

COMPARISON OF THE INELASTIC RESPONSE OF STEEL BUILDING  
FRAMES TO STRONG EARTHQUAKE AND UNDERGROUND NUCLEAR  
EXPLOSION GROUND MOTION

by

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SYNOPSIS

Analytic studies have been made into the adequacy of simulating earthquake effects at the U.S. Energy Research and Development Administration's Nevada Test Site for structural testing purposes.

An earlier study<sup>1</sup> concluded that ground motion characteristics produced by strong earthquakes and those by underground nuclear explosives routinely detonated at the Nevada Test Site are very comparable. This study compares the inelastic response of steel structures.<sup>2</sup> A five-story, one-bay and a ten-story, one-bay building frame designed in accordance with the Uniform Building Code were considered. The structures were subjected to ground motions from four strong earthquakes and three typical underground nuclear explosions. The dynamic time-dependent response of the structures was calculated with an inelastic two-dimensional computer program. Measured accelerograms were used as the input excitation. Comparisons of maximum ductility ratio, maximum displacement, and maximum story drift indicated that the structural behavior is comparable for both types of ground excitation.

It is concluded that underground nuclear explosion ground motion will produce inelastic behavior and damage comparable to that produced by strong earthquakes. The generally longer duration of earthquakes compared with underground nuclear explosions does not appear to significantly affect the structural behavior of the building frames considered. A comparison of maximum ductility ratios, maximum story drifts, and maximum displacement indicate similar structural behavior for both types of ground motion. Low yield (10 - kt) underground nuclear explosions are capable of producing inelastic behavior in large structures. Ground motion produced by underground nuclear explosions can produce inelastic earthquake-like effects in large structures and could be used for testing large structures in the inelastic response regime. The Nevada Test Site is a feasible earthquake simulator for testing large structures.

REFERENCE

1. Bernreuter, D. L. and Tokarz, F. J., "Providing an Earthquake-Like Environment for Testing Full-Scale Structures by Using the Ground Motion from Underground Nuclear Tests," 5th World Conference of Earthquake Engineering, Rome, Vol. I, Paper 25, June 1973.
2. Murray, R. C. and Tokarz, F. J., Inelastic Response of Steel Frames to Seismic Motion, Lawrence Livermore Laboratory Report, UCRL-75154, June 7, 1974.

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