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Design and Development of Machine for Deepscreening of Railway Tracks

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Abstract*: Deep screening process is the Track maintenance in the Indian Railways. It is the process of removing gravels from track. Which is used for removing of damaged sleepers from the track. For this work Indian railway using more man power with high cost. By this process time lag occurred in passenger travelling. Our design is for developing the related design for reduce cost of man power and time. In this paper proposed a design and development of a machine for deepscreening of railway tracks by using AUTODESK Invnentor software for saving man, machine and materials.

Index Terms*: Deep screening, Railway track, Autodesk inventor.

I. INTRODUCTION

Deep screening is the process using by the Indian railways to renovate or replace the damaged sleepers with new sleepers. This process is called deep screening of railway tracks. Indian railways using many types of methods for this work. And too much expenditure spending on this. The methods which are manpower and larger machines. This all are requires high maintenance and cost. By this process we have occurred some problems in work. Mainly we have time lag in train services, too much of labor cost in work. And also, in the time of working larger machines stations requires to shut down the train services between the two stations. Hence this process has to many complications. In this process sometimes labors are sacrificing their life to work. As perliterature survey we are find some interested topics related from railway track field with track maintainers. As they explain the minimum time required for removing and replacing time of sleeper is 40 minutes to one hour. It is main point to consider.In this whole process of work removal of gravels from the track takes 90 percent of total time. Larger machines only used for total track change or total gravels removed from the track between the two tracks. When the time of one to ten sleepers' machines are not required to this process.

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That time Railway using labors for work. The gravels are compressed by train movements regularly. Normally Indian railways using different types of gauges in tracks maximum of gauges are broad gauge. This are 4 types which is Broad gauge, Standard gauge, Metre gauge, and Narrow gauges. Distinguish between these gauges are different sizes.That are Broad gauge with the width of 1676 mm to 1524 mm, Standard gauge is with width of 1435 mm to 1451 mm, Metre gauge with 1067 mm to 915 mm, and the last one is Narrow gauge is 762 mm to 610 mm. Fig.1 shows the railway ballast layer.

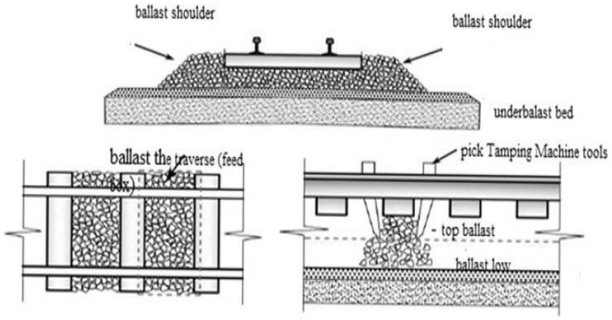

Fig 1 Railway ballast layer

Indian railways using different types of large machines for Deep screening process. But these machines are conventional type machines. Indian railways are getting many types of new technology in different departments. Deep screening machine is consuming more time and diesel.If the time of below Ten sleepers damage that will be a different issue. That is not using any machine. In that time railway workers are solving that problem. But the only problem here is gravels. Gravels are compressed by trains movement. It's going too tight. So, it's not that much easy to remove gravels from the track. Minimum time taken for remove of gravels from the track is 40 to 60 minutes. Various simulation studies were done by using contact stress analysis of disc brakes CFD and ANSYS software [1-4]. Fig.2 shows the conventional type of large deep screening machine.

Fig.2 Conventional type large deep screening machine

II. MODELLING OF MACHINE

After the literature survey we are working for reduce time of work, cost of work and work efficiency. As per the manual process of gravel removing will be take one-hour of time. And it is the too large time. We are working for this. The design is very complicated to develop.We are using Autodesk Inventor design software for module development. This software easy my work to develop my project design. As per the details the width of track is 1600 mm maximum and distance between the sleeper to sleeper is 26 to 30 mm.

Our design is related to that dimensions. As per the track our dimensions are 500 mm of length and 30mm of width. This machine is the portable type machine having weight up to 30 kilograms. And material using for this machine is mild steel weld. Many of other materials for different components.

To this machine we are applying the chain drive mechanism for transmission of rollers. Rollers consist of sharp buckets for easy to drill into the gravels. This machine is consisting of two rollers, four chain sprockets. For the power supply we are developing Dc motor with power battery system. Working of this machine is common like all machines. First the operator the machine as usual with power button. The is connects the both motor and sprocket of the first roller. And another chain connects from first sprocket to second one. The chains are rotating in anti-clock wise mode. This is the working phenomena of the machine.

Major components of machine

a. Chain Drive system
b. Rollers
c. Bearings
d. Dc motor
e. Lipo battery
f. Speed controller
g. Plastic trolley wheels
h. Frame
i. Sprockets
j. Bolt and Nut

These are major parts for developing this machine in physical view. Here we are using only the names as Battery and motor. That both or decided after the load test of the machine. The Lipo battery is the latest generation battery which more capacity to store the power and recharge too.

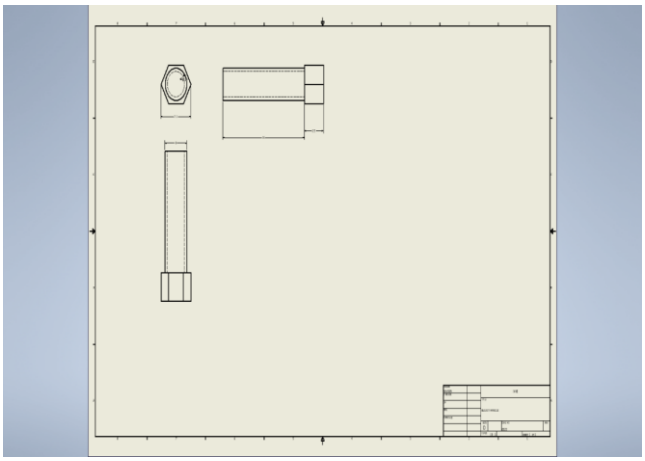

Fig.3 Fastener diagram in Autodesk inventor

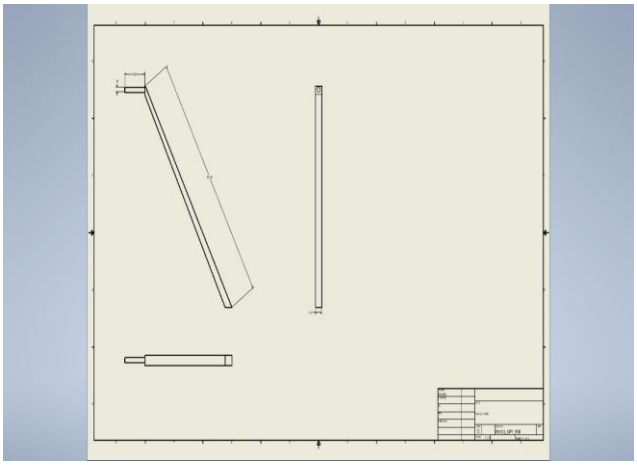

Fig .4 Handle diagram in Autodesk inventor

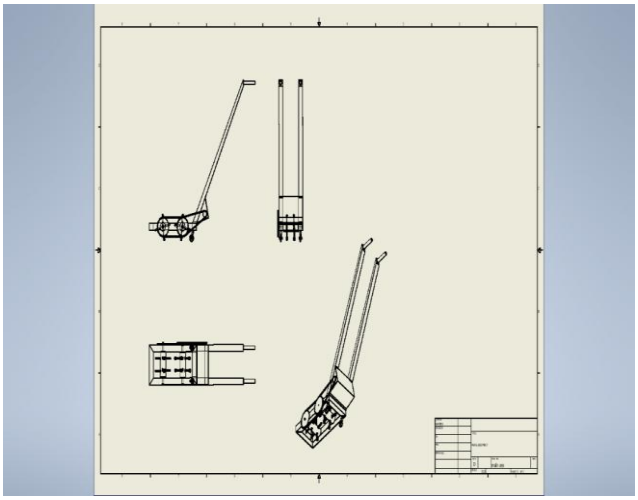

Fig. 5 Assembly of machine in Autodesk inventor

The design also, developed in the 3D base model for easy understanding to everyone. That is developed in the Auto desk Inventor software. Fig.3-4 represents the parts of a machine in AUTO DESK INVENTOR.

III. RESULT AND DISCUSSIONS

This chapter is studying about the outcome of the research of design model of the deep screening machine. Developing of the machine design in the software of Autodesk Inventor software. This software did well support in developing the design. As shown in the above figures that are result.For the production we are develop the 2D drawing for manufacturing process. That are easy to implement in production. As per the this design the machine has more capacity then required. And also, it is the very useful method.And the main part in this process is different forces apply test on the machine capacity. Come to the stress applications we are apply the 100 kilograms of load on the different locations. Like frame, rollers etc. For the presentation purpose we are develop the 3D based model. This is visual based model for easy understand. This model will be shown in the below fig.7. The design stress analysis report has done by the simulation process. The loads which are applied are vertical load, rotational and many etc. Fig 6 represents the 3D model of a machine.

Fig.6.3D model of a machine

Discussion held on the design of the deep screening machine development. There is also some of negative flaws are in this design. That are possible to sort out after the practical working conditions. And the using parts like battery and motor installation depends on the actual load.The stress analysis report has done. That is attached below. Mass 39.5341 kg, Area 1121820 mm^2 , Volume 5036200 mm^3 Centre of Gravityx=-389.484 mm y=-436.12 mm z=-351.923 mm.

Operating conditions

Force:1

Load Type	Force
Magnitude	100.000 N
Vector X	-0.000 N
Vector Y	-100.000 N
Vector Z	0.308

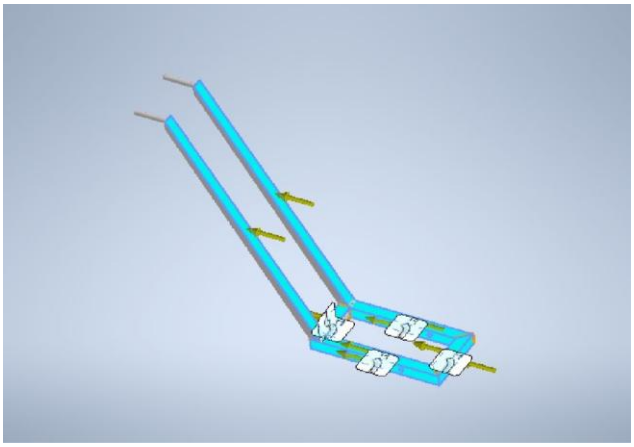

Fig.7 Constrianed model of machine

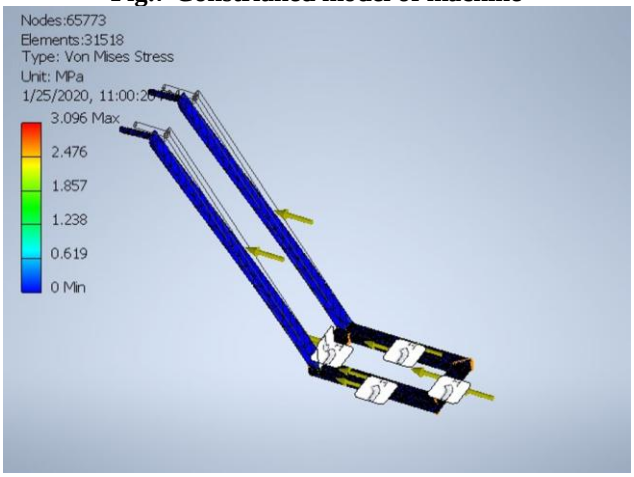

Fig.8 Vonmises stress analysis of frame of machine

In the fig.8 it is observed that maximum stress occurred at the contact point and minimum at the blue color ie handle frame.

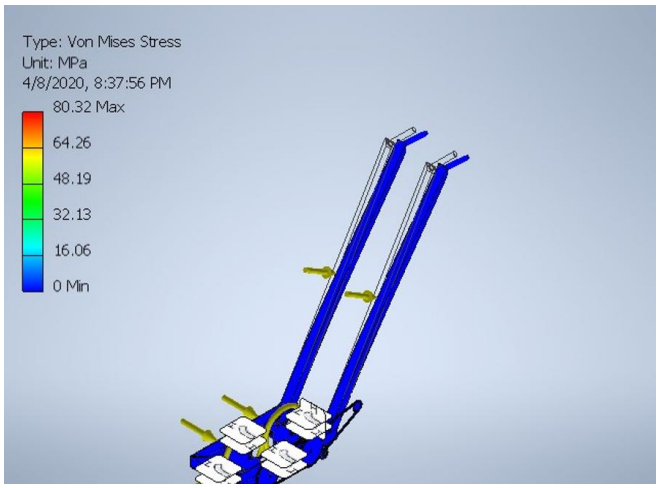

Fig.9 Vonmises stress analysis of a machine

Fig 7 -10 represents the vonmisses stress values of a frame, machine and deflection values

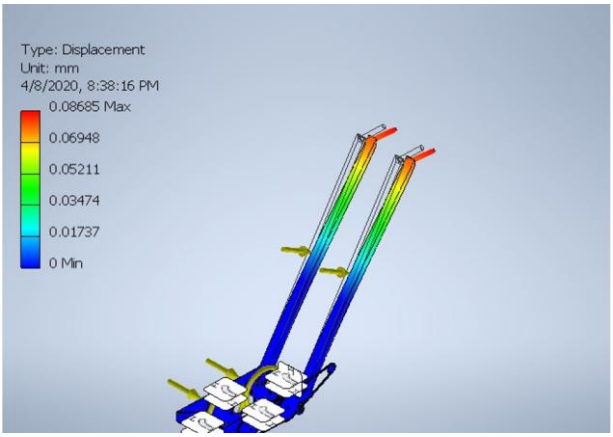

Fig.10 Deflection values of a machine

Table 1 gives the observed values from static analysis of a machine.

Table.1

	Minimum	Maximum
Volume	5036200 mm^3	
Mass	39.5341 kg	
Von Mises Stress	0.0000140816 MPa	3.09556 MPa
1st Principal Stress	-0.279685 MPa	3.20488 MPa
3rd Principal Stress	-2.69101 MPa	0.390096 MPa
Displacement	0	0.0719072 mm

IV. CONCLUSION

This machine design is useful to manufacture the machine for railway deep screening machine. This vary from the large machine-like continuous tamping machine (csm). This machine is reduced man work in the field. And also, reduce the time of working, train delays. Deploy of the machine into the railway is help to many changes.

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K Viswanath Allamraju, completed his M-Tech from **MANIT Bhopal** and PhD from **NIT Warangal**. His research areas are finite element method, neural networks, material characterization of metals and composite materials, vibration analysis and machine design. He has published more than 50 articles in various International journals (Scopus indexed). He had participated 60 International conferences at various IITs and IISC.

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