Seismic Fragility of Double-Deck Curved Girder Bridge Based on Artificial Neural Network and Lasso-Logistic Regression

Weizuo Guo

School of Transportation, Southeast University, Nanjing, China

Kehai Wang

Research Institute of Highway, Ministry of Transport, Beijing, China

Contact:kh.wang@rioh.cn

Abstract

Double-deck curved girder bridges are frequently used to satisfy the demands of traffic lines to accomplish quick ascents. However, damage to this type of bridge has a significant impact on the entire transportation network. Therefore, it is necessary to study the seismic fragility of this type of bridge. The seismic demand model and the multidimensional seismic fragility model of a double-deck curved girder bridge are established using the artificial neural network and the Lasso-logistic regression method. The following conclusions are drawn: 1) The gap value has a significant impact on the fragility of the bearing and limit device. 2) The impact of the friction coefficient of bearing and concrete strength on component fragility reduces as the damage level increases. 3) The ground motion intensity is the most important factor in pier damage.

Keywords: Double-deck curved girder bridge; fragility; artificial neural network; Lasso-logistic regression.

1 Introduction

Seismic fragility quantifies the seismic performance of a structure using the probability method and describes the relationship between the ground motion intensity and the degree of structural damage [1], which promotes the development of performance-based seismic concepts and serves as an important research means for uncertainty transmission. The fragility curve is the primary indicator of seismic fragility. Hwang et al. [2] introduced in detail the systematic analysis method of fragility curve of reinforced concrete structures under earthquakes, and drew the fragility curve of a concrete continuous beam bridge on an expressway in the Middle East of the United States. Moschonas et al. [3] established the seismic fragility curve of a typical bridge on modern Greek expressways, considering the uncertainties of bridge structures such as pier type, beam, connection mode between pier and beam, and the surrounding conditions of abutment. Borzi et al. [4] established the comprehensive database of seismic fragility of existing highway bridges in Italy and developed the analysis and evaluation program of fragility curve.

https://doi.org/10.2749/nanjing.2022.1848
Distributed by structurae