地震中桥梁碰撞刚度取值的修正

Bridge Impact Stiffness Values of Correction in the Earthquake

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关键词：

碰撞刚度；接触单元；桥梁抗震；Impact Stiffness；Contact Element；Bridge Seismic

摘要：

在桥梁碰撞研究中，一般采用接触单元来分析碰撞机理，其中碰撞刚度合理取值方法一直没有统一的结论。目前所采用的碰撞刚度建议取0.5倍较短主梁的轴向刚度。该取值存在一定的局限性与主观性。本文根据桥梁碰撞变形机理，认为碰撞刚度在碰撞过程中是不断变化的，通过柔度法和应力应变公式反推碰撞刚度，用应力应变等参数描述碰撞刚度的变化。分析参数表明：碰撞刚度和邻梁比对碰撞力、碰撞持续时间影响最大。

Generally, the analysis mechanism of collision is based on the contact element method in the collision study of the bridge, which impacting stiffness has been controversial. Currently, it adopted by the colliding stiffness suggest take 0.5 times short axial stiffness of the beam, which has limitations and department of subjective. In this paper, the author believes that collision stiffness is changing in the collision process according to collision deformation mechanism on the bridge. Collision stiffness derived by flexibility method and stress strain formula and the change of impact stiffness described by parameters such as stress and strain. Results of analyzing the parameters show that collision stiffness and adjacent beam ratio have a significant affect on the impacting force and duration.

参考文献

[1] 蒋劲松, 庄卫林, 刘振宇. 汶川地震百花大桥震害调查分析[J]. 桥梁建设, 2008, 6: 41-44.

[2] 同济大学土木工程防灾减灾国家重点实验室. 汶川地震震害[M]. 上海: 同济大学出版社, 2008.

[3] The 1999 Ji-Ji Earthquake. Taiwan-investigation into the da- mage to civil engineering structures. Yotsuya: Japan Society of Civil Engineers (JSCE), 1999.

[4] K. Kawashima, J. Penzien. Correlative investiga-tion on theo- retical and experimental dynamic behavior of a model bridge structure. Report No. EERC-76-26, University of California, Berkeley, 1976.

[5] B. D. Westermo. The dynamic of inter structural connection to prevent pounding. Enterprise Elementary School District, 1989, 18: 687-699.

[6] 王东升等. 基于直杆共轴碰撞理论的桥梁地震反应邻梁碰撞分析模[J]. 工程力学, 2004, 21: 157-166.

[7] 李忠献, 岳福青, 周莉. 地震时桥梁碰撞分析的等效Kelvin 撞击模型[J]. 工程力学, 2008, 25(4): 128-133.

[8] P. Zhu, A. Masato and Y. Fujino. Modeling three dimensional nonlinear seismic performance of elevated bridges with empha- sis on pounding of girders. Earthquake Engineering and Struc- tural Dynamics, 2002, 31(11): 1891-1913.

[9] 李宏男. 结构多维抗震理论[M]. 北京: 科学出版社, 2006.

[10] R. Jankowski, K. Wilde and Y. Fujino. Reduction of pounding effects in elevated bridges during earthquakes. Earthquake En- gineering and Structural Dynamics, 2000, 29(2): 195-212.

[11] 柳国环, 李宏男, 陆新征. LRB曲线桥震致碰撞效应的非线性分析方法[J]. 土木建筑与环境工程, 2012, 34(5): 17-24.