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# POST-NORTHRIDGE RESEARCH EFFORTS TO IMPROVE STEEL FRAME BUILDING PERFORMANCE

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## ABSTRACT

The 1994 Northridge earthquake caused extensive and severe damage to a large number of welded steel moment resisting frame buildings that was largely unexpected by the structural engineering community. Both practicing engineers and researchers have expended a tremendous amount of effort since the earthquake in an attempt to better understand the causes of the damage, to determine how to effectively repair the damage, and to develop improved design procedures and connection details that will result in better performance in future earthquakes.

With funding provided by FEMA and the California Office of Emergency Services, the major effort in response to the Northridge earthquake steel building damage has been made by the SAC Joint Venture. The first phase of the SAC Steel Project included a major data collection and evaluation effort and a series of preliminary analytical and experimental investigations. These studies were done, in order to develop information related to the inspection, evaluation, repair and design of these structures, and have led to significant advances to our understanding of the potential performance of so called "pre-Northridge" steel moment connections in future events, the accuracy (or lack thereof) of presently available analytical techniques in the prediction of damage distribution on either a global or local basis, the effect of various ground motion parameters on frame performance, and the expected performance of repaired and/or modified connections. This work culminated with the publication of FEMA document 267, "Interim Guidelines: Evaluation, Repair, Modification and Design of Welded Steel Moment Frame Structures" in September of 1995. FEMA has recently funded the SAC Joint Venture for a second phase of work that is intended to develop long-term solutions and standards of practice for the design and evaluation of steel moment resisting frame buildings over the next three years.

A number of other efforts, both privately and publicly funded, are also adding significantly to the rapidly expanding experimental and analytical data that has been generated since the Northridge earthquake. The SAC Steel Project, in coordination with these and many other investigations, will undoubtedly result in significant research developments that will lead to advances in the seismic design and construction of steel frame buildings. But, because there is still so much to be learned, the coordination and cooperation that has occurred during the two years since the Northridge earthquake must continue, if long-term solutions to this problem are to be realized.

## KEYWORDS

Northridge Earthquake, steel moment frames, connections, damage, research.