ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Vol 2, Issue 3, March 2017

Strength Assessment of Corroded Steel Truss Bridge at Godavari

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***Abstract:*— In the present scenario the deterioration of bridges causing many problems. Numbers of steel brides are increasing throughout world but maintenance is also responsible task due to the lack of maintenance it gets corroded due to that strength will be affected. Therefore work to be carried out in this paper present the condition of Railway Bridge at Godavari. Based on the visual inspection the defects like corrosion prone areas, rivet missing and member deterioration etc., were identified. Based on the field conditions model is prepare by using TEKLA STRUCTURES subjected to load conditions and the stress ranges are obtained by using STAAD.PRO software. Corrosion prone members are experimentally tested for calculating the percentage of corrosion on the structure and it affects on the strength parameters. Recommendation for rehabilitation of members will be suggested based on the corrosion percentage.**

***Index Terms* - TEKLA, LOAD COMBINATIONS, CORROSION, BRIDGE**

I. INTRODUCTION

In olden days bridges were built in wooden, stone, masonry, steel etc., when compared to all other materials steel bridges mostly used now a days. But due to the lack of maintenance and climatic conditions the bridge gets affected Due to the adverse climate conditions and traffic loads Rajahmundry Godavari Bridge affected to corrosion. The development of transport system and transportation the usage of steel increased. Present construction industry mainly using conventional steel when compared to concrete. Because concrete has more self weight and high heat of hydration due to that now a days the usage of concrete is reducing day by day. When coming to the bridges most of the bridges are constructed by using steel. The use of steel in bridges 100 years ago. When steel is used as a structural element now a day's. Steel is available in different shapes channel sections, I sections, etc., based on the sections the strength parameters varies. When compared to the normal bridges it means prestressed bridges and concrete bridges the span of the steel bridges are high and the life span of the steel structure is 120 years. But the major problem in the steel structure is corrosion. Due to the climatic conditions the steel gets corroded. Corrosion deteriorates the structural member and reduces the strength capacity and sometimes there is no remedial measure or no rehabilitation technique. It is connecting kovvur and Rajahmundry and it is a steel k- truss bridge in Godavari. The span of the bride is 2.7 km and it is constructed in 1974. A structure is considered to have failed it is suddenly collapse or some local defects. And evaluation of existing structure can be done carefully carrying current loads and estimation of necessity of retrofitting or rehabilitation technique of some corroded members. The most common method used for the repair of corrosion is coating. If rehabilitation is not possible then the member should be replaced. Based on the corrosion conditions and strength parameters the member should be replaced.

Protection of corrosion is critical task to the engineer. Almost all engineering structures are designed to resist corrosion. But due to increase of pollution the member loss their designed criteria and it gets affected. Infrastructure Management should take the responsibilities of corrosion prone areas, load carrying member conditions and determine the maintenance requirements.

literature review

Alemdar Bayraktaret al(2016) *Soil Dynamics and Earthquake Engineering, Science Direct:* To determine the experimental dynamic characteristics such as mode shapes, natural frequencies and damping ratio etc., From the site inspections, the bridge were modeled by using frame and plane elements and the model was supported as one end of the pinned bearing and the other end rolled bearings Accelerometers are placed in the bridge deck both horizontal and vertical directions. Finite element model is prepared by using the bridge survey data. Updating the FEM model and assigning the different load conditions. Based on the AISC-ASD89 (Allowable Stress Design) stress can be checked.

Vit Krivyet al (2015) *Development and failures of corrosion layers on typical surfaces of weathering steel bridges*: In order to evaluate the specific local factors affecting the formation of corrosion products, it was necessary to install corrosion specimens and realize the required measurements

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on a sufficient number of surfaces of various weathering steel structures.By using the x-ray diffraction analysis.Based on ISO 9226 test panels dimensions 100*150*1.5mm and separate arrangement carried out to attach the panels. And rust thickness was measured by thickness gauge and every surface they recorded 30 measurements and the tests are carried out 1, 3 and 10 years. Based on the results expansion joint is very affected due to the water leakages. The contact area between the pressure element and the corrosion specimen is minimal, so there is no influence in the development of corrosion products on the exposed surface and specimens copy the thermal inertia of structural elements

HISTORICAL DEVELOPMENT OF GODAVARI

They are totally three bridges in Godavari Havelock bridge, Godavari arch bridge and rail cum road bridge. It was constructed at 1974 it is connected to Kovvur–Rajahmundry Bridgend it is truss bridge spanning in Godavari. The span of the bridge is 4.1 km (2.8 km rail part and 4.1 km road part). It consisting of 27 spans of 91.5m and 13 spans of 45.72m. And it is third longest road cum Railway Bridge in Asia constructed across the water body.

Figure 1

Figure 2

III.METHODOLOGY

Inspection: Site investigation of Godavari road cum Rail Bridge and calculate the current deficiencies like rivet missing, corrosion prone areas it means where the member should be replaced or any rehabilitation technique should be suggested.

Modal analysis: When compared to the all other software's modeling is a difficult task because the bridge has so many connections and diagonal and vertical members are connected by lacing and batten and gusset plate connections.

For modeling this type of heavy structure can't be possible in all software's. Based on the field conditions **TEKLA**

SOFTWARE is better to because it satisfy all requirements and connections.

After completion of model in the **TEKLA SOFTWARE** the model is exported to **STAAD V8I** based on that load combinations should be considered.

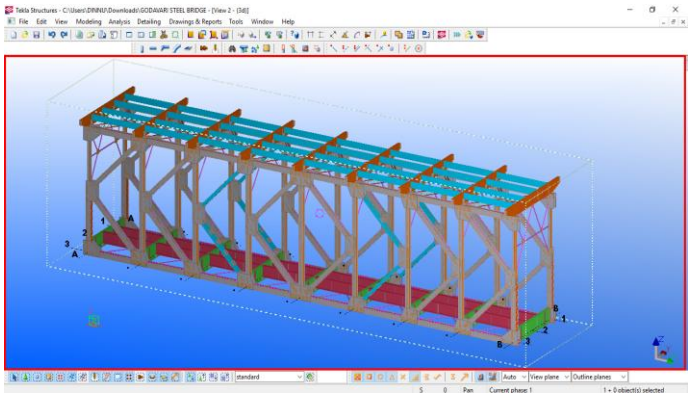

Figure 3

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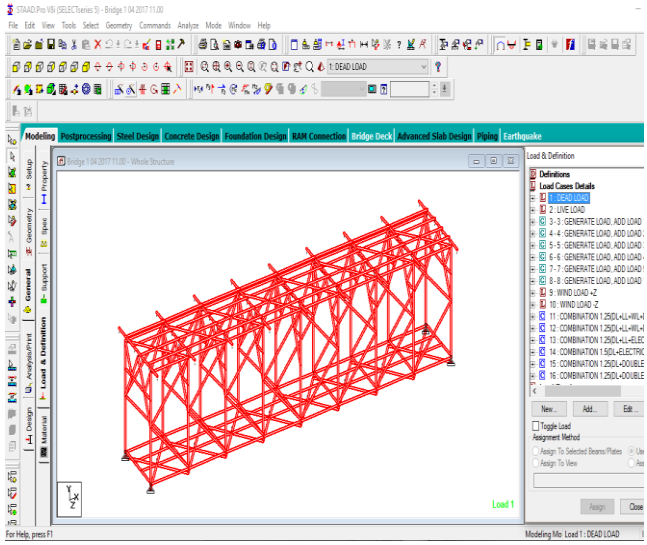

Figure 4

load conditions or combinations

Based on bridge rules *specifying the loads for design of sub-structure and super structure of bridges and for assessment of strength of existing bridge.*

Based on railway standards RESEARCH DESIGN AND STANDARD ORGINISATION LUCKNOW

- Dead loads:
  - steel: 190 tonnes
  - Track: 15 tonnes
  - Concrete: 230 tonnes
  - Gang way & other
  - service appliances: 15 tonnes
  - Total: 450 tonnes
  - Load/track length cm:

(450 tonnes/2)x(1/4800cm)
=0.0469 tonnes/cm

- Live loads:
  - Railway loads: Based on B.G.M.L standards (1926) codal provisions.
  - Trailing load : 7.67tonnes/mt
  - Tractive force: 47.6tonnes
  - Axle load:22.9tonnes
  - Impact factor:20/(14+(length of girder))
  - Road way loading:
  - One way of class AA loading or two way class A loading as per IRC bridge code.

LOADS COMBINATIONS:-

- 1.25(DL+LL+WL+DOUBLE HEADED DIESEL)
- 1.25(DL+LL+ELECTRIC LOCOMOTIVE)
- 1.5(DL+ELECTRIC LOCOMOTIVE+SINGLE TRUCK)
- 1.25(DL+DOUBLE HEADED ELECTRIC LOCOMOTIVE+DOUBLE TRUCK+WL)

V.RESULTS AND DISCUSSION

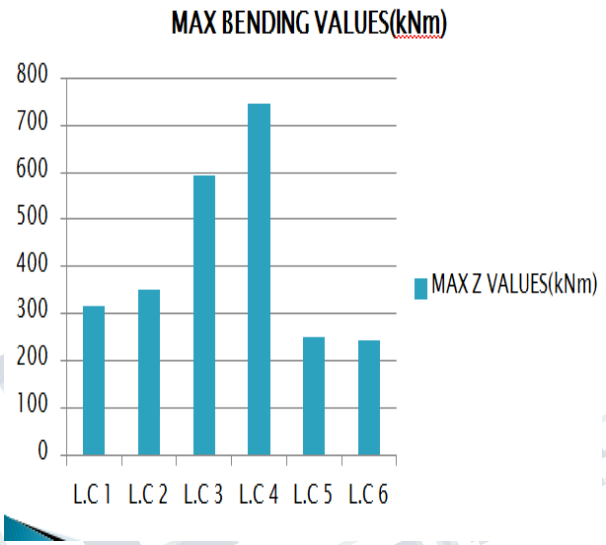

Figure 5

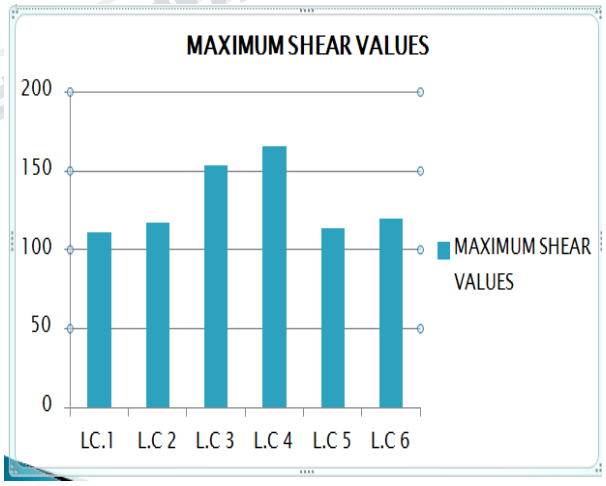

Figure 6

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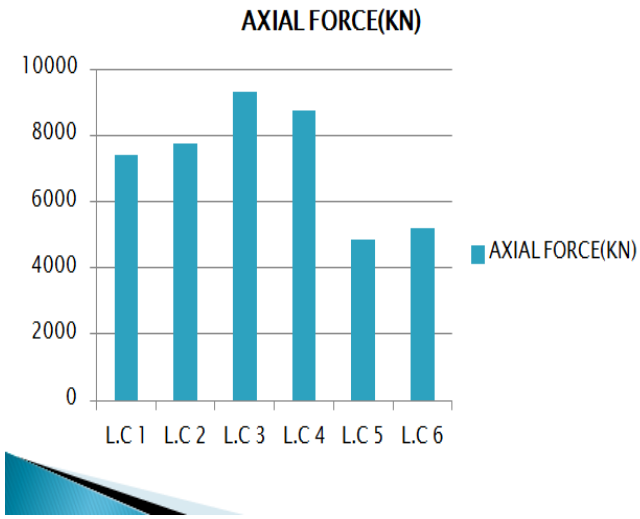

Figure 7

Based on the above results the maximum bending moment and maximum shear force is at load combination 4.and coming to the axial force at load combination 3 the force is maximum. These values are based on the analytical report and bridge codal provisions.

WORK ON PROCESS

VI.LAB EXPERIMENTS

- ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY
- TAFEL EXTRAPOLATION TECHINQUE

CONCLUSION

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions. Based on the analysis results the vertical member with least M.I has the higher axial stresses. Considering the impact of corrosion ,the reduced M.I will further increase this effect. Due to the increase of corrosion it may leads to structural damage.

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