

Study on Mechanical Properties of a Negative Poisson's Ratio Structural Bridge Block

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Abstract

This paper is based on the design concept of the block is not damaged under small earthquakes and can be used sustainably and in the medium earthquake does not fall, convenient structure replacement and it can be destroyed during a large earthquake, sacrificing itself to protect the main beam. Based on the characteristics of graded energy dissipation and the advantages of negative Poisson's ratio compared with traditional structures in energy absorption and impact resistance, an anti-seismic energy dissipation bridge block was designed. The mechanical properties of the block were studied by uniaxial loading test and finite element simulation. Through the comparative analysis of normalized curves, it is found that the block structure has a good limiting ability compared with other types of blocks, which can be multi-enhanced stiffness characteristics and excellent bearing capacity.

Keywords: bridge block; negative Poisson's ratio; energy absorption; uniaxial load test; finite element; normalized curves

1 Introduction

With the improvement of our economic strength, infrastructure projects have been constantly improved. According to the “*Statistical Communiqué on the Development of the Transport Industry in 2020*”, by the end of 2020, there were 912,800 highway Bridges in China, covering 66.285,500 meters [1]. As an indispensable transverse limiting member of medium and small-span girder bridges, the retaining block can limit the transverse movement of the main beam and prevent the main beam from settling or even

falling under the action of lateral load (such as an earthquake). At the same time, it is also one of the ways to transfer the inertia force of the main beam to the substructure. In recent years, with the continuous summary of seismic experience and the continuous improvement of seismic measures, the role and design of the block have gradually become a research focus. In the Code for Design of Highway Bridge in 2020, the block, as a structural measure between the main beam and pier, has also been proposed to effectively reduce the earthquake damage to the bridge.