

Aero Design for Automobiles

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Abstract – In automobile the aero design grabs the priority after getting to know the importance. Where we can counter the drawbacks by optimizing the design. The design contribution may indirectly improve the automobile efficiency. In this paper we brief the air drag due to design and the better design for automobile with five tire system in comparison with four tire system. This system reduces the air friction by limiting the front face of the vehicle, by maintaining its stability.

Key Words: Friction, Design, Frame, Efficiency, Energy

1. INTRODUCTION

The priority of the aero design increased with the chronological changes. The air drag design is highly considered in the manufacturing of any automobile. The aero dynamic design differs from air to ground but the effect of air drag is similar in both the cases. The air drag is an added disadvantage for the automobile in motion. The design of an automobile is considered in this paper and the effective ways to reduce the energy losses were briefed. This aero-design is adaptable for any sort of vehicle which runs with various forms of energy (i.e. gasoline, petrol, diesel, battery). However, it functions in reducing the air losses, noise, vibrations and improving the energy efficiency for an automobile in motion.

1.1 Aero design

The aero design plays active role in eliminating the air drag which indirectly effect the automobile efficiency. The automobile designers came to know the importance of aerodynamics in recent years. Whenever an automobile moves it need to overcome the wind. Design plays a major function in safeguarding the automobile where the better design lies in the stability of the automobile which can be obtained through aero-design. Aero design increases the energy usage efficiency and do the speed of the vehicle by dispersing the wind from the point of contact. Aero design reduces the risk during external impacts.

1.2 Five tire system

The conventional vehicle consists of four wheels. Which are sub-classified into front and rear axles. The arrangement of these tires are basically at rectangular corners as shown in figure 1.2.1.

While coming to the design of five-wheel structure as shown in the figure 1.2.2, fifth wheel act to direct the vehicle in desired direction by reducing the air losses and maintaining the stability. The five-wheel design reduce the risk during the accident. Through this design we can reduce the noise at higher speed as the air contact area is less there will be less noise and this also reduce the vibration by maintain safety.

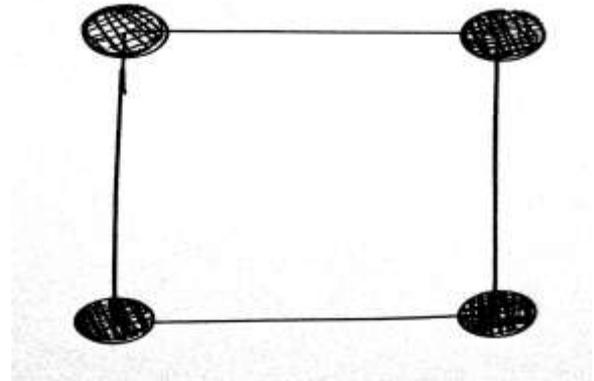


Fig -1.2.1: Four-wheel setup in automobile

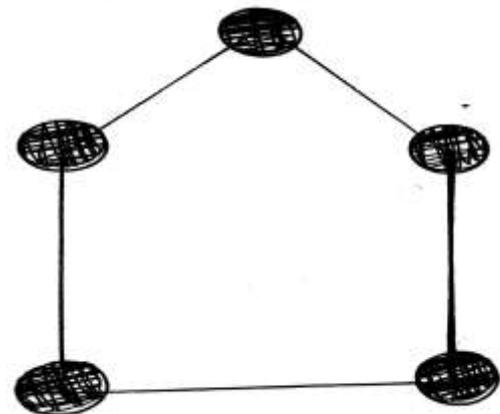


Fig -1.2.2: Five-wheel setup in automobile

2. Automobile Design

The design of automobile include appearance and the functionality of assemblies. The design is of interior and exterior based were the interior deals with the comforts and the fitting coming to the exterior it deals with the appearance and the aerodynamics of the automobiles.

2.1 Design of four tire system

The design of four system tire may similar to other automobile designs were the occupancy cannot be reduced at front. The automobile of increased surface contact may increase the air resisting surface which may increase the effect of air drag on automobile and it even reduce the stability of automobile which further increase the risk of handling automobile

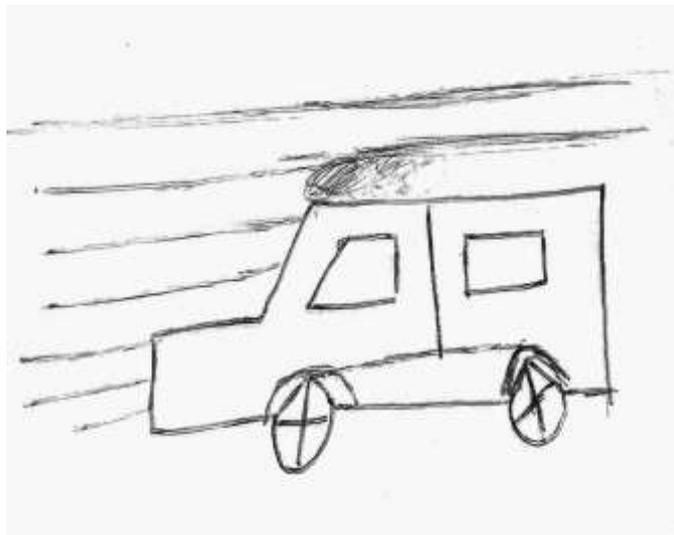


Fig -2.1.1: Air drag in four wheeled automobile

As shown in the fig-2.1.1. When the automobile is at high speed higher the effort required. The effort required to overcome the air force may affect the overall efficiency this can be considered as a drawback. The optimization of the design can resolve these drawbacks which at last generate a better system with negligible errors.

2.2 Design of five tire system

The design of five tire system involves additional advantages compared to other automobile design this design helps in enriching the features of automobile without disturbing the existed features. Coming to the front phase of design in automobiles with the five tire

system it provides a better design to reduce air drag than that of four tire system as the front phase of four tire system offer more resisting air compared to five tire system. The effort required by the five tire vehicle is low as the fifth tire limit the front phase through the inclination in design the air can be deviated at ease.

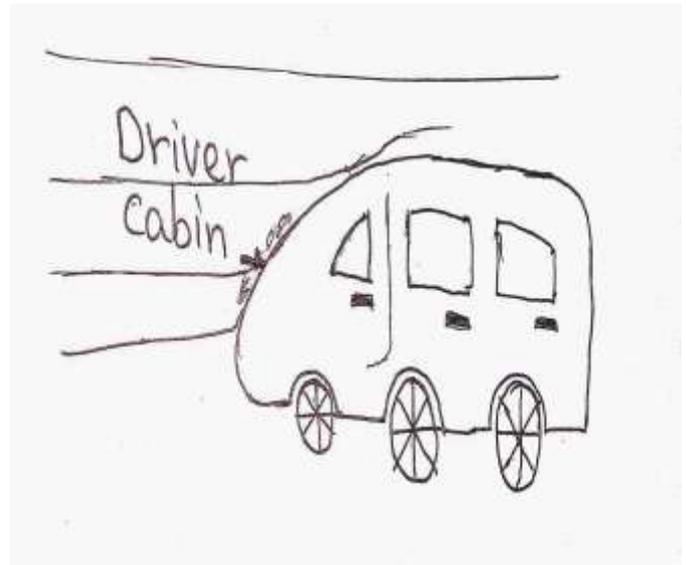


Fig -2.2.1: Air drag in five wheeled automobile

The air drag reduces the speed of automobiles by creating high pressure at higher speeds and does affect the overall efficiency indirectly. The air drag at higher speeds reduces the stability of the automobile by generating vibrations. The continues vibration may affect the vehicle structure and do damage the system of assemblies.

The aero design for five-wheel system to opt is of two variants curved and the coned structures as shown in the figure below. The curve is preferred as compared to the cone as its shape does not support a proper design for driver cabin. Coming to the curve shape it provide driver accurate steering view and even helps in reducing the air losses and improving the efficiency of automobile at higher speeds. The five tire system supports the safety of the passengers by reducing the front phase.

Table -1: Comparison between four-wheeled and five- wheeled aero-design of automobile.

Factors	Four wheeler	Five wheeler
Air losses	More	Less
Stability	Medium	High

Wheels	Four	Five
Efficiency	less	High
Energy required	High	Less
Safety	Less	High

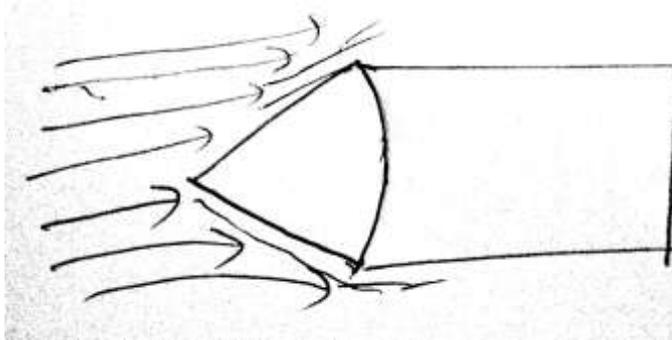


Fig -2.2.2: Air distribution at cone contact

when the airflow is subjected towards the cone design as the contact is a point there will be less air drag offered as shown in the fig-2.2.2 the air gets in contact with the cone surface and directed away from the automobile this reduces air drag to high extents but cannot be implemented as the fusibility of the design is low and do increase complexity in the steering mechanism the cone design is cannot be suggested for the appearance and the difficulty in design. The cone may disperse air more efficiently. Though the contribution of the cone design may high in reducing the air drag but the flexibility of the design is low compared to the curved structure. The cone cannot be adopted as this increase the difficulty in handling the automobile as it ends with a point.

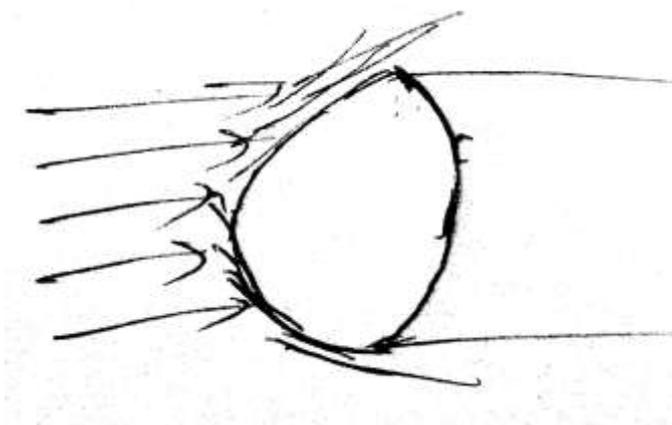


Fig -2.2.3: Air distribution at curved contact

The curve reduces air drag to high extents compared to the normal design. As shown in the fig-2.2.3 at the point contact the curved structure act ideal, the airflow gets deviated with the inclination involved in the design there might be air drag but not high as compared to the design in use. By adopting this design, we can indirectly decrease the energy consumption at high speed as the force required to overcome reduces it helps indirectly to improve the efficiency of an automobile and do the noise. By opting curved design, we can reduce the effect of external impact as area of contact is less in front phase of automobile chance of impact is low. The flexibility of the curve is high compared to the cone.

CONCLUSION

The paper dealt with the effective ways of reducing air drag and noise through modification in design with an example of five tire system.

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