Seismic Isolator, Damper and Expansion Joint System for two Viaducts of Toluca – Mexico City Intercity Train

Luca Paroli, Peter Huber

MAURER SE, Munich, Germany

Contact: p.huber@maurer.eu

Abstract

The Toluca–Mexico City Intercity Train will connect the metropolitan areas of Toluca with Mexico City. The seismic condition of max. 0,77 g for 1 s structural period represents a major challenge for two of the longer viaducts - namely Viaduct 2 and Viaduct 4 - with a total length of 3,8 km and 1,4 km respectively. Strengthening design of the structural members was technically not possible anymore even knowing that it also would not be economical. The applied longitudinal seismic isolation, lateral guiding and damping system according to EN1998 and EN15129 will significantly reduce the longitudinal forces by approx. factor three to five in combination with reasonable displacements of the decks. The final goal of lesser total structural cost as well as ensuring the safety of the structures and its functionality after seismic events was achieved.

Keywords: Seismic protection system; railway; isolator; viscous damper; expansion joint.

1 Introduction

Mexico City has the urgent need to improve public transportation towards the west where the town Toluca is located in a distance of 70 km. Once operational towards the end of 2017 the train will provide service to over 300 000 passengers a day. The approximate total investment for the project is US$ 2,51 bn. Therefore it was decided to establish this intercity train connection within which two rather long viaducts are located.

The Viaduct 2 is a structure of 3 865 meters length, which is divided in five continuous sections whose respective lengths are between 690 metres and 850 meters (Figure 1). The Viaduct 4 is 1 448 metres long.

Viaduct 4 is similar in design and construction however shorter. Therefore mainly Viaduct 2 due to its greater complexity will be described further on in this paper.

The decks of the viaducts will be built as a pre-stressed concrete box girder with a typical span of 52-64 m and it will be cast with a mobile scaffolding system. The most remarkable aspects of the design of the viaduct is its anti-seismic conception, due to the high seismic risk of the region.

On the final structural seismic design the applied bridge bearings, hydraulic dampers and railway expansion joints have special influence, i.e. effectively reduce the longitudinally acting forces while still controlling the displacements.

2 General design remarks regarding the structures

2.1 Seismic spectrum

The seismic design spectrum was determined from a series of studies conducted by the National

https://doi.org/10.2749/nantes.2018.s4-1
Distributed by structurae