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CONTRIBUTION TO THE IMPROVEMENT OF SEISMIC PERFORMANCE OF INTEGRAL BRIDGES

IOANNIS TEGOS
Professor, Department of Civil Engineering, Aristotle University Thessaloniki

ANASTASIOS SEXTOS
Lecturer, Department of Civil Engineering, Aristotle University Thessaloniki

STERGIOS MITOULIS
Civil Engineer, MSc, Aristotle University Thessaloniki

MICHALIS TSITOTAS
Civil Engineer, EGNATIA ODOS S.A.

ABSTRACT

Integral bridges are jointless bridge structures with continuous deck and monolithic pier-deck and/or deck-abutment connections. Mainly constructed in the U.S., but also built in Europe, integral bridges are structures of high redundancy that due to their increased stiffness exhibit lower seismic displacement demand while they do not present the disadvantages of the non-monolithic bridges such as the salt, dirt and eventually corrosion at the expansion joints. On the other hand, the inevitable penalty, are the unfavorable internal stresses attributed to the temperature variations. Integral bridges can be distinguished in three main categories mainly on the basis of the pier-deck and/or deck-abutment connections as well as on the flexibility of the abutment-backfill system: (a) integral bridges with monolithic deck connected to the abutment with expansion joints (b) integral bridges with movable abutments and (c) integral bridges with rigidly supported abutments. Each one of the above cases requires a different approach in terms of seismic design. What is examined in this paper, is the role played by the abutment when it is monolithically connected to the deck and its potential implications on the bridge integrity, regularity and complexity. For this purpose, a typical, conventional bridge belonging to the case (a) above (i.e. with joint-type deck-abutment connection) has been used as a ‘reference’ case while two alternative bridge systems (involving innovative abutments of appropriately modified rigidity and connectivity to the deck) have been used for comparison purposes. The target is the reduction of the uncertainties resulting from the currently applied practice. By comparing the three characteristic bridge types, it is concluded that the dynamic response of the structures in the critical longitudinal direction depends on the overall dynamic stiffness of the deck-abutment-foundation system. Moreover, drastic reduction of seismic demand is generally observed when the abutment stiffness is activated, provided that the