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预应力混凝土T形梁桥横向振幅行车安全限值分析

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摘要: 运用列车脱轨能量随机分析理论计算5座横向振幅超限桥梁列车走行安全性。基于脱轨分析理论, 提出新的铁路桥梁横向振幅行车安全限值分析方法。具体步骤为: 建立考虑一定误差系数的预防脱轨条件, 确定桥梁横向刚度行车安全判别参数, 确定预防脱轨的临界梁墩系统, 计算梁墩系统横向振幅行车安全限值。运用此方法, 计算提速线预应力混凝土T形梁桥横向振幅行车安全限值。研究表明: 现有的桥梁横向振幅行车安全限值过于严格; 提速线跨度为32 m 和24 m 的预应力混凝土T形梁桥横向振幅行车安全限值分别为 $L/3$ 980和 $L/4$ 411(L 为桥梁跨度); 取 $L/4$ 500作为提速线预应力混凝土T形梁桥横向振幅行车安全限值建议值。

关键词: 横向振幅; 限值; 预防脱轨; 能量随机分析; 预应力混凝土梁

Limit value of lateral vibration amplitude for traffic safety of T-shape prestressed concrete bridge

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Abstract: Based on the theory of energy random analysis for train derailment, the safety of running trains on five bridges whose lateral vibration amplitudes surpassed limit values given by the code for rating existing railway bridges was analyzed. A new method for establishing the limit value of bridge lateral vibration amplitude for traffic safety was proposed on the basis of the analysis theory for train derailment. The detailed steps of the method were as follows: Condition with an error coefficient for derailment prevention was presented, the index of bridge lateral rigidity for traffic safety and the critical system of beam and pier for derailment prevention were determined, and the limit value of bridge lateral vibration amplitude for traffic safety for the system of beam and pier was calculated. With the method, the limit value of lateral vibration amplitude for traffic safety for T-shape prestressed concrete bridge was calculated. The results show that the existing limit value of bridge lateral vibration amplitude for traffic safety is too conservative. The limit value of lateral vibration amplitude for traffic safety of 32 m and 24 m long T-shape prestressed concrete bridge are determined as $L/3$ 980 and $L/4$ 411 respectively (L is bridge span). Finally, $L/4$ 500 is determined as the recommended limit value of lateral amplitude for traffic safety for T-shape prestressed concrete bridge on speed-raised line.

Key words: lateral vibration amplitude; limit value; derailment prevention; energy random analysis; prestressed concrete beam

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