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Experimental Behavior on Elastomeric Bearing on Bridge Structure

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Abstract: ***This paper evaluating the behavior, performance and experimental of elastomeric bearings. The study includes an experimental evaluation and elastomeric bearing should satisfy the following condition as per IRC 83 (Part II) CODE. The experimental investigation studied the elastomeric bearing, elastomer, reinforced bearing and unreinforced bearing behavior in less hardness, tensile strength, elongation at break, shear modulus, strength on elastomer, compression, shear, moment, rotation, horizontal and vertical force. The elastomer considerable under load and return to their original shape on removal of the load. The elongation can range up to 10 times their original dimensions. The chemical process for rubber or related to polymer into more durable material by heating them with sulfur is more percentage to produce an unreinforced elastomeric bearing.***

Keywords: Elastomeric bearings, IRC 83 (Part II) CODE, bridge, reinforced bearing and unreinforced bearing, elastomer, sulfur, vulcanization.

I. INTRODUCTION

elastomeric bearing is a commonly used modern bridge structure in bearing. There are several different types of bridge bearing that include elastomer bearing, elastomer bearing pads, seismic isolated bridge bearing, laminated elastomeric bridge bearing which are all generally referred to as bridge bearing in the construction industry. Bearing are mechanical arrangement provide in superstructure to substructure transmitted the load. They can be thought of as the interface between the superstructure and the substructure. The internal structure consists of a sandwich of rubber and mild steel mold as one unit. There are manufactures and designed based on standard and specification of such as B.S, European norms and AASTHO. Depending on function behavior there can be classified. An elastomeric bearing, in elastomer is a polymeric substance obtains after the vulcanization of rubber. An elastomeric bearing can consist of an unreinforced elastomeric pad or reinforced elastomeric bearing may also be fabricated by binding together alternate layers of rubber and mild steel plates. This type of bearing a new investigation. The chemical process for rubber or related to polymer into more durable material by heating them with sulfur is more percentage to produce an unreinforced elastomeric bearing.

II. MATERIAL STUDY AND TESTING RESULTS

A. General: materials – elastomer rubber & sulfur

Elastomer Rubber Bearing: Natural or synthetic polymer having elastic properties. Rubber - like solid properties are called elastomers .polymer chains are held together in elastomer by week intermolecular forces. elastomeric bearing, in elastomer is a polymeric substance obtains after vulcanization of rubber ambient temperature rubber are thus relatively soft (e=3 mpa) and deformable.eg fig 1

Sulfur: Sulfur is chemical elements, with symbol s and atomic number 16. Sulfur from cyclic octatonic molecules with a chemical formula s8.sulfur is essential elements for all life, element sulfur is a bright yellow crystalline solid at room temperature .chemically sulfur reacts with all except for gold, rubber, etc. show in figure 2.

Fig. 1. Elastomeric bearings

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Fig : 2 Sulfur

B. Code Practice:

There are manufactures and designed based on standard and specification of given following code books to be referred.

1. IRC: 83 (Part II) -1987, Standard Specifications and Code of Practice for Road Bridges.
2. IS 3400 (PART 1): 2012. ISO 37:2011.Methods of test for vulcanized rubber.
3. IS 3400 (PART 2): 2003. ISO 48:1994.Methods of test for vulcanized rubber.

III Test on complete section

All tests shall be conducted on test bearings chosen at random from the lot under acceptance testing. All the testing shall be done at room temperatures. Test pieces are two test bearing. Experimental test on Size of rubber mould in 160:320 width (b) x length (l) mm. the size takenas standard plan dimension and design data in IRC 83 Part II-1987.

The main constitutes of elastomer in polymeric substance obtained after vulcanization of rubber. The chemical process for rubber or related to polymer into more durable material by heating them with sulfur is more percentage. That rubber can be more than elongation of the original shape.

Table: No .1 Property of material:

PROPERTY	UNIT	TEST METHOD IS SPECIFICATION REFERENCE	CHARACTERISTIC SPECIFIED VALUE
Hardness	IRHD	METOD N	80± 5
Min tensile strength	Mpa	IS 3400 PART - I	21
Min elongation at break	%	IS 3400 PART - I	450
Max change in harness	IRHD	METOD N	±12
Max compression test	%	IS 3400 PART - IVI IS 3400 PART - IV	45

A. Test for shear modulus

S=ab/ 2t(a+b) , thickness t = 30 mm and area of bearing A= 51200 mm^2

Shape factor S= 1.626 tan H/GA

tan Φ= 70 , u= t tan Φ

,u= 21 but t> 1.43 u therefore the design is safe.

Average shear stain $\tau_{m=H/A,}$ $\tau_{m=}$ 400/4.6 =86.6

Shear modulus G= Δ $\tau_{m/\Delta}$ tanγ, MPa ----- G =1.45 Mpa.

The test result shall be deemed satisfactory if G is 20 % off within 1 Mpa.

B. Test for elastic modulus:

The test determines the value of **elastic modulus E_0** under axial loading.

Test pieces are two test bearing. The compressive stress-strain curve can be potted and the value of apparent elastic modulus shall be determined.

E_a = Δ σ_m / Δ_E MPa. Maximum test loading $\sigma_{m=}$23 M Pa

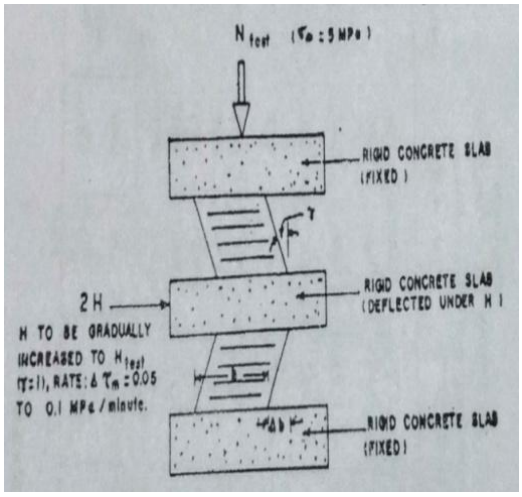

Fig.3.Shear stain diagram

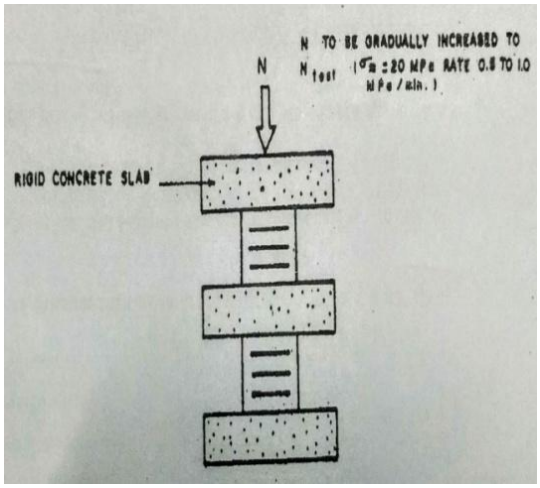

fig. 4.Elastic modulus test assembly

C. Test for elastic modulus

The test determines the values of elastic modulus E0 under axial loading. Test piece are two test bearing. Compressive stress strain curve can be potted and the value of apparent elastic modulus shall be determined.

$E_a = \Delta \sigma_m / \Delta_E$ MPa.

Maximum test loading σm=23 MPa.

D. Test for ultimate compressive strength

The test pieces are to be loaded either till the failure of the steel laminates out of elastomer whichever is earlier. The rate of loading shall not exceed 10 MPa .

$\sigma_m = P/A' < 2GS$

$= 140x10^3 / 44480 < 2GS$

, $\sigma_m = 2.25 < 2.3$therefore, design safe.

IV. QUALITY CONTROL

Where deemed necessary and so demented specifically by the specifically by the engineer, the manufacturer shall furnish to him a complete report on the process quality control comprising the standard deviation range and minimum value of the following characteristic shall be reported for the period maintain in composing of raw elastomeric and content, hardness, tensile strength , elongation at break, compression test, and shear modulus.

V. CONCLUSION

This type of bearing a new investigation. The unreinforced elastomeric bearings considerably under load and return to their original shape on removal of the load. The elongation can range up to more than 10 times their original dimensions. The successful behavior of a bridge structure depended to a large extent upon the functioning of its bearings as anticipated in the design. The vulcanizations of a chemical process for bridge bearing in elastomer soften to add them sulfur more than percentage that result testing on bearing more than elongation of original shape.

The designer should have a clear understanding of the nature of forces development in structure. They have no moving part, therefore, they required less maintenance. The event of cracking in bearing, it can be easy access and replaced with a new one. The height of bearing less thus, effecting redaction in the cost of approaches.

REFERENCES

1. N. Krishna raju , 4th editon ,design of bridges,. Published by oxford&ibh publishing co.pvt.ltd.
2. Byung-Young Moon, Gyung-ju Kang(2004), Design of elastomeric bearing system and analysis of it mechanical properties, Springerm - January 2004, Volume 18, Issue 1.
3. Ren zeo wang , Analytical Simulations of the Steel-Laminated Elastomeric Bridge Bearing, Journal of Mechanics
4. Khushndy Khilji , Karan Parbhakar, Analysis of Bridge Bearings and Stability, International Journal of Innovative Research in Science, Engineering and Technology.
5. Imtiyaz Ahmad Parry, Dr. D. K. Kulkarni,Basavaraj Gudadappanavar, Performance Evaluation of Elastomeric Pads as Bridge Bearings under Earthquake Loads, (IRJET) e-ISSN: 2395-0056.
6. IRC: 83 (Part II) -1987, Standard Specifications and Code of Practice for Road Bridges (Section: IX Bearings) Part II-Elastomeric Bearings.
7. Design of Bridge Structure, 2nd Ed. T.R. Jagadeesh And M.A. Jayaram Published By PHI Learning Private Limited, New Delhi -110001,2009.
8. Gurcharan Singh and Jagdish Singh , Building Materials (Materials Of Construction). Published By standard publishers distributors,1705-B,Nail Sarak, Delhi -110006.
9. IS 3400 (PART 1): 2012. ISO 37:2011.Methods of test for vulcanized rubber, part 1 determination of tensile stress and strain properties(third revision).
10. IS 3400 (PART 2): 2003. ISO 48:1994.Methods of test for vulcanized rubber, part 2 Rubber, vulcanized or thermoplastic- determination of harness (harness between 10 ihrd and 100 irhd) (third revision).
11. https://en.m.wikipedia.org –electrometric bridge bearing.
12. Charles W.Roeder and john f.Stanton, Design of laminated elastomeric bridge bearings, Transportation research record 1290.
13. Test methods for elastomeric bridge on bearing by y.j.Arditzoglou, research report 1304 -2 “elastomeric bearing” centers Transportation research.
14. Bridge Bearings – A Review, Arun Mohan C M, Sowmya V Krishnankutty, ijret , Volume: 04 Issue: 01 | Jan-2017.
15. Can Akogul and Oguz C. Celik ,Effect Of Elastomeric Bearing Modeling Parameters On The Seismis Design Of Rc Highway Bridges With Precast Concrete Girders, The 14 th World Conference on Earthquake Engineering October 12-17, 2008, Beijing, China.
16. S.-K. Chen, K.-Y. Liu, C.-Y. Wang, Analytical Simulations of the Steel-Laminated Elastomeric Bridge Bearing, Journal of mechanics, Published online by Cambridge University

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