Available online at www.elixirpublishers.com (Elixir International Journal)

Civil Engineering

Elixir Civil Engg. 97 (2016) 42361-42362

ISSN: 2229-712X

Rehabilitation of a Wooden Bridge (Zero Bridge)

Amreen Yaqoob Shah[1], Mohseen Ul Hassan[2], Bisma Mehraj[1] and Saiqa Nabi[1]

[1]SSM college of Engineering & Technology Baramulla, J&K, India.

[2]Department of Civil Engineering, Kurukshetra University, Haryana, India.

ARTICLE INFO

Article history:

Received: 03 August 2015;

Received in revised form:

20 August 2016;

Accepted: 30 August 2016;

Keywords

Rehabilitation,

Timber,

Beams,

Piers,

Columns.

ABSTRACT

This paper presents the rehabilitation of a bridge (Zero bridge) which is constructed of old traditional construction material i.e. Wood (Timber). It includes the design considerations of substructure and superstructure of the bridge, Need for rehabilitation of bridge, difference between old and new design of bridge. Apart from the modern construction materials which are well documented in the codes of practice, Wood is an old traditional construction material which has proved to be durable, easy constructable, and effective for resisting earthquake loading as well.

© 2016 Elixir All rights reserved.

Introduction

Zero bridge was constructed in 1950's when when late Bakshi Ghulam Mohammad was the Prime Minister of Jammu and Kashmir. Since Amira Kadal, ahead if which the zero bridge was constructed on Jhelum river, was known as the first bridge , the name Zero bridge was given to thus bridge. The bridge was closed for vehicular traffic two decades ago and only pedestrian movement was allowed in this historic bridge after its closure. Since it could no longer support vehicular traffic.

Wood as Earthquake Resistant Material

There are certain building materials that will withstand earthquake vibrations better than others. Concrete is very good at resisting damage from earthquakes while wood is also a preferred material for construction in earthquake prone areas. Wood is one of the best materials for earthquake-resistant construction since it is lightweight and more flexible than masonry. It is easy to work with and less expensive than steel, masonry, or concrete. Properly designed wood structures have high ductility, which is important characteristic for resisting shock loading during earthquake. A ductile structure has energy absorbing capacity and sudden failure during lateral loading will not occur.

Need for Rehabilitation of Zero bridge

The bridge is regarded as part of local heritage by many and it is must to keep it in safe and original condition. As the timber below the water level remained safe and good. So timber above the water level has been damaged due to temperature exposure. Also in order to give high strength, there is replacement of many things in existing structure of a bridge.

Actually need for reconstruction can be explained by designing differences between existing and new structures as follows:

Construction and Design details

Zero bridge is completely composed of Timber. It comprises of:

a) Two Abutments.

b) Total span of bridge is 500 ft. Which is divided into nine spans of length 55 ft each. Width of bridge is 28 ft.

c) Total no. of piers is eight. Among which two are double membered and rest are single membered.

The complete bridge is divided into two parts:

1) Substructure.

2) Superstructure.

Check for design

Results:a) Under Class AA loading design is unsafe. While as under Class A loading design is safe.

b) Load carrying capacity of Column is 880 KN.

c) Bearing stress of Beam is 0.0114 N/mm^2 which is less than safe bearing stress(2.06 N/mm^2)

Material used in bridge construction

1) wood: Deodar

2) Country made nails

3) Galvanised Iron pipes class C.

4)RCC with grade of concrete M25 and steel of grade Fe 450.

Load test at site

The settlement above the timber beams prior to casting of deck slab was determined by load test at site. The initial RL at various points on downstream side, mid and upstream side prior to placing load (aggregate bags in this case) on deck sheathing along the entire span. Weight of each bag was about 35 kg. The stack of 2400 bags was placed.....

After the removal of bags the Rl's were taken once again on the same points.

Material used: Coarse aggeregate bags 2400 in number..........

Result: The difference between initial and final RL's of 1 mm was recorded.

Recommendations

1. Underpinning in the form of extra Timber piles should be provided.

2. It is necessary to provide Polycarbonate Pannel sheets. These are actually the industrial standard for green house covering and these should be provided between maximum and minimum water level perpendicular to the direction of flow.

Tele:

E-mail address: amreen.shah1560@gmail.com

© 2016 Elixir All rights reserved

Design differences between existing structure and new structure

S.no	Existing Structure	New Structure
1.	Main longitudinal beams were connected by butt fish joint	Main logitudenal beams are connected by rebated lap joint.
2.	Main longitudenal members were as discontinuous members.	The main beams act as monolithic unit and are continuous members.
3.	Floor joists were 28 in number in each span with spacing of 20 inches.	Flooring joists are 20 in number in each span with spacing of 2'9".
4.	Double piers were provided with 3 struts in elevation.	The design is symmetrical.
5.	Section of beam was 12"×22",12"×20"& 12"×18"	Section is uniform throughout as12"×15"
6.	Strength was less to some extent due to discontinuity.	Strength is more due to continuity of members.
7.	Mild strips were provided which later got corroded.	Steel sections are totally avoided.

1) Substructure of the bridge is composed of following components as shown in table

S.No.	Component	Specification
1.	Foundation	It is composed of Deodar wooden piles about 25 – 30 ft long and led 2 ft apart at right angles alternatively laid with stone.
2.	Piers	Each and every component of timber trestle pier are of deodar timber.
2.1	Column	It is of square cross section. Size of wooden column is 25’-14”×14’-4”. These are 6 in number & are arranged in a single row. The c/c spacing is 4’6”.
2.2	Ledgers	In case of single pier these ledgers are 6 in number, one pair at bottom, one at mid, and one at top. While in case of double piers these are douyble in number. Size of bottom & top ledger is 32’×12”×14”. Size of Mid ledger 36’×12”×14”.
2.3	A Shaped Members	These are provided between wooden pedestal and top ledger. These are of shape capital letter A. These are 5 in number ,In every single pier and 10 in double pier. Size of these members is 6’×14”×5”.
2.4	Cross Shaped Members	These are wooden members of shape capital letter X provided in between the ledgers. Size: 5’×14”×4”.
2.5	Struts	These are inclined wooden members provided on both sided of columns. In each column these are 4 in number which implies 24 such struts in each pier.
2.6	Pier Cap	Each single pier carries pier of size 28’ and in case of double pier these are 2 in number.
2.7	Wooden edestal	These members are 6 in number 7 are provided longitudinally above the pier cap.

2) Superstructure: It is composed of following components

S.No.	Component	Specification
1.	Wooden Beams	These are the main longitudinal beams 72 in number in each span. These beams are joined together in such a way that they form a monolithic unit with the help of rebated joint. Size 55’×12”×15”.
	Floor joists	These are the secondary beams transversally placed and are 20 in number in each span.
	Deck slab	It is composed of RCC with grade of concrete as M25 and steel of grade Fe 450.

3. Polycarbonate sheets should be provided to prevent wooden members from exposure of sunlight.
4. Since the bridge is prone to weathering effects (snowfall, rainfall) and in order to avoid this drawback we are suggesting the superstructured deck of bridge should have covering for entire stretch and also to enhance aesthetic appearance of bridge.
5. It is suggested that shelling wires should be tightened and should be fixed with the group of existing piles.
6. It is also suggested that the stones or boulders of specific shape and size to be dumped encircling the Pire to increase its strength, to withstand the impact of water during floods.

Conclusion

The bridge in original design was unsafe for vehicular as with passage of time it was deteriorated, damaged to greater extent. Thus its rehabilitation was must. In the process of rehabilitation its weak points were eradicated like unsymmetrical members of individual span of bridge were replaced by symmetrical sections to reduce the dead load and make it quite safe and durable.

References

1. Design of steel structures by Ramchandra vol. 1.
2. Design of Bridges by N. Krishna Raju.
3.Recommended guidelines of IS 883 (1994) Design of Structural Timber.
4. Recommended guidelines of IRC 6 – 2000 for classs A and AA loading.