First Time Use of LRB for Seismic Isolation of a Major Bridge in India - A case study

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Abstract

This paper presents first time application of Lead Rubber Bearings (LRB) in one of the Bridges in India, presently under construction and located in high seismic zone (Zone IV). LRB is adopted as a Seismic Isolation device for reduction of seismic demand. LRBs have found wide application worldwide because of their simplicity and combined Isolation-energy dissipation function in a single unit. Its components include a lead core and a laminated rubber bearing. In addition to withstanding a strong horizontal and vertical load, the lead core also has the ability to absorb energy through plastic deformation via hysteretic damping. LRB enhances flexibility of the structure and thereby the natural time period of structure defers with the natural time period of ground motion. LRB being the most viable option in high seismic zone, it was decided to use it in one of the projects, namely the viaduct approach spans of the 4-lane bridge over river Ganga at Patna, Bihar (Parallel to the Existing Mahatma Gandhi Setu). The project is being executed on EPC contract Mode.

Keywords: Lead rubber bearing (LRB), Seismic Isolation, stiffness, system analysis, lead plug, hysteresis damping, time period, energy dissipation, Euro codes.

1 Introduction

Lead Rubber Bearing (LRB) is being used as a seismic isolation device in Viaduct of Mahatma Gandhi Setu for the first time in India. Key features of Viaduct are as follows:

The approach Viaduct to the main bridge has a length of 1565,1 metres. The span arrangement comprises of several modules of spans, ranging from 2 span modules (2 x 33,3m), 3 span module (3x33,3m) and a few 4-span module of similar span range. The structural scheme of 18m wide deck superstructure comprise of five numbers pretensioned girders with in-situ RCC deck slab and diaphragms. Continuity is established through deck slab only within a module. Each span is supported on eight nos LRBs. The deck structure is resting on pier cap with single pier. The pier is in turn supported on bored-cast-in-situ piles. Soil strata in the area is such that loose filled-up soil is encountered up to 15m depth from ground level. To cater for large forces arising due to high seismic forces and poor soil conditions, LRBs have been resorted to in this project as this type of bearing cum isolation device reduces seismic demand considerably. **Fig.1** and **Fig.2** shows the Elevation and Cross-Section of the viaduct. **Fig. 3** shows the photo of under-construction Viaduct. LRBs used in Viaduct are multi-directional to allow translation in any horizontal direction. This paper gives salient technical details of the LRBs used in this project.

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