PERIOD RELATIONSHIPS FROM INSTRUMENTED BUILDINGS IN THE 1971 SAN FERNANDO EARTHQUAKE

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Empirical building period formulas used in current codes are based primarily upon ambient vibration surveys performed by the U.S. GEological Survey on West Coast type construction during the 1930's and 1940's. Current construction practices have turned, for economic reasons, to light weight floor and wall systems, which do not possess the same high degree of structural and nonstructural stiffness as found in the earlier forms of construction. Furthermore, ambient vibration data has been found to underestimate the natural period of structural vibration for most types of structural framing systems during large earthquake response.

Modern building codes are being refined to more closely represent the dynamic response of a building to earthquakes, however, the design force used is sensitive to the estimation of the true building period for strong motion. Verification of the structural design could be made on the completed structure provided a relationship between ambient natural period and a strong motion period could be reliably determined. Following is a preliminary determination of this relationship.

θ = Ambient Building Period/Earthquake Building Period

STRUCTURAL SYSTEM	* Pre-ambient		* Post ambient		** Pre-ambient		** Post ambient	
	No.	$\bar{\theta}$ s	No.	$\bar{\theta}$ s	No.	$\bar{\theta}$ s	No.	$\bar{\theta}$ s
Shearwall	12	0.73 0.14	16	0.83 0.14	10	0.79 0.06	13	0.86 0.07
Concrete Frame	18	0.59 0.10	20	0.72 0.09	15	0.58 0.07	16	0.73 0.05
Steel Frame	15	0.70 0.07	32	0.78 0.07	11	0.71 0.04	23	0.78 0.05
	* All data points included				** Inconsistent points deleted			

$\bar{\theta}$ = Mean s = standard deviation

Building parameters from 60 buildings having strong motion records from the 1971 San Fernando earthquake are being assembled (about 70% complete). These parameters are being taken from original structural design drawings and include such data as construction materials, structural systems, building geometry, building density, mass distribution, etc. These parameters are being evaluated for significant relationships to ambient and strong motion periods. A detailed report will be presented on this evaluation in a future paper.

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