SUPPLEMENTING ASCE-41 WITH COMPONENT TESTING AND SOIL MODELING

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Abstract:

Performance-based seismic rehabilitation for structures subject to strong ground motion has been gaining major attention in the last few years. ASCE/SEI Standard 41-06 is the latest generation of performance-based seismic rehabilitation methodology.

This paper presents the application of nonlinear analysis techniques for the performance-based seismic retrofit of two existing hospital buildings in California. Both buildings are perforated concrete shear wall structures that were built before the 1970's. Nonlinear static pushover analyses using the displacement coefficient method, as described in FEMA 356, were used to evaluate the seismic performance of the existing buildings.

From the existing structural drawings and field verifications, it was determined that most of the existing horizontal wall segments (spandrels) have a vertical groove at the middle of their span. Furthermore, at these "weakened plane joints" a significant portion of the horizontal reinforcing was cut at the time of construction. Extensive component testing was conducted at the structural laboratory of the Department of Civil Engineering at UCLA for various shear wall segment conditions including the wall segments with "Weakened plane joints". Nonlinear modeling of the primary shear wall elements for the building was based upon the testing results as well as nonlinear shear load-deformation relationships as defined in FEMA 356.

In this investigation, nonlinear modeling of the soil supports was also included to explicitly take into account the soil-structure interaction of the system.

Seismic retrofits based on the pushover analyses were proposed and the results showed that the life-safety target performance of the upgraded buildings was achieved.

This investigation supplemented current ASCE-41 with shear wall component testing as well as nonlinear soil modeling for performance-based procedure.