A Review of Traffic Safety Research on the High-speed Train Crossing Deep Canyon Bridge and Tunnel Sections

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Abstract

With the rapid development of rail transit in recent years, the high-speed railway network has been gradually established in China. As the lines cross the bridge and tunnel section (BTS) in deep canyons, canyon winds will contribute to the sudden change in the aerodynamic loads on high-speed trains (HSTs), which will increase the risk of HST overturning. In addition, wind-induced vibration of bridges and ineffective smoke exhaust from tunnels caused by canyon winds can also have negative effects on traffic safety. Furthermore, the shielding effect of bridge components on airflow also disturbs the aerodynamic response of HSTs. To address the traffic safety challenges associated with HSTs passing through BTSs in canyons, this paper provides a relatively comprehensive review of relevant research, focusing on the following aspects: (a) wind field characteristics in canyons, especially at bridge sites; (b) variations in aerodynamic loads on HSTs and the flow field characteristics around them when traversing BTSs in canyon winds; (c) traffic risks faced by HSTs passing through BTSs in canyon winds; and (d) effective measures to ensure the safety of the HST operations. Despite the above research on the traffic safety of HSTs in deep canyons has made significant progress, there are still some deficiencies. Specifically, the deficiencies are mainly reflected in the aerodynamic response of HSTs crossing tunnels in canyon non-weather winds and variations in aerodynamic loads on HSTs interacting in bridge-tunnel connection sections (BTCS) under canyon winds.

Keywords

Canyon Wind, Aerodynamic Response, Traffic Safety, High-speed Train (HST)