

# Comparison between Dual Suspension and Mono Suspension of Two Wheelers

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**Abstract:-** Suspension system is the main part of the vehicle which is used for comfort and for better ride through rough roads. It absorbs shocks and vibration by providing smooth functioning to the vehicle. So, currently there are different types of suspension in the market. So, let us consider mono suspension and dual suspension. Now a days, we see that mostly all the two wheeler have mono suspension. So, there should be difference between mono suspension and dual suspension. So, we compare mono suspension and dual suspension of two wheeler vehicle to know how they differ from each other. Also, we discuss any type of change in the stability of vehicle. The Changes which will be feel by passenger, difference between them and the working of suspension system are included in this paper.

**Key Words:** Dualsuspension, Monosuspension, Damper, spring, Shock Absorber

## 1. INTRODUCTION

Suspension of a vehicle absorbs shock impulse and dissipates it in the form of kinetic energy it handles the stability of vehicle as well as provides comfort on vehicle rides. It works in two cycle that is compression cycle and expansion cycle. When vehicle passes through potholes the compression energy is stored and after that it is dissipated during expansion. Use of mono and dual suspension in vehicle is challenging as it affects the stability of vehicle. Now a days telescopic forks are being replaced by mono suspension system. This paper presents the comparison of mono suspension and suspension of two wheeler vehicle. The suspension system absorb shocks received due to UN even surface or when vehicle is subjected due to potholes and bumps in uneven surface. This paper describes the comparison of mono and dual suspension it deals with the impulse due to shocks and produces kinetic energy, Telescopic suspension is used widely in two wheeler but telescopic forks are replaced by mono suspension as it has an better shock absorbing ability and also comfort and bouncing free motion it also improves the stability on uneven surfaces. Shock absorber is used to dissipate kinetic energy and absorb vibration. Spring is used in suspension system whose function is to store energy when deflected by force and return equivalent amount of energy on being released. For two wheelers helical compression springs are widely used. Springs are made of hardened steel. Today's manufacturers are mainly concentrated on weight optimization of product.

## 2. LITERATURE REVIEW

Kartik Dhayalkar, T-Kamalahar, T.Vinu Sakthi, R.S.Maney, S.Shanmugasudaram [1] Observed that suspension serve for the dual purpose. The first purpose is to absorb shock impulse and dissipate kinetic energy and the second purpose is vehicle handling and braking. It also balances vehicle frames and stability and secure straight running stability and rotationality of the vehicles. The shock absorber can be controlled by increasing and decreasing the resistance to the fluid flow in the shock absorber. Mono shock absorber is much longer than dual shock absorber.

Manpreet Singh, Er. Jasvinder Singh, Er. Gurpreet Singh[2] observed that shock absorber consist of spring and damper system where spring is elastic member as well as device which stores mechanical energy. It is also known as oil pumps, a piston is installed at the end of piston rod and runs hydraulically. When vehicle moves on a road then it moves up and down due to jerks or damps condition of road. So, hydraulic fluid force through same orifice holes consisting piston this orifice allows only little amount of fluid as oil enters through the piston. Due to this restriction caused to piston.

Mr.Kommalapati Rameshbabu and Mr.Tippa Bhimasankara Rao[3] did analysis on shock absorber by varying the spring material, Spring Steel and Berillium Copper and observed that stress and displacement value for Spring Steel is less than Berillium Copper and concluded that Spring Steel for spring is best.

Mr.T.Balasubramania and Mr.Baraniprasath, D.Dhinesh Kumar, R.Maneeshwar, R.Ponmani[4] had studied the assembly of modified horizontal dual suspension system for two wheelers they faced problems during fabrication. The first was in chain transmission system the oscillation of triangular plate oscillated at a high angle thus varying the chain length on both tight and slack side other was in brake system which led to improper working of the system. The problem were tackled by using shaft and universal joint in case of chain transmission and by using flexible cables brakes and disc brakes in case of braking system.

Vidya S.Visave, J.R.Mahajan[5] checked the convenient method of replacing metal coil spring with the composite coil spring using composite materials like carbon fiber, glass fiber and combination of Carbon fiber and glass fiber. Using composite material it will reduce the weight of the coil spring, According to experimental result the spring rate of the carbon fiber is 34% more than the glass fiber and 45% more than the glass fiber/carbon fiber spring. The cost of

glass fiber springs are 25% more than steel springs and cost of the carbon fiber spring is 200% more than steel springs. The stiffness of composite spring is less than steel springs and hence its application is limited to light vehicles.

Prof. Sagar S Khatavkar, Mr. Shrikant Dabekar, Ms. Namrata Bhokare, Ms. Nikita Dhandhukia and Ms. Shilpa Bafna[6] states that Mono shocks gives a superior vehicle handling and provides safety while braking than telescopic fork. The spring in Mono shocks have been designed by consideration of many practical condition like dynamic resistance, road tracks and aerodynamic properties. In Mono shock suspension design the uneven vibration in the telescopic forks have been balanced using the mass centralization concept. This design of suspension using mass centralization concept may antiquate the present telescopic forks and alloy steel is most suitable for suspension system.

### 2.1. Shock Absorber

Shock absorber damp out the motion of a vehicle up and down on its spring. They must damp out the wheel bounce while driving. It converts kinetic energy of shock into another form of energy. Also the dirt found on the shock absorber is due to wheel bounce. It also use to control travel speed and resistance to vehicle suspension. The vehicle can be settled properly on the road if we provide proper damping coefficient. Damping can be controlled by increasing and decreasing fluid flow in the shock absorber.[1]



**Fig 1:-Shock Absorber**

In order to select the optimum damper modeling strategy for a 'virtual damper tuning environment', the suitability of the differing approaches were determined with respect to the different criterion like ability to capture damper non-linearity and dynamic behavior, flexibility to model different shock absorber types, ease of model generation, suitability for use in vehicle simulations and usefulness as a predictive tool. [6]

#### 2.1.1 Dual Suspension

It is the most widely used suspension in two wheeler vehicle. It transfer loads equally to the chassis of the vehicle. There is no any type of harm to this suspension if we increase load on the vehicle. It is widely prefer in the vehicle which is used in rough terrain vehicle. As in rough roads there is continuously

changing loads on the vehicle ,so its suspension transfer the load properly to get better ride comfort. The adjustment of this suspension is difficult. We can drive the vehicle if any one of suspension gets oil leaked, damaged and failed while driving. The lifespan of this suspension is more that is why it's used in more number of two wheeler vehicles. It is cost effective suspension. The two piston also completely separate the shock fluid and the gas components. Whenever we encounter the bump on a motorcycle with two shocks, both the shocks compress but there is a rare situation when both of them compress for equal length. This leads to downgraded dynamics when it comes to stability.[1]



**Fig 2:-Dual Suspension**

#### Advantages:-

- 1) Load bearing capacity of dual suspension is more
- 2) If one of the shock absorber leaks oil then the other can still carry the load
- 3) Cost of dual suspension is less
- 4) Maintenance of dual suspension is easy as compare to mono shocks
- 5) Gives a smooth ride through rough terrain

#### Disadvantages:-

- 1) Tuning has to be done in dual suspension
- 2) Adjustment is difficult on the vehicle frame
- 3) Does not provide proper cornering
- 4) Ride is compromised at high speed

#### 2.1.2 Mono Suspension

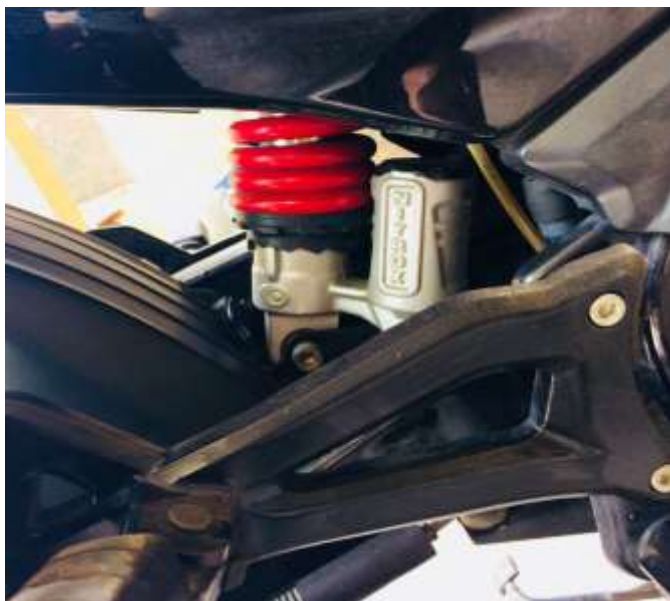
Traditionally telescopic suspension is used in two wheelers motorcycles with only one Shock Absorber and helical coil springs over it are called mono shock motorcycles. Telescopic forks are replaced by mono shock for better ride comfort, it provides better handling and steering of vehicle increasing life of suspension. Whereas in telescopic suspension there is unequal length distribution while taking turn. Mono shock

suspension provides safety while breaking. The analysis of mono suspension is done with the help of ansys software and FE analysis. It is observed that in mono suspension, increase in speed leads to increase deflection and on other hand leads to decrease in shear stress. Due to this mono suspension system is superior to twin suspension system. Mono shocks are placed at the centre of the bike which is quite stiff and hence can handle load from any direction. Hence they provide better cornering ability. Nowadays offset type of mono shock suspension are used.[5]

Mono shock suspension also eliminate torque to the swing arm and provide more consistent handling and breaking. It is also a gas pressurized shock, the piston in the shock is also called as working piston and it moves in relative synchrony inside the pressure tube in response to changes in road smoothness. Length of mono shock absorber is more than the dual shock absorber. Mono shock absorber can be mounted in either way i.e. is does not have any directionality. It does not have any compression valve, whose role has been taken up by dividing piston and the gas in a mono tube shock is under high pressure which can actually help it to support some of the vehicle's weight.[1]

At constant speed as load increases system transmissibility goes on decreasing gradually.[3]

Horizontal suspensional displacement can be achieved by using a pivoted triangular section.[4]



**Fig 3:-Mono Suspension**

**Advantages:-**

- 1) Mono shock eliminate torque to the swing arm and improve braking and handling of vehicle
- 2) Easier to adjust on the vehicle as there is only one shock to adjust
- 3) The linkage used to connect the shock to the swing arm are frequently designed to give a rising rate of damping for the rear
- 4) It has better cornering ability

**Disadvantages:-**

- 1) Cost of ownership and maintenance is high
- 2) May get failed if excess load applied.

**Table -1: Comparison between Dual Suspension and Mono Suspension**

Dual Suspension	Mono Suspension
1. Cornering is not better in this suspension.	1. Cornering is better in this type of suspension.
2. Weight of the vehicle increases.	2. Weight of Vehicle decreases.
3. Dual Shock is Lighter than Mono shock.	3. Mono Shock is heavier than dual shock.
4. It is harder to tuning.	4. It is easier to tuning.
5. It doesn't gives better stability to vehicle.	5. It gives better Stability to vehicle.

**3. CONCLUSIONS**

From the above research we hereby conclude that mono suspension is more superior to dual suspension system. In a recent test, pulsar, apache and unicorn were pitted against each other on a test track. In that test unicorn is not fastest but it is more balanced.

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