ISSN: 2633-4828 Vol. 5 No.4, December, 2023

International Journal of Applied Engineering & Technology

ANALYTICAL AND EXPERIMENTAL STUDY OF TWIN BLOCK RAILWAY CONCRETE SLEEPER WITH STATIC LOADING

Abhishek Shrivastava[1], Dr. G. Shravan Kumar[2] and Dr. Jyoti Yadav[3]
[1]Ph.D Scholar and [2]Professor, Department of Civil Engineering, SRK University, Bhopal (M.P.) India
[3]Assistant Professor & head of Civil Engineering Department, SRK University, Bhopal (M.P) India

ABSTRACT
This dissertation work is for the change of conventional railway concrete sleeper by a "Twin Block Railway Concrete Sleeper". Prestressed concrete sleepers (PCSs) are the generally used type railway sleeper. They are important role in track performance pattern, behavior & safety factor. This studies is to be consists for a working three- dimensional non-linear models by using ANSYS Software and these Software are able to take in account the behavior of Non-Linear model of Twin Block Railway concrete sleeper. The Results are carried out to find the Static and Dynamic behavior of Twin block Railway concrete sleeper by ANSYS model will be accurately the Experimental results .The commonly type of sleeper was used in a french open railway network system with no problem. The following application are finding the structural analysis & design lead to be better durability aspect and the long - term performance of a twin-block railway concrete sleepers in current practice.

Keywords : Twin block Railway sleeper, Flexure strength, Static bending test, Non- linear model, ANSYS model

1. INTRODUCTION
For the new design practices on a twin block railway concrete sleeper is type of railway sleeper wherever two RCC concrete blocks are linked through metal bar or a rigid steel beam in a figure 1.The standard sleeper weight 230Kg which be less mono block sleeper equivalent. But handling and a placing can be difficult due to twisting tendency. Twin block sleepers can also be provide in a resilient 'boots' or it can be included into non-ballasted slab track or a monolithic embedment in a road surfaces for the light rail street running. Twin block railway concrete sleeper is also a composite sleeper is to be suitable alternative for a replacing of the existing concrete material & steel material and particularly timber sleeper. We will utilize twin block sleeper because it is cost effective. So it gives more strength as compare to normal railway sleeper.

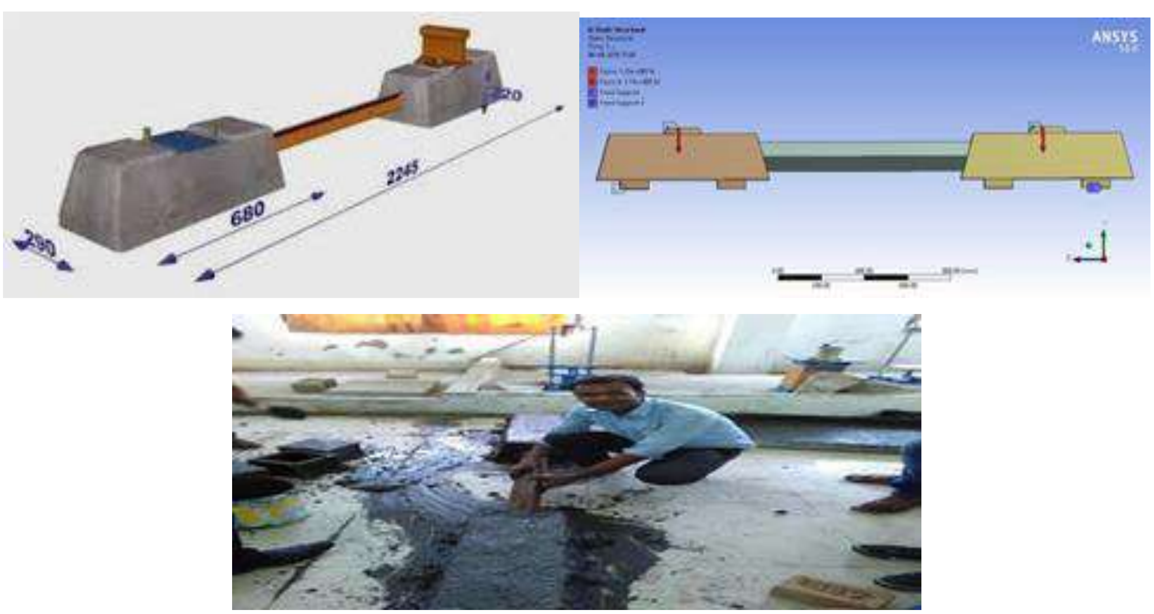


Figure:-1. (a), (b) & (C) Model of Twin block railway concrete sleeper

1.1 Merits of Twin Block Sleeper:-

1. Better lateral displacement resistance
2. More elastic behaviour
3. To Easy handle due to the low weight

1.2 Demerits of Twin Block Sleeper:-

1. Required special elastic fastening system
2. Declination of a railway track centre position
3. Defects are generated for the reason of a corrosion of steel & fatigue of steel.

2. REVIEW OF LITERATURE

J. Taherinezhad et.al:- This research studies is to be done for the investigation the material requirement of railway concrete sleeper in order to be meet with structural and durability aspect.

Robert H. Crawford:- In this analytical study to examine the life cycle greenhouse gas emissions was associate with timber (river red gum) and reinforced prestressed concrete sleepers and this studies is very useful in future infrastructure decisions.

D. Kishore Kumar et.al:- In this research article to demonstrate the detailed analysis of the prestessed concrete sleeper for the static and dynamic load parameter. Also to be check the dynamic effect on railway sleeper due to impact load.

Sakdirat Kaewunruen et.al:- In this article examine the application and the development of FEM modelling is to be predicting the dynamic motion responses of prestessed concrete railway sleepers. The analysis is to be done on LS-Dyna method.

Gerard Vanerp et.al :- For a research examine to discuss the details of a new polymer sleepers and comparison with normal available material sleeper were used.

Sakdirat Kaewunruen et.al:- To evaluate the dynamic responses of the voided concrete sleeper due to impact loading. To assets the life of railway sleeper and mode shape failure of concrete railway sleepers. It is also better in dynamic behaviour performance of the voided concrete sleeper.

3. METHODOLOGY

In this dissertation, the study is focussed in assessing the behaviour of a twin mono block railway concrete sleeper. The Static and Dynamic performance of Twin- mono block railway concrete sleeper studied by ANSYS as well as Experimental work is carried out. This dissertation work is achieved in the two stages-

3.1 Analysis of the Twin Mono Block Railway Sleeper by ANSYS Software.

3.2 Experimental Study of Twin Block Railway Concrete Sleeper.

3.1 Analysis of the Twin Mono Block Railway Sleeper by ANSYS Software:-

3.1.1 Modelling of a twin mono block railway sleeper by ANSYS:-

(1) In this section, ANSYS model for twin Block railway concrete sleeper is discussed**.** Firstly go through the ANSYS Workbench.

(2) In Second Stage Go through the Static structural.

(3) After Static Structural and then click to Engineering data and then input the properties of related concrete and steel material.

(4) After the Input engineering data Go through the Geometry click and Again Go through Import Geometry then Go to model click.

(5) After Import the geometry then generate the Mesh for following model.

(6) After mesh is generate then go through Static structural and also Input the Support and force(Two point loading) are applied in the following such twin block railway concrete sleeper Model.

(7) After load are assign then solution may be obtain

3.2 Experimental Study of twin block railway concrete sleeper:-

3.2.1 Compressive Strength of Concrete (M-60):-
As per the RDSO, The minimum number of three cubes was casted in batching process for a nominal mix design. To determine compressive strength of a concrete. Check the durability of materials

3.2.2 Static bending test for sleepers:-
3.2.2.1 Moulding of twin mono block railway sleeper: - Take a Twin block railway concrete sleeper mould whose dimension is 2.245m length, width 290 mm and 229mm height.

3.2.2.2 Casting of Twin Mono Block Railway Sleeper:- As we talk about casting of Twin block railway concrete sleeper for determining flexural strength and Static bending of Twin block railway concrete sleeper, according to Railway Is code T-39-85,standard size of test twin block concrete sleeper specimen should 2245mm*290mm*220. This research work was used a twin mono block railway concrete sleeper mould of size 2245mm*290mm*220 for preparing twin block concrete sleeper specimen. During casting of Twin block railway concrete sleeper. A railway IS-code standard was kept in mind of mixing of materials, proportion and preparation of cube mould is to be done as per RDSO (T-39.85). Same mix proportion is adopted for twin block railway concrete sleeper may be casting.

3.2.2.3 Test process of Static Bending Test:- The sleepers was loaded gradually 30 to 40 KN/min per standard specified load which retained at this level to one minute for observing cracks.

Moment of resistance: - The railway concrete sleeper passed, if loads are specified in a without crack. Railway sleepers were subjected to loading till appearance of first cracks is to be occurring.

Moment of Failure: - The railway sleeper was passed, if they are able to take a load beyond a specified load test.

Moment of Failure Test (for Rail Seat Bottom):- In a production technique, If they are one sleeper for every 250 sleepers were manufactured shall tested here. After production technique gets to be stabilized testing scale should be decreases to one sleeper for an every 2500 sleepers were produced.

Moment of resistance (MR) test (Rail seat bottom):- On the 15 days of cubes strength of the lot mention .For the scale of testing are as follow-

i) For the 55 N/mm^2 above for a M55 Grade & 60 N/mm^2 above for M60 Grade –one sleeper per lot.

ii) For M-55 grade: - Is to be less than 55 N/mm^2 but up to 48 N/mm^2 – two sleepers per lot.

iii) For M- 60 grade:-less than 60 N/mm^2 but up to 55 N/mm^2 – two sleepers per lot.

3.2.3 Measurement of electrical resistance:-
All sleepers are tested as per electrical resistance for their fitness of railway track.

4. RESULTS AND DISCUSSION

4.1 Compression of Numerical and ANSYS Model: - As per results for numerical model with the experimental model.

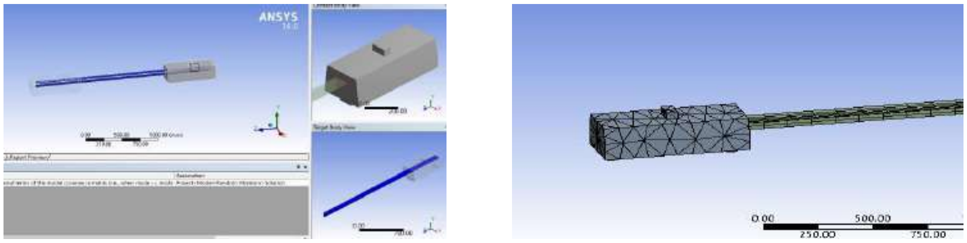


Figure.2 Contact region with concrete and steel & Mesh Model

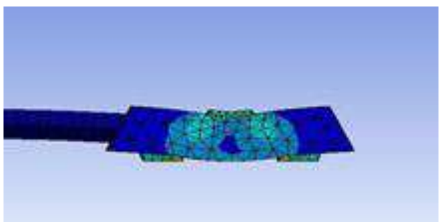


Figure.3 Equivalent Elastic Strain

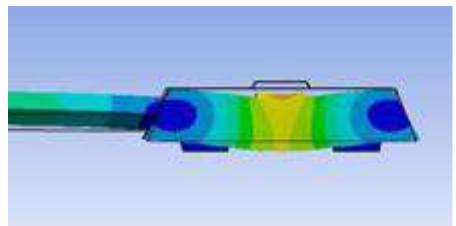
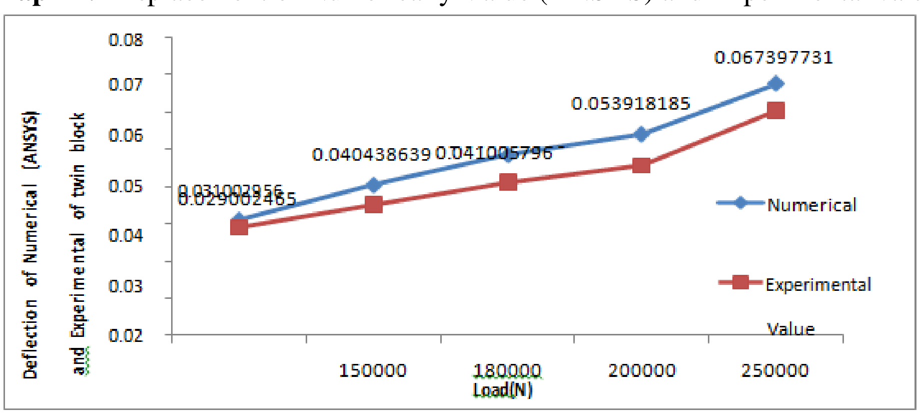


Figure 4. Displacement

Table .1 Comparison of Numerical and ANSYS model

Load (N)	Displacement (MM)	
	Numerical(ANSYS)	Experimental
115000	0.031002956	0.029002465
150000	0.040438639	0.035025864
180000	0.048526366	0.041005796
200000	0.053918185	0.045600481
250000	0.067397731	0.060287645

Graph 1:-Displacement of Numerically Value (ANSYS) and Experimental value



4.1.1 It's to be noticed that a total behaviour of numerical experimental model its very quite close to be the laboratory test method with variation on displacements.

4.1.2 As shown in graph.3,4&5(7,14&28 days strength), compressive strength is suitably increased.

4.1.3 In the field, there will be no crack in experimental model but the ANSYS models at 200KN crack are generated.

4.1.4 Comparison between the flexural strength/Static bending strength and cost of standard sleeper manufactured by making use of standard material of 53- Grade and the Twin block railway concrete sleeper manufactured through efficient use normal cement material,(generally known as locally available material) for broad-gauge.

4.1.5 As shown in graph.8(static bending strength),the strength of the standard sleeper should be 230KN and strength of manually manufactured twin block railway concrete sleeper comes out to be 232KN,234KN and 238KN and also Satisfactory results of Analysis of twin block railway concrete sleeper with ANSYS16.0 Software.

4.1.6 The cost of manually design Twin block railway concrete sleeper is economical as compare to Standard prestressed railway concrete sleeper.

5. CONCLUSION

As per the result analysis the static behaviour change of a twin- mono block railway concrete sleeper with use of non-linear material properties and the ANSYS16.0 workbench calculation. The purpose of this project is to compare and check the flexural strength/Static bending strength of normal manufactured twin block railway concrete sleeper with the manufactured railway sleeper in laboratory which is less expensive as compared to railway sleeper that are manufactured in industries. The cost of manually design Twin block railway concrete sleeper is economical as compare to Standard prestressed railway sleeper. The strength of the standard sleeper should be 230KN and strength of manually manufactured twin block railway concrete sleeper comes out to be 232KN, 234KN and 238KN also there are satisfactory results of analysis of twin block railway concrete sleeper with ANSYS16.0 workbench Software. Hence inference achieved from this project is that it gives satisfactory results for Metre Gauge/Broad-Gauge. This twin block railway concrete sleeper is good enough for economic point of view. Potential for total strength of railway sleeper was high and enough to carry out the future activity.

6. FUTURE SCOPE

For the future to improve the durability aspects of twin block railway concrete sleeper. These reviews establish that further work needs to be done in the terms of high performance materials and their effect of sudden dynamic load. Hence it is suggested that twin mono block concrete sleeper be able to manufacture with the normal cement available in the market.

7. REFERENCES

{1} **J. Taherinezhad*, M. Sofi, P. A. Mendis and T. Ngo:-** A Review of Behaviour of Prestressed Concrete Sleepers, Electronic Journal of Structural Engineering,13 -January, 2013.

{2} **Robert H. Crawford:-** Using Life Cycle Assessment To Inform Infrastructure Decisions: The Case Of Railway Sleepers, The University of Melbourne, Parkville, Victoria 2010, Australia.

{3} **D.Kishore Kumar, K.Sambasivarao:-** Static and Dynamic Analysis of Railway Track Sleeper, International Journal of Engineering Research and General Science Volume 2, ISSN 2091-2730, , October-November, 2014

{4} **SakdiratKaewunruen and Alex M Remennikov:-** Low-velocity impact analysis of railway prestressed concrete sleepers, 23rd Biennial Conference of the Concrete Institute of Australia: Design, Materials, and Construction, Adelaide, Australia, ISBN 0 909375 78 X, 18-20 October 2007,

{5} **Gerard VAN ERP & Malcolm MCKAY:-** Recent Australian Developments in Fibre Composite Railway Sleepers, Electronic Journal of Structural Engineering, 13-January 2013

{6} **Sakdirat Kaewunruen , Alex M Remennikov and Akira Aikawa:-** A statistical study to assess dynamic response of void concrete railway sleepers to impact loading, Paper Number 88, Proceedings of ACOUSTICS 2011, Gold Coast, Australia, 2-4 November 2011.