that was found is the damage to medical equipment due to the tremor. For that, we bought medical equipment to study its response. The equipment is a nurse's table mounted on wheels, given that the majority of the hospital equipments are mounted on wheels. Four sets of experiments were done; 1) the first on free wheels, 2) one wheel locked and three free, 3) two wheels locked and two free and 4) four wheels all locked. We vibrated the equipment with different types of waves, sinusoidal records of previous events. For the case of the sinusoidal waves we chose different frequencies to cover the majority of floors where the table may exist. Our first impression is that the four-free wheel case is the safest since the response is the lowest which makes any other equipment above it safe from falling. The results of tests are being under investigation to compare the theoretical results with experimental ones. More tests are planned to cover more cases.

Outcome of research

It is hoped that the research will give some suggestions to some of the problems found during our international investigations, also an estimation of the damage that a healthcare facility may go through following an earthquake.

Publications:

- Nebil Achour et al., Damage to Hospitals during the Bam, Iran, earthquake of December 26th 2003, Proceedings of 1st International Conference on Urban Disaster Reduction, Kobe, Japan, 2005.
- Nebil Achour et al., Lessons from the Bam Earthquake; Organization of Healthcare Facilities, Proceeding of the Conference of Geohazards: Natural Hazards and Methods of Confronting with them, Tabriz University, Iran, 2005.
- Nebil Achour et al., Damage Analysis of Health Care Facilities in the 2004 Niigata-ken Chuetsu Earthquake, Journal of Earthquake Engineering, JSCE, Vol. 28 (CD-ROM), 2005.
- Nebil Achour et al., Post Earthquake Lifeline Alternatives and Solar Panels (under review).