

Lead Rubber Bearings for Seismic Isolation of Structures in Cold Climates - New Developments

Carlos Mendez-Galindo

Mageba Mexico, Mexico City, Mexico

Gianni Moor, Samy Rassy

Mageba International, New York, USA

Contact: cmendez@mageba.mx

Abstract

Nowadays, even in areas that have not been well known for the application of seismic protective measures, there is a growing tendency to design highway bridges, especially curved ones, to withstand strong seismic demands. This paper describes the challenge faced in the seismic isolation using LRBs of a curved highway viaduct where low temperatures must be considered in the design. Specifically, the LRBs must be able to withstand temperatures as low as -30 °C for up to 72 hours, while displaying only minor variations in their effective stiffness. This extreme condition required the development of a new rubber mixture, and the optimization of the general design of the isolators. Since the relevant specifications such as AASHTO Guide Specifications for Seismic Isolation Design and EN 15129: Anti-Seismic Devices contain only limited test data relating to low-temperature performance, extensive full-scale low-temperature dynamic testing was carried out.

Keywords: seismic isolation; full-scale testing; low temperature; lead rubber bearings.

1 Introduction

Increasing awareness of the threats posed by seismic events to critical transport infrastructure has led to the need to seismically retrofit highway viaducts and other bridges to improve their ability to withstand a strong earthquake. Continually evolving technology and the improving evaluation of the design abilities of practitioners have also contributed to the need for such solutions, also incentivized by the increasingly stringent national design standards.

In recent years, curved highway bridges have become more widely used, as the most viable option at complicated interchanges or river

crossings. Curved structures are more prone to seismic damage than straight ones, and may sustain severe seismic damage owing to rotation of the superstructure or displacement toward the outside of the curve line due to the complex vibrations that arise during strong earthquake ground motions.

2 Seismic Isolation of Highway Bridges

Bridges' bearings have historically been among its most vulnerable components with respect to seismic damage. Steel bearings in particular have performed poorly and have been damaged by relatively minor seismic shaking [1].