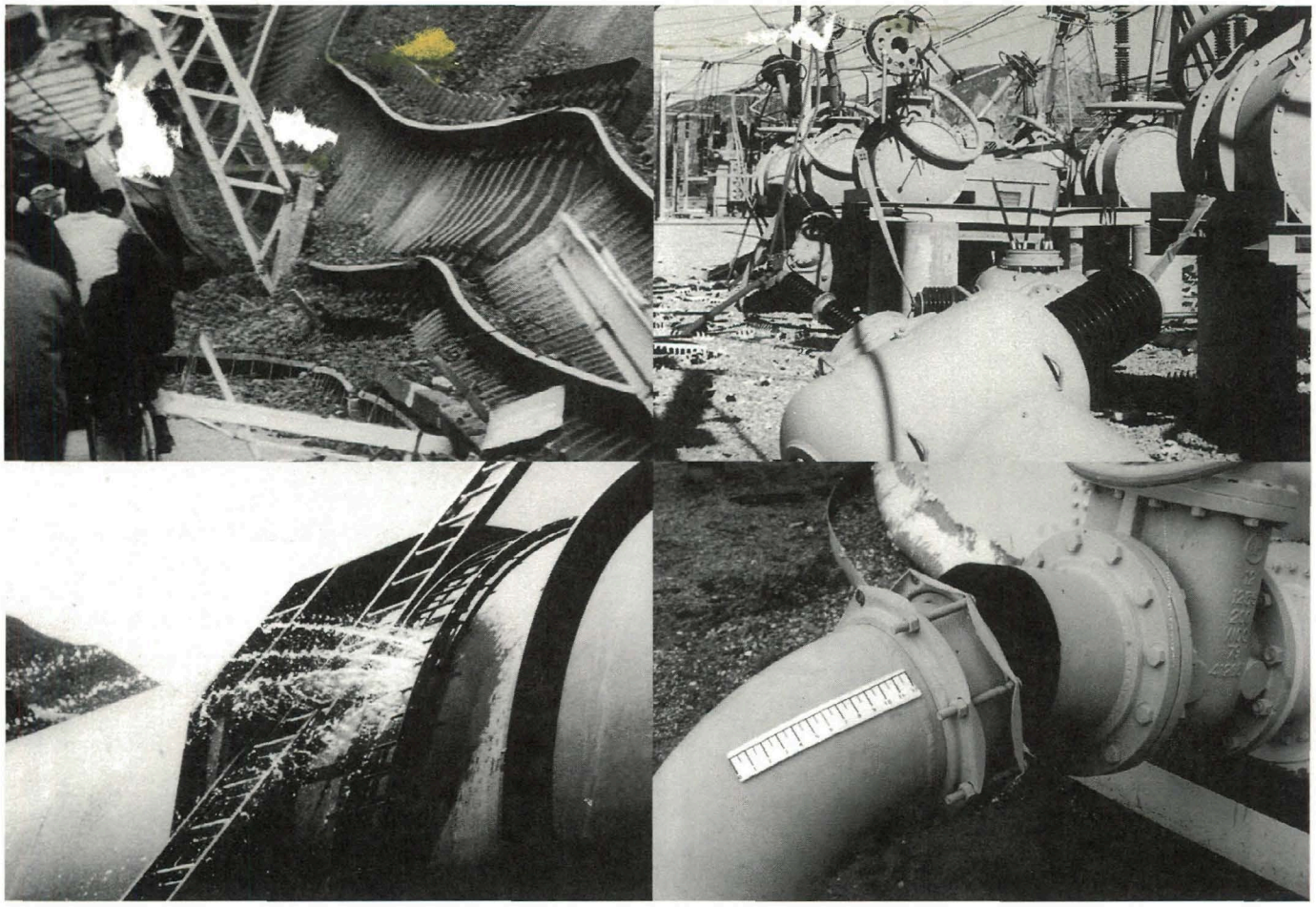
Guide to

POST-EARTHQUAKE INVESTIGATION OF LIFELINES

Edited by Anshel J. Schiff



Technical Council on Lifeline Earthquake Engineering
Monograph No. 11
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ASCE

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Abstract: The ASCE Technical Council on Lifeline Earthquake Engineering's Earthquake Investigations Committee has developed the second edition of this Guide to incorporate the lessons learned from the 1989 Loma Prieta, 1994 Northridge, and 1995 Kobe (Japan) earthquakes. New sections concerning additional lifelines and critical emergency response facilities have been added. Chapter organization has been standardized. The format has been changed from bound to unbound to permit ease of updating. Lifeline interdependencies are provided. Chapters 1 through 5 cover overviews, general and specific investigative preparations, general procedures for performing investigations, and discuss the effects of earthquakes. Chapters 6 through 23 are specific to lifelines, critical facilities, or those systems common to lifelines and critical facilities. Finally, checklists, report formats and writing tips, references, and publications are provided.

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FOREWORD FIRST EDITION

For a number of years, the post-earthquake investigation of lifelines was primarily directed at documenting the location and types of lifeline damage that occurred. As a result, the types of facilities and equipment that were vulnerable to earthquake damage were identified and certain patterns of damage started to emerge. While this provided a start to defining lifeline vulnerabilities, these investigations had several deficiencies. The formally organized investigations, particularly those in foreign countries, typically had one individual who was responsible for collecting all lifeline data. Considering the number and complexity of lifelines and the type of data that was needed, this was an impossible task for one individual. In addition to the type of facilities and equipment that were damaged and a count of each type, information was needed to advance the state-of-the-art of seismic design of facilities and equipment. Failure modes and factors contributing to them had to be identified. Also, the impacts of failures on system operations and the resources and time required to restore facilities was needed for utility emergency planning as well as for emergency response planning within the community. The expertise required for a post-earthquake investigator, even if only one lifeline was to be focused upon, is beyond what any individual within that lifeline would be expected to know. Knowledge of the entire system and its operation is needed as well as the operation, construction and design of system facilities and equipment. Finally, information on the response of the overall system, facilities and equipment to past earthquake should be known.

This training guide is an attempt to gather material to meet four primary objectives.

1. Provide information so that an investigator will be familiar with the overall operation of major lifeline systems.
2. Provide information so that the investigator will be familiar with the function and operation of lifeline facilities and equipment.
3. Provide information so that the investigator will be familiar with past seismic performance of the lifeline and its facilities and equipment.
4. Provide guidance for methods to gather pertinent information and a means for improving the process.

Anshel J. Schiff
May 1991

FOREWORD SECOND EDITION

Since the first guide was developed and issued, many lessons learned from the 1989 Loma Prieta, 1994 Northridge, and 1995 Kobe, Japan, earthquakes have been learned about the performance of lifelines in earthquakes and how to better conduct post-earthquake investigations. The new guide has added several new sections dealing with additional lifelines and critical emergency response facilities for which lifelines play an important role. New or greatly expanded lifeline material highways, railways, and transportation management have been included. Sections that are common to several lifelines and critical facilities that have been expanded or added include emergency power systems, hospitals, dams and locks, emergency operation centers, fire protection and rescue. The content of material in each of the lifeline chapters has been expanded, and reorganized. The organization of the material for each lifeline has been standardized, so that material will be easier to find. More information on the description and earthquake performance of lifeline equipment has been added. New sections have also been added that identify high priority information that is desired for each lifelines, the dependencies of each lifeline on other lifelines, and how other lifelines are dependent on a given lifeline. Finally, the format of the guide has been changed to a 8-1/2 inch by 11 inch page size so that picture formats can be larger and details will be easier to see. The guide is now produced in an unbound format so that as new information in gathered, parts of individual sections can be updated.

Anshel J. Schiff
May, 1997

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