

# MEASURING WEIGHT OF LOAD TRUCK USING SUSPENSION SYSTEM

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**Abstract** - This system proposes the method for estimating the weight of load truck based on the compression of suspension system. Conventional method for estimation of truck load weight depends on the weighing stations close to the highways. The present framework has a genuine burden that the truck must be conveyed to the weighing station every time to quantify the load which causes wastage of time and it additionally includes false estimation of weight. These sensors are appended to the base of the truck's holder. At the point when the truck is loaded, the heaviness of the load causes compression of suspension of the truck because of this there is variation in distance delivered by ultrasonic sensors. The normal estimation of the distances obtained by different ultrasonic sensors are taken to calculate the weight. With the varied statures acquired, weight of the load are often estimated experimentally strategy by utilizing known standard loads. This determined weight is shown in LCD screen conveyed within the driver's lodge.

**Key Words:** Suspension, overloading, deflection, weight, dynamics.

## 1. INTRODUCTION

The development of each nation's economy is estimated by the development of its road transportation. Trucks play an essential job in transportation of goods over long distances. Vehicles which convey substantial burden present risk to human life and makes the vehicle less steady and leads to accidents. Surpassing a vehicle's most extreme reasonable weight is an illicit offense which conveys it with a scope of dangers and subjected to severe punishments.

### 1.1 EXISTING METHOD

Current procedure for estimating truck load is by weighing stations. Customary interstate weight estimation frameworks set near side of the road. The current system utilizes load cells and each time the truck must be conveyed to the gauging stations. The static weighing of vehicles in a parkways has a few inconveniences including being tedious, costly and perilous on intensely voyage roads.

## 2. LITERATURE SURVEY

**Yanling Liu et.al (2018)** They have utilized vibration sensors to gather vibration information, as indicated by the shifted sizes of vibration information, they have identified over-burden. Raspberry pi is utilized as the center of information gathering gear. A signal conditioning circuit board is structured freely to channel and intensify unique vibration signal, and convert simple analog signal to computerized signals. The implanted hubs arrange the information and decide the vehicle status.

**H. D. Kattimani et.al (2017)** In their venture, the practicality of vehicle load control framework through the strain measure load cell introduced in the vehicle, the single- chip microcontroller gets the data transmitted by the weight sensors and computes the complete load of the vehicle load. If overweight, the single-chip microcontroller will send directions to the vehicle framework to avert the start of the framework.

**Vinoth. A et.al (2016)** They proposed a system dependent on the pressure of the spring. Two wooden sheets are utilized. At the point when load goes past its admissible cutoff the spring gets packed and the littler springs inside the spring contacts the base screw which is appended to the lower board. Subsequently, the model turns into a short out leaving the electron stream from positive to negative of the battery. This prompts the discovery of over-burden.

**Renju K et.al (2015)** In their proposed methodology they have utilized video surveillance framework which mounted at the signals to catch the over-burden vehicle data automatically and send to server for handling. The framework catches vehicle number, time, place automatically and prompt move would be made against the proprietor of the vehicle. There are various strategies to distinguish over-burden vehicle, for example, separating data about pivot load, tallying the quantity of travelers and furthermore by gauging vehicle utilizing Weigh In Motion (WIM) sensors.

**Jimin Yuan et.al (2013)** Their system depends on getting the scope and the longitude of vehicles through the GPS satellite situating, The CDMA remote correspondence system will communicate with the observing center in order to genuine opportune send the different data of transport vehicles to the observing center. At that point the checking center can inquire and dispatch the entire traffic group. This framework cannot just give full play to the incredible application improvement abilities of the normal altering apparatuses, yet in addition exploit the rich usefulness of the current GIS framework.

### 3. METHODOLOGY

It is always found that trucks must go to the nearest weighing yard to measure the weight of the truck on the load. If the system is inbuilt in the truck and displayed on the dashboard, how much load the truck carrying, which reduces the weighing centers in the highway. The system should measure based on the displacement of the suspension in standstill and calculate the load on the vehicle by deducting the original weight from the calculated weight.

### 4. PROBLEM IDENTIFICATION

Current procedure for estimating truck load is by weighing stations. Customary interstate weight estimation frameworks set near side of the road. The current system utilizes load cells and each time the truck must be conveyed to the gauging stations and to eliminate the complexity in conventional weighing methods. If the system is inbuilt in the truck and displayed on the dashboard, how much load the truck carrying, which reduces the weighing centers in the highway. The system should measure based on the displacement of the suspension in standstill and calculate the load on the vehicle by deducting the original weight from the calculated weight.

### 5. MODELLING

\*Dimensions taken from specifications of Ashok Leyland Viking

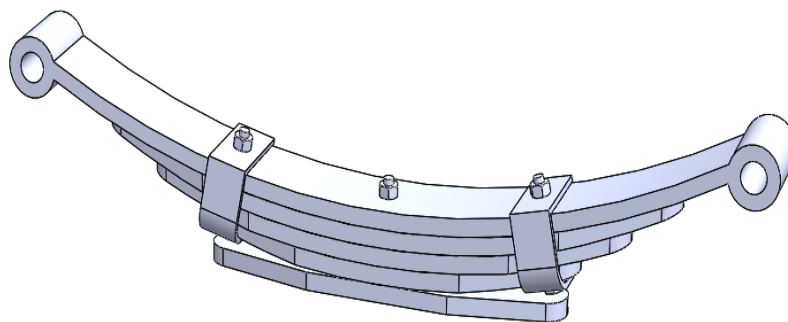


Fig -1: Model of the leaf spring

### 6. ANALYSIS

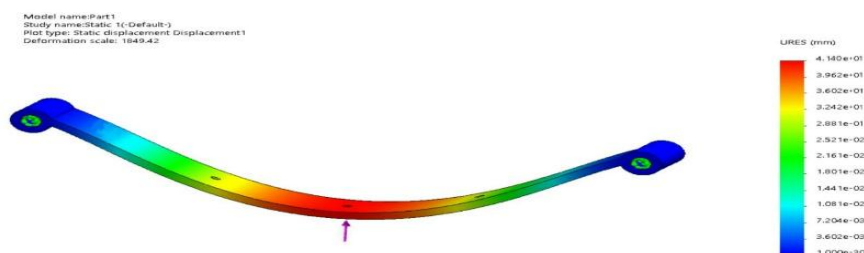


Fig -2: Analysis the top leaf using solid works for a deflection of 1.5 Tonne

### 7. DESIGN CALCULATIONS

As leaf spring is a type of simply supported beam,

Maximum bending moment,  $M = \text{Load} * \text{perpendicular distance (occurs at the center of the spring)}$

$$= \frac{w}{2} (\text{load at either eyes}) * \frac{L}{2}$$

$$M = \frac{wL}{4}$$

By using bending moment equation,

$$\frac{M}{I} = \frac{\sigma}{y}$$

$$M = \frac{\sigma * I}{y} = \frac{\sigma * bt^3}{12 * (\frac{t}{2})}$$

$$M = \frac{\sigma bt^2}{6} \rightarrow \text{eqn. (1)}$$

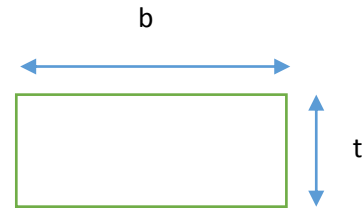


Fig -3: Rectangular Cross section

Where,

M - Max. Bending moment for single leaf

I - Moment of inertia =  $\frac{bt^3}{12}$  (rectangular)

$\sigma$  - Bending stress of leaf spring

y - Axial distance =  $\frac{t}{2}$

For every leaf in leaf spring,

$$\text{Total bending moment, } M = \frac{\sigma bnt^2}{6} \rightarrow \text{eqn. (2)}$$

where, 'n' is the number of leaf.

Equating the equations (1) and (2),

$$\frac{\sigma bnt^2}{6} = \frac{wL}{4}$$

$$\text{Stress on leaf spring, } \sigma = \frac{3}{2} * \frac{wL}{bnt^2} \rightarrow \text{eqn. (3)}$$

For a parabolic simply supported beam,

$$\frac{\sigma}{y} = \frac{E}{R}$$

$$\Delta = \frac{L^2}{8} * \frac{\sigma}{Ey}$$

From eqn. (3) and  $y = t/2$ ,

$$\Delta = \frac{L^2}{8E} * \frac{2}{t} * \frac{3}{2} * \frac{wL}{bnt^2}$$

Load should be equally distributed to avoid disasters,

$$\Delta = \frac{3}{8} * \frac{wL^3}{nEbt^3}$$

There are N leaf springs for N wheel as the load (P) should equally distributed on all N wheel. Thus, the stability can be attained. i.e.,  $W = P/N$ .

For a standard leaf spring type,

(i.e.,) specifications taken from Ashok Leyland Viking

$$W_i = \frac{8}{3} * \frac{10 * 2.1 * 0.08 * 64 * 10^{11} * 10^{-9}}{(1.372)^3} * \Delta_i$$

$$W_i = 88814.860716 \Delta_i \text{ (in kg)}$$

For calculation, considering perfect equilibrium,

$$P = 88814.860716 (\Delta N)$$

As  $N = 4$ ,

$$P = 88814.860716 (\Delta * 4)$$

$$P = 355259.44286 \Delta$$

$$\Delta \text{ (in m)} = 2.8148443 * 10^{-6} P \text{ (in N)}$$

$$\Delta \text{ (in mm)} * 10^{-3} = 2.8148443 * 10^{-6} * 9.81 * 1000 * P \text{ (in Tonne)}$$

$$\Delta \text{ (in mm)} = 27.604192855 * P \text{ (in Tonne)}$$

### 7.1 DESIGN SPECIFICATIONS

The material used is Carbon Steel.

REQUIREMENTS	SYMBOL	VALUES
No of leaf springs	N	4
Overall length of the spring	l	1.372 m
No of leaves in each leaf spring	n	10
Width of leaves	b	0.08 m
Thickness of each leaf	t	0.008 m
Young's modulus	E	$2.1 * 10^{11} \frac{N}{m^2}$

## 7.2 MANUAL CALCULATIONS

1. P= 0.5 Tonne

$$\Delta = 27.604192855 * 0.5$$

$$\Delta = 13.802096428 \text{ mm}$$

2. P = 1 Tonne

$$\Delta = 27.604192855 * 1$$

$$\Delta = 27.604192855 \text{ mm}$$

3. P = 1.5 Tonne

$$\Delta = 27.604192855 * 1.5$$

$$\Delta = 41.406289282 \text{ mm}$$

## 8. ADVANTAGES

- Requires less space for setup.
- Minimal wear and tear.
- Simple and easily mountable.
- Applied to a wide range of trucks.

## 9. CONCLUSION

This suspension system gives a dynamic method for estimation of load on the truck. It tends to be used effectively in a wide range of vehicles which has a suspension system. This will help us to avoid road accidents due to over loading. At present if the truck is continuously overloaded, the information can be sent to the driver and concerned transport authority through SMS. So in future this system can be used for ceasing of motor start when overloading is detected.

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