

**Note for Instructor**

For completion of this project, students, working in teams, should prepare a carefully researched, well-documented, in-depth paper on various aspects of earthquake disasters. They may choose from among topics suggested by the instructor, or they may propose one of their own.

## Earthquake Hazard Management – Term Project

### **Term Project:**

Your task will be to prepare a carefully researched, well-documented, in-depth paper on various aspects related to earthquake disasters. You may choose from among the topics listed below, or propose one of your own, provided it meets with the instructor's approval. Important elements of this assignment are as follows:

### **Teams:**

This project is to be completed by working in teams of three or four. You can organize into teams of your own choosing. For the most part, there should be only one team working on each topic listed below. It is expected that each will contribute equally to the information gathering, analysis, organization, and report preparation. The final report should be at least 25 pages in length in terms of text for teams of three and at least 30 pages for teams of four (does not include figures).

Because these reports are relatively short with respect to the number of people working on them (about 8 pages per person), it is especially important to be efficient in your work. That is, you should cover the work in a thorough and complete manner, but present the information in a succinct manner. **Teamwork is a very important part of this assignment**, and it is intended that you work together to develop the entire paper. **Do not simply divvy up sections of the paper and have each person independently write six pages and then merge the pieces into a single document.** That is, although it is anticipated that each team member will have a certain responsibility toward completing the paper, all aspects of the paper should be thoroughly discussed among all team members-- **the combined thoughts and perspectives from cooperative work and discussion among all members are important.** This approach allows a more seamless document and accomplishes the objective of working in a team environment. Finally, it is important that each person puts forth his or her best effort and does his or her fair share, as you each will be asked confidentially to grade the effort of your other team members.

### **The Task**

With respect to the topic you choose, please focus your review of information, analyses, conclusions, and recommendations on the following considerations (to the extent that they are applicable to your project):

- Development and defense of a position; e.g., with respect to a zoning law, a design loading condition, the cause of a failure, the prediction of an extreme event.
- Application of material, ideas, and methods from the class to the problem under study.
- Explanation of complex material so that it can be understood by all members of the class.

- Comparison of alternative explanations for what happened, alternative designs, different mitigation strategies, costs, etc.
- Policy issues involved in and/or raised by the disaster, the project, or the mitigation strategies.
- Incorporation of personal experiences, if relevant.

### **Learning Objectives**

This assignment has the following objectives:

- To provide opportunity to learn in more depth about various aspects of earthquake disasters and their effects, as well as earthquake mitigation, and recovery measures.
- To provide opportunity to improve written communication skills.
- To provide opportunity to work in a team environment
- To attain one or more of the objectives listed in the course syllabus.

### **Audience**

Write your paper so that it appeals to the other students in the class who, we assume, also will have an interest in the topic, but not the time to dig out and evaluate all the information that you can.

### **Sources**

You may use any information sources available to you, including the course instructors, handouts, other faculty, classmates, libraries, the Internet, engineering reports, etc. You must be very careful to properly acknowledge the sources of any information that is given to you. Cite references completely, i.e., author(s), title, journal, volume, issue number, date, page numbers, publisher (in the case of a book), Internet address.

Anything that you copy must be referenced as to source, and credit must be given. If you have any questions at all concerning proper use of other's written work, please see the instructor.

### **Format**

Please adhere to the following guidelines in preparation of your report:

- For the body of the paper, a minimum of 25 pages of text for groups of three, and 30 pages for four-person teams.
- Double spacing of text
- Type font size of 12 point, Times New Roman or Arial preferred. Single-sided text only.
- Include an informative abstract of about 250 words between the title/author block and the introduction.

- Include figures and tables at the end of your report. Be sure that they are called out properly in the text.
- Include a table of contents, lists of figures, and table captions after the title page
- Do not include appendices to the report, unless the information in them is essential to the meaning and value of the report (if the material is that important, it should probably be in the main body of the text).
- Your report should be bound, with a clear plastic cover over a title page.

### **Criteria for Evaluation**

Points will be assigned according to the following general scale:

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|--|-----|
| • Content                              | 25% |
| • Creative thinking and ideas          | 20% |
| • Lessons learned                      | 15% |
| • Clarity and effectiveness of writing | 20% |
| • Organization                         | 10% |
| • Appearance                           | 10% |

### **Topics**

Following are some **suggestions** of topics from which you may choose for your project. You do not have to select one of them, and it is not necessary that you focus your study only in the directions indicated. In fact, you are encouraged to expand or modify the scope of the suggested topics as you see fit. The items below are listed simply to illustrate the kind of issues that you may want to consider. The topics are unsorted with respect to their importance. These titles and descriptions are necessarily brief. For virtually all of them, it should be possible to summarize some lessons learned and to identify some implications for the future.

1. **Costs and Benefits of Earthquake Hazard Mitigation** – Select one of the following cases that are described in FEMA 331, *Protecting Business Operations*, August 1998. Contact the writers of the case studies (identified in the Acknowledgements section of the report) and/or the representative of the business, also identified in the Acknowledgements. Expand the write-up of the case you have chosen to include more detailed and specific information about what was done, including designs if appropriate. You may use information from other sources. For example, the Questar Corporation used base isolation systems, and you might want to learn about them so that you could give a fuller explanation in your report. The cases you may want to select from are: Bell South, Andritz, Inc., Hewlett-Packard Company, Checkers Drive-In Restaurants, Inc., Questar Corporation, and Kingsford Manufacturing.

Alternatively, you may wish to develop a report on more recent studies and case histories on the effectiveness of mitigation for earthquake hazards that are

becoming available. For instance, the Applied Technology Council was recently involved with such a study and might be a good first starting point for such research; see <http://www.atcouncil.org/>.

2. **Feasibility of Natural Hazard Insurance** – Some forms of natural hazard insurance are not available to individual homeowners. One idea is to create a general insurance fund that would cover damages from all forms of natural disasters, including earthquakes. The risk and associated cost would be spread out over many policyholders. Is this approach feasible? What are the primary issues that relate to this concept?
3. **Sustainability in Earthquake Hazards Mitigation** – A primary concern of FEMA and other government agencies relates to sustainable development. Mitigation activities must meet the needs of the present without compromising future generations. Thus, mitigation options must consider social, economic, and environmental issues. Discuss this principle and provide examples of application, etc.
4. **Lifelines** – their protection against and restoration after an earthquake. This study could focus on a specific type of lifeline. e.g., transportation system, water supply, electric transmission and distribution system, gas system, pipeline, communication system. It could focus on a particular community or region, leading to a plan.
5. **Geographical Information System (GIS) Applications in Earthquake Hazard Mitigation and Recovery** – How are GIS systems being used for earthquake hazard planning and mitigation?
6. **The Role of Technology in Earthquake Hazard Mitigation and Recovery** – What impacts are new technological developments, such as global communication systems, remote sensing technologies, and GPS/GIS systems, having in the field of natural hazard mitigation and recovery?
7. **Building performance in recent earthquakes** – Lessons were learned about many aspects of building performance in recent earthquakes, e.g., masonry buildings in the 1989 Loma Prieta earthquake; movement-resistant steel frame buildings in the 1994 Northridge earthquake; small framed houses with heavy roofs in the 1995 Kobe earthquake. What are these lessons? How have building codes been impacted? How is the post-earthquake condition of a damaged building assessed?
8. **Mitigation of seismic damage and retrofitting of structures (buildings, bridges, dams, etc.); and/or the actual performance of the retrofitted facilities in earthquakes.**

9. **Earthquake prediction** – Where do we stand? Is it possible? What is the scientific basis? What are the policy, political, and economic ramifications?
10. **Post-Earthquake Reconstruction and Retrofitting of Transportation Systems** – Transportation systems have become an integral necessity of today's metropolitan areas. Recent earthquakes, in particular the 1989 Loma Prieta Earthquake in the San Francisco Bay area, the 1994 Northridge Earthquake in the Los Angeles area, and the 1995 earthquake in Kobe, Japan, caused enormous damage to urban transportation infrastructure and great disruption of daily life. How did the responses in California and Japan compare? How we can design our transportation systems to minimize the delays and disruptions due to failed structures in the event of an earthquake?
11. **Performance of Bridges Under Earthquake Loading** – a comparative study of bridges in the Great Alaska (1964), San Fernando (1971), Loma Prieta (1989), Northridge (1994), and Kobe (1995) earthquakes, with emphasis on lessons learned for minimizing bridge failure risk in future earthquakes.
12. **Earthquakes versus Human-Induced (Terrorism) Hazards**– Case histories suggest that measures used to protect structures from earthquakes share many similarities with measures used to protect structure from terrorist-related activities, such as bomb blasts. For instance, a recent study by FEMA found that even minimal earthquake protection would have provided enough reinforcement to prevent the collapse of the Murrah Federal building in Oklahoma City following the bomb attack in 1995. What are the major similarities and differences in approaches for protection of infrastructure from these hazards? What impact, if any, does the current focus on protection from terrorism have upon earthquake mitigation efforts? Can these two approaches be integrated?
13. **The importance and impact of earthquake policy in earthquake hazard reduction** – What has been the impact of policies on the reduction of earthquake hazards worldwide? What studies have been conducted and what studies are needed?
14. **Differences in seismic risk between the eastern and western United States** – Both the seismic history and the nature of earthquakes that have affected the eastern and western U. S. differ. Why? What are the impacts on seismic preparedness?

**Note:** Again, these topics are only *suggestions*. You are not required to select one of them, and it is not necessary that you focus your study only in the directions indicated.