

# Design And Analysis of Differential Gearbox in Light Motor Vehicles

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**Abstract:** - This project “Design and Analysis of Differential Gearbox in Light Motor Vehicle” mainly focus on the mechanical design and analysis of gearbox as transmit the power with a view to get knowledge about the technologies as well as application of theories. This project contains the design and material selection of the gearbox for some different type of light motor vehicle as for better efficiency improvement of power transmit rate is important phenomenon.

**Key Words:** *Design of differential gearbox, Analysis of differential gearbox.*

## I. INTRODUCTION

A differential is a mechanical device made up of several gears. It is used in almost all mechanized four-wheel vehicles. It is used to transmit the power from the driveshaft to drive wheels. Its main function is to allow the drive wheel to turn at different rpms allowing the wheels to go around corners while still receiving power from the engine. It receives one input and provides two outputs this is found in most automobiles and in the other way, it combines two inputs to create an output that is the sum difference or average of the inputs. In automobiles and other wheeled vehicles, the differential allows each of the driving road wheels to rotate at different speeds while for most vehicles supplying equal torque to each of them. A vehicles wheels rotate at different speeds mainly when turning corners. The differential is designed to drive a pair of wheels with equal torque while allowing them to rotate at different speeds.

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## II. LITERATURE REVIEW

The main object of this paper is to perform mechanical design of differential gearbox and analysis of gears in gearbox. We have taken grey cast iron and aluminium alloy materials for conducting the analysis. Presently used materials for gears and gear shafts is cast iron, Cast steel. So, in this paper we are checking as the aluminium can be the other material for the differential gearbox for light utility vehicles. So, we can reduce the weight. K. Dinesh Babu, M. Siva Nagendra, Ch. Phanideep, J. Sai Trinadh, Design and Analysis of Differential Gearbox in Automobile. [Ref.-1]

The main aim of the project is to focus on the mechanical design and contact analysis on assembly of gears in gear box when they transmit power at different speeds at 2400 rpm, 5000 rpm and 6400 rpm. Analysis is also conducted by varying the materials for gears, Cast Iron, Nickel Chromium Alloy Steels and Aluminum Alloy. The analysis is conducted to verify the best material for the gears in the gear box at higher speeds by analyzing stress, displacement and also by considering weight reduction. Design calculations are done on the differential of Ashok ley-land 2516M by varying materials and speeds. Differential gear is modeled in Solid works. Analysis is done on the differential by applying tangential and static loads. N.

Vijayababu1, Ch. Sekhar2, 'Design and analysis of differential gear box used in heavy vehicle'. [Ref.-2]

The main objective of this paper is to perform mechanical design of differential gear box and analysis of gears in gear box. We have taken grey cast iron and aluminium alloy materials for conducting the analysis. Presently used materials for gears and gears shafts is Cast Iron, Cast Steel. So, in this paper we are checking as the aluminum can be the other material for the differential gear box for light utility vehicles so, we can reduce the weight. Design and Analysis of Differential Gear Box Kunal chitale1, Jay Dalwadi2, Himanshu mishra3, Gaurav singh4, Vimal kumar Patel5. [Ref.-3]

In this project, a differential gearbox is modelled in 3D modelling software solid works 16 and theoretical calculations and also static is done by using ANSYS Workbench 16.0. Present used material for differential gearbox is cast iron. In this project, it is replaced with Grey cast iron, magnesium alloy, Aluminum Alloy, and structural steel. Has been selected for static Analysis has been done to find the total deformation, equivalent stress and equivalent elastic strain. By comparing the results, it is clear that magnesium alloy has less deformation than other materials, so using the materials is safe. And by comparing the Theoretical Calculations between materials, magnesium alloy is more advantageous than other materials due to its less weight and high strength. Design And Analysis of Differential Gear Box R. Karthick1, V. Mohankumar2, S. Mohanprabhu3 & V. Manoj. [Ref.- 4]

### III. METHODOLOGY

Differential is an essential part of any four wheeled vehicle. A differential allows wheels of a vehicle to rotate at different speeds. This is necessary when the vehicle turns. The Differential gear is a part for all four wheelers, wheel reserved the power from engine to gear box then by drive shaft to differential gear. Differential innovation was created hundreds of years prior and is viewed as a standout amongst the most astute developments human reasoning has ever delivered the car differential enables a vehicle to turn a corner while shielding the wheels from sliding. In automotive mechanics, gear arrangement that permits power from the engine to be transmitted to a pair of driving wheels, dividing the force equally between them but permitting them to follow paths of different lengths, as when turning a corner or traversing an uneven road. On a straight road the wheels rotate at the same speed; when turning a corner, the outside wheel has farther to go and will turn faster than the inner wheel if unrestrained. The

Wheels are taking the force power from the engine by a drive shaft. The wheels that get power and make the vehicle push ahead are known as the drive wheels. The fundamental capacity of the differential rigging is to permit the drive wheels to turn at diversely RPMs while both are getting power from the motor engine, Power from the engine is flowed to the wheels via a drive shaft.

### IV. PROPOSED WORKING

- When the vehicle moves in a straight line, the power comes from the propeller shaft to the bevel pinion which drives the crown wheel. Then it is carried to the differential cage in which a set of planet pinions and sun gears are located. From the sun gear it is transmitted to the road wheels through axle half shafts. In this case, the crown wheel, differential cage, planet pinions, and sun gears all turn as a single unit and there is no relative motion between the sun gear and planet pinion. The planet pinions do not rotate about their own axis. The road wheels, half shafts, and sun wheels offer the same resistance to being turned and the differential gearing does not therefore operate. Both the road wheels turn at the same speed.
- When the vehicle takes a turn, the inner wheel experiences resistance and tends to rotate in the opposite direction. Due to this the planet pinions start rotating about their own axis and around the sun gear and transmit more rotary motion to the outer side sun gear. So that outer sun gear rotates faster than the inner sun gear. Therefore, the outer road wheel runs faster than the inner road wheel and covers a more distance

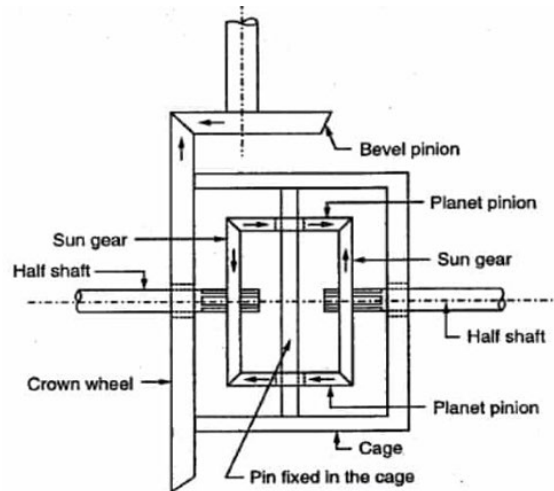


Fig.1. Differential Gearbox

## V. PROBLEM DEFINITION

A differential is a device, usually but not necessarily employing gears, capable of transmitting torque and rotation through three shafts, almost always used in one of two ways: in one way, it receives one input and provides two outputs this is found in most automobiles and in the other way, it combines two inputs to create an output that is the sum, difference, or average, of the inputs. In automobiles and other wheeled vehicles, the differential allows each of the driving roadwheels to rotate at different speeds, while for most vehicles supplying equal torque to each of them.

Identify the problems of differential gear box.

### 5.1 Gears Slipping

If your car does not synchronize with your actions despite being manual, it is one of the most common gearbox problems. You may notice that your vehicle turns back to its previous gear after a gear shift; it is called a gear slip. In most cases, the gear falls into a lower or neutral gear which can be dangerous while maneuvering your car.

*Reasons:*

- Damaged or broken shift fork or lock spring
- Insufficient gear mesh
- Exhausted gear, bearing retainers or bushing
- Faulty gearbox and engine alignment
- Excessive clearance between gear teeth in mesh
- Insufficient transmission fluid

### 5.2 Grinding Noise and Buzzing During the Gear Shifts

One of the most common gearbox problems is the shaking and grinding of your car during a gear shift. In cases, you may also visibly notice your car shaking along with the buzzing feeling.

*Reasons:*

- Dry rear wheel bearing on the main shaft
- A damaged speedometer drives gears
- Insufficient lubrication
- Worn out bearings and shaft
- Too much recoil in a gear train

### 5.3 Broken pinion-gear tooth

Does your car frequently make loud clicking or clunking sounds when in motion? This could be caused by a broken pinion-gear tooth.

### 5.4 Worn U-joints

If your car excessively shakes or vibrates, worn U-joints could be to blame. In many cases, this vibration becomes more noticeable as the vehicle gathers speed.

*Objective:*

In this project Aims to design and analysis of differential gearbox in light motor vehicle. We have, taken the material grey cast iron, Aluminum alloy and mild steel and also done CAD model.

## VI. CONCLUSION

In this project, we have taken the material grey cast iron, aluminum alloy and mild steel to made differential gearbox. And to design the differential gearbox, CAD model and analysis of the differential gearbox. To performing the application of application of differential gearbox in light motor vehicle. Nevertheless, when it comes to weight for light utility vehicles aluminum alloy is preferred.

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