Application of First-Order Second-Moment Level 2 Reliability Analysis of Prestressed Concrete Bridges

A. Hosseinnejad, Msc. Research Scholar, azizh@yahoo.com
Department of Civil Engineering, Faculty of Engineering, The University of Guilan, Rasht, I.R. Iran.

S. Pourzeynali¹, Associate Professor, pourzeynali@guilan.ac.ir
Department of Civil Engineering, Faculty of Engineering, The University of Guilan, Rasht, I. R. Iran.

J. Razzaghi, Assistant Professor, javadr@guilan.ac.ir

Abstract
A numerical approach to the reliability analysis of prestressed reinforced concrete long span bridges is presented. Bridge is modeled by finite element software and the analysis is accomplished in the form of non-linear time history analysis. Considered random variables are: the specific strength of concrete; yielding stress of steel bars; yielding stress of prestressed bars; all sectional dimensions; structural damping ratio; effective depth of steel bars; magnitude and PGA of earthquake. The proposed procedure is applied to evaluate the reliability of an existing prestressed arch concrete bridge located in Bandar-e-Anzali in Iran. Bandar-e-Anzali is a very high-risk earthquake occurring place. Results of the study show that the structural damping ratio, magnitude and PGA of earthquakes have a significant effect on the variation of reliability in the structure, while variation in dimensions of the structure has a little effect on the reliability index.

Keywords: Structural reliability, non-linear analysis, arch bridge, prestressed concrete structures.

1-Introduction
Most of the existing bridges were designed using deterministic approaches. Due to random properties of most parameters involved in design process, deterministic approach does not have a complete view about the bridge responses in various limit states. Therefore, in order to get a reasonable response of the structure, it seems to be necessary to analyze the structure by probabilistic methods. So, it seems that the reliability of these structures, which takes into account randomness of the involved parameters, could be able to breakdown the failure risk of such structures.

Reliability analysis of structures due to static loadings was investigated by many researchers, but the reliability analysis of these structures due to dynamic loads has not been reported much more. Nowak et al. [1] evaluated reliability of a prestressed concrete bridge due to live and dead loads based on the three codes, (Spanish Norma IAP-98 1998, ASHTO LRFD, 1998, ENV 1991-3 Euro Code). Castillo et al. [2] compared the three most common methods applied for evaluating the reliability of the structures (Level 1, Level 2, and Level 3 Reliability Methods). They applied these methods for a single supported beam subjected by a single concentrated dead load and

¹ Corresponding Author