

## Reinforced Concrete Box Girder Bridge Hinge Replacement and Horizontal and Vertical Earthquake Restrainers

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**Abstract :** There are old cast-in-place concrete box girder bridges in California with inter-span hinges that are designed based on old earthquake codes. Hinge removal is part of the bridges' earthquake retrofitting project, and hinges were removed and replaced with modified hinges per new earthquake codes. The span that has a hinge is divided into short and long cantilevers in which the short cantilever supports the long cantilever. In the recent bridge hinge replacement, the length of the short and long cantilevers were 20ft and 80ft, respectively. The seat in the new design is wider than the old design, and the horizontal and vertical movements of the deck at the hinge location must be computed to check if restraints are needed. In this paper, besides considering the conventional reinforced concrete box girder bridges, the hinge removal operations, along with the response spectrum analysis based on the El Centro 1940 earthquake, will be presented to verify if vertical and horizontal restrainers are needed.

**Keywords :** hinge replacement, restrainers, vertical earthquake, response spectrum analysis

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