IARJSET

ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 10, Issue 7, July 2023

DOI: 10.17148/IARJSET.2023.10732

Traffic Management using Movable Bridge

Adesh Pawar[1], Vaibhav Lavate[2] and Prof. S. N. Phule[3]

Department of Civil Engineering, Sahakar Maharshi Shankarrao Mohite Patil Institute of Technology and Research, Shankarnagar Akluj, Maharashtra, India[1,2]

Department of Civil Engineering, Sahakar Maharshi Shankarrao Mohite Patil Institute of Technology and Research, Shankarnagar Akluj, Maharashtra, India[3]

Abstract: Movable bridges are designed and constructed to change its position and occasionally its shapes to permit the passage of vessels and boats in the waterway. This type of bridge is generally cost effective since the utilization of long approaches and high piers are not required. When the waterway is opened to vessels and ships, traffics over the bridge would be stopped and vice-versa. Moveable bridge is a bridge that can change position (and even shape in some cases) to allow for passage of boats below. This has a lower cost of building because it has no high piers and long approaches but its use stops the road traffic when the bridge is open for river traffic. The oldest know movable bridge was built in the 2nd millennium BC in the ancient Egypt.

History also knows for one early movable bridge built in Chaldea in the Middle East in 6th century BC. Since then they were almost forgotten until middle Ages when they again appeared in Europe. Leonardo da Vinci designed and built designed and built bascule bridges in 15th century. He also made designs and built models of swing and retractable bridges. Industrial revolution allowed for new technologies like mass-produced steel and powerful machines and it is no surprise that new types of modern movable bridges appeared in 19th century. They are built even today but many movable bridges that are still in use in United States are built in early 20th century. In time, some of them are repaired with lighter materials and their gears are replaced with hydraulics

Keywords: Traffic, Movable bridges

I. INTRODUCTION

Movable bridges are special structures that can change position to allow navigation across waterways. They are composed of structural, electro-mechanical, hydraulic and control systems. Bascule Bridge types constitute by far of majority of movable bridge designs. The objective of this report is to present a detailed description of a new born bascule bridge in Egypt. The new bridge design consists of six bays each of about 22 meters span and width of 14.8 meters, with movable bascule intermediate span, providing a navigation channel with infinite vertical clearance.

The fixed bays are designed as composite multi-girder steel bridge with reinforced concrete slabs above, while the movable bay has been designed as plate girder with orthotropic steel deck and a light pavement. The movable bay dimensions have a length and width The spacing between balance weight supporting columns, allowing to a maximum open angle of 70 degrees. The operating system includes the gearbox, driving unit, shafts and brakes.

The project is a good example of how functional and limited budget constrains can be taken into account in a movable bridge project. These constrains were considered starting from the concept design stage and extended up to the detailed drawing stage. The project required detailed inspection of material condition and structural configuration. The motor of the bridge lifting system has to be strong enough to operate the bridge against normal and higher wind pressures.

1.1 Objective of the Project:

- To understand the basic principal of the our project
- Describe the construction and working of various parts of our project
- Development of the working model of the our project
- To reduce time spent on this activity.
- To analyze the technology according to needs and capabilities.

DOI: 10.17148/IARJSET.2023.10732

II. LITERATURE REVIEW

The various researchers presented the following research work related to the hydraulic Movable bridges system as following:

Movable bridges have been an essential part of any country's transportation system, their development being in coherence with that of the development of the highway and railroad systems. Movable bridges have proved to be an economical solution to the problem of how to carry highway and rail lines across an active waterway. The number of movable bridges being constructed are increasing at a fast pace. One of the most important types of movable bridge is the bascule bridge. The Pamban Bridge that connects the town of Rameshwaram on Pamban Island to mainland India was constructed in the year 1914 and is over a hundred years old. It is the only movable bridge in India. It has a double leafed mid span which can be opened for the passage of ships and barges and works on the principle of a bascule bridge. The material used for the construction of the bridge plays an important role due to the factors like the stresses that act upon it due to the varying loading condition throughout its length along with climatic conditions which may very well be corrosive in nature in a bridge constructed over a sea along with the duration that the bridge must not fail like in this case of more than 100 years and hence the material selection should be such that it can withstand all such parameters and stand still with utmost safety. Zhendong Qian et al., proposed the usage of a lightweight epoxy asphalt mixture (LEAM) for pavement on bascule bridges. Test results demonstrated that the LEAM had a decent imperviousness to dampness harm, lasting twisting, and low-temperature splitting. The LEAM with a 70% lightweight total substitution rate was found to have the best impact on deadweight lessening and additionally the other execution measures. In addition, the explanatory outcome demonstrated that LEAM could decrease asphalt stretch altogether when contrasted with an epoxy asphalt mixture, which shows that the LEAM has a decent structural performance. Significant reductions in density at the higher lightweight aggregate percentages and overall better performance of the rounded lightweight mixtures was found to have been achieved by using 70% of the lightweight aggregate in the mixtures which would be vital for the optimal performance for the bridge deck paving. The study further provides a basis and motivation for the design and use of lightweight epoxy asphalt mixtures for bridge deck paving. G. Besterfield et al., proposed a procedure for the assembly of trunnion-hub-girder (THG) in bascule bridges which could help in avoiding failures. The study was conducted to understand the failures due to the general assembly procedure followed and the results were used to develop specifications and recommendations for assembly. The causes of failures include the development of high stresses at low temperatures during assembly, while noting that fracture toughness of THG materials decreases with temperature. Recommended specifications included following an alternative assembly procedure that nearly doubles allowable crack length, and that lowers cooling temperatures to avoid trunnion sticking in the hub. Based on the results of the study, various recommendations were made for the THG assembly procedure. Few of them included developing inspection specifications to determine if voids or cracks were bigger than an allowable value, to specify tight machining tolerances for the inner diameter of the hub, to consider heating the outer component as opposed to cooling the inner component as heating is a slow process and hence would not create large transient thermal stress. The maximum Von-Mises stress was found to occur when the whole assembly reaches steady state. The maximum hoop stress on the other hand was found to occur due to thermal shock when the hub was cooled down by immersion in liquid Nitrogen. J W Smith et al., proposed a method for calculating cycles of stress in steel bridge decks under heavy traffic. This was achieved by using influence surfaces, derived by finite element analysis, and simulating the passage of heavy vehicles by a Monte-Carlo technique. The predicted stress cycle counts compared favourably with experimental observations on a real bridge using an electronic continuous monitoring system. A simplified method for the calculation of the cycles of stress in steel decks under heavy vehicles was developed by Smith and Wastling. They made use of an average bridge temperature and treated wheel loads separately. Their results were conservative when compared with observations on a full scale bridge. An advanced method of analysis was presented in their paper. The paper made it evident that the theoretical method of calculation overestimates damage at high temperatures and underestimates the damage at low temperatures. F. Necati Catbas et al., proposed a machine learning algorithm for processing of massive data collected from the mechanical components of movable bridges. The proposed approach consisted of training and monitoring phases. The training phase was focused on the extracting statistical features and conducting cross correlation analysis (CCA) and robust regression analysis (RRA). The monitoring phase included tracking of errors associated with the derived models. The main goal was to analyze the efficiency of the developed system for health monitoring of the bridge mechanical components such as gearbox, motor and rack and pinion. Data was collected from Sunrise Movable Bridge, Florida, USA, for 4 years through sensors and was used to assess the performance of the algorithm under baseline and different common damage scenarios. Based on the results, the proposed health monitoring system had a satisfactory performance for the detection of the damage scenarios caused by leakage and lack of sufficient oil in gearbox, as well as bolt removal from rack and pinion. The introduced algorithm could be regarded as a valuable tool for the management and interpretation of the massive (big) data collected for structural health monitoring (SHM) of movable bridges

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁑ Impact Factor 8.066 ⁑ Peer-reviewed / Refereed journal ⁑ Vol. 10, Issue 7, July 2023

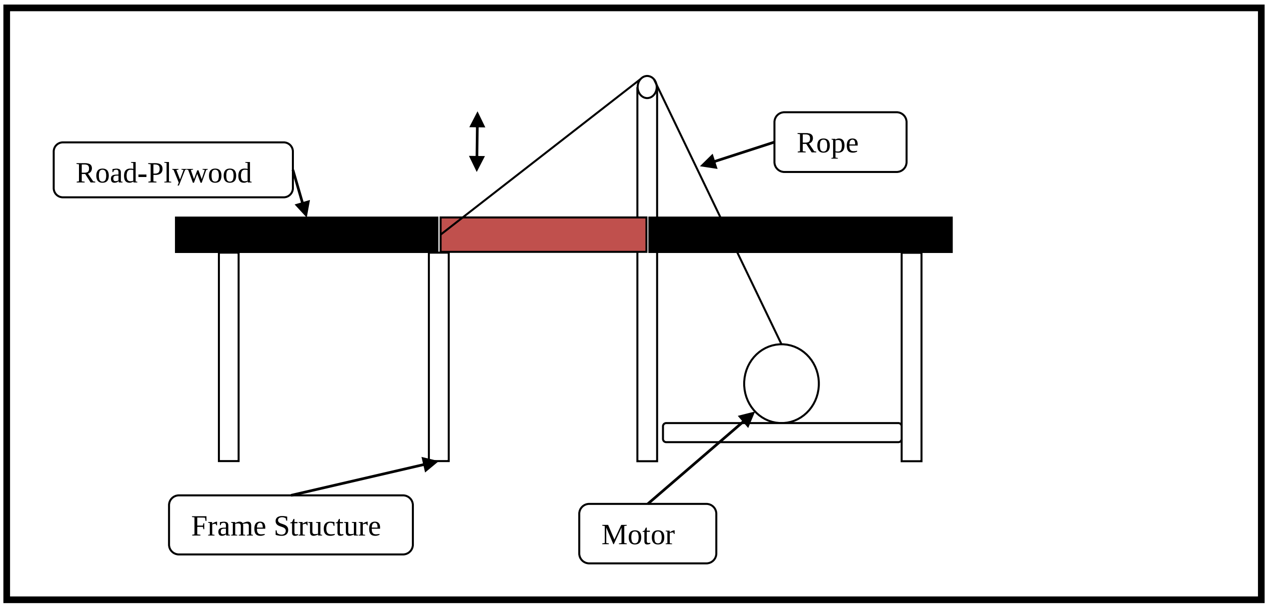
DOI: 10.17148/IARJSET.2023.10732

III. DEVELOPMENT OF THE PROJECT

3.1 Parts used in the Project

- Motor
- Battery
- Pulley
- On off Switch
- LED indicator
- Road-(Plywood)

3.2 Diagram of the Project



3.3 Working of the Project:

In this project consist of the motor, on off button, pulley and rope. The rope is connected with motor through plywood over the pulley. When button is on on one side the motor start rotating bridge is open and button is on on other side bridge is close in other side.

IV. ADVANTAGES, DISADVANTAGES AND APPLICATION OF THE PROJECT

4.1. Advantages of the Project:

Advantages of the project as per following like as:

- It opens the water way for ships and vessels with considerable speed and it permits the passage of small size boats to pass through even if the passage is not opened completely.
- It is reported that, the passage of small boat through partially opened bascule bridge is safer compare with partial opening of vertical lift bridge and Swing Bridge, especially if the bascule bridge is double leaf.
- Whether fully or partially opened, most of bascule Superstructure Bridge is out of vessel reach during collision, so it would not suffer considerable damage.
- The time required to pass vessels through Bascule Bridge is smaller than that of vertical lifting bridge and Swing Bridge. This is because vessels may come closer to the partially opened bascule than partially opened swing or vertical lifting bridge.
- Both single leaf and double leaf Bascule Bridge provide obstacles for the cars, but single leaf provides barrier at one side of the road.
- Double leaf Bascule Bridge offers the broadest spaces for vessels compared with other types of movable bridges.
- The depth of the span that extended from the pier to the center of the bridge can be decreased.

DOI: 10.17148/IARJSET.2023.10732

4.2. Disadvantages of the Project:

Dis-advantages of the project as per following like as:

- ❖ Bascule Bridge is subjected to considerable wind load especially when it is opened. So, this should be accounted for during the design of Bascule Bridge.
- ❖ The machinery used to control bascule bridge should be crucially strong and robust compared to the case where wind load is not present

4.4 Future Scope:

The Swing Bridge is the best alternative for the short span rivers and canals and also suitable for large spans if carefully designed. It is more preferable than that of Bascule Bridge. Accidents and many failures caused in these types of bridges are because of the improper operation and functioning and also improper designing. If during the time of construction and designing proper designing is done also if material chosen for the bridge serves all properties there is no chance of failure for a long duration

4.5 Conclusion:

The study hence proved that bascule bridges when designed with appropriate counter balance mechanism and proper material, they can withstand high loads even such of trains. The study here proves structural steel to be a better material for the construction of the bascule bridge as it does not deform as much as stainless steel. The design of the bascule bridge was such that it could open to a maximum of 27 degrees but for future scope, researchers can design it in such a way that it opens for larger angles for taller ships and barges to pass through them. Instead of gearing mechanism, the future studies can also look into the opening and closing of the bridge by a motor

REFERENCES

[1] Zhendong Qian, Leilei Chen, Chenlong Jiang, Sang Luo, "Performance evaluation of a lightweight epoxy asphalt mixture for bascule bridge pavements" Construction and Building Materials, Volume 25, Issue 7, July 2011, Pages 3117–3122

[2] G. Besterfield, A. Kaw, S. Nichani, B. Ratnam, T.A. Cherukara, M. Denninger, "Assembly procedures of trunnion–hub–girder for bascule bridges" Theoretical and Applied Fracture Mechanic, Volume 40, Issue 2, September–October 2003, Pages 123–134

[3] J W Smith, M A Wastling, "Predicting the fatigue life of steel bridge decks" The Life of Structures, Physical Testing, 1989, Pages 368–375

[4] F. Necati Catbas, Masoud Malekzadeh, "A machine learning-based algorithm for processing massive data collected from the mechanical components of movable bridges" Automation in Construction, Volume 72, Part 3, December 2016, Pages 269–278

[5] Pellegrino, S. 1986. "Kinematically indeterminate structures," Dissertation, Univ. of Cambridge, U.K.

[6] Wallner, M., Pircher, M., and Egger, H. 2002. "Structures reacting to environmental boundary conditions." Proc., IABSE-Symposium 2002, Melbourne, 110–111.

[7] Abrahams, M. J. 2000. Bridge engineering handbook, W. F. Chen and L. Duan, eds., CRC, New York, Chap. 21.

[8] Ecale, H., Brown, G., and Kocsis, P. 1977. "Chicago type Bascule balancing: A new technique." J. Struct. Div., 10311, 2269–2272.