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Blast Load Resistance of Bridge Columns

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Abstract : The objective of this study is to evaluate the effects of the detailing in the seismic design of reinforced concrete (RC) bridge columns on the blast load resistance. A generic two-span continuous RC bridge located in Victoria, British Columbia, which represents the highest seismicity in Canada, was examined in the study. The bridge superstructure consists of a single cell box girder while the substructure consists of two circular columns. The bridge was designed according to the 2006 Canadian Highway Bridge Design Code. More specifically, response spectrum analysis was performed to determine the seismic demands using CSI Bridge. The 3D blast load analysis is carried out in the platform of LS-DYNA. Two charge heights, i.e., one at the mid-height of the column and the other at the bottom of the column, are considered. For each height, three cases are analyzed in order to investigate the effects of standoff and charge weight on the structural response. The blast load resistance of the column is assessed in terms of the concrete failure mechanism, steel stress distribution, and column lateral displacement. The results from the study indicate that a column designed in accordance with the code requirements could survive during the blast attack. Spiral columns perform much better than tied columns. The results also show that the charge weight has more impact on the structural response than the standoff. These results are beneficial for the development of the Canadian standards for the design of bridges under blast loads.

Keywords : blast, bridge, charge, height, seismic, standoff
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