# PERFORMANCE-BASED SEISMIC RESPONSE OF BURIED STEEL PIPELINSE

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## ABSTRACT

Performance-Based Earthquake Engineering (PBEE) has appeared as a basis of modern earthquake engineering as it attempts to improve deciding about seismic risk by methods that are more informative than current approaches. However, little work has been carried out investigating the seismic response of buried steel pipelines within a performance-based framework. In this research the seismic demands of buried steel pipelines are studied in a performance-based context. Several nonlinear dynamic analyses of four buried steel pipe models with different D/t, H/Dratios and different soil properties and different pressures, performed under an ensemble offar-field earthquake ground motion records were scaled to several intensity levels to capture the behavior of buried pipeline from elastic response through to global instability. Several scalar ground motion intensity measures (IMs) are used to investigate their correlation with engineering demand parameter (EDP) which is measured by peak axial compressive strain in critical section of pipe. Using regression analysis it is concluded that, velocity-based IMs are the most appropriate ones in evaluating the buried steel pipelines response efficiently.

## INTRODUCTION

Seismic demand estimation is one of the main aspects of Performance-based seismic design (PBSD), or performance-based earthquake engineering (PBEE) as some have selected that name (Moehle and Deierlein, 2004). Uncertainties in the earthquake ground motions as well as uncertainties in the nonlinear behaviour of structures are the major challenges in assessing seismic demands, thus probabilistic seismic demand analysis (PSDA) is utilizedto such a framework (Luco, 2002). PSDA is applied as a tool to evaluate the mean annual frequency of exceeding a particular value of an engineering demand parameter.

Probabilistic evaluation of performance has been applied in the SAC project for steel buildings (FEMA, 2000), but the method may be applied for any type of investigated structures including buried steel pipelines. Incremental Dynamic Analysis (IDA) is an appropriate method for meeting these needs. In this parametric analysis method a structural model is subjected to an ensemble of earthquake records, each scaled to multiple intensity levels, to obtain response of structure from elasticity to final failure (Vamvatsikos and Cornell, 2002). Finally, IDA curves can be generated. The IDA curve is a graph of an Engineering Demand Parameter (EDP) versus an Intensity Measure. Eliminating of the uncertainties in performance-based design framework is performed by using of Intensity Measure. Considerable research has been conducted on specifying IMs which efficiently estimate structural response due to seismic excitation (e.g. Shome and Cornell, 1999; Baker and Cornell, 2005).

In this paper the performance-based response of buried steel pipelines is examined. Nonlinear dynamic