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STUDY OF THE BEHAVIOR OF STEEL LAMINATED RUBBER BEARINGS UNDER PRESCRIBED LOADS

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ABSTRACT

The extensive new highway construction in Greece has created an increased interested in rubber bearings as supports of the highway bridges. Summary results are presented of an ongoing experimental investigation focusing on the behavior steel-laminated rubber bearings. Two of the tested isolators were prototypes having small dimensions and were supplied by their manufacturers whereas one was specially constructed as a model isolator. The objective is to obtain their mechanical characteristics when they are subjected to loading sequences prescribed by the Greek regulation for the design of bridges. Apart from obtaining the stiffness and the damping ratio the influence of the axial load as well as the frequency of applying the horizontal displacement is also studied. This experimental investigation is further complemented with a numerical study which tries to simulate the obtained results with relatively simple numerical tools. The obtained numerical predictions are also presented and their agreement with the corresponding experimental results is discussed.

1. INTRODUCTION

Seismic isolation has attracted scientific attention during the last two decades as a promising alternative for earthquake-resistant design of bridges. The main objective of using the isolation technique is to reduce the seismic forces to (or near) the elastic limit capacity of structural elements so as to avoid (or limit) inelastic deformations and related damage phenomena. This is achieved by shifting the fundamental frequency of a structure away from the dominant frequencies of earthquake ground motion and the fundamental frequency of the fixed base superstructure (typically in the range of 0.4-1.5sec). As a result of employing the isolation strategy, the superstructure motion is decoupled from the piers motion during the earthquake (as seen in figure 1), thus producing an effect of the reduction of inertia forces, a fact that is further amplified by energy dissipation concentrated in isolators that are suitably designed for this purpose, in order to reduce the transmitted acceleration into the superstructure.

A variety of isolation devices including elastomeric (Rubber) Bearings (RB), that is, alternating rubber layers and steel plates vulcanised appropriately, Lead Rubber Bearings (LRB), High Damping Rubber Bearings (HDRB) and others, as the Frictional/Sliding Bearings and Roller Bearings, have been developed and used practically for seismic design of buildings