

SYSTEM IDENTIFICATION AND MODELING OF BRIDGE SYSTEMS FOR  
ASSESSING CURRENT DESIGN PROCEDURES

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**ABSTRACT**

The recorded motions by California Strong Motion Instrumentation Program (CSMIP) for seven different bridge systems are analyzed using parametric and non-parametric system identification methods. The results of these analyses include identification of modal frequencies, mode shapes and damping ratios. An excellent fit of the recorded motion in time domain is obtained using parametric methods. Utilizing the results from the identification study, the paper evaluates commonly used bridge design provisions in California.

**INTRODUCTION**

Identification of structural systems has been a major tool in the last two decades to verify and determine vibration characteristics. Numerous works have been conducted on building systems. In this paper, no attempt is made to review literature on buildings. Instead, the focus of the following concise literature review is on the identification and evaluation techniques performed on bridge structures.

Prior to 1999, there were 54 instrumented bridges in California, 47 of which were instrumented in the last decade. Complete list of instrumented bridges can be found in Hipley (1998). One of the older extensively instrumented bridges is El Centro Highway 8/Meloland Overpass. Several researchers, e.g. Werner et al. (1987, 1994) and Wilson and Tan (1990) have studied this bridge. Modal properties were determined using single-input/single-output and multi-input/multi-output methods. Levine and Scott (1989) used the ground motion recordings for verification of the bridge foundation model they established. Wilson (1986) used the recordings from San Juan Bautista 156/101 Overpass to evaluate the seismic response. Goel and Chopra (1995) studied Rio Dell-Hwy 101/Painter Street Overpass to estimate stiffness of abutments. McCallen and Romstadt (1994) performed detailed finite element modeling to evaluate the same structure. Saadeghvaziri and Foutch (1989) investigated the effects of vertical earthquake motions on highway bridges using data from Rio Dell-Hwy101/Painter Street Overpass. Safak (1994) used data from this bridge subjected to small earthquakes to predict the larger earthquake response. Fenves and Desroches (1994) evaluated the response of Interstate 5/Route 14 interchange using non-parametric and parametric identification

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