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Drag Reduction of TVS Scooty using a Windshield for the Rider Comfort Improvement

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ABSTRACT:

Rider comfort and safety has become an essential theme in the design of two-wheeler vehicles. Comfort incorporates wind noise, air pressure on the rider, visibility and the stability of the Scooty handle. Rider comfort and the potential aerodynamics concern have encouraged the current authors to carry out the Computational Fluid Dynamics (CFD) analysis of TVS pep+ Scooty. Numerical computations were carried out using the standard k-ε turbulence model to examine the aerodynamic force coefficients, pressure distribution, velocity vector and streamlines around the Scooty and rider. Simulations were done for a range of speed on an existing and redesigned model of Scooty with a different windshield height. The simulation result shows that there is a reduction in the coefficient of drag (Cd) from 1.58 (baseline model) to 0.95 (model 3) at a speed of 60kmph. The pressure contour reveals the inclusion of the windshield of height 130mm in the baseline model has diminished the pressure drag on the rider. Visual of velocity contour depicts that the velocity of the air decrease above the neck region with in-creasing windshield height at a vehicle speed 120kmph. This study reinforces the need of windshield height of 150mm in the baseline model to avoid unwanted aerodynamic benefits on the rider.

KEYWORDS:

Scooty; Windshield; Rider comfort; Computational fluid dynamics; Coefficient of drag

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NOMENCLATURE:

k	turbulence kinetic energy
Ɛ	turbulence dissipation rate
Gk	turbulence kinetic energy due to the mean velocity gradients
Gb	turbulence kinetic energy due to buoyancy
Ym	fluctuating dilatation incompressible turbulence to the overall dissipation rate

1. Introduction

Transport is the backbone for the development of any country. Two-Wheeler is one of the important modes of road transport for commuting due to the convenience and affordability that it offers. India has the second-largest two-wheeler market in the world after China. TVS Company is the third-largest two-wheeler manufacturer in the country. In the two-wheeler's category, Scooty is more comfortable to old persons and teenage girls because of the leg space availability within the vehicle body. Aerodynamics is a significant factor in vehicle design. The surrounding of a rider on a two-wheeler is an open space that is entirely dissimilar from the four-wheeler passenger surrounding in an automobile. Aerodynamics of Scooty plays a vital role in the comfort of the rider.

Several studies have been carried out to analyse the aerodynamic aspect and flow visualization in the automobile sector. A few studies have been reported here related to a bus. Raveendran et al [1] redesigned the external style of a bus for superior aerodynamics performance. CFD code was used to evaluate the aerodynamic performance. The results of the modified external body revealed a decrease in the coefficient of discharge and overall drag decline by 60% due to the combined reduced coefficient of discharge and frontal area. Abinesh et al [2] modified the back-view mirror, air conditioning position and front face of the Volvo intercity bus and found 10% reduction in the aerodynamic drag force when compared to the existing bus. These design changes have resulted in improved performance and decreases the fuel necessity. Drag force in this study is determined by using ANSYS Fluent software.