CFD Study on 2D Rear wing/Spoiler on a passenger vehicle

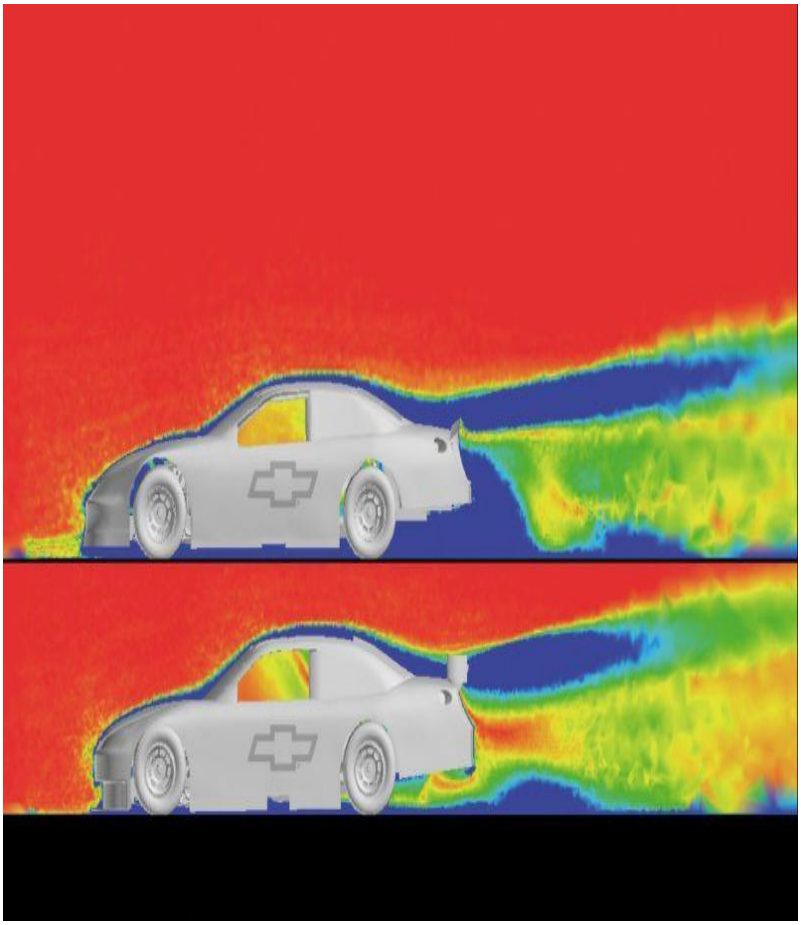
Abstract

A Spoiler is an automotive add on device which enables to counter undesirable air flow around the vehicle known as eddies or turbulence. As a result the pressure drag reduces and it also improves handling characteristics by enhancing down force and thus traction .Generally it is found that the wake region in the hind side contributes maximum to overall drag. Therefore spoilers are provided in the rear. However front spoilers are also in use in the form of diffusers under the front bumper which decrease flow underneath of vehicle and therefore decrease drag and also lift .In some cases the spoilers are mounted above front windshield. The comparison is done on both with and without spoiler .

Keywords: Drag, Lift, Down force, spoilers

Problem statement

When a driver drives his or her car in high speed condition(>110 km/hr.)



Boundary Conditions (for all cases and benchmarks)		
Velocity Inlet	Magnitude and Direction	30m/s (Positive Z-direction)
	Turbulence Intensity	1.00%
Pressure Outlet	Gauge Pressure magnitude	0 Pascal
	Gauge Pressure direction	Normal to boundary
	Turbulence Specification Method	Intensity and Viscosity Ratio
	Backflow Turbulence Intensity	10%
Wall Zones	No Slip	
Symmetry	No Slip	
Fluid Properties	Fluid Type	Air
	Density	ρ = 1.2 kg/m^3

AERODYNAMIC FORCES

Drag force

- DA = ½ ρ v2 CD A
- Where CD = coefficient drag [dimensionless]
- A = frontal area [m2]
- ρ = density of air [kg/m3]
- v = velocity of vehicle [m/s]

Lift force

- LA = ½ ρ v2 CL A
- LA = lift force
- CL = coefficient of lift
- A = frontal area

Down force

- Downforce is created when air moves through and over parts of the car.

References

- Car G.W. The Study of Road Vehicle Aerodynamics, Using Wind Tunnel Models. Paper 14, Proc. 1st Sump. Road Vehicle Aerodynamics, London, 1969.
- Website:http://www.nasa.gov/audience/forstudents/5-8/features/what-is-aerodynamics-58.html.