International Journal of Engineering Research and Development
e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com
Volume 12, Issue 1 (January 2016), PP.12-27

Load Capacity and Field Assessments of Concrete Bridge before Strengthening

Haleem K. Hussain[*1], Liu Gui Wei[2], Mudhar Hasan Gatea[3]
[*1]*Basrah University, College of Engineering, Civil Engineering Department, Basrah City, Iraq*
[2]*School of transportation science and Engineering /Bridge and Tunnel Engineering Dep. /Harbin Institute of Technology/. Harbin City/China, [150090]*
[3]*Basrah University, College of Engineering, Civil Engineering Department, Basrah City, Iraq*

Abstract:- Bridge failures are often observed due different reasons, such as environmental sever conditions, exceed the traffic load, poor initial design requirements, etc; as well as the unexpected disaster accidents such as earthquakes, As a result, evaluation of the stability of bridge abutments has become an important part of engineering research. This study present the whole inspection process of the Zhong Xing Bridge including the main beam , support, deck system (pavement, drainage , side walk and railing guard), pier, reinforcement protect layer and corrosion and the abutment (ear walls, cone slope and foundation). The investigation showing the bridge has minor defects through the substructures while the super structure consist of the T-beam girders section parts. The data showing the T-beam have no enough reservoir capacity and need to strengthening, while the other parts in a good condition and meet the design requirements. This research also proposed design strengthening method of bridge.

Keywords:- Field investigation, concrete T-Beam girder, site inspection, Zhong Xing Bridge.

I. INTRODUCTION

There are several situations in which a civil structure would require strengthening or rehabilitation due to lack of strength, stiffness, ductility and durability.

Bridges can be considered structurally deficient if significant load capacity is found to be in poor or bad conditions because of deterioration or damage. The facts that a bridge is structurally deficient does not meet the standard requirements that it is likely to be is unsafe. Bridges are considered functionally out of date when the geometry of the road no longer meets the minimum design specification.

The sufficiency rating or damage level of a bridge can be classified between 0 (low) to 100 (high), based on bridge conditions, geometry, traffic, the condition of waterway passes underneath the bridge. Any way the low sufficiency rating does not mean the bridge is unsafe or immediately need repair.

The problem of corrosion deterioration of concrete bridges was first identified in United States in early 1960's (Richard et al.). The ultimate strength and material properties of concrete like strength and modulus of elasticity estimated from Non Destructive tests can vary from actual values and load tests as well as NDT data can be used for assessment purposes (Jaroslay et al. 2002) [1].

Doebling et al. [2] have presented a comprehensive review on damage detection from vibration characteristics. An important problem in this area of research is to detect the local damage using structural responses under operational moving loads. Lee et al. [3] studied the identification of the operational modal properties of a bridge structure under traffic loading and carried out the condition assessment based on the estimated modal parameters. Static and dynamic responses were used to identify local damages in plate- like structure [4]. Time frequency analysis is also used for the detection of cracks in a beam and gear and roller system [5]. A strategy based on energy change [6] was proposed for damage detection with long-span bridges.

Corrosion induced deterioration of RC structures, especially bridges, due to frequently applied deicing salts, is a main challenge to civil asset managers worldwide. Corrosion affects the reliability of RC structures, both in strength and serviceability limit states. In the past decade, many researchers worldwide have proposed various reliability based maintenance management systems. In these systems, mechanistic deterioration models are utilized in a probabilistic framework to account for temporal variations in material properties and loads as random variables [7].

In most bridge management systems, routine inspections are mandatory, biannually. This is not only an expensive approach, but also in some congested traffic regions or severe environments, more frequent inspections may be necessary during the lifetime of the bridge. Suo and Stewart [8] showed the usage of data gathered during inspections in the updating of reliability models.

Haleem et al [9] describes and evaluates the state of Qing Shang Bridge. The deterioration of bridge can be occurred due to increased internal forces led to higher loading and due to sever climatic and