DESIGN AND CONTACT ANALYSIS OF RAIL TRACK USING SOLIDWORKS AND ANSYS

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ABSTRACT

Computer aided investigations are carried using ANSYS, to verify maximum stress and its location. To predict detailed stress 3D solid model has been chosen with the help of SOLIDWORK software.First 2D geometry is created using SOLIDWORKS than its revolved by revolve extrude command to make wheel. Additionally, after selecting the loading and boundary conditions and appropriate finite elements, the nonlinear axis symmetric 2D FE models were generated and simulated in non-uniform and non-homogeneous conditions. A solver mode in ANSYS software calculates the stresses, deflections, bending moments and their relations without manual interventions, reduces the time compared with the method of mathematical calculations by a human. ANSYS static analysis work is carried out by considered caststeel and their relative performances have been observed respectively.

***Keywords*: *ANSYS 11, SOLIDWORKS 2010, Stress Analysis, Wheel Rim*.**

I. INTRODUCTION

Railway transportation system, as one of the notable meansof commuting systems, has served for human societies andhas pursued its improvements as other promoted aspects oflife. In recent years, the capacity of carrying axial loads forworld railways as well as their velocities has been enhancedwhich results in increasing the amount of strains and stresseson lines and digression of rails. By this augmentation,interactions between railway components become more considerable.The rolling contact of awheel on a rail is the basis ofmany Rail-Wheel related problems including the rail corrugation,wear, plastic deformation, rotating interaction fatigue, thermo-elastic-plastic behavior in contact, fracture, creep,and vehicle dynamics vibration. Therefore, it has attracted alot of researchers to various railway networks.The stress distribution is an important factor at the Rail-Wheel contact interfaces, that is, two materials contacting atrolling interfaces which are extremely influenced by geometry of the contacting surfaces,material attributes, and loadingand boundary conditions. Convincing theories as well as computer software have been developed to evaluate all the influential parametersinvolving in the Rail-Wheel interaction. Recently, tendency towards finite element method (FEM) has increased because of its simplicity, accuracy, cost efficiency, and versatility. FE analysis results in a set of simultaneous algebraic equations[1].

1.1 Rails

Rails are longitudinal steel members that are placed on spaced sleepers to guide the rolling stock. Their strength and stiffness must be sufficient to maintain a steady shape and smooth track configuration and resist various forces exerted by travelling rolling stock. One of their primary functions is to accommodate and transfer the wheel/axle loads onto the supporting sleepers. Divided into three parts:

1.1.1 Rail head: the top surface that contacts the wheel tire

1.1.2 Rail web: the middle part that supports the rail head, like columns

1.1.3 Rail foot: the bottom part that distributes the load from the web to the underlying[2].

II.WHEEL ELEMENT AND MATERIAL

Permissible Load on wheel 98 ton is calculated from KARL GEORGE wheel catalogue.

Dead weight of vehicle	50 ton
Lining weight	5 ton
Carrying capacity	250 ton
Max drive wheel load	88 ton
Max permissible wheel load	98 ton
Permissible pressure per unit area	5.6 n/mm2(rail 590 N/mm2, wheel rim 590 N/mm2)
Wheel speed	30m/min
Number of wheel	4

CAST STEEL
G35CrNiMo6-6QT1, EN10293
MATERIAL NO. : 1.6579
Rm = 800 MPa (Min.)
Rp 0.2 = 650 MPa (Min.)
A = 12% Min.
KV = 30 J (Min.) ×
} FOR t = 150 TO 250 mm
×AVERAGE VALUE OF 3 SEPERATE SPECIMENS FOR IMPACT TEST CARRIED OUT AT ROOM TEMPERATURE. LOWEST INDIVIDUAL VALUE ≥ 21 J.

III. DESIGN OF WHEEL AND TRACK ASSEMBLY

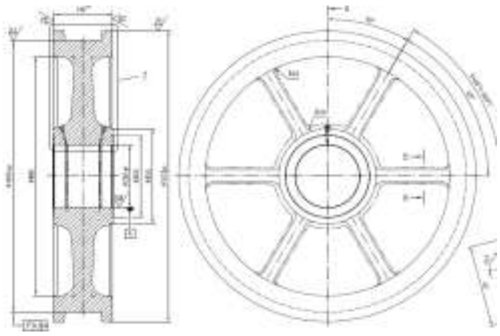


Figure 3.1 Drawing of wheel

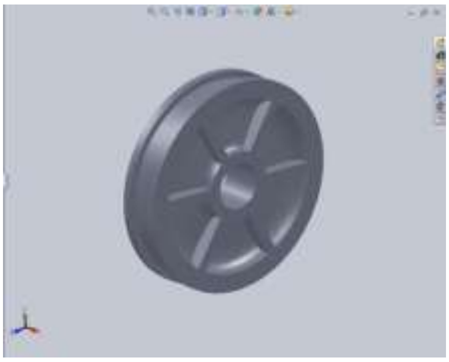


Figure 3.2 3D model of wheel on SOLIDWORK

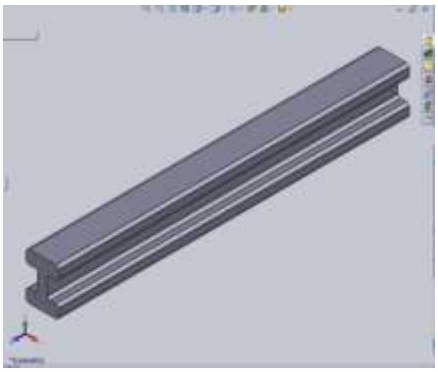


Figure 3.33D model of track

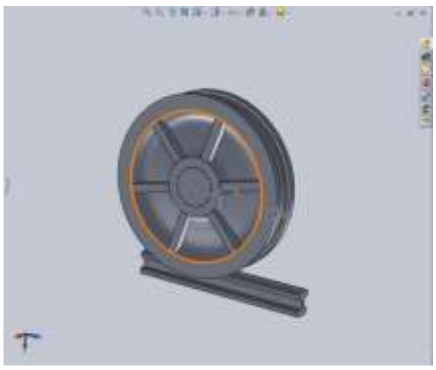
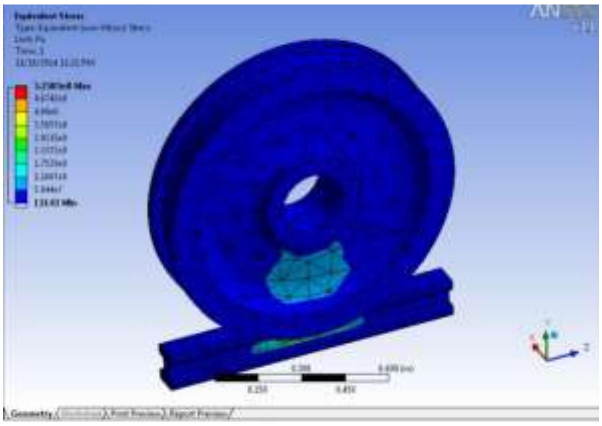


Figure3.43D model of wheel and track assembly

IV. ANSYS PROCEDURE FOR CONTACTANALYSIS



1. File of the wheel and track is saved in IGS format.
2. 3D model of wheel and track assembly is inserted in ANSYS.
3. Than simulation option is selected for analysisof wheel and track.
4. Connection is made between wheel and rail by connections in project tree.
5. Rough Contact between wheel and rail is selected by contact option.
6. Tetrahedral element is selected in Meshing method under mesh and mesh is generated.
7. Track is fixed in all 3 DOF by fixture option.
8. 98 ton of permissible load is applied on wheel. Stress result is obtained by showing the final result option

V. RESULT

		Maximum contact stress
1.	Yield strength	525 Mpa
2.	Factor of safety	1.23

VI. CONCLUSION

CAD model of the wheel track is generated in solidworks and this model is imported to ANSYS for processing work. An amount of force 98 ton is applied along the circumference of the wheel and track is fixed. Following are the conclusions from the results obtained:

- Maximum stress by ANSYS is lower than the yield stress of material.
- Von-mises stresses are less than ultimate strength.
- Since the von-mises stresses is less than the ultimate strength, talking deflections into account, cast steel is preferred as best material for designed wheel track.

VII. SCOPE FOR FUTURE WORK

In the above proposed work only force acting circumferentially on the wheel track is only considered, this can be Extended to other forces that act on the wheel rim and structural analysis is carried out, this can be extended to TransientAnalysis.

REFERANCE

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