Actual Stiffness Identification of Constructed Bridges

Dianshi Feng
PhD Student
Tongji University
Shanghai, China
033803@gmail.com

Dianshi Feng, born 1984, received his civil engineering degree from Tongji University.

Xuefei Shi
Professor
Tongji University
Shanghai, China
shixuefei@gmail.com

Xuefei Shi, born 1964, received his civil engineering degree from Tongji University.

Xin Ruan
Lecturer
Tongji University
Shanghai, China
ruanxin.tj@gmail.com

Xin Ruan, born 1977, received his civil engineering degree from Tongji University.

Summary

In recent years, the frequent occurrences of bridge accidents promoted the concerns about condition assessment and strengthening of constructed bridges. Bridge stiffness estimation plays an important role in the process of bridge condition assessment. Difference always exists between the actual stiffness and design value of a constructed bridge because of material variability, construction error and structural behaviour deterioration. So it has important significance to identify the actual stiffness of a bridge precisely.

Based on the vehicle load test of Tanzhou Bridge, a continuous box girder bridge with a span of 75m+125m+75m, this paper firstly identified the actual stiffness of this Bridge; then analyzed the effect of such factors as concrete pavement thickness, girder damage and strengthening, material module etc; lastly, analyzed the influence degree of stiffness deviation on load effect.

Conclusions are as follows: considering various influencing factors, the actual stiffness of Tanzhou Bridge is significantly larger than design value; in view of the fact that girder stiffness considering the contribution of concrete pavement is larger by 10~12% than not, modified stiffness coefficient decreases obviously after considering pavement's contribution to girder stiffness, but is still larger than design value; while the deviation between identified stiffness and design one has little influence on dead load effect, it has significant influence on live load effect. The vertical displacement of mid-span section calculated with the former is only 62% of the one with the later.

Keywords: constructed bridge; long-span beam bridge; stiffness identification; influencing factors; pavement thickness.

1. Introduction

In recent years, the frequent occurrences of bridge accidents promoted the concerns about condition assessment and strengthening of constructed bridges. Bridge stiffness estimation plays an important role in the process of bridge condition assessment. Difference always exists between the actual stiffness and design value of a constructed bridge because of material variability, construction error and structural behaviour deterioration. So it has important significance to identify the actual stiffness of a bridge precisely.

In this paper, the influence line of deflection of main girder was measured through static load test; the flexural stiffness of finite element was modified repeatedly till theoretically calculated displacements approached the measured value and theoretically calculated flexural stiffness was close to the actual; the aim at actual structure stiffness identification was achieved. Based on Tanzhou Bridge, a highway bridge constructed in 1996 and with serious structural deflection, the actual rigidity was identified; the influence of structure stiffness injury on dead load stresses, live load stresses and the displacement under live load was analyzed. The method and experience on structural stiffness identification can also be applied to similar bridges.

https://doi.org/10.2749/222137810796063210