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Dynamic Behaviour of Railway-bridges: A Review of Code Provisions for Passengers' Comfort and Operational Safety

Mohit Khajuria[1], Yogendra Singh[2]

[1]M.Tech. Student, Dept. of Earthquake Engineering, IIT Roorkee
[2]Professor, Dept. of Earthquake Engineering, IIT Roorkee

Abstract

Railway has a larger number of advantages over other modes of transportation, such as cost efficiency, environmental friendliness, larger capacity, etc., which has led to rapid growth in high-speed and semi high speed railways during the last decade. Bridges are subjected to much higher impact due to high-speed train load, magnified several times in the vicinity of resonance. Indian bridge rule takes into account the dynamic effects with the help of the coefficient of dynamic augment (CDA) and is limited up to the speed of 160 km/h only. As speed increases beyond 160 km/h, chances of resonance are going to increase, nothing about which is mentioned in the Indian code. A comparative study of the Euro code, UIC guidelines, and Indian bridge rule is carried out to investigate the effects of resonance on passengers' comfort and running safety of trains at higher speeds on bridges designed as per Indian bridge rule. FEM model of a standard Research Designs and Standards Organisations (RDSO) bridge in MIDAS, as per UIC and Euro code guidelines, and Vandebharat train loading is considered in this study. Model verification with the theoretical solution of Chopra (2007) is presented. It is concluded that the design of bridges considering CDA is insufficient for high-speed trains, as it is not able to capture magnifications due to resonance.

Keywords: Dynamic analysis, High-speed trains, Railway bridge, Indian bridge rule