Disaster Preparedness for the Cultural Heritage

Projects of the Getty Conservation Institute
Marina Del Rey, California

ABSTRACT

DISASTER PREPAREDNESS FOR THE CULTURAL HERITAGE

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Since 1985, the GCI has been actively working in the field of disaster preparedness and response, to serve as an advocate for the protection of cultural property and to also develop practical solutions to technical problems faced by museums, historic structures, libraries, and other cultural institutions located in seismic zones.

Project activities have included advocacy at the national and international level and the publication of Sir Bernard Feilden's Between Two Earthquakes: Cultural Property in Seismic Zones (in English and Spanish). From 1988 - 90, technical studies were carried out with the J. Paul Getty Museum and the University of Southern California to test the methodology and effectiveness of various earthquake mitigation techniques employed to secure the collections at the Museum. A final research report is available from the GCI. Additional research is now underway on conservation and seismic strengthening techniques for historic Byzantine monuments located in the Macedonian region of Yugoslavia, and for adobe structures in the American Southwest. In Yugoslavia, the GCI is collaborating with the Institute of Earthquake Engineering and Engineering Seismology and the Republic Institute for Cultural Monuments. The adobe research is conducted under the guidance of an advisory committee composed of structural engineers, preservation and historic architects, adobe specialists, materials scientists, historic site managers, and representatives of state and national agencies.

Responding to the need for cultural institutions to receive emergency assistance after a catastrophic event, the GCI has piloted several emergency response missions in partnership with other agencies. These have included participation in the EERI's multidisciplinary response to the Loma Prieta Earthquake, and the National Academy of Sciences' response efforts following Hurricane Hugo. The GCI has also responded to individual disasters when possible, such as the Los Angeles Library fire, the Huntington Library fire, the Soviet Academy of Sciences Library fire in Leningrad, the fire at the Louisiana State Museum in New Orleans, and the flooding of the Carillo Gill Museum in Mexico City. Based on these experiences, the GCI is now working with a variety of agencies to develop strategies during the International Decade for Hazard Mitigation, with the objective of establishing mechanisms and resources to protect cultural property from the effects of disasters.

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Though it has long been recognized that disaster preparedness should be a priority within the cultural community, resources to protect irreplaceable property of historic or artistic value remain limited. Communication problems -- both within the conservation profession and between cultural institutions and disaster planning agencies -- and the absence of specific, easily-implemented recommendations have undermined the best of intentions. A lack of experience and cooperation among architects, engineers, urban planners, and cultural and civic authorities has led to fragmented and inadequate attempts to protect some of the most outstanding examples of our material cultural.

Since 1985, the Getty Conservation Institute has been actively working in the field of disaster preparedness and response, to serve as an advocate for the protection of cultural property and to also develop practical solutions to technical problems faced by museums, historic structures, libraries, and other cultural institutions in disastrous or emergency circumstances.

Initially, an international steering committee was established by the GCI to identify needs in the field, to help build bridges among disaster organizations and cultural agencies, and to develop projects to address the conservation needs of cultural property. Since those initial meetings, held from 1985 through 1987, the GCI has developed a variety of activities in the following areas:

- scientific research on conservation and seismic mitigation techniques and analysis;
- training in disaster preparedness for museum professionals;
- information exchange and publications;
- pilot emergency response missions; and
- advocacy at the national and international level

Scientific Research

Scientists and engineers have developed various methods for safeguarding objects in commercial and industrial buildings from earthquake-induced damage. Objects in museums, however, present experts with special problems: a wide variation in object characteristics that must be considered; the absence of usable guides that relate those characteristics to the probable failure mechanisms; and the need to balance the concerns for the objects' safety with the aesthetic values in their display -- that is, any modifications to the support or object must not interfere with its overall appearance. These considerable obstacles help explain why little has been done within museums to address systematically the problem of earthquake safety.

Located near a fault in a seismic region, the J. Paul Getty Museum began experimental work in the mid-1980's to develop systems for mounting, displaying, and storing works of art that would help ensure their survival in the event of an earthquake. In 1987, the University of Southern California (USC), the J. Paul Getty Museum, and the GCI began a two year research project to evaluate the effectiveness of these seismic damage mitigation measures. The results of the joint study, directed by Dr. M. S. Agbabian of USC's Department of Civil Engineering, provide a quantitative evaluation of the seismic damage mitigation methods developed and used for the support and protection of objects in the collection of the Museum. The resulting report provides general guidelines for use by the Museum for the design and application of basic seismic mitigation concepts for specific categories of objects.

The study was developed in response to the needs of museums to protect art objects in seismic areas, whether on display or in storage. The earthquake resistance of an object depends on the seismic risk of the building, the object's structural characteristics, and the methods used for its support. Any modifications to the object or support to increase resistance to the effects of earthquakes must not interfere with the overall physical appearance of the object itself. The research team took seismic response data on the Museum's building and a representative earthquake accelerogram, and then evaluated the performance of various damage mitigation measures. The study included an initial categorization of objects in the collection, and analytical and experimental studies of the behavior of these objects and their support systems when subjected to the representative earthquake environment.

Though art objects each have unique structural characteristics and supports, an attempt was made to develop an object database – categorized by material and geometric description, object type, support type, and probable earthquake response, taking into account any damage mitigation method in use– to develop a classification of generic objects and supports. Analytical

modeling and experimental tests were performed to determine the response behavior of the generic systems under simulated earthquake conditions. Individual objects and supports were then related to the generic systems using appropriate parameters.

In the experimental studies, potential effects of earthquakes of varying strengths on objects were determined by placing generic objects on a computer-controlled electromechanical shake table. The acceleration and displacement of the table was governed by the preprogrammed representative earthquake accelerogram. Computer programs were also used to analyze the effects of shaking on mathematical models of objects and supports. Object response categories that were modeled and studied included sliding, rocking, and overturning of rigid objects and flexible swinging objects. The behavior of base isolation systems was modeled for frictional, horizontal, and rotational isolation systems. With these data, investigators tested the effectiveness of the various damage mitigation methods that are in use and established guidelines for testing the effectiveness of methods in development.

Although the analyses and tests were directed specifically to the needs of the Getty Museum, the concepts and methodology used to determine the effectiveness of damage mitigation measures are applicable to other museums. The research report, available from the GCI's Scientific Research Program, provides analyses of specific objects in the Getty collection as well as general guidelines for museum professionals to evaluate the seismic vulnerability of other objects. In applying this information to the conservation needs of other collections, two important factors must be considered. First, objects are often unique so their physical properties may deviate from standard values found in reference works, and second, earthquake characteristics and ground and building responses vary and should be evaluated on a site-specific basis.

Because the GCI addresses the conservation needs of immovable as well as movable cultural property, studies are also being carried out of seismic strengthening techniques for historic architecture and monuments. The GCI, together with the Institute of Earthquake Engineering and Engineering Seismology and the Republic Institute for the Protection of Cultural Monuments, in Skopje, Yugoslavia, began a three year research program in 1990 to develop a scientific methodology for seismic strengthening and repair of Byzantine monuments in Macedonia.

The joint project includes condition surveys of selected Byzantine structures in the region, with the purpose of identifying architectural characteristics and materials that have contributed to the remarkable stability of the structures over the centuries, and developing appropriate strengthening techniques. Results of the study will be evaluated for potential field application to selected historic structures in Yugoslavia.

The Getty Seismic Adobe Project was begun in 1990 with the goal of addressing and balancing the needs for public safety with the effective and sensitive conservation of property of historic and cultural value. The goals of the project will be to develop and evaluate new methods to stabilize historic adobe structures that consider and maintain the historical and architectural fabric of the structures. The immense destructive potential of seismic events on the earthen architectural heritage has long been recognized as an important global concern. The Loma Prieta earthquake of October 17, 1989 in California dramatized the urgency of the need to strengthen some of the state's earliest architectural structures, such as the California missions and historic adobe monuments, to protect both life and property. Adobe structures dating from the state's Spanish Colonial and Mexican periods and similar monuments throughout Latin America are in locations designated as "Seismic Zone 4," areas with the highest vulnerability to a potentially catastrophic seismic event. The development of appropriate technology to protect the cultural heritage in earthquake zones has not kept pace with the heightened awareness of vulnerability. While tremendous progress has been made in securing modern buildings in recent years, historic adobe structures have been lost. The San Fernando Mission Church was demolished following the 1971 earthquake; the San Gabriel de los Tremblores Mission Church and the Pio Pico State Historic Monument both remain closed since the 1987 Whittier Narrows earthquake; and historic adobe monuments were severely damaged by the Loma Prieta earthquake.

Historically, the performance of adobe structures during earthquakes has been very poor, both in an absolute sense and when compared to other types of construction. The seismic behavior of adobe buildings is usually characterized by sudden and dramatic failure. The local or general collapse of structures is usually accompanied by a high likelihood of serious injuries and life loss. Although many adobes have been modified in the past to decrease their vulnerability, preservationists believe that current techniques for retrofitting historic adobe structures are too invasive.

Accordingly, this project has been established to develop technical procedures to improve the seismic performance of existing historic adobe structures. The project includes engineering tests of new retrofitting techniques that enhance the stability of adobe structures during an earthquake and that preserve the historic architectural value of the buildings. Experiments using shake table tests to evaluate the performances of the techniques are under study. Adobe sites in the southwestern United States will be selected for field testing at an appropriate time.

The project is being carried out under the guidance of an advisory committee composed of structural engineers, preservation and historical architects, specialists in adobe construction and restoration, materials scientists, historic site managers, and representatives of state and national

agencies concerned with the preservation of historic buildings in seismic zones.

Training in Disaster Preparedness

Incorporated into the GCI's annual courses dealing with preventive conservation methods and techniques is training for museum staff on disaster preparedness and response. Beginning in January 1992, the GCI and the Getty Museum will be offering a professional workshop for museum personnel on "Emergency Planning in Museums." The workshop will emphasize the role that top management plays in making emergency preparedness a priority within the museum, and in determining the institution's approach to planning for and responding to disasters. Both the GCI and the Getty Museum recognize that emergency planning is an integral aspect of preventive conservation and sound museum management.

Information Exchange

Through conferences, publications, and the Conservation Information Network, the GCI disseminates information internationally on topics related to disaster preparedness and response. In October 1988, the GCI released its award-winning publication, Between Two Earthquakes: Cultural Property in Seismic Zones, at the international meeting of ICOMOS in Washington, D.C. Since that time, the GCI has translated the publication into Spanish with the UNDP in Lima, Peru, for distribution throughout Latin America. The GCI is currently reviewing proposals for additional publications in this field.

In September 1990, the Library of the USSR Academy of Sciences (BAN), the Library of Congress, the German Friends of BAN, and the GCI jointly organized an international seminar devoted to "Conservation and Disaster Recovery: International Cooperation at the Library of the USSR Academy of Sciences," in Leningrad. Held in recognition that the conservation of the cultural heritage is a global concern to professionals of all nationalities, the seminar brought together conservators, engineers, librarians, and conservation scientists from the Republics of the USSR, Canada, Finland, Germany, Scotland, and the United States to review the recovery process that has occurred at BAN since the fire of February 1988 and to assess future directions. Over 200 participants exchanged information freely, providing the basis for continued international collaboration within the relevant professional fields.

The four-day seminar was organized to focus world attention on the importance and global significance of BAN'S holdings, to bring together

experts to review the recovery process, and to insure that the experience of BAN is made available to libraries in other parts of the world.

The seminar program included over forty presentations organized within the following topics: administrative and organizational issues in the recovery process; salvage of materials; biological and environmental control during recovery; restoration of collections; standards and ethics of library practices; environmental standards and phased conservation; and disaster preparedness for library and archival collections. All sessions included speakers from the Soviet Union and from other nations. The conference proceedings are being edited for publication.

GCI staff regularly participate in conference sessions of other organizations to underscore the need to include the cultural heritage in disaster programs. Through this on-going program of outreach, the GCI aims to continue bringing information to related professionals about the importance of protecting objects and monuments of historic or artistic value to society from the effects of catastrophic occurrences.

PILOT EMERGENCY MISSIONS

Since 1988, the GCI has been participating in selected emergency response missions, with the purpose of gaining experience in assisting the cultural community in these difficult moments. These response efforts have included collaboration with the National Academy of Sciences in response to the Armenian earthquake and Hurricane Hugo, and with the Earthquake Engineers Research Institute in response to the Loma Prieta earthquake. Additional missions have been organized to assist individual institutions hit by various disasters, including the Louisiana State Museum's fire in 1988; the Carillo Gil Museum's flood in 1987; and the aforementioned Soviet Academy of Sciences fire, also in 1988.

Building on these experiences, the GCI is now working with such groups as the National Institute for Conservation, the National Park Service, and the Federal Emergency Management Agency to develop a program to support and assist museums and other cultural agencies to develop better and more effective methods of protecting their collections and buildings from disasters.

ADVOCACY FOR THE PROTECTION OF THE CULTURAL HERITAGE

The GCI is dedicated to searching for new and better ways to preserve the world's artistic and historic treasures. This dedication, extending beyond research, training and documentation, embraces advocacy in the service of conservation.

Today, as conservation confronts growing needs and limited resources, difficult choices must be made. To preserve the best of our past requires the understanding and support of public and private agencies and individuals. The Institute seeks to educate policy-makers and the broader world community so that informed decisions can be made to protect our cultural inheritance, and to accept our shared responsibilities for its preservation.

All information resulting from projects undertaken by the GCI is available for use both by the field and by the public. Over the coming years, the GCI will be making a concerted effort to bring the results of its scientific research and experiences in information and training to the attention of an expanded audience, with the intent of creating a larger commitment and base of support for the need to protect the manmade environment.