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RESEARCH ARTICLE

CFD ANALYSIS ON HEAVY DUTY TRUCKS FOR DRAG REDUCTION.

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Manuscript Info

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Manuscript History

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Key words:-
CFD, DRAG, Heavy Duty Truck.

Abstract

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Today's demand of reducing the fuel consumption of vehicles is one of the most challenging issues within the automotive industry. Together with the increased fuel price, the development of more fuel efficient vehicles has escalated. A recent research about fuel reduction technologies for trucks showed that aerodynamic improvement is one of the most important technologies when it comes to fuel saving. C.F.D is useful for designers of vehicles to improve the aerodynamic characteristics. C.F.D methodology can be involved in the construction of GEOMETRY as per the given dimensions, assigning the tetrahedral hypothesis by number of divisions of components during the mesh. In CODE SATURN physical conditions of truck can be given along with the calculation features. In PARAVIEW the flow visualization can be analyzed.

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Objective and Approch:-

The aim of this project is to investigate how the flow above a heavy duty truck is influence by drag reducing trailer devices, such as front deflectors and to see how much it is possible to reduce drag. Additionally, the ambition is to obtain an understanding of drag contribution from different areas around the truck, and to see where it is possible to gain most drag reduction. Finally, this project will also include a short evaluation of possible aerodynamic profits of a mutual development of the tractor and the trailer.

- The main objective of this proposal motive of the work is to reduction of coefficient of drag by wind tunnel analysis on truck.
- Aerodynamics which helps to reduce coefficient of drag. The motive of this project is identifying the best spoiler for the truck
- CFD analysis is carried for determining the coefficient of drag values with wind tunnel technique.

Aerodynamics:-

In aerodynamics problems, the forces acting on the vehicle are lift, drag, thrust and weight. Of these, lift and drag are aerodynamic forces, i.e. forces due to air flow over a solid body. One of the most important aim of the aerodynamic drag reduction researches is to save energy and to protect the global environment, fuel consumption reduction is primary concern of automotive development. Aerodynamic problems are typically solved using fluid dynamics conservation laws as applied to a fluid continuum. Conservation of laws are conservation of mass, conservation of momentum and conservation of energy. These problems are classified by the flow environment or properties of the flow, including flow speed, compressibility and viscosity. Generally classified into external aerodynamics and internal fluid dynamics. External aerodynamics is the study of flow around solid objects of

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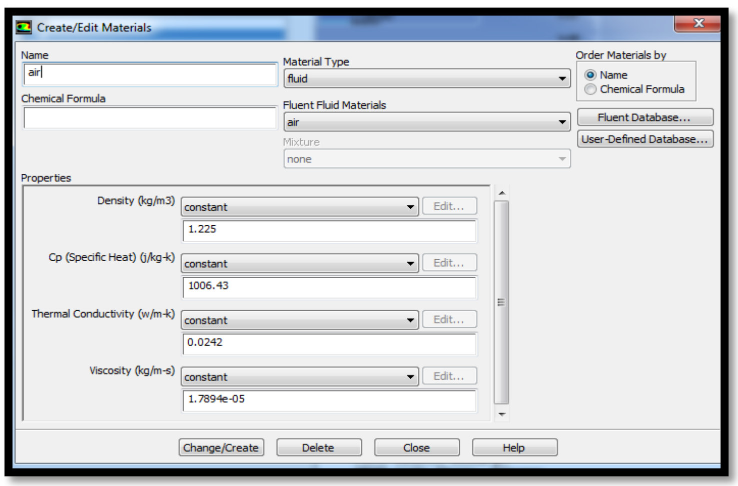
various shapes. Evaluating the lift and drag on a vehicle. Internal aerodynamics is the study of flow through passages in solid objects. For instance, internal

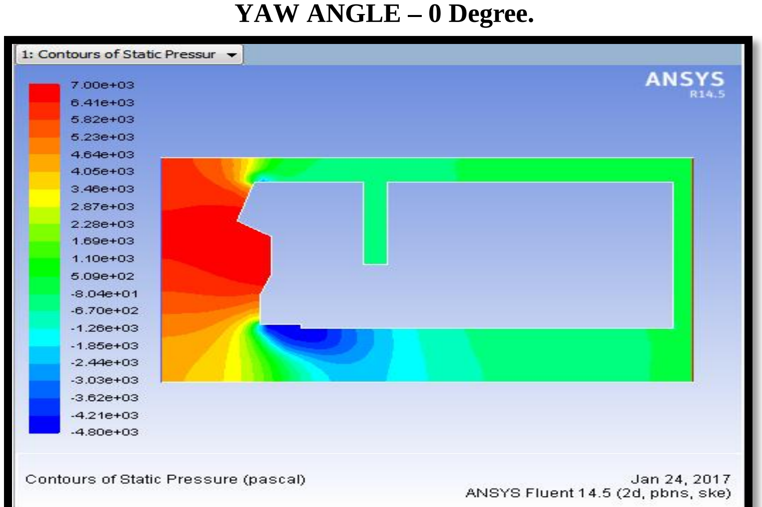
Cfd Analysis Of Heavy Duty Trucks For Drag Reduction:-

Existing Model

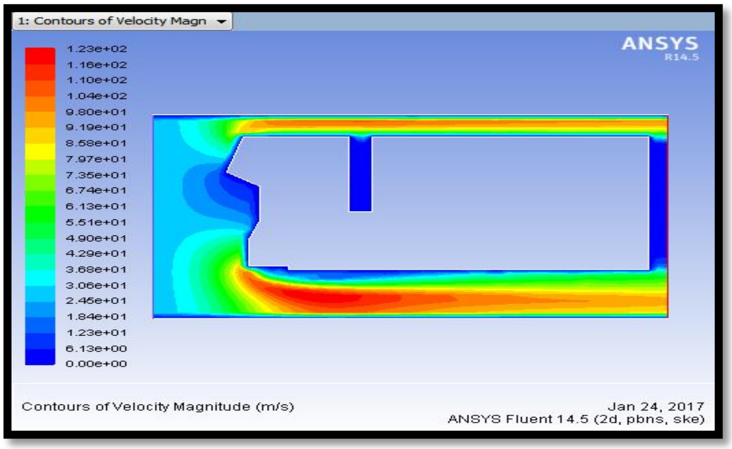
Fluid properties of air



YAW ANGLE – 0 Degree.

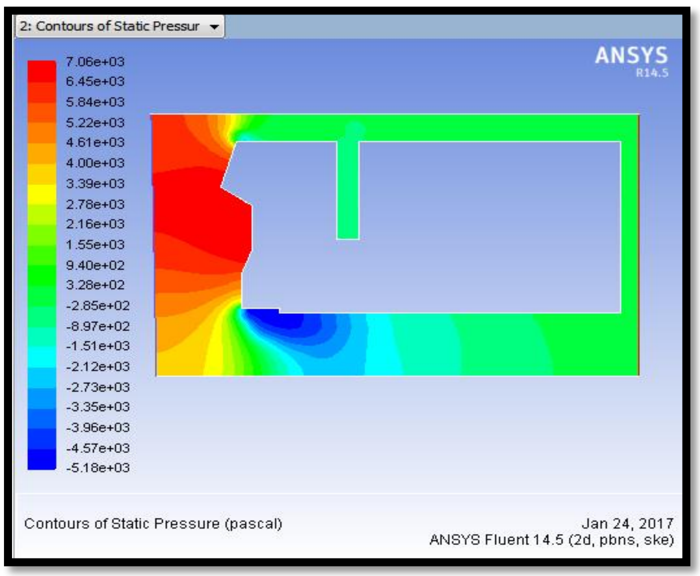


Static Pressure.

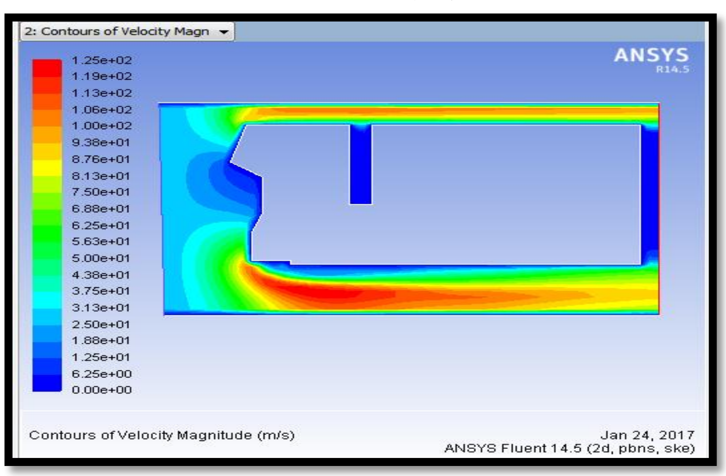


Velocity

Yaw Angle – 1 Degree.

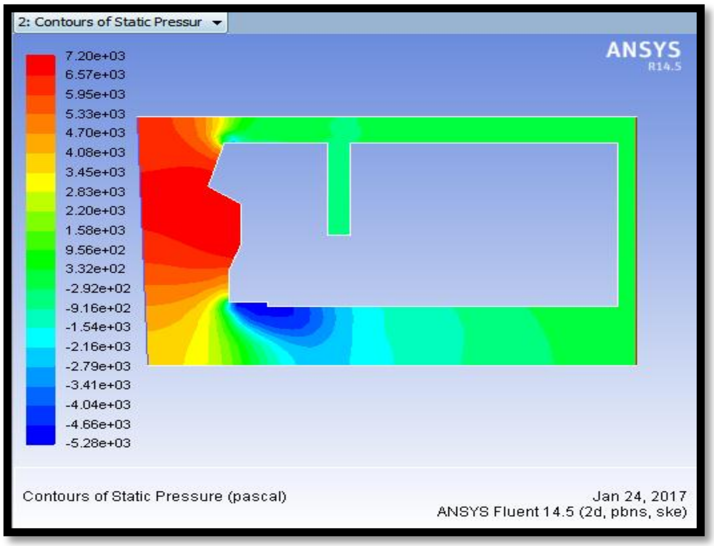


Static Pressure.

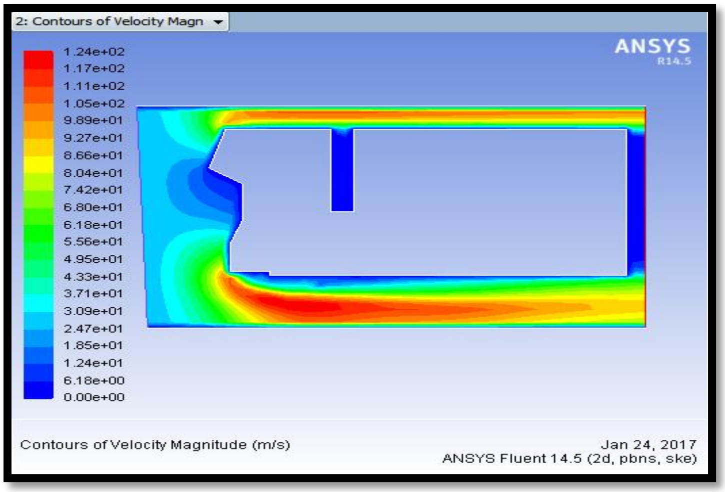


Velocity

YAW ANGLE – 2 Degree.

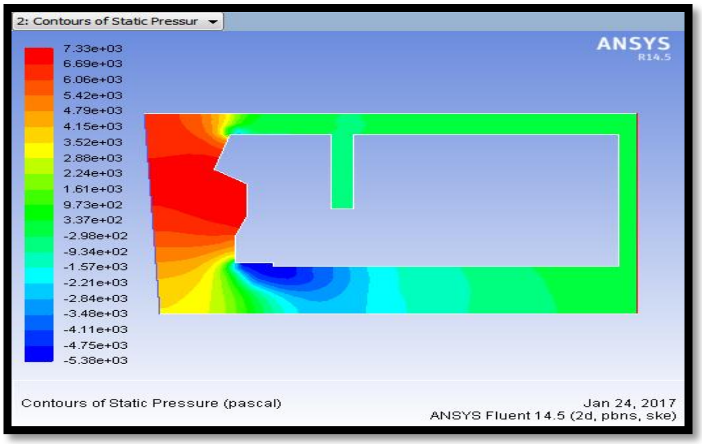


Pressure

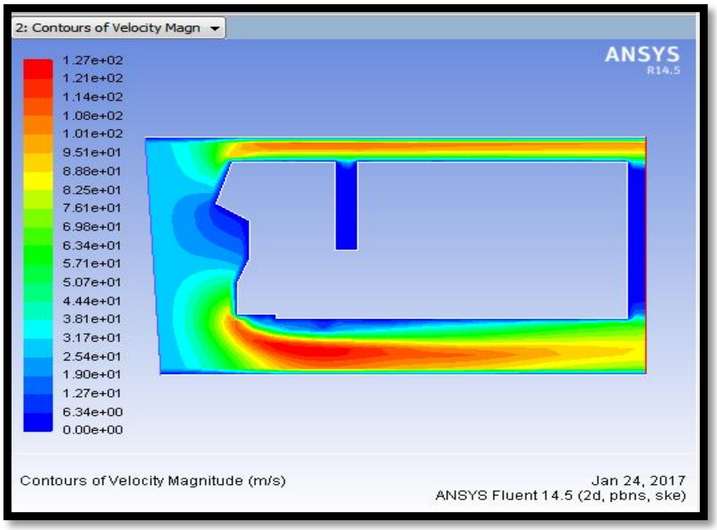


Velocity

YAW ANGLE- 3 Degree.

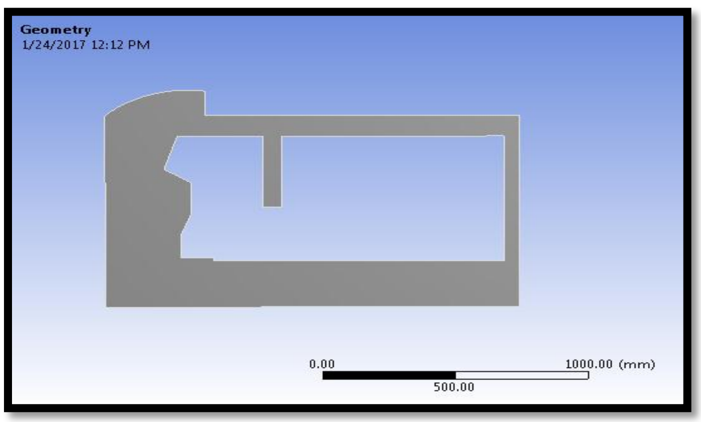


Pressure

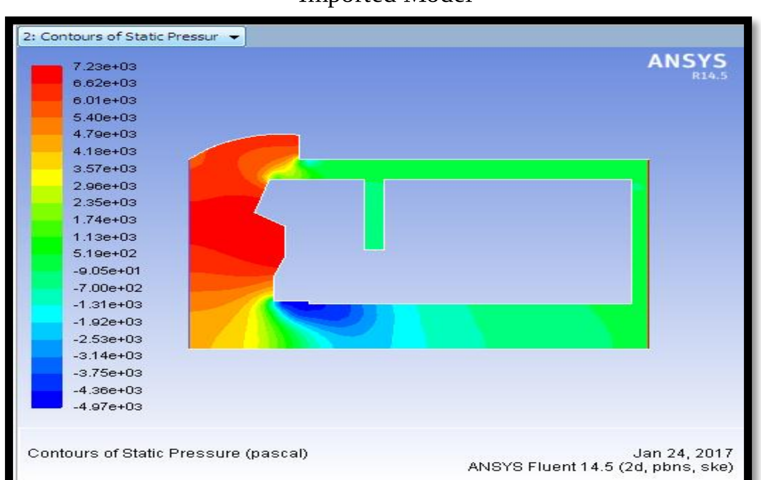


Velocity

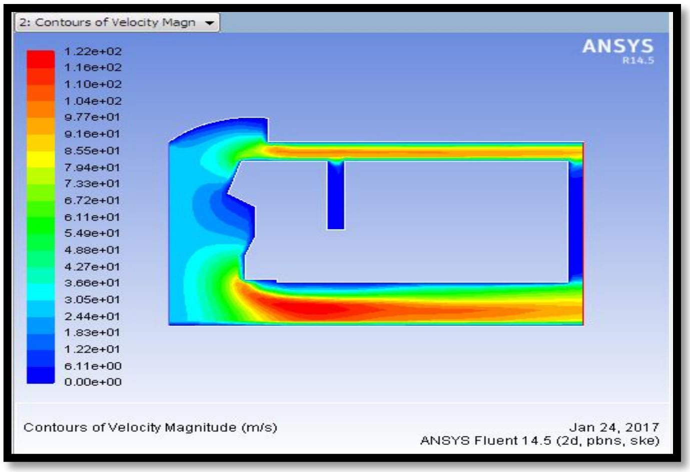
MODIFIED MODEL
YAW ANGLE- 0 Degree



Imported Model

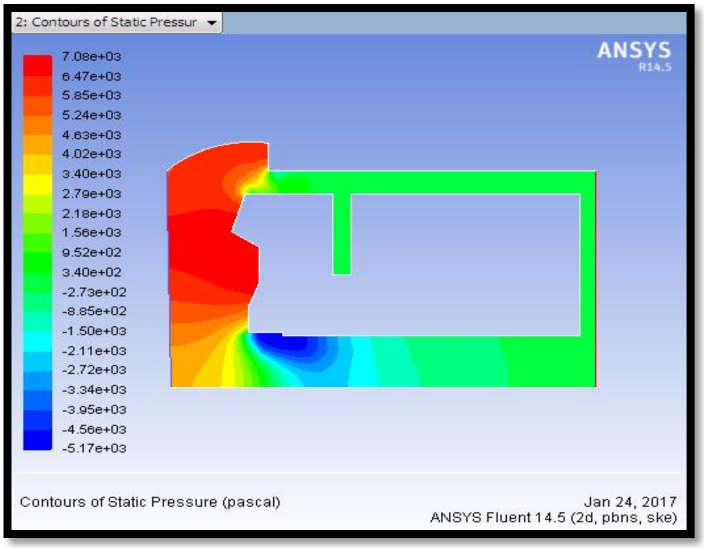


Pressure

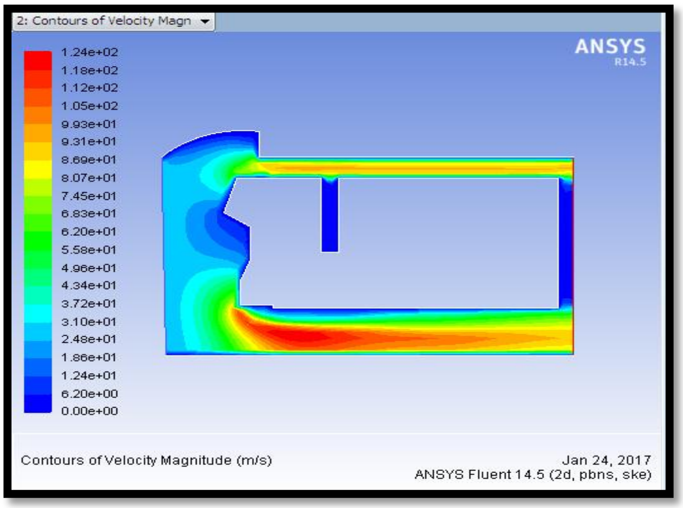


Velocity

YAW ANGLE-1 Degree.

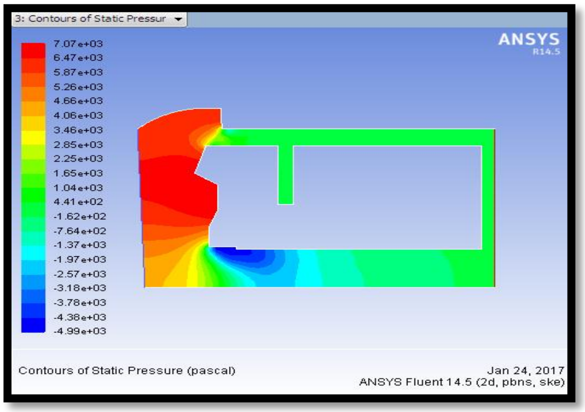


Pressure

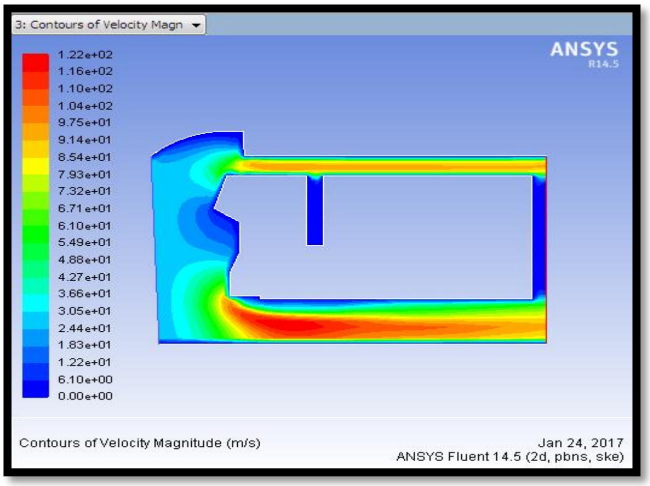


Velocity

YAW ANGLE-2 Degree

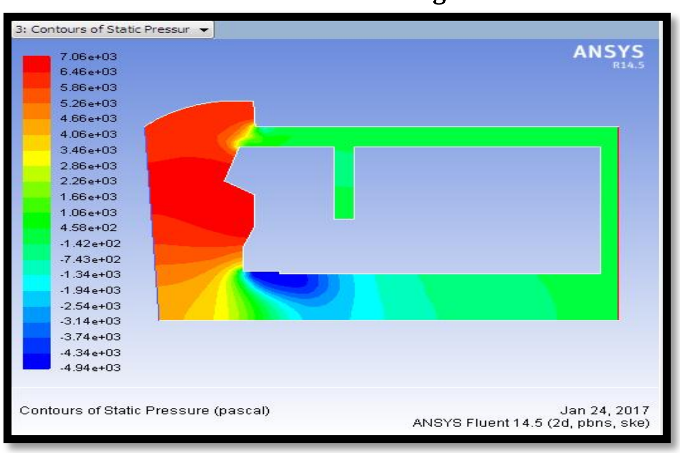


Pressure

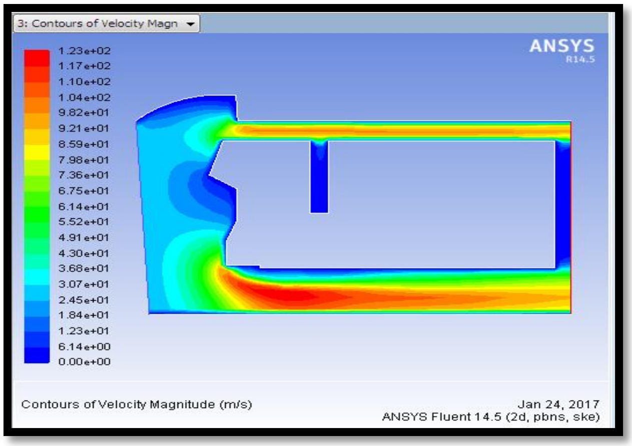


Velocity

YAW ANGLE-3 Degree



Pressure



Velocity

Result:-

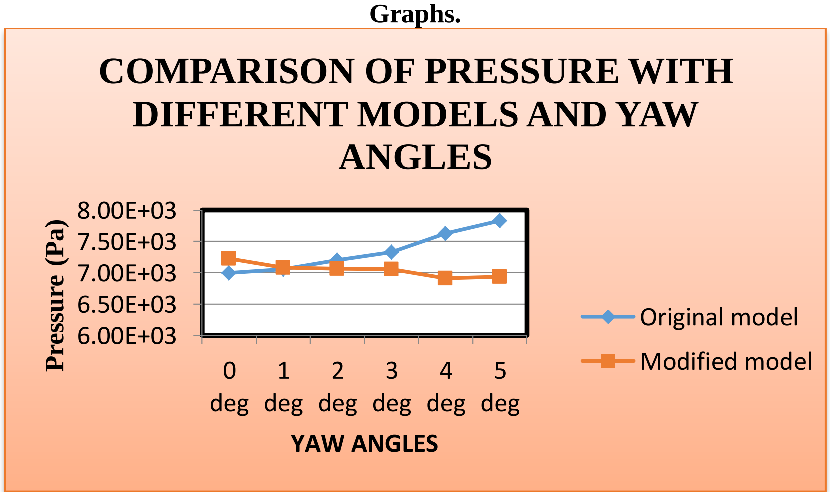
Existing Model.

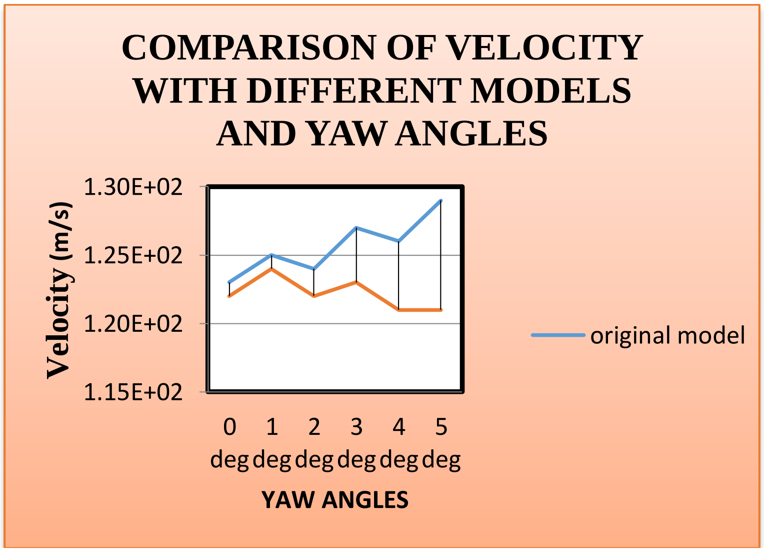
	PRESSURE (N/mm^2)	VELOCITY (m/s)	DRAG FORCE(N)	LIFT FORCE(N)
0-deg	7.00e+03	1.23e+02	3699.2855	-23.000178
1-deg	7.06e+03	1.25e+02	3591.9445	91.70718
2-deg	7.20e+03	1.24e+02	3486.3478	199.14139
3-deg	7.33e+03	1.27e+02	3453.9187	308.95235
4-deg	7.63e+03	1.26e+02	3412.1785	435.938
5-deg	7.83e+03	1.29e+02	3346.796	564.79953

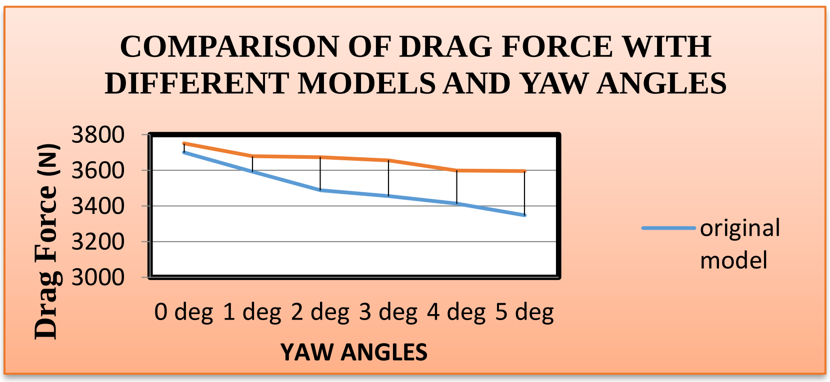
Modified Model.

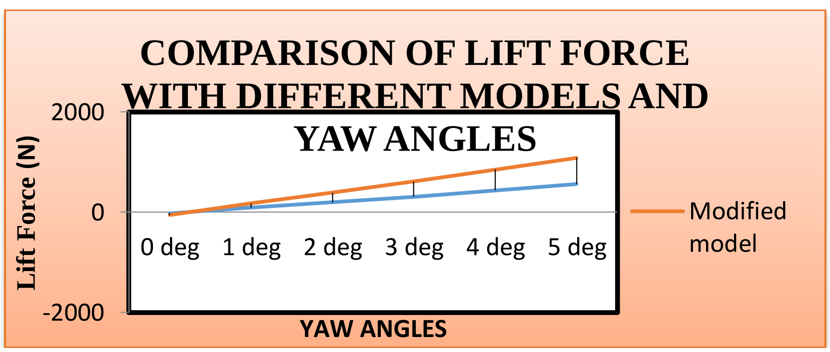
	PRESSURE (Pa)	VELOCITY (m/s)	DRAG FORCE(N)	LIFT FORCE(N)
0-deg	7.23e+03	1.22e+02	3750.3736	-34.067584
1-deg	7.08e+03	1.24e+02	3678.1884	87.159243
2-deg	7.07e+03	1.22e+02	3672.7824	187.70013
3-deg	7.06e+03	1.23e+02	3655.922	306.36756
4-deg	6.91e+03	1.21e+02	3598.1378	416.30607
5-deg	6.94e+03	1.21e+02	3594.3167	522.77513

Graphs.









Conclusion:-

This work verifies the possibilities of improving the aerodynamics around a truck in order to reduce the fuel consumption. Aerodynamic trailer devices have a great potential of reducing drag. Compared to the original modal, the trailer is much more susceptible for aerodynamic drag improvements and thus the fuel consumption can be substantially reduced by using trailer devices. By combining the devices, even larger drag improvements can be achieved.

In this analysis we have taken 10 Ton truck as experimental model. The results show that the largest effects of the trailer devices are achieved during 5° yaw. By observing above result we are concluding that after adding trailer slant device on top of the truck increase lift force and reduce drag force are reduced from 0^{o} to 5^{o} yaw angle.