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Importance of various Part in Formula One Racing Car

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Abstract-Aerodynamics is a part of dynamics fluids which is related with study the air motion which is strikes on the car which a solid objects. With the Studying the Aerodynamics of racing car designing, a Formula car has the most powerful importance and significant aspects is to study two primary consideration, one is the producing the down force which is helpful to push car onto track with the traction and second one is to improve cornering forces and minimizing the drag has acts on car to slow down of racing car. In this era, the different types of forces acts which is acting on the Formula car with its various parts of car which is useful to minimizing the drag forces and increasing the down forces. The various forces will be overcome by the many varrious devices that aim to be reducing drag and lift forces acts on car, which is helpful to reducing the lap time. Aerodynamics performances of formula one car has to be a improve by using various varrious devices with different CFD analysis survey on different varrious devices used for racing application models of some varrious devices like front wing, nose wing, rear wing, barge board, roof spoiler and wheel scallops with best performances of it. The modified formula racing race car with varrious device has been carried out for different speeds. Aerodynamics performances like lift forces, drag forces are evaluated for different configuration of varrious devices for different speed.

1.1 INTRODUCTION

The Formula One is a very competitive event in which small improvements in the design of car may largely affect the car's performance. In case to reduce drag for of racing formula car it can be goes faster on the straights or completion of lap. Design of car shape is to be generated amount of some level in downward pressure which is sometimes also known as down on cars tires, after this level of consider force car goes faster on track around the corners. A Formula one car has many varrious devices that aim at reducing the lift as well as drag forces on the car and thereby reducing the lap timing. But lift as well as drag forces are proportional inverse to each part. Configuration of all the varrious devices is what contributes to the helpful for the reduced lap times and not the design of the individual varrious devices. Taken example on the reduction a lift is to be achieved with an varrious device like front wing, around consideration cost of higher area to increase in its drag onto the car, but additional down force is required for racing car as high speed required large amount in traction on road helps to improve stability for allow higher speed. Racing car wings can helps to operate on likewise same principle of other as wings, but sometimes it can be cause a towards downward force compare on the basis on upward. A modern latest updated formula racing one car is capacity to developing six times of its car weight toward lateral acting cornering of car force this all about design theory parts due to the its own aerodynamic developing of down word force toward the design. The aerodynamic acting down word force capable for allowing types of force greater than its weight of car body. This is means that at higher speed of car they can driving on the surface suitable for structure which upside down car body surface. The most efficient design of aerodynamic devices used for formula one racing car is front as well as rear wings, this is helpful for accounting the 60% of down word force with its floor responsibility for rest motion of it. These types of useful add on devices like wings are with varrious types profile fitted with varrious output of down forces as per required with the specified efficient track. Tighten or slow circuits with its nature of wing is minimized to helping for reduce drag with increase car speed on the tack for long straights.

1.2 FROCES ACTING ON CAR BODY

Automobile racing vehicles, design also be important to produce down force to improve traction on the road

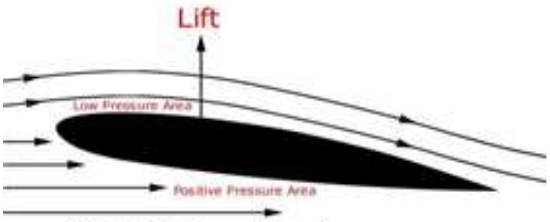

Fig 1.Lift Force Direction

used with its capability. An aerodynamic car is not only capable of going fast but it also has producing the down force which is helpful for car tires traction on road. The main forces producing on the car which is as follows-

1. Drag force 2. Lift force

3. Thrust force 4. Down force

1.2.1 DRAG FORCE

Drag forces is force in that air particles with laminar flow can pass top surface of car as well as the layers of air particles nearest to the adhere surface, this part of layer known as Boundary drag layer and also called as Skin Friction Drag. This drag is caused due to actual contact between the air particles flowing against the car surface or moving any object. Above this layer attached particles can be slides over surface of them, but is reposed to slowed down due to the non-moving or rest particles on the car surface. The molecules force can required to shift the containing air molecules out of the part who creates the another second types of drag force, based on this part of phenomenon, the less amount of small area of front area of vehicle, the small size of area containing of molecules which can must to shifted, Due to this the amount of energy required to push vehicle through air is less. With less amount of engine effort is taking action through moving air, this effort increases more amount engine power helping will go on the moving car onto track to reducing lap time faster.

1.2.2 LIFT FORCE

Lift is the one of part or components of the pressure as well as shear force towards the direction flow which is shown in fig1 is to flow tend to move the body in that direction. It can avoid the object toward fly. The

pressure difference between top of the surface as well as bottom surface on wing is generate an upward force to the car body wing to lift. Regarding car shape bodies like a wings, the shear force parallel acts at nearly to the direction of flow, due to this it helpful as well as contribution to the lift of it is small. The lift to be depend totally onto fluid density, the racing car size, shape, and orientation of the body, among other things, and not practical to list these force for a numbers of variety to the situations.

1.2.3 DOWN FORCE

Racing car to be faster you required power, but there was a limitation to how much power you can put on the ground. To increase this power limit, force to ground must be applied on the car wheels. Increasing car weight can do this, but weight makes need to require more power. So we need some virtual weight, we call it down force and get it from airflow nearest the car. Typically the known term "lift" used when talking about any kind of aerodynamically induced force acting on a surface. In aerodynamics design of ground racing car the "lift" is generated purely avoided as its meaning is almost always implied as positive, lifting towards the vehicle onto off the track. The term is known as "down force" therefore, should always implied as negative force.

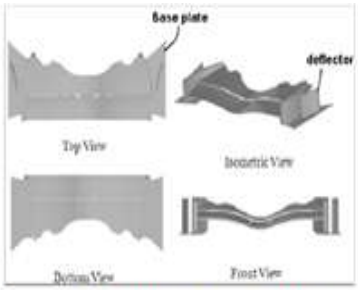

Fig3. Modified front wing Base plate and Deflector

1.3 VARIOUS DEVICES ON FORMULA ONE RACING CAR

In formula car aerodynamic is need to be smart and powerful with minimum drag and lift forces with maximum amount of down force is needed. To complete this aims its need to do study of various devices which is attach on the formula car as follows-

Fig2 Forntal wing and Rear wing of car

a. Frontal & Rear Wings
b. Base Plate & Deflector
c. Bargeboard
d. Nose Wing
e. Roof Spoiler
f. Scallops of Rear Wheel

1.3.1 FRONTAL & REAR WINGS

The first thing we see regarding front is definitely the part of front wing, 3-D view of the frontal wing is shown in fig 2. Being the first means that it's the first thing on the car that interacts with the air, therefore its necessary thing in this era is to determine the under stream flow through the rest motion of car. The frontal wing has to generate between 25% to 40% total amount of down force. Major part design modification has lies onto the endplates with flaps of wing, aim to reduce with part like tip vortex as well as wake of frontal wheel of car body, which is one of major and biggest drag components part. The rear wing design is closely related to exhaust/cooling, side pod and rear diffuser as shown in fig2. Teams have different adjustments based on their cars. Major methods & calculation to reduce forces like down force or down drag in with Monza should contain slimming as rear wings, it also helpful to introducing profile like V-shape as well as use of gurney flap onto diffusers.

1.3.2 BASE PLATE AND DEFLECTOR

The frontal wing in the original design does not have end plates and deflectors on it. This output results in the air directly coming in contact with the frontal wheels to contribute to the drag. Hence, the base plate is designed such that the trailing edges of the plate help in streamlining the flow of the under-body air away from front wheels as shown in fig3. The deflectors also the same function of streamlining the air around near to front wheels on the upper body side. As its name suggests, it just deflects the air away from the tire such that the streamlines get re-attached with the flow along the car body as soon as it passes the tires.

1.3.3 BARGEBOARD

This are vertical panels located in range of front wheels to side pods. It can be deals regarding with dirty air introducing from front wheels, smoothing air flow into the side pod and guiding flow of air. In recent year designs of F1 car, it used to feeding more amount of air in part like diffuser. Turning vanes with vertical plates or it to be usually curved which is mounted on side of chassis congaing between the front wheels, intakes of side pod, first appear on racing cars in the early 1990s. In late 1990s design & early 2000s aerodynamic shape, they became very complex devices consisting with multiple elements, during shapes of this period cars also turning vanes into various other positions around the car, such as on the edges of on the side pods and under the nose.

1.3.4 NOSE WING

In design nose wing air flows larger amount to get flow of air on each pat or side of a car bodies, rather than it direct over on the nose & onto the helmet area. Aerodynamicists realized that never use of feeding air on the area of helmet, as air flow is in a turbulent zonal area that negatively effects on rear wing's efficiency. Exactly with a design of high nose followed, the exist nose was now designed help to way towards feed air onto the side pod to aid cooling, while on the other hand increasing airflow around and underneath the car. With more amount of air flowing on underneath the racing car, the flow diffuser air flow has also increases, enhancing the suction effect on the car towards the ground, design of the nose wing shown. This effect is highly desired by designers as down force generated this way comes with less drag compared to front or rear wings. Generally, design of nose box is only limited with its strength and also dimension requirements for design calculation, even regulations also stipulate is not to allowed for change it during a race with a heavier version. Moving elements inside the nose are also banned as they are like to be considered as moving aerodynamic devices.

1.4 CONCLUSION

In this study, an attempt to improve the performance of aerodynamic design in formula car by using various devices like frontal wing, bargeboard, rear wing, nose wing, roof spoiler and with wheel scallops with different configurations.

A formula car with all various devices attached and the following points were concluded:

- Up to reduction of 9-10% and 4-5% with drag force and drag co-efficient respectively is seen in the model without various devices.
- There was a reduction of 6-7% with drag force and 5-6% reduction in the drag co-efficient in the modified model with the various devices
- The down force and the lift co-efficient were seen to increase by 2 times for the model with all various devices attached when compared to without any devices model.

REFERENCES

[1] Sneh Hetawal, Mandar Gophane, Ajay B.K, Yagnavalkya Mukkamala, "Aerodynamics Study Of Formula SAE Car",GCMM 2014.

[2] Rizal E.M. Nasir, Firdaus Mohamad, Ramlan Kasiran, M. Shahriman Adenan, M. Faizal, "Aerodynamics of ARTeC's PEc2011 Emo-C Car",IRIS 2012.

[3] B.N Devaiah, S. Umesh, "ENHANCEMENT OF AERODYNAMIC PERFORMANCE OF A FORMULA-1 RACE CAR USING VARRIOUS DEVICES, 2015.

[4] Mohd Shahmal Bin Mohd Shahid, "STUDY OF FORMULA RACING CAR AERODYNAMIC REAR WING USING COMPUTATIONAL FLUID DYNAMIC (CFD)", DEC 2010.

[5] S.M. Sapuan, K.W.Ham, K.M.Ng, C.V.Woo, "Design of composite racing car body for student based competition", JULY 2009

[6] Robert L. Perry and David D. Marshall, "An Evaluation of Proposed Formula 1 Aerodynamic Regulations Changes Using Computational Fluid Dynamic", AUG 2008