Uplifting Slide Bearing (1) －Characterization of Dynamic Properties－

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Summary

The Uplifting Slide Bearing is developed as a seismic response control device for multi-span continuous girder bridges; the idea of the proposed device is represented by the use of combination of horizontal and inclined sliding surfaces in the sliding bearings, and can be used as a feasible and cost-effective solution to the problem of increased sizes of expansion joints for seismic design of the bridges of this type in urbanized areas for strong earthquakes, by reducing expected girder displacements in the event of strong earthquakes, while the problem of thermal expansion and contraction of the girders is effectively circumvented. The fundamental dynamic behaviour and effectiveness of the Uplifting Slide Bearing installed to bridges are investigated based on the energy principles of dynamics of structural systems involving the concept of kinetic energy, gravitational potential energy, and numerical seismic response analysis using simplified and bridge models. Evaluation of seismic response and design principles to achieve the target seismic performance of bridge structures with the use of the proposed device is discussed.

Keywords: seismic response control, multi-span continuous girder bridge, seismic isolation, friction, bearing

1. Introduction

Seismic isolation has been widely employed to multi-span continuous girder bridges to ensure enhanced seismic performance of highway bridges and viaducts typically constructed in urban areas. The isolators for this purpose include elastomeric bearings, slide bearings, and the combination of these, and are typically used to support the multi-span continuous girder on top of columns. In spite of advantage of the isolated bridge girder system, it also has an inherent disadvantage of potential large girder displacements in the event of strong earthquakes; isolated bridges designed with anticipated large horizontal girder displacements consequently require corresponding amount of clearance for girder displacements and expansion joints of a greater size, which tend to be problematic in the maintenance as well as the cost of the bridges of this type. For this reason, reduction of expected girder displacements for seismic design of isolated multi-span continuous girder bridges would be an important concept for efficient bridge construction.

The Uplifting Slide Bearing, which is referred to as UPSS, was developed as a seismic response control device for multi-span continuous girder bridges [1]; the idea of the proposed device is represented by the use of combination of horizontal and inclined sliding surfaces in the sliding bearings, as shown in Fig.1, and the use of UPSS as in Fig.2 is expected to be a feasible and cost-effective solution to the problem of reducing expected girder displacements in the event of strong earthquakes by providing restoring force generated by the sliding along the inclined slope, while the

https://doi.org/10.2749/222137810796024925