# Site Category and Region Specific Attenuation Relations for Los Angeles

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## Abstract

The objective of this project is to evaluate how much amplification of ground motion occurs at a surface site where an engineering structure is located relative to the seismic motion incident upon the basement rock beneath the site. To accomplish this objective, we compared the coda amplification factor with the S-wave site amplification using nine aftershocks of the 1994 Northridge earthquake. We found that the average value of amplitude ratio for coda waves show good agreement with averaged S-wave amplitude spectral ratios for all three component. The result for the coda waves, however, shows much less scattering at each frequency supporting the earlier finding by Tsujiura (1978).

A method for correcting the coda amplification factor for the non-linear effect has been applied successfully using the strong motion data from the Landers earthquake of 1992 and the Loma Prieta earthquake of 1989 (Aki and Chin, 1994). The nonlinear site response is taken into account by using a simple attenuation factor of the form $\exp(-\alpha f)$. The predicted response spectra matched the observations, suggesting that a site-specific response spectra for future earthquake could be obtained by using source parameters and knowing the coda amplification factors to determine the nonlinear response of the site. In this study, we found that our procedure of correction for the nonlinear site effect gives satisfactory agreement with observations during the 1994 Northridge earthquake.

In this study, we also demonstrate the nonlinear effect without using the coda amplification factor. The Loma Prieta earthquake data supported a universal relation between the surface PGA and the basement PGA applicable to most soil sites. We found, however, that the same relation does not apply to the Northridge earthquake data. We developed a new universal curve derived from a downtown Los Angeles site TAH using 1-D nonlinear analysis. One-dimensional nonlinear site response analysis has been used to modify three selected time histories to reflect representative site soil condition. A non-linear explicit finite difference program DETRAN which is a modified version of the program NONLI3 (Joyner and Chen, 1975) has been used to calculate the nonlinear site response.