EXPERIMENTAL STUDY OF THE AERODYNAMICS OF AN AHMED BODY, INCLUDING PASSIVE DRAG CONTROL

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The aerodynamic studies are nowadays fundamental. They do not only allow to increase the performance of race cars but also to reduce the consumption of vehicles. Indeed, the main source of energy consumption comes from drag. It is why its control is very important.
The objectives of the project are to qualify the facility for ground vehicle testing, to understand the flow at the rear of a vehicle and, finally, to make a passive drag control.

To simulate the same conditions on the road, the VKI L-1B closed wind tunnel and the elevated floor are chosen. The latter neglects the ground effect, but minimizes the boundary layer upstream to the model.
The qualification of the facility is studied: flow leakage in the wind tunnel and characterization of the upstream flow. Avoiding leakage for aerodynamic measurements is important: +12% for the drag coefficient with leakage. Moreover, from velocity profiles and flow angles, the upstream flow of the model seems quite good.

As a reference, a car-shape model, the Ahmed body, is used. Due to its simplified geometry, it is used as a reference model for wind tunnel testing and numerical simulation.
Test campaigns are carried out with a rear angle of 25° and 40° to understand the mechanism of increasing and decreasing of drag. Results are compared with literature data: drag coefficient in function of the rear angle (Figure 1). The physical interpretation for the rear angle of 25° is supported by oil visualization and wall pressure measurements.
The results are very similar with literature. The results agree within 5% with the one published in the literature. The wall pressure measurements confirm the flow behavior found with oil visualization.

For the passive drag control, a flap is used. Two configurations are carried out: at the junction of the roof and the slant surface of the Ahmed body and, at the middle of the slant surface. Maximum drag reduction is found with the first configuration: 5% (Figure 2). The physical interpretation is also supported by oil visualization and wall pressure measurements.

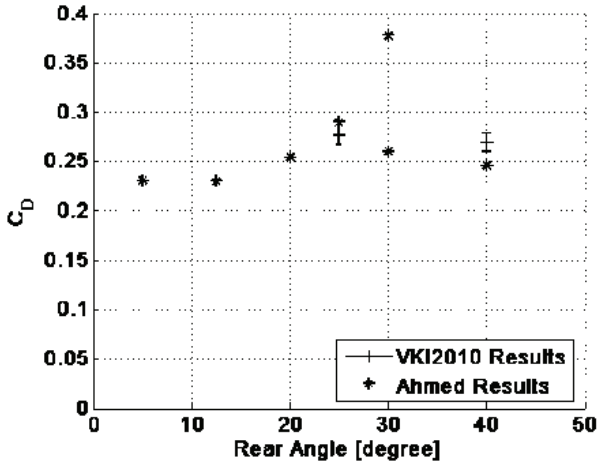

Figure 1: Drag coefficient in function of the rear Angle

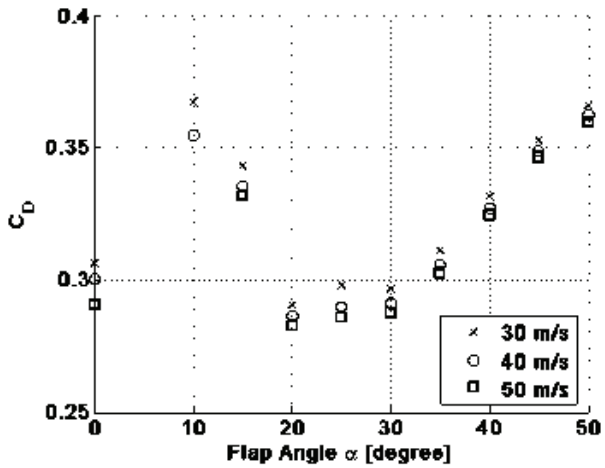

Figure 2: Drag control: first configuration