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MODAL PUSHOVER ANALYSIS AS A MEANS FOR THE SEISMIC ASSESSMENT OF BRIDGE STRUCTURES

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ABSTRACT

Nonlinear static (pushover) analysis has become a popular tool during the last decade for the assessment of buildings. Nevertheless, its main advantage of lower computational cost compared to nonlinear dynamic time-history analysis is balanced by the inherent restriction that essentially only the fundamental mode is utilized. Extension of the pushover approach to consider higher modes effects has attracted attention, the effort being to match as closely as possible the results of nonlinear time history analysis. So far such work has primarily focused on buildings, while corresponding work for bridges has been very limited. Hence, the aim of this study is to investigate the extension of the modal pushover method to bridges, and the investigation of its applicability in the case of complex bridges. To this effect, a real, long and curved bridge is chosen, designed according to current seismic codes; this bridge is assessed using the aforementioned three nonlinear analysis methods. Comparative evaluation of the calculated response of the bridge illustrates the applicability and potential of the modal pushover method for bridges, and quantifies its relative accuracy compared to that obtained through the 'standard' pushover approach.

INTRODUCTION

Although elastic analysis provides a useful overview of the expected dynamic response of a bridge, in general it cannot predict the failure mechanisms or the redistribution of forces that follow plastic hinge development during strong ground shaking. Nonlinear pushover analysis on the other hand, is a widely used analytical tool for the evaluation of the structural behaviour in the inelastic range and the identification of the locations of structural weaknesses as well as of failure mechanisms [1], [2]. Nevertheless, the method