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Experimental Study Analysis of Flow over Pickup Truck's Cargo Area Using Bed Covers

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Abstract : Automobiles are modeled in various forms, and they interact with air when in motion. Aerodynamics is the study of such interactions where solid bodies affect the way air moves around them. The shape of solid bodies can impact the ease at which they move against the flow of air; due to which any additional freightage, or loads, impact its aerodynamics. It is important to transport people and cargo safely. Despite the various safety measures, there are a large number of vehicle-related accidents. This study precisely explores the effects an automobile experiences, with added cargo and covers. The addition of these items changes the original vehicle shape and the approved design for safe driving. This paper showcases the effects of the changed vehicle shape and design via experimental testing conducted on a physical 1:27 scale and CAD model of an F-150 pickup truck, the most common pickup truck in the United States, with differently shaped loads and weight traveling at a constant speed. The additional freightage produces unwanted drag or lift resulting in lower fuel efficiencies and unsafe driving conditions. This study employs an adjustable external shell on the F-150 pickup truck to create a controlled aerodynamic geometry to combat the detrimental effects of additional freightage. The results utilize colored powder [which acts as a visual medium for the interaction of air with the vehicle], to highlight the impact of the additional freight on the automobile's external shell. This will be done along with simulation models using Altair CFD software of twelve cases regarding the effects of an added load onto an F-150 pickup truck. This paper is an attempt toward standardizing the geometric design of the external shell, given the uniqueness of every load and its placement on the vehicle; while providing real-time data to be compared to simulation results from the existing literature.

Keywords : aerodynamics, CFD, freightage, pickup cover
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