Description of Work

ASSESS PAST PERFORMANCE OF STEEL BUILDINGS

Subtask 3.1.3 Evaluation of Inspection Reliability and Identification of W1a Damage

Background: It is the purpose of Task 3.1.1 to collect general data on buildings inspected under the Los Angeles Inspection Ordinance. This task is part of Task 3, whose goal is to document and assess the performance of welded steel moment frame buildings (WSMF) in past earthquakes and to provide means to evaluate and predict impacts in future earthquakes.

During SAC Phase 1, an extensive data base was developed that characterized the specific inspection results of buildings, focusing on damaged buildings. It was exploratory in nature and thereby incomplete for analysis purposes. Task 3 of SAC Phase 2 will supplement, and in some cases replace, this data set to provide statistically consistent, reliably characterized data that will allow the formulation of predictive models for damageability and economic impact for specific buildings and groups of buildings, evaluation of the efficacy of current procedures for the inspection and evaluation of building conditions, based on Chapter 3 and 4 of the 1995 SAC Guidelines, and assessment of the impacts on the provision of repair related services within a community. The task will collect five distinct types of data: 1) general data for all of the buildings subject to the Los Angeles Municipal inspection ordinance; 2) specific engineering data for selected buildings that is as complete as practical; 3) data addressing the nature and reliability of the inspection process; 4) identification and documentation of damage to WSMF connections in other earthquakes; and, 5) documentation and characterization of the impacts of WSMF damage on selected construction service providers, financial institutions, and regulatory agencies.

Task 3.1.3 will collect information of the inspection of a selected few buildings where the building had multiple inspections to determine whether the results of the separate inspections can be reconciled. This will lead to recommendations for the conduct of such inspections and the characterization of the results of such inspections. Collaterally, it will address the issue of whether a W1a damage index (as defined in the SAC Phase 1 *Interim Guidelines*) indicates a prior condition or is possibly earthquake-induced damage.

Prior to selection of specific buildings for analysis or investigation, there will be a review to determine if there are technical, legal or procedural reasons not to consider the specific building or conditions. The selection of specific buildings will be made after consultation with the Task Coordinator of the Performance of Steel Buildings in Past Earthquakes and the Project Director for Topical Investigations. All data collected from specific buildings will be kept confidential in line with the practices established in SAC Phase 1.

Objectives

Objective 1: Participate in the overall conduct of the Task as a member of the team on Past Perfor-

mance of Steel Buildings in Earthquakes. Participate in the formulation of the Task work plan, and contribute to the determination of what questions are to be answered in subsequent Task 3 efforts using the information gathered by Task 3.1 efforts. The investigators will make themselves available for participation in Task 3.2, which will use the data and information collected to formulate impact models and assessment procedures.

Objective 2: Attend project team meetings. Review and comment on material prepared by other SAC task team members, responding to review comments in a timely manner. Each task will draw information from, and provide information to each of the other efforts under Task 3.1 as well as other activities outside of the Past Performance area.

Objective 3: Prepare written documentation of investigation methods and detailed findings for incorporation into the Task report; incorporate review comments from others as appropriate. Provide timely review of summary Task documents that describe and include results, data, and findings from the work completed under this sub-task. Fully document data collected by providing copies of all interview and record forms, and provide SAC with copies of all computer files and data bases developed. Where so committed to the providers, all data collected will be kept confidential in line with the practice established in SAC Phase 1.

Objective 4: Consistently characterize the frequency and distribution of W1's and other reported steel frame damage. This activity consists primarily of an in-depth evaluation of the largest unbiased data set available — the steel frame inspection reports filed in fulfillment of City of Los Angeles Ordinance #170406, in cooperation with the data collected in Tasks 3.1.1 and 3.1.2. The intent of the summary is to address the following questions:

a. What is the population of inspected buildings for which only W1's or no damage was found?
b. What is the population of buildings with damage other than W1's?
c. What is the population of buildings for which a significant number of non-W1-type damage was found?
d. How are these buildings distributed geographically?
e. Is there a directional or height based component to these data?

Objective 6: Assess and evaluate information collected on the occurrence of W1-style damage as part of completed inspection and repair programs.

a. Access and review data obtained via destructive investigation of W1's. There has been a limited amount of destructive investigation of the occurrence of W1's in buildings damaged in Northridge. Such investigations have included destructive sampling of flanges with reported W1-type conditions for laboratory microscopic evaluation, as well as W1's that have been examined in-situ subsequent to removal of the weld backing bar, although the latter category of investigation is considered to be inherently less reliable.
b. Access and catalogue the inventory of fracture specimens stored by various firms (primarily W3 type through-flange fractures) to define the frequency with which W1-type root defects can be observed within these specimens. To the extent possible, this phase of study will differentiate between specimens obtained from buildings that were 100% ultra-

sonically inspected during construction and those that were not.

c. Identify and study inspection reports from buildings that did not experience strong earthquake ground motion but were subjected to post-Northridge style earthquake damage inspection.

d. Identify a few connections that are scheduled for demolition, retrofit, or other major repair work and generate recommendations for removal of W1 occurrences for microscopic evaluation. This is the most direct way to obtain unequivocal information about W1-type conditions. The tests themselves are not within scope for performance by this task.

Objective 5: Assess typical UT inspection processes and procedures. Review test reports from comparative ultrasonic inspections of a building in the Los Angeles area utilizing scans from FACE A in accordance with standard inspection practice during construction and using scans from FACE B and FACE C in accordance with common post-earthquake damage inspections. Conduct interviews with UT inspectors in the Los Angeles area to define the state of inspection practices pre-Northridge and the difference between construction-related UT inspection and post-earthquake damage survey UT. Experience suggests that these different scanning techniques are largely responsible for the widespread reporting of a significant number of root defects in previously inspected buildings. Test reports might also become available from test specimens being fabricated during other SAC studies that are deliberately inspected in this fashion. Whether or not reports are available, diagramming of various connection configurations will be performed to define which scanning positions can be used to reliably inspect the weld root. Experience also suggests that inspection practice during construction before Northridge was sharply affected by lack of access, the realities of production welding schedules, limitations on the budget for inspection, the dynamics of the relationship between welding contractors and inspectors, and job-security considerations on the part of UT technicians.

Objective 6: Study buildings that were subjected to two or more separate post-earthquake inspections, at least one of which was complete or nearly complete to determine the consistency of results and the degree of or possible causes of disagreement. At least four buildings will be investigated. Four candidates for study are:

a. 3-story building in San Fernando Valley

b. 6-story building in Santa Monica

c. a complex of four 6-story buildings

d. 10-story building in San Fernando Valley

Each of these illustrate particular areas in which the SAC Interim Guidelines, and the state of the practice in general, could be improved. Other buildings may be substituted in lieu of the above should other Task 3 efforts identify buildings of particular significance or preference.

Deliverables: The primary products of this investigation will be the collected data and associated interpretations, synthesized in a final report. All interview and record forms, inspection reports, and computerized catalogs and databases shall be made available to SAC at the time the draft report is submitted. Any computerized information should be in a format which can be converted to on-line format for distribution on the World Wide Web. The confidentiality of all such informa-

tion will be maintained in accordance with procedures adopted in Phase 1 of the SAC project. The final report shall summarize significant findings of the data collection and evaluation process, as well as identifying additional issues which may be addressed in follow-up studies under Task 3.2. Significant results of this study will also be incorporated into the State-of-the-Art Report on the Performance of Steel Buildings in Past Earthquakes. Interim reports will be required to update the Task Coordinator and SAC management on progress.

Task Management and Review: This subtask is supervised by James Malley, Project Director for Topical Investigations. The members of the team investigating the Performance of Steel Buildings in Past Earthquakes will provide oversight and an advisory role on the conduct of the research and will review, provide specific comments and evaluate all reports and recommendations. Team Leaders and selected members of the Materials and Fracture TAP, the Joining and Inspection TAP, and the Connection Performance TAP will also review and evaluate this work. It is expected that the subcontractor/consultant selected for this subtask will be responsive to issues and concerns raised by the Project Director, the Task Coordinator for Performance of Steel Buildings in Past Earthquakes, and other reviewers. The subcontractor shall be responsible for regularly reporting progress and difficulties to the Past Performance Task Coordinator and the Project Director for Topical Investigations.

Target Audience: The work products of this subtask will be directly used by the Joining and Inspection team and the guideline writers working on the SAC Phase 2 project. There will also be a need to integrate these results with the various other investigations throughout the progress of the program. They will also be of interest to Topical Investigation Team Leaders for Materials and Fracture, Joining and Inspection, and Connection Performance. The results of this sub-task will be used to develop the State-of-the-Art Report on Performance of Steel Buildings in Past Earthquakes. It is expected that the results will also be of great interest to the general profession and research community.