Seismic Performance of Composite Inverted Pendulum Light Railway Station

Liyan Xu, Xin Nie, Liangdong Zhuang

Key Lab of Civil Engineering Safety and Durability of China Education Ministry; Department of Civil Engineering, Beijing, China, 100084

Contact: zhuangld12@126.com

Abstract

Elevated light railway stations are being widely used in big cities because of its advantages in utilization of urban space and structural integrity. Among these stations, an inverted pendulum structural form, characterized with long cantilevers and single columns, is most preferred as it can spare more space for the city. However, limitations on these structures in high-intensity earthquake regions have been highlighted due to their inferiority in lateral and vertical resistance. Consequently, a composite form of this inverted pendulum elevated structures is proposed in this study, seismic performance of this composite station is investigated using self-developed finite element software, it is proved to be robust enough in high-intensity earthquake regions. Finally, design suggestions are given for this composite inverted pendulum elevated structure.

Keywords: elevated station; inverted pendulum structures; seismic behaviour; composite structure.

1 Introduction

Elevated railway transit is popular in big cities because it saves urban land compared with ground railway transit and shortens construction period compared with underground railway transit. Elevated railway station is the junction of elevated railway transit, which connects the railway and the passengers. Figure 1 shows a typical elevated railway station in an inverted pendulum structural form, which is extensively adopted in crowded cities as it can minimize the disturbance of stations on ground. However, this form has many disadvantages from the perspective of structure design, especially in seismic areas [1-4]. Specifically, the whole structure is supported by single base columns laterally and by cantilevers vertically, the failure of base columns or cantilevers will directly lead to the collapse of the structure. Therefore, effective approaches should be explored to strength the performance of these critical members to increase the seismic resistance of the whole structure.

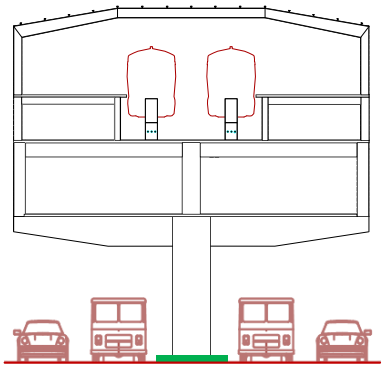

Figure 1. Typical elevated railway station with single columns and long cantilevers

In this article, a composite scheme for the elevated railway station structure is proposed and then analysed with self-developed finite element software. Key indexes of the seismic performance of the composite structure are summarized and assessed. Finally, feasibility of this proposed

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