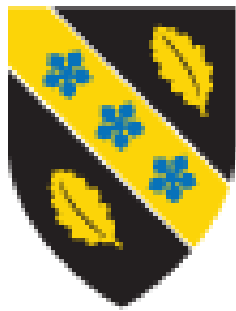


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After over a decade of being in the sport is DRS still worth having in

Formula 1?

Academic Skills

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1 Introduction

In this technical report I will be investigating if DRS is still needed in Formula 1 or if it is outdated and unnecessary. I will be delving into previous seasons of Formula 1 and investigating different regulation changes and how they have affected overtaking in Formula 1.

1.1 Justification

I will be conducting this investigation because now more than ever there are questions being raised about DRS in Formula 1. More specifically, is it too effective? Is it effective enough? Should F1 resort to a 'push to pass' system as seen in Indycar. All of which are valid questions. The job of DRS in Formula 1 is to allow a car to get alongside or in some cases overtake the car ahead before the next braking zone for the next turn. However, there have been some races in recent seasons that, even with DRS, have been absolute bore fests for the viewers because of the infamous 'DRS trains'. This is when many drivers are in DRS of each other and cannot overtake. Although, in some cases like we see in Mexico City. DRS is not always the problem. As the Mexico City Grand Prix takes place at a high altitude (highest of the whole season) the air density is very thin leading to less air resistance which results in DRS not being that effective.

1.2 Aims

- 1] To carry out a thorough investigation to argue whether DRS still has a place in Formula 1 today.
- 2] To establish an understanding on how new regulations have impacted overtaking in Formula 1.

1.3 Objectives

- 1] I will gather data and statistics and compare the number of overtakes before and after DRS was introduced. To be concise with my evaluation I will be comparing the 2010 Formula 1 season (before DRS was introduced) and the 2011 Formula 1 season (after DRS was introduced), to give a side by side comparison.
- 2] I will look into a variety of recent regulations and understand what the regulations changed and how that impacted overtaking in Formula 1. Those regulations are from the seasons of 2014,'17 and '22. Here I will evaluate the changes to see if they have positively or negatively affected overtaking in Formula 1.

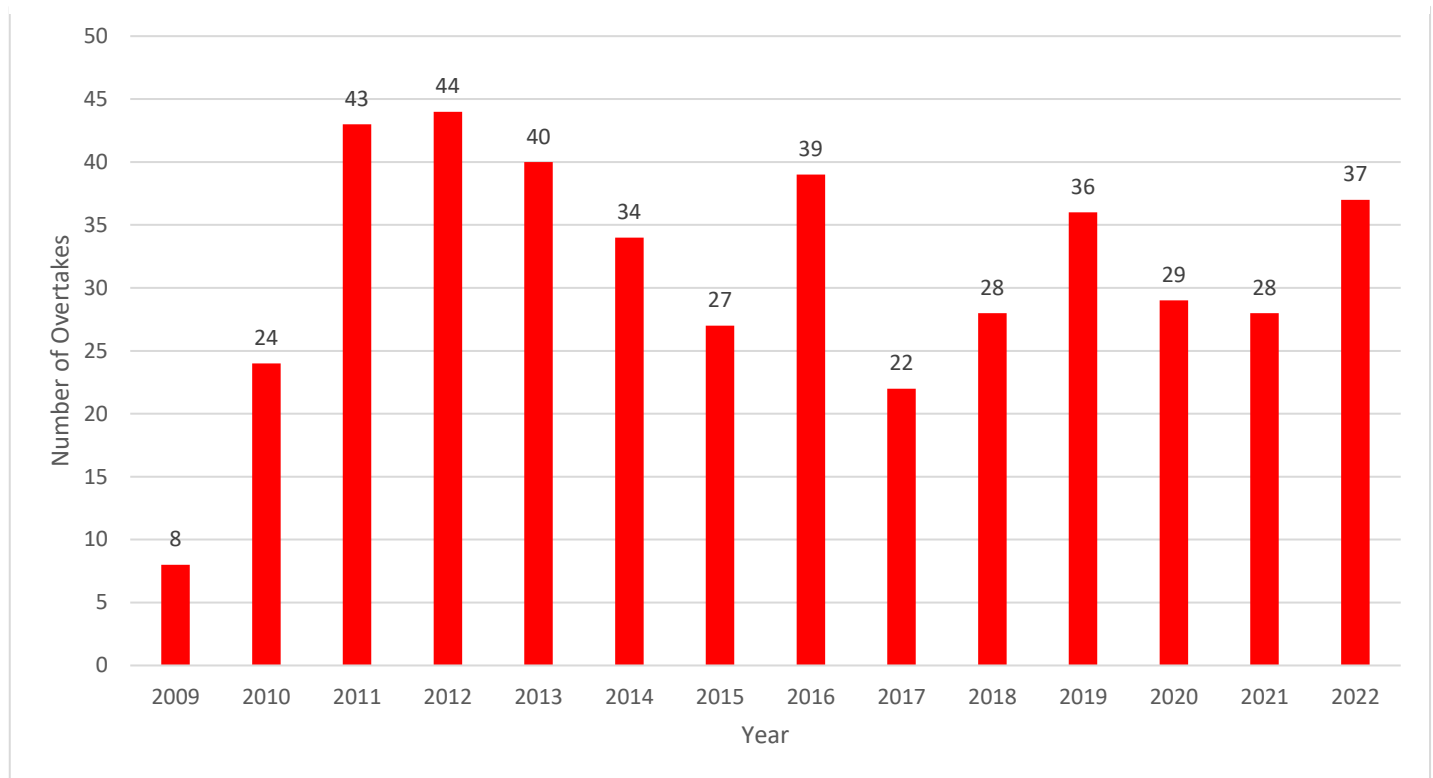
2 Background

The Drag Reduction System (DRS) was introduced to Formula 1 in the 2011 season. It is a system that allows drivers to adjust the upper element of the rear wing to reduce the drag along with increase the speed at which the car is travelling. As a result, the driver behind has a better chance of overtaking the car ahead of them. However, in order to activate the DRS the driver must be within 1 second of the car ahead when they cross a DRS detection zone as per the rules and regulations created by the governing body – the FIA. Depending on how the circuit layout looks there are usually 2 to 3 DRS zones. However, DRS can only be activated on a straight because once the rear wing opens, often described as a 'letterbox', the car loses around 30% of it's downforce. Therefore it is too dangerous to have DRS active going around corners. Likewise, when it rains or the track conditions are wet the FIA deems it too dangerous for DRS full stop. Why does the car lose downforce when DRS is active? Well, without DRS the air that flows over the rear wing is projected upwards causing the car to be pressed downwards towards the ground which generates downforce. On the other hand, when DRS is active the upper element of the rear wing opens causing air to travel through the rear wing rather than pressing down resulting in less downforce being generated. (PlanetF1.com, 2022)

Now that you know what DRS is, why was it actually introduced?

3 Discussion

Figure 1 shows the average number of overtakes per race in Formula 1 by season



Note: Only overtakes that were completed in normal racing conditions were counted. Excluding: first lap, pit stops, crashes, mechanical failures, standing starts after a red flag.

As seen in figure 1 above, the correlation since DRS was first introduced prior to the 2011 Formula 1 season is that there was a significant increase in the number of overtakes. This can be seen during the periods of 2011 to 2013. There is then a slight decrease in overtakes in the coming seasons due to the 2014 regulation changes which were the biggest in quite some time. They included an overhaul in the powertrain department, with the introduction of ERS (Energy Recovery System) and a complete revamp of the engine. Going from a 2.4 litre naturally aspirated V8, which were introduced in 2006, to a 1.6 litre turbo hybrid engine which remains in the sport today. (Keberz.com, 2022)

Just when the number of overtakes were increasing again during the 2016 season, the new 2017 regulations were introduced. Although not as big as the 2014 rule change, the 2017 regulations significantly impacted the number of overtakes that were possible during a race. The cars became wider and as a result produced more dirty air.

What is dirty air? In Formula 1, dirty air is a term used to describe the hot turbulent air that is pushed behind the car via aerodynamics. Dirty air was a problem for overtaking in the late 2010s, early 2020s. Due to the fact that a car behind struggled to flow another car because all the dirty air that was being pushed behind was reducing the following cars downforce.

As seen in Figure 1, overtaking in the 2022 season increased. This is because of the 2022 regulation changes which were the biggest since 2014. The 2022 generation of cars had a totally new look and philosophy. Instead of downforce being generated on the bodywork via bargeboards for example, ground effect is the new thing. When a car is travelling at high speeds, air is vacuumed underneath the car creating a low pressure environment. Therefore air is circulating at quicker speeds resulting in a substantial amount of downforce being made. Even more downforce that is being created by the front and rear wings. (Pretorius, L. 2022)

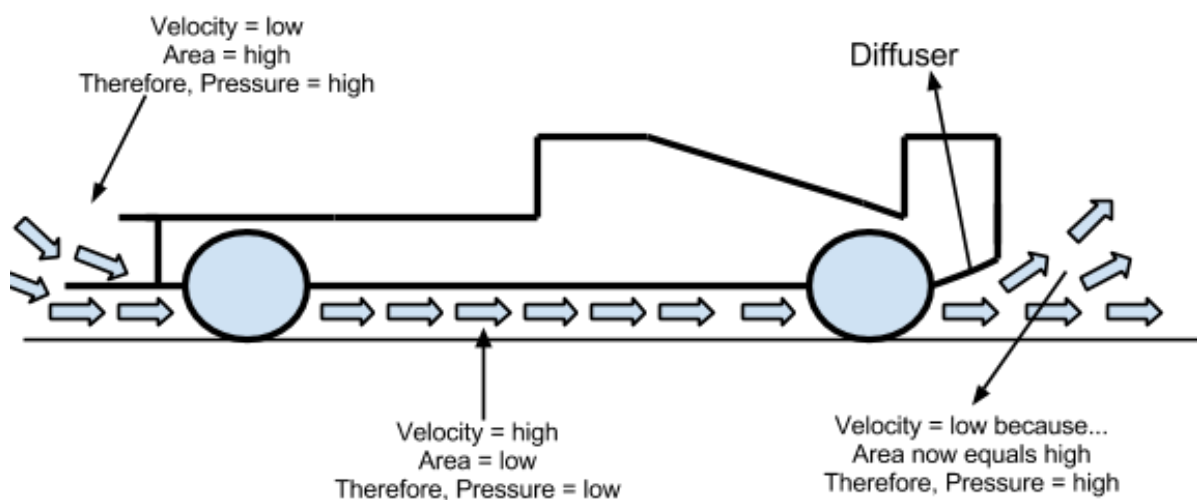


Figure 2 shows the 'venturi effect' which is a big part of the 2022 regulations

Dirty air effect in Formula 1

Keberz
Engineering

2017-2021 bodywork



2022 bodywork



Figure 3 the number of laps in traffic per overtake, Note: "in traffic" meaning if the car was within 1 second of the next car at the start – finish line, excluding lapped cars.

Above in Figure 3 is a diagram that displays how the 2017 aerodynamic changes caused a lack of overtaking. The following seasons (2018 to 2021) were not as bad as 2017 in my opinion, but all were similar in the fact that you needed a different kind of delta to overtake. For example, a tyre wear delta contributes massively to overtaking in Formula 1. This is when a car that has recently pitted to put on a fresh set of tyres has much more of an advantage than a car that hasn't pitted and remains on older degrading tyres. Also a car performance delta is another large contributor for overtaking in Formula 1. This is when a car has a significant pace advantage over another car. For example: In 2019, the Williams was by far the most poorly performing car on the grid, sometimes being lapped more than 2 times in a race. Compare this to the championship-winning Mercedes. It's like taking candy from a baby in regards to overtaking.

4 Conclusion

To conclude this investigation, I can confidently say that DRS is still needed in Formula 1 today. The duty of DRS is to encourage overtaking by helping a car behind go side by side or even pass the car in front heading into the next braking zone. Therefore, in my opinion, DRS fulfils it's role in Formula 1. I found that new regulation changes, such as those in 2017, can negatively effect overtaking. Which is why DRS is essential to the sport of Formula 1 to keep overtaking possible. I believe that I have managed to keep my investigation relevant to the aims & objectives that I set at the start of the investigation.

5 References

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