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Experimental Analysis Conventional Leaf Spring

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ABSTRACT: *In this work a review is taken related to the conventional leaf spring. Approximately ten research papers are considered to complete the review. The aim of the project analysis of Conventional Leaf Spring likes as load carrying capacity, stresses, stiffnes,etc.*
In many research papers it is observed that lot of experimentation is done on conventional leaf spring ,hence aim of these paper is to collect all data in a single paper.

INTRODUCTION: Leaf spring is main component of automobile suspension system. It consists of a number of flat plates, which are stacked together. The longest leaf, called the master leaf, is bend at both ends to form spring eyes. Through the eyes, spring is attached to the body of the vehicle.One or two more full length leaves are provided between main or master leaf and other type of leaves known as Graduated leaves. These extra full length leaves are provided to support the transverse shear force, in addition to bending load.[8]

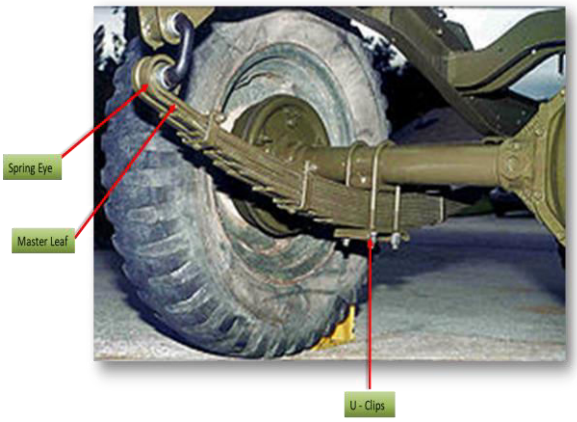

Fig.No.01-Construction of Leaf Spring

The leaves are given an initial curvature known as camber. This initial curvature is provided so that the leaves will tend to straighten under the load. The leaves are held together by means of U-bolts and the central bolt or band shrunk around them at centre. Rebound clips are located at intermediate positions along the length of the spring. So that the graduated leaves share the rebound load with main or master leaf. The rebound clips also help to keep to keep leaves in alignment and prevent lateral shifting of leaves during the operation.
Suspension system prevents the road shocks from being transmitted to the vehicle components also safeguard the occupants, it preserves the stability of the vehicle in rolling, while in motion.

LITERATURE SURVEY:
Dinesh R. Satput[1], has a conference paper is comparative study has been made between composite and steel leaf spring with respect to weight, cost and deflection. The composite leaf spring is lighter and more economical than the conventional steel spring with similar design specifications.

Bhaumik A. Bhandari[2], has performed Analysis of comparative study of composite and conventional leaf spring and the acheive This design helps in the replacement of conventional steel leaf springs with composite mono-leaf spring with better ride quality.To achieve weight reduction in the suspension system by replacing steel leaf spring with mono composite leaf spring.

L. Radhakrishna[3], has analysis the Hybrid composite leaf spring was fabricated and tested. The Experimental results are compared with the existing steel leaf spring. The report proves that the composite material chosen (glass- and kevlar-fiber-reinforced plastic) can withstand the maximum load, the maximum deformation, and the maximum stress and can be used to create compact suspension systems.

E. Mahdi, [4], has explained this paper , the influence of ellipticity ratio on performance of woven roving wrapped composite elliptical springs has been investigated both experimentally and numerically. A series of experiments was conducted for composite elliptical springs with elliticityratios(a/b) ranging from one to two .

Mayur D. Teli, [5], has performed a experimental and finite element analysis result are compared for validation of this analysis. From results is observed that % difference in values for deflection 3.93%, for stiffness 4.06%, for energy absorbed 3.94% and for natural frequency is 5.25%, which are satisfactory values. Weight difference between EN 46 leaf spring and GFRP leaf spring is 67.70% . From above points, it is found that Glass Fiber Reinforced Plastic (GFRP) leaf spring is better material and economical alternate instead of EN 46 for electric vehicle with excess battery weight for static conditions.

Rajan P, [6], has performed a comparative study has been made between steel and hybrid composite leaf spring with respect to strength and weight. Hybrid composite leaf spring reduces the weight by 64.23% over steel leaf spring. The size optimization has been carried out for further mass reduction of composite leaf spring. The stresses in the composite leaf spring are much lower than that of the steel. Of course, the reduction is attributed to lower elastic modulus and better geometric (free of notch) characteristics of the composite materials.

P. Shinde, P. Talekar, Y. Kamble and S. Desai,[7] The research demonstrated that composites can be used for leaf springs for light weight vehicles and meet the requirements, together with substantial weight savings. A comparative study has been made between composite and steel leaf spring with respect to weight and strength. From above experimentation, it is obtained that the natural frequencies of the composite leaf spring is more than the steel leaf spring with similar design specifications but not always is cost- effective over their steel counterparts.

Janarthan1 M. Venkatesan2, PG scholar,[9] the best of tensile and bending stress, deformation, and natural frequency compare the other composition. The natural frequencies of various parametric combinations are compared with the excitation frequency for different road irregularities. The strength to weight ratio is higher for composite leaf spring than conventional steel spring with similar design.

Ashish P. Borhade [10], Results obtained by experimental modal analysis and by FEA analysis are nearly same. So, one can say that these are quite correct values of frequencies of selected steel leaf spring. So, if material of this steel leaf spring is changed keeping its dimensions same as initial dimensions and if the change in natural frequencies of that spring is studied with respect to change in material of that spring, this study will be useful for material optimization of leaf spring.

DESIGN AND EXPERIMENTATION:

Material and Diemensions of Leaf Spring :

Material of steel structure is steel.
Theakness of leaf = t =6 mm
Width of Leaf = b =50 mm
Length of Leaf = l =960 mm

Testing Procedure of Leaf Spring:

1. Arrange the holding clamp of UTM machine as per the size of leaf spring.
2. Switch on the CPU of computer and the UTM machine.
3. Reset the UTM machine as per ourrequirement.
4. The variation in deflection with respect to applied load is selected on thesoftware.
5. Apply the load gradually from starting with 0 KN to maximum load springsustain.
6. Observe the deflection for that applied load.
7. When inner surface of the leaf spring will get touch to the workbench of UTM machine, stop theload.
8. Observe the maximum deflection occurred in the spring at specificload.
9. Take all the readings of the load vs deflection from thesoftware.
10. Remove the load applied gradually till the spring regains its meanposition.
11. Remove the leaf spring from holding clampfixture.

Fig.No.02- Conventional leaf spring under loading Condition

PRECAUTION:

1) Fix the leaf spring on the workbenchcarefully.
2) Apply the load gradually to avoid the sudden failure in thespring.
3) Control the speed of the UTMmachine.
4) Check the initial condition as no load condition on the spring to avoid the faultyreadings.
5) Maintain the safe distance from the machine while testing the leafspring.

OBSERVATIONS:

We got the following results by testing the conventional leaf spring on universal testing machine. Base on the result obtained by taking suitable load value we prepared following observation table and observed corresponding deflection value. After that we got the graph load vs deeflection.

OBERVATIONTABLE :

Table 1- For Conventional leaf spring

SR NO.	Load applied on conventional leaf spring (Newton)	Deflection occurred in the conventional spring in 'mm'.
1	0	0
2	1000	10.97
3	2000	20.25
4	3000	30.95
5	4000	42.39
6	5000	58.31
7	5900	72.4

GRAPH OF LOAD VS DEFLECTION

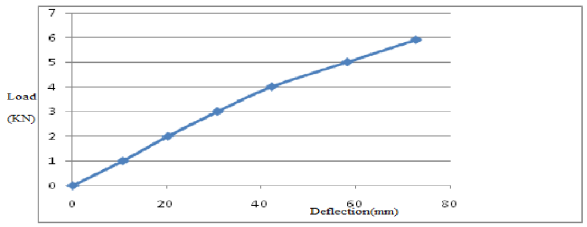

Fig.No.03-Graph of load vs. deflection for conventional leaf spring

The graph of load vs. deflection is plotted by taking the load in 'KN' on y-axis and deflection on x-axis in 'mm'.
From above graph we get the linear relationship between load and deflection. As the load increases the deflection also increases gradually. The graph is passing through the origin. Hence we conclude that the applied load is directly proportional to the deflection occurred in the spring.

Fig.No.04-Convential Leaf spring

FUNCTIONS OF LEAF SPRING :

· Support the weight of the vehicle.
· Provide adequate stability and resistance to side away and rollover.
· Resist cornering effects when negotiating a curve.

COATING MATERIALS :

1. Epoxy Resin :

Epoxy is an adhesive, paint ,plastic or other material that is created as a polymer of epoxides. The term 'epoxy' is used to describe coating that are created from two components ,meaning, a combustion mix of two different chemicals, reffered to as 'resin.' This classifies as a copolymer.

Fig.No.05-Epoxy Resin

2. Phenal formaldehyde :

Used as the basis for the production of molded products including billieard balls, laboratory countertrops, and as coatings and adhesives.

Fig.No.06-Phenal Formaldehyde

3. Teflon :

Teflon FEP (fluorinated ethelene propelene) resins offer excellent chemical resistance and electrical properties while functioning at high service tem. Upto 2000C . Teflon FEP resins also provide unique flame resistance and best in class low temp. toughness . Teflon FEP is also available as a coating , film or dispersion.

Fig.No.07-White Teflon Bar

FUNCTIONS OF LEAF SPRING :

1. Support the weight of the vehicle.
2. Provide adequate stability and resistance to side away and rollover.
3. Resist cornering effects when negotiating a curve.

APPLICATIONS :

1. leaf springs are still used in heavy commercial vehicles such as vans and trucks, SUVs, and railway carriages.
2. leaf springs also locate the rear axle, eliminating the need for trailing arms.

CONCLUSION :

- The leaf spring is tested under universal testing machine in industry and got the results as shown previously,
- The selected spring has sustained upto 6KN with 72.4 mm of deflection.
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FUTURE SCOPE :

- The material for leaf spring can be changed and tested for different parameters in different loading conditions.
- The surface roughness of leaf spring can also be tested and analyzed for further research.
- The conventional leaf spring can be coated with various types of coatings like Epoxy resin, Phenal Formaldehyde, Teflon,etc and again tested upto failure.

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