Unseating Prevention of Continuous Viaduct Bridges for Huge Earthquakes

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Unseating prevention system is important for bridges for huge earthquakes. However, the effect and the design method of the buffer for the unseating prevention system is not established. Nevertheless, few researches have been done on the unseating prevention system for continuous girder bridges. This paper shows a rational design method of unseating prevention cables with buffers for continuous viaduct bridges.

First, a design method of unseating prevention cable for a simple girder bridge was proposed using the law of conservation of energy. Dynamic analysis of falling girder showed that the necessary capacity of the nonlinear unseating prevention cable was smaller than the linear one.

Second, a design method of unseating prevention cable for a continuous girder bridge was proposed using the stiffness ratio of the cable and the girder. The dynamic analysis showed that the low stiffness cable resulted in the excessive bending moment at the support adjacent to the fallen end. Necessary stiffness ratio of the cable from the dynamic analysis was larger than that from the static analysis.

The dynamic analysis was conducted for the falling of the continuous girder considering the nonlinear behavior of the girder due to large deformation. The necessary stiffness ratio of the cable to prevent the yield of the girder was 270 for the constant cross section with constant span girder bridge, 300 for the variable cross section with constant span girder bridge, and 500 for the variable cross section with variable span girder bridge. The strength of the cable in variable cross section with variable span girder bridge was almost 2 times larger than the simple girder bridge or the constant cross section with constant span girder bridge.

Finally, the rational design method of the unseating prevention system for the continuous viaduct bridges was proposed through this study.