

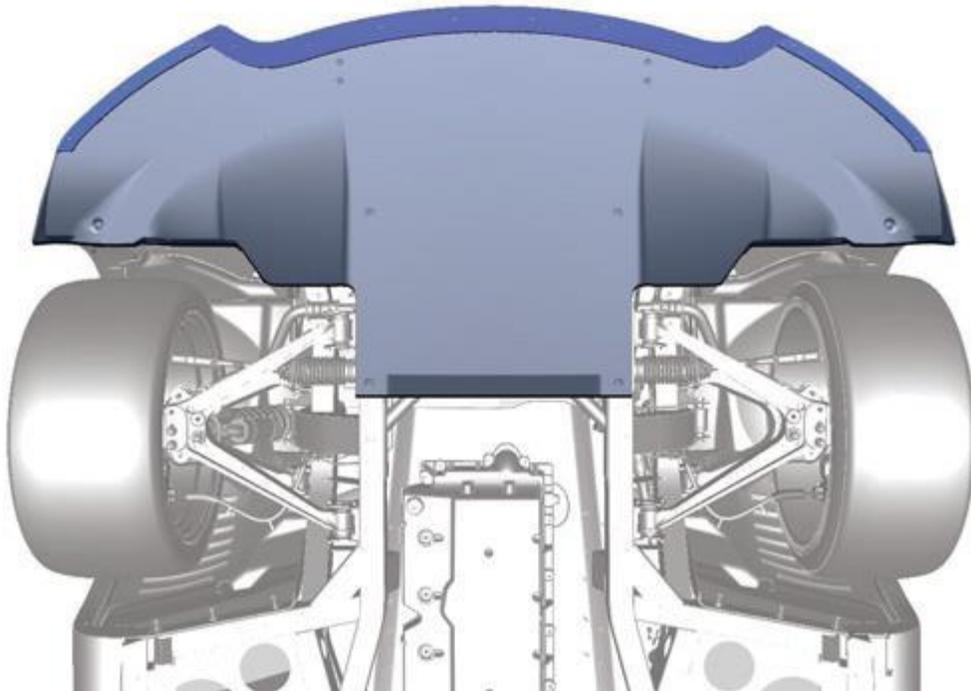
AERO 101

Greetings! We are now on the sixth segment of Aero 101. The topic of today's discussion is diffusers! There are front and rear diffusers, and they both do the same thing. The term diffuser actually comes from action of the air as it leaves the underside of the vehicle. Diffusers themselves do not create any significant drag, making it a very efficient device. It seems like most of you have a good grasp on the topics we've covered so far, but if you have questions, don't be afraid to ask!

Front Diffusers

Most splitters continue on horizontally aft of the airdam. However, a variation to this is to angle the rearward section of the splitter upwards slightly to form a 'diffuser'. They can exist as one single wide diffuser, to a pair of separate narrow diffusers in line with the space between the wheels and the chassis, or even four small diffusers, spread throughout. Front diffusers have been shown to increase overall downforce, although concentrated on the front, by almost 4%! When a front diffuser is fitted onto a car, the static pressure underneath the splitter significantly drops, generating downforce. Another benefit of adding a front diffuser to a splitter is increasing the mass flow. We stated in previous segments that increasing the airflow underneath the car has the effect of increasing the airflow's velocity. However, it is important to note that the angle of the diffuser has a very large affect on its effectiveness. The rear of the diffuser has a higher static pressure due to the expanding air, and the gradient caused by the front of the diffuser (low static pressure) and the rear of the diffuser is too severe, and causes airflow to separate. Therefore, optimization of the angle of the diffuser would improve attached airflow. If you are thinking about adding front diffusers to your splitter, you need to make note that the airflow needs a place to go or exit (this is why

some diffusers are aimed at the space between the wheels and chassis).



Rear Diffusers

Much like the front diffuser, the rear diffuser allows the air underneath the car to expand and return to the ambient pressure of the freestream air. Pressure is lowest in the underbody, where the car creates a 'throat' with the ground. Low pressure persists for longer when there is a longer underbody. Thus, in order to have a long underbody, the diffuser needs to be short and steep. This creates a problem because as we know, steep diffusers commonly have flow separation. It would be beneficial to figure out ways to keep flow attached to steep diffusers, such as using vortex generators, as this would result in the largest increase of downforce. A general rule of thumb is to keep the diffuser angle between 6-12*, unless CFD has been involved.

Another way to keep flow attached is by use of a rear wing, as we have discussed before. There is an interaction that occurs between the rear wing and the diffuser that helps 'drive' the diffuser. The wing has a low static pressure underneath it, which results in a considerably reduced static pressure region behind the car. The low pressure region causes a strong pull on the airflow emerging from underneath the car, which keeps the flow attached. The negative of this is that the reduced pressure region causes more drag. It is also important to note that air coming off the tires will negatively affect the airflow of the diffuser, so it is best to try to isolate the diffuser flow using fences and such.

