The use of helical spring and fluid damper isolation systems for bridge structures subjected to vertical ground acceleration

A. Parvin [1] and **Z. Ma** [2]

[1] *A/Professor, Department of Civil Engineering, University of Toledo, OH 43606-3390 USA*
Email: aparvin@eng.utoledo.edu

[2] *Former Grad. Student, Department of Civil Engineering, University of Toledo, OH 43606-3390 USA*
Received 17 May 2001; revised 22 July 2001; accepted 24 July 2001

ABSTRACT

In this study a combination of helical springs and fluid dampers are proposed as isolation and energy dissipation devices for bridges subjected to earthquake loads. Vertical helical springs are placed between the superstructure and substructure as bearings and isolation devices to support the bridge and to eliminate or minimize the damage due to earthquake loads. Additionally, horizontal helical springs are placed between the abutments and bridge deck to save the structure from damage. Since helical springs provide stiffness in any direction, a multi-directional seismic isolation system is achieved which includes isolation in the vertical direction. To reduce the response of displacement, nonlinear fluid dampers are introduced as energy dissipation devices. Time history analysis studies conducted show that the proposed bridge system is sufficiently flexible to reduce the response of acceleration. The response of displacement due to provided flexibility is effectively controlled by the addition of energy dissipation devices.

KEYWORDS

Seismic isolated structures; dynamic analysis; vertical motion; helical spring.