SAC
Steel Project

Background Document

Implementation Issues for Improved Seismic Design Criteria: Report on the Social, Economic, Policy and Political Issues Workshop

Report No. SAC/BD-98/03

SAC Joint Venture
A partnership of
Structural Engineers Association of California (SEAOC)
Applied Technology Council (ATC)
California Universities for Research in Earthquake Engineering (CUREe)

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Submitted for distribution to
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DISCLAIMER

This document is one of a series documenting background information related to Phase II of the FEMA-funded SAC Steel Project. It is being disseminated in the public interest to increase awareness of the many factors which contribute to the seismic performance of steel moment frame structures. The information contained herein is not for design use and is not acceptable to specific building projects. This report has not been reviewed for accuracy, and the SAC Joint Venture has not verified any of the results presented. **No warranty is offered with regard to the recommendations contained herein, by the Federal Emergency Management Agency, the SAC Joint Venture, the individual joint venture partners, or the partner's directors, members or employees. These organizations and their employees do not assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any of the information, products or processes included in this publication. The reader is cautioned to review carefully the material presented herein and exercise independent judgment as to its suitability for application to specific engineering projects.** This publication has been prepared by the SAC Joint Venture with funding provided by the Federal Emergency Management Agency, under contract number EMW-95-C-4770.

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THE SAC JOINT VENTURE

SAC is a joint venture of the Structural Engineers Association of California (SEAOC), the Applied Technology Council (ATC), and California Universities for Research in Earthquake Engineering (CUREe), formed specifically to address both immediate and long-term needs related to solving performance problems with welded, steel moment-frame connections discovered following the 1994 Northridge earthquake. SEAOC is a professional organization composed of more than 3,000 practicing structural engineers in California. The volunteer efforts of SEAOC's members on various technical committees have been instrumental in the development of the earthquake design provisions contained in the *Uniform Building Code* and the 1997 *National Earthquake Hazards Reduction Program (NEHRP) Recommended Provisions for Seismic Regulations for New Buildings and other Structures*. ATC is a nonprofit corporation founded to develop structural engineering resources and applications to mitigate the effects of natural and other hazards on the built environment. Since its inception in the early 1970s, ATC has developed the technical basis for the current model national seismic design codes for buildings; the *de facto* national standard for postearthquake safety evaluation of buildings; nationally applicable guidelines and procedures for the identification, evaluation, and rehabilitation of seismically hazardous buildings; and other widely used procedures and data to improve structural engineering practice. CUREe is a nonprofit organization formed to promote and conduct research and educational activities related to earthquake hazard mitigation. CUREe's eight institutional members are the California Institute of Technology, Stanford University, the University of California at Berkeley, the University of California at Davis, the University of California at Irvine, the University of California at Los Angeles, the University of California at San Diego, and the University of Southern California. These laboratory, library, computer and faculty resources are among the most extensive in the United States. The SAC Joint Venture allows these three organizations to combine their extensive and unique resources, augmented by subcontractor universities and organizations from across the nation, into an integrated team of practitioners and researchers, uniquely qualified to solve problems related to the seismic performance of steel moment-frame buildings.

ACKNOWLEDGEMENTS

Funding for Phases I and II of the SAC Steel Program to Reduce the Earthquake Hazards of Steel Moment-Frame Structures was principally provided by the Federal Emergency Management Agency, with ten percent of the Phase I program funded by the State of California, Office of Emergency Services. Substantial additional support, in the form of donated materials, services, and data has been provided by a number of individual consulting engineers, inspectors, researchers, fabricators, materials suppliers and industry groups. Special efforts have been made to maintain a liaison with the engineering profession, researchers, the steel industry, fabricators, code-writing organizations and model code groups, building officials, insurance and risk-management groups, and federal and state agencies active in earthquake hazard mitigation efforts. SAC wishes to acknowledge the support and participation of each of the above groups, organizations and individuals. In particular, we wish to acknowledge the contributions provided by the American Institute of Steel Construction, the Lincoln Electric Company, the National Institute of Standards and Technology, the National Science Foundation, and the Structural Shape Producers Council. SAC also takes this opportunity to acknowledge the efforts of the project participants – the managers, investigators, writers, and editorial and production staff – whose work has contributed to the development of these documents. Finally, SAC extends special acknowledgement to Mr. Michael Mahoney, FEMA Project Officer, and Dr. Robert Hanson, FEMA Technical Advisor, for their continued support and contribution to the success of this effort.

PREFACE

The overall objective of the FEMA/SAC Phase II Project is to develop reliable, practical and cost-effective guidelines and standards of practice related to steel moment-resisting frame buildings. These products are to be used for the following:

1. The identification, inspection and rehabilitation of existing at -risk buildings prior to a damaging earthquake;

2. The identification, inspection and repair or upgrading of damaged buildings following an earthquake; and

3. The design and construction of new buildings.

Task 10 of the Project Work Plan provides for an assessment of the economic, social and political costs and other ramifications of these new guidelines and standards of practice. The specific task objectives are to accomplish the following:

1. Assess the economic, social and political costs and ramifications of the Seismic Design Criteria;

2. Use these assessments in the development of the project work products to reduce barriers that otherwise might discourage implementation; and

3. Identify actions that should be undertaken by the Project, and or an optional additional year, to facilitate implementation of the Seismic Design Criteria.

This report responds to Task 10.08 of the Project Work Plan which calls for a report on barriers to effective implementation. The task, this report, the background papers contained in this report and the workshop documented in this report share a simple premise: By raising and discussing policy, economic, legal, social, administrative and political issues and the concerns of representative stakeholders (owners, tenants, insurers, lenders, building officials, designers and constructors), the guideline writers – and project management – will be better able to anticipate and evaluate significant issues and concerns and address them when drafting the guidelines.

Summary

Implementation of the SAC Project Guidelines and other materials will be determined by stakeholders whose policy, economic, legal, social, administrative and political concerns should be considered by the SAC Project guideline writers and Project management. This report, the points it raises and its findings are intended to help the SAC Project leadership anticipate, evaluate and respond to these concerns when drafting and revising Project materials.

A workshop involving members of the Social, Economic and Policy Panel (SEPP), guideline writers and Project Management Committee was held in conjunction with the Project Oversight Committee. These persons are responsible for the contents and form of the SAC Project materials. Prior to the workshop, ten background papers (see Section III) were given to workshop participants. Breakout sessions focusing on guidelines for new and existing buildings and buildings damaged by earthquakes are summarized in Section IV. Plenary discussions addressed the major issues. Section II provides a summary of the issues raised at the workshop.

Guideline implementation will be enhanced by incorporating the following points:

- Describe expected performance of buildings quantitatively with probabilities and levels of uncertainty.
- Use both advisory and prescriptive language as necessary.
- Be clear and easy to read, but not simplistic. The Guidelines should be written so stakeholders can glean the concepts needed to make their decisions.
- Include a clear statement regarding the vulnerability of steel moment-resisting frame buildings relative to other structural systems and materials.

Communicating effectively with a number of stakeholder groups, many of whom are not trained in structural engineering or the related specialty areas, will enhance implementation. Because project materials are intended for technically proficient users, brochures and other audience-appropriate materials relative to the public safety, engineering and business decisions attendant to implementation are needed to provide the following:

- An overview document for general audiences explaining the Guidelines and its concepts and providing a perspective regarding the performance of steel moment frame buildings relative to buildings with other systems and materials.
- Audience-specific explanatory materials focusing on specific concerns. For example, brochures explaining how decisions can be made regarding the acceptability of risk for individual buildings or for public policy decisions.
- Materials from which owners can understand and apply the concepts in the Guidelines and discuss them with their engineers.

Many of the concepts contained in the guidelines are at the state of the art and many members of critical stakeholder groups, including structural engineers, will not understand them, or appreciate their importance without focused training. These parties must be able to explain and discuss the concepts with non technical owners and other stakeholders.

- Probabilistic descriptions of building performance. Materials should describe performance in quantitative terms meaningful to owners and other stakeholders. Materials that describe post-earthquake conditions and consequences might be helpful.
- Implications for lenders and insurers should be discussed in separate publications on probable maximum loss (PML), acceptable risk, performance and underwriting procedures.
- Building performance involves non-structural elements and utility services beyond the control of structural engineers. The importance of these elements, and responsibility for

achieving desired performance should be discussed in the Guideline's commentary and other audience specific materials.

The Guidelines will allow for owners and their engineers to select performance objectives consistent with their needs and resources:

- A matrix would be a good way to display the range of choices available.
- Materials are needed to help design engineers discuss the expected uses and performance expectations and explain the concepts and limitations to building owners. Unless there are materials for the dialogue, critical communications will be inadequate.

The Guidelines address matters of quality control and quality assurance because the materials and practices used are essential to achieving buildings that perform as desired:

- The Guidelines should encourage improved quality in construction and fabrication, certification of fabricator quality control, and improved oversight by local building officials. Quality welding, quality control and quality assurance are needed, and the level of one depends on the level of the other.

A number of areas of potential liability were discussed, including the SAC Joint Venture and users of the SAC products. Liability and responsibility are intertwined and SAC is responsible for its products. There is a potential for liability and lawsuits cannot be prevented, but measures can be taken to minimize the risk of liability. Five steps can be taken to manage the liability exposure of the SAC Joint Venture and participants in the SAC Project. If the steps are followed and the results properly presented, the liability risks to members of the SAC Joint Venture should not be inappropriate. The steps are the following:

1. Every one involved in the Project should be covered by an insurance policy;
2. The Project should use consensus procedures for reaching decisions;
3. The Project should be completed in the way FEMA requires it to be done to qualify for consideration under the government purpose doctrine (somewhat akin to government immunity); and
4. The SAC Project and its participants should confine activities to legitimate conduct under the umbrella of the SAC Project;
5. Legal counsel should review all final products before they are published.

Including prequalified beam-column connections derived from limited testing of different combinations of materials, sizes, configurations and welding practices in the Guidelines may create liability for SAC. Therefore, the Guidelines should define the applicability of each beam-column connection or include procedures for prequalifying future connections, and state that applications are limited to those situations where appropriate testing has been performed.

Conclusion

The background reports and workshop discussions presented in this report cover a wide range of issues of interest to the stakeholders who ultimately will determine how well the SAC Project Guidelines and other materials improve the earthquake performance of steel moment-resisting frame buildings. Because there are few "right" answers, there was no attempt to reach a consensus on specific measures SAC should incorporate. The prospects for successful implementation of the Guidelines and other materials will be improved if the guideline writers and SAC Project decision makers consider the issues in this report and use their best judgment on how to respond.

Acknowledgments

The Social, Economic and Policy Panel (SEPP) members deserve recognition for their thoughtful approach to planning the workshop summarized in this report, for writing the background papers that make up Section III, and most of all, for actively participating in the two day workshop. While the SAC Project reimburses Panel members for expenses and provides a small amount of remuneration, each of the panelists has voluntarily chosen to give time, energy and expertise to contribute to the successful conclusion of the SAC Project and a workable approach to finding and implementing sound engineering practices in the broader context of the social, economic, legal and political world we enjoy. The SEPP Panel members are Karl Deppe, Eugene Lecomte, James Madison, Alan Merson, Joanne Nigg, William Petak, Martha Cox-Nitikman, Francine Rabinovitz, Dennis Randall, David Ratterman and Stephen Toth.

The Project Management Committee (PMC) has championed the idea that the SAC Project cannot focus solely on the materials, connection techniques and physics of steel moment frame buildings, but also must consider the broader social issues that affect implementation. The PMC supported the idea of a workshop, participated in it sessions and will use their view of the issues to guide them as they exercise their judgment regarding the style and content of the SAC Guidelines and other SAC Project documents. The PMC members are Ronald Hamburger, William Holmes, Stephen Mahin, James Malley, Chris Rojahn and Robin Shepherd.

The Project Oversight Committee (POC) and its chair, William Hall, has been steadfast in its support for considering the social, economic, legal, policy and political issues that affect implementation of the SAC Guidelines. These issues are discussed frequently at POC meetings. The workshop described in this report was held as part of a POC meeting so POC members could actively participate. POC member John Wiggins applies his considerable experience in the policy arena and consistently assures that related issues are addressed. The POC's ongoing concern for these issues provides the emphasis needed at the highest levels of the SAC Project. POC members are Shirín Ader, John Barsom, Roger Ferch, Theodore Galambos, John Gross, William Hall, James Harris, Richard Holguin, Nestor Iwankiw, Roy Johnston, Duane Miller, John Theiss, Charles Thornton and John Wiggins.

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