TEAM DEFIANZ RACING

NEWSLETTER

MARCH 2020

ISSUE 4

Memoria

You can't be here!

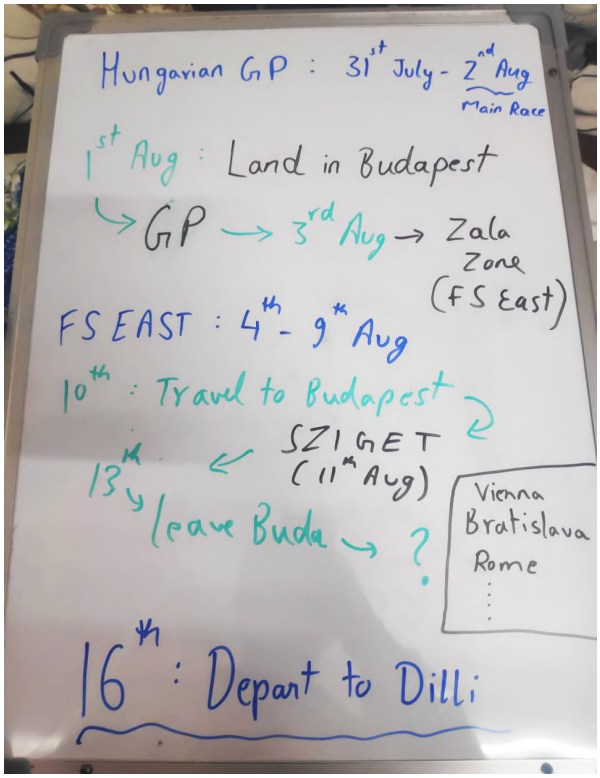
This photo depicts a funny incident when our dedicated photographer just settled down at the start line of the endurance event and a track marshall had to walk all the way from the tent to shoo him away!

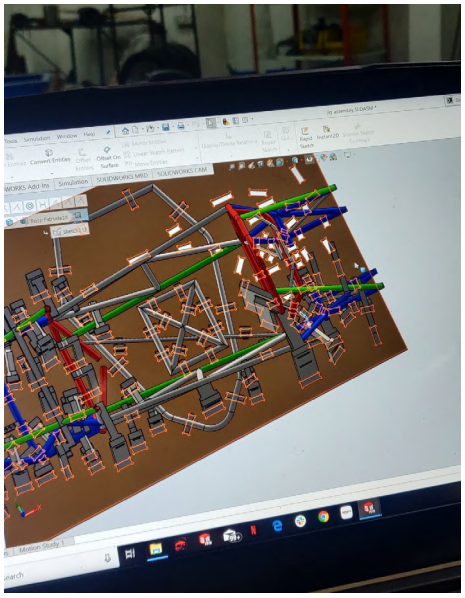
The media person tapped the shutter button at the perfect moment, yet again. Take that, marshall!

P.s. We love you, dear marshall. You did a great job back there!

UNFILTERED

EVERY PICTURE TELLS A STORY





Team Updates

- With the on-going COVID - 19 pandemic, the team has taken certain decisions which prioritise the health and safety of all its members and also **encourage social distancing**.

- We have put a **halt to all our manufacturing and workshop activities**, and all the team members are working from home. In order to stay connected during these times, there are regular online meetings and group discussions along with dedicated research and **documentation tasks being handed out to all members**.

- Our upcoming competition, **FS EAST (Hungary) has been cancelled** due to the pandemic; a decision which the team supports completely.

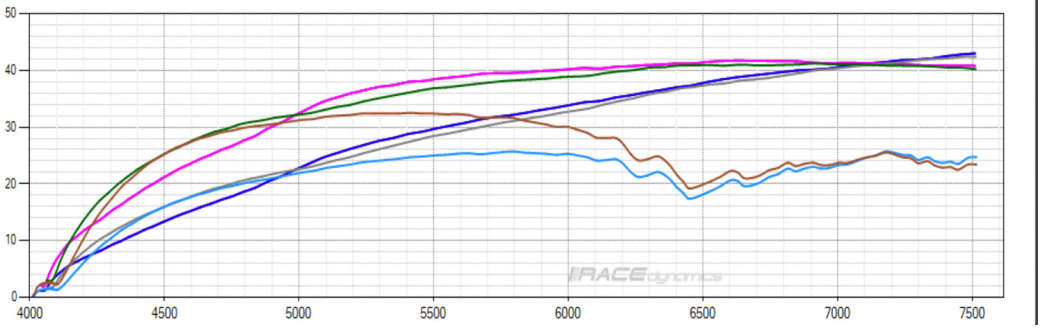
- We shall continue to closely monitor the situation and head back to manufacturing our IC race-car whenever time dictates. In the meantime, the team's priority would be to indulge in research needed to **fabricate its first ever electric vehicle**.

Departmental updates

Powertrain

- Prior to the halt of operations, our Powertrain department finally managed to accomplish one its major targets and taste some **success with ECU Tuning**. We finally stand equipped to unleash the power given to us by the DTA Fast Tuneable ECU. **End result - 43 bhp giving us a power to weight ratio of 226 bhp per tonne!**
- This accomplishment comes as a culmination of constant willpower and determination displayed by all the **powertrain members**. The team would also like to give a major shout out to all the **alumini members** who have been constantly guiding us in this process and continuing to believe in us.

Max HP	Max Tq (Nm)	AFR	Mx Spd(km/h)	Pr (KPa)	Temp (deg	SAE Cor	Humidity (%)	Drive Ratio	Overall Trim	Dyno Config
43.0	41.7		73.11	98.37	30.15	1.021	42	6.14	1	Car - front set
43.0	41.7		73.11	98.37	30.15	1.021	42	6.14	1	Car - front set
42.4	41.2		73.14	98.37	30.1	1.021	42	6.14	1	Car - front set
25.7	32.5		72.83	98.37	29.37	1.019	47	6.16	1	Car - front set



Real time dyno plots showing Engine HP and Torque in different conditions.

- The 3-D printing of our 2020 intake manifold is currently underway. The team would like to extend a warm welcome to **Fraxus Solutions Pvt. Ltd.** upon its board of sponsors. They have been very generous towards the team by sponsoring the 3D print of the intake. It is with their precise and reliable manufacturing that the team stands assured of a quality intake system.
- Testing of our previous season car: DR18 was done with new fuel and ignition map. **The results look extremely promising** and the team is eagerly waiting to replicate the same on our upcoming car, DR19.

VEHICLE DYNAMICS

- Realizing the pivotal role of the vehicle dynamics department in the swift manufacturing of major components to meet the deadlines, all the VD members worked day in and day out to **ensure our vehicle could stand on all 4 wheels by due time.**

- Multiple suspension inboard mounts were manufactured. Our **Anti-Roll Bar blades were also machined**, first on lathe and then on CNC finally being assembled with the ARB housing which was made on aluminium 7-series on lathe. The **Anti-Roll Bars to be mounted on DR20 look extremely promising** and the team awaits the track testing sessions to analyze their performance.

- Learning from its past, the department has been putting extreme hardwork into designing an **impeccable and highly reliable brake system.** The braking calculations were refined to incorporate tire load sensitivity and to design new, improved brake discs. The brake disc designs are currently under going **thermal analysis simulations on ANSYS** which would help the team in selecting the most optimized design.

- The department also purchased and pre-machined all the required material needed for manufacturing its major components like bulkhead, rockers, pedal-box etc. **The machining is expected to continue in full swing once the ongoing pandemic stabilizes.**

Software and Electronics

Continuing its work on the vehicle data-logging and telemetry system, the software and electronics department undertook various projects to further its goals:

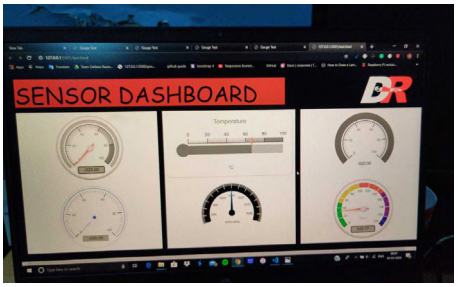
- The department stabilised the CAN Bus module by using Rotary Pots by MCP2515. We also started exploring about the masking and filtering features of CAN Bus.

- **Accuracy of IMU (GY-511) was tested** before it can be implemented on the vehicle. Since our application calls for reliable data being extracted from the IMU, we make sure that it performs up to the mark.

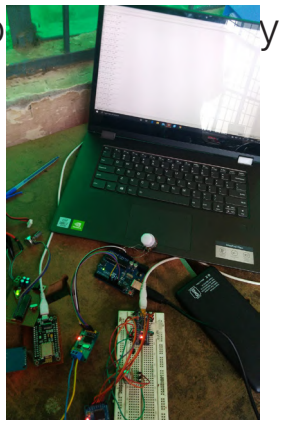
- A data sheet was made describing the Power Needs of all electrical Components in the car.

- A major problem on the hands of the department is with the fluctuating voltage of the electrical system; which is to be **rectified with use of Closed loop buck boost converter**. Hence, various research papers are b y

- The department practiced the display of the real time sensor data using dials on the telemetry web server. Studies about the Antenna selection and simulations are being undertaken.



Protoype sensor dashboard.



Chassis

With the majority of the chassis welding being completed, the team has finally managed to give a structure to its dream; the DR2019. Some major highlights of the department's endeavors include:

- An MDF rig was used to ensure correct position of the engine mount with respect to bulkhead. The team used **MDF replicas of engine mounts and bulk head** along with another MDF piece being used for **ensuring correct distance** between both engine mounting points.

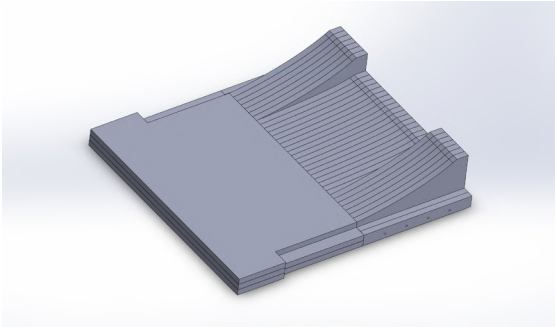
- **Final filling of the welding gaps**, welding of the Anti Intrusion Plate and Pedal box base tube was done.

- The department made preparations for the upcoming manufacturing of various chassis mounts; All DXFs of single shear and other components were cross checked and finalized. Inboard fittings were checked.

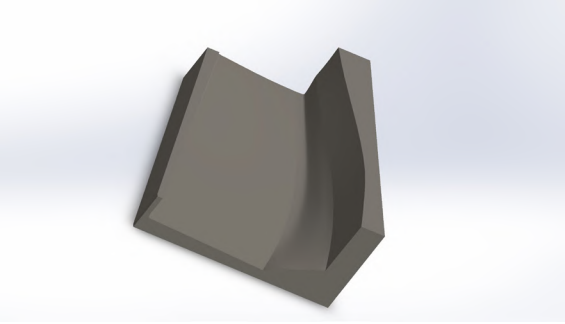
Jigs for welding engine mounts.

Chassis: post filling weld gaps

AERODYNAMICS



Diffuser mould



Nose mould

- The department had begun the manufacturing of the aerodynamics package which was being done hand in hand with procurement of the necessary materials which include epoxy resins, bagging equipment and Carbon Fibre. The current focus is on **manufacturing of the MDF moulds of the nose and diffuser** which would be utilized in the vacuum bagging process. A second set of wing moulds were tested for improving the manufacturing of the wings.

- **Ride height maps and steady-state cornering** simulations are being carried out to predict the actual performance of the components.

Meet your member

Aswin P. Nair
A.K.A Paneer
Automotive - 3rd yr.
Team Captain

I'd say I'm am a funny bloke but people prefer to call me an asshole.

I work in the **Vehicle Dynamics** department in the team and sucking out the brake fluid remains one of my noblest of achievements. I joined the team in my **second semester** as I wasted my first semester looking at old professors tummies. Team Defianz Racing has been **an eye opener** for me, allowing me to gauge my limits and sharpen my abilities.

Moreover the community of Formula Student has showed me the level of competition in the field of motor racing and the organisational skills involved.

Team Defianz Racing is a **second family to me** and it has been an honour to lead the team in the ongoing season.

My journey with the team has been something that I'll never forget and **a part of me will always stay with them.**

ROLLING BACK THE DAYS

Mohammad Saad
Batch of 2017

Pursuing **MBA** from **XLRI** (started in 2019)

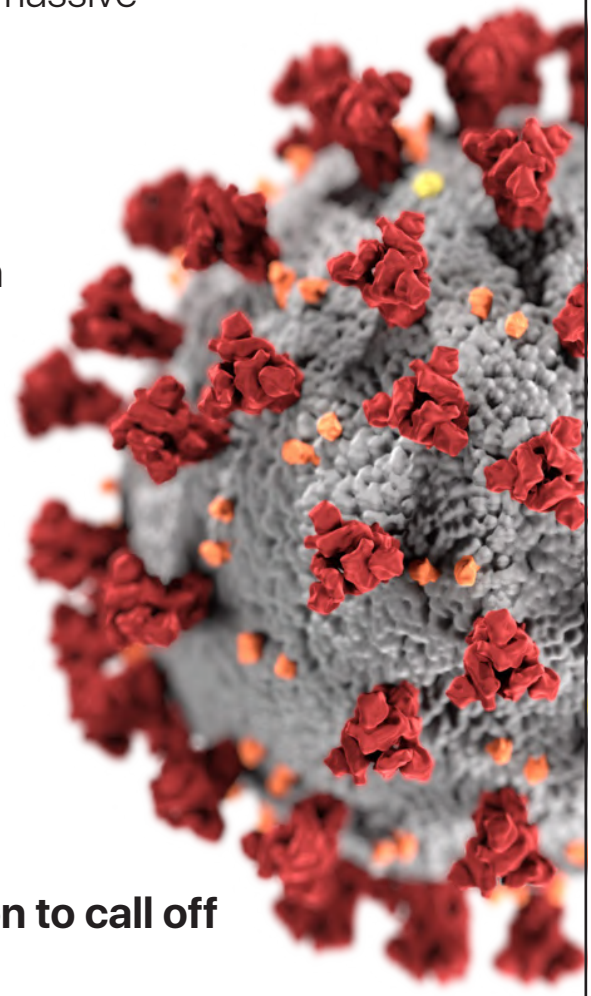
I joined TDR during my **4th semester** in the **VD department** around the time when the design phase was in full swing! Even **as a new recruit**, I had the opportunity to assist my seniors and colleagues, who were senior in experience, with various major designs, and was given complete responsibility of many smaller components. **Having the complete trust of everyone around meant a lot to me**, and I believe this is one of the aspects that makes TDR so special! Everyone in the team is capable, and is given ample opportunity to improve his existing capabilities and add new ones. **Keep challenging yourself to achieve more, it will benefit the team, and you more than anyone else!**

TDR provides you one of the best opportunities you can hope for in an undergraduate programme, make sure you make the best of it! Every instance in TDR has been equally important for me, be it as a **new recruit or the head of VD or as a team manager.**

It's not just a team that you're a part of, *it's a family*. You will have the most memorable moments during the course with the team. There will be many sleepless nights that you'll spend with the team, you will even disagree with each other when taking major decisions, but it will all be worth it when you see YOUR car run for the first time, and when you see it drive around the circuit during the competition. I still remember all the times that I drove DR16, and every instance was exhilarating! Enjoy yourselves, go on parties, **make sure you take as many treats from your seniors as possible**, make sure you have a good time!

COVID-19

The coronavirus, known as COVID-19, is wreaking havoc on global supply chains woefully unprepared for the massive scale of the emerging disruption.



Exacerbating the problem is that the spread of COVID-19 is a moving target. Although COVID-19 originated in China it is now spreading quickly across continents and is already in countries such as South Korea, Australia, Japan, Iran, and others. With China comprising 17% of the global economy the stoppage in production will have a cascading affect.

Our Stand.

This year the team was supposed to take part in FS East in Hungary. With the whole world now facing an unprecedented and unfortunate situation and with the announcements this weekend from many European competitions, we feel it is important to **stand strong with FS East organisers' decision to call off the 2020 event.**

Steps taken by us.

- We strongly support the practice of **social distancing** and hence our workshop has been closed.
- The team has encouraged **work from home** and for that we have already established a remote work option through Slack.
- The team leaders have guided the team to utilise this time to its best by exploring newer ideas and venturing into areas which go beyond the project at hand.
- The team would be participating in **Formula Bharat** and a clear road map has been established pertaining to what all is to be achieved till the competition next year.
- Though the cancellation is saddening yet necessary, we are taking this in a positive stride as now we have the time to relentlessly innovate and brainstorm.

Formula Student events

The event organisers have made it abundantly clear that all students involved in Formula Student world-wide should adhere to restrictions and regulations by their respective governments and the World Health Organisation in relation to COVID-19.
The FS organisers are currently planning a number of ways to honour the efforts and ensure the core purpose of Formula Student, education and real-world experience, is still possible whilst ensuring that any preparatory work required to complete the events can be done remotely but collaboratively.
These include:

- Virtual FS-AI competition.
- Virtual Business Presentation, Engineering Design and Cost & Manufacturing presentations.
- Scrutineering documents feedback.
- Virtual racing competition.

Shown here are the FS competitions which stand cancelled as of now.

Respect the virus.

Yes, you got it right. As easy as it might be for the majority of us, this pandemic situation is no less than a world at war. We all need to come together by staying apart and conquer the coronavirus.
Stepping out of our homes means we're entering the warzone.
DO NOT enter the warzone. If you must, make sure you're in your battlesuit - wearing a mask, carrying a strong sanitizer and some presence of mind.
We must respect the situation, respect the virus and act wise.
Peace.

Motorsport Buzz

Our little effort into bringing you the highlights from the world of motorsports.

Formula 1 : Updates

The Formula One season is **on hold sine die** due to the coronavirus pandemic.
This year was supposed to feature a record-breaking 22 races, but as it stands **the first eight will not go ahead as scheduled.**
After several announcements on Thursday about race postponements and the effect of the coronavirus outbreak on the 2020 and 2021 seasons, Formula 1 CEO Chase Carey has provided an update on the current situation.
Formula 1 and the FIA will now work to finalise a revised 2020 calendar once the situation improves. In addition, as announced by the FIA, it has been agreed unanimously that the **implementation of the Technical Regulations due to take effect from the 2021 season will be postponed until 2022.**
Due to the currently volatile financial situation this has created, it has been agreed that **teams will use their 2020 chassis for 2021**, with the potential freezing of further components to be discussed in due course. **The introduction and implementation of the Financial Regulations will go ahead as planned in 2021.**

A team of teams in action

Formula One teams are exploring ways to aid government and health authorities in the fight against the coronavirus by supplying ventilators.
The coronavirus pandemic has stretched healthcare systems across the world to a breaking point.
A collective of **seven UK-based Formula 1 teams** - *Aston Martin Red Bull Racing*, *BWT Racing Point F1 Team*, *Haas F1 Team*, *McLaren F1 Team*, *Mercedes-AMG Petronas F1 Team*, *Renault DP World F1 Team* and *ROKiT Williams Racing* - **have come together to manufacture medical devices** to help aid in the treatment of patients who have contracted coronavirus, the UK Government confirmed on Friday.
Christened **'Project Pitlane'**, this partnership is part of a UK industry-wide effort to help the National Health Service (NHS) deal with the outbreak of COVID-19 in the island nation.
All the teams have expert design, technology and production capabilities, **and specialise in rapid prototyping and high value manufacturing**, which is hoped can be applied to the critical needs set out by UK Government.

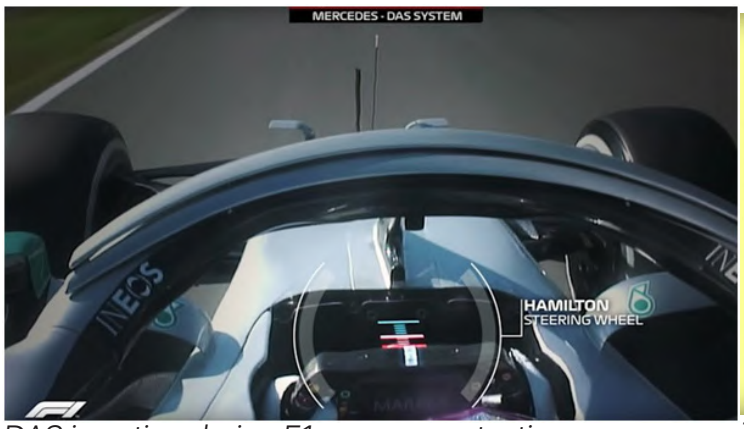
Other Major Events impacted

- **FIA Formula-E :** Season suspended, Speculated return in **May**
- **NASCAR:** Season suspended till **3rd of May**, at least.
- **24 Hours of Le-Mans:** Postponed to tentative dates **Sept. 18-19**
- **Mille Miglia:** Postponed to expected dates from **Oct. 22-25**
- **Indy 500:** Postponed to **Aug. 23**

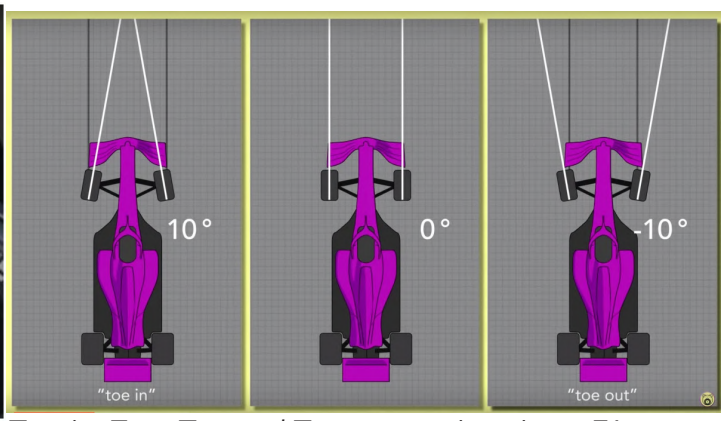
Latest Innovations

Dual Axis Steering (DAS)

Mercedes surprised no one by regularly topping the timing screens in F1 testing, but they did manage to spring a surprise with their steering wheel innovation: DAS or, to give it its full name, dual-axis steering.
To put it simply, this system can change the steering angle for the wheels and also the toe angle between the wheels.



DAS in action during F1 pre season testing.



Toe-in, Zero Toe and Toe-out settings in an F1 car.

Toe

To know what the DAS system does we first need to know what we mean with the toe.
Toe is a part of the suspension setup that the team adjusts for every race. Toe describes the angle of the wheels relative to the straight line on the track. So when a car drives with 0 degrees toe the wheels will be straight with the head of the car. When we have a car with a positive toe the wheels will point inwards and with a negative toe, the wheels will point outwards.
In a race situation, the teams could use a system with a negative toe, or a positive toe.

Effects

But what are the effects that make toe so important? When you have 0° toe you will minimize tire wear on the straights, but most of the tracks have corners also (Unless you are doing a drag race). Hence, **0° toe while give you the best straight-line speed.**

But when you go in a corner you will notice that the inside tire doesn't need as much track as the outside tire. So if you change your front wheel toe in a negative degree both your wheels will point outwards. This is ideal for taking lots of corners, but you will lose speed on the straight. **This would mean that a negative toe would be ideal in a circuit with many corners**

Using a positive toe with the wheels pointing inwards you will have a much more stable car on the straights, and it would be much harder to control the cars into the corners. **A positive toe would mean the car gets much more easy to handle on the straight.**

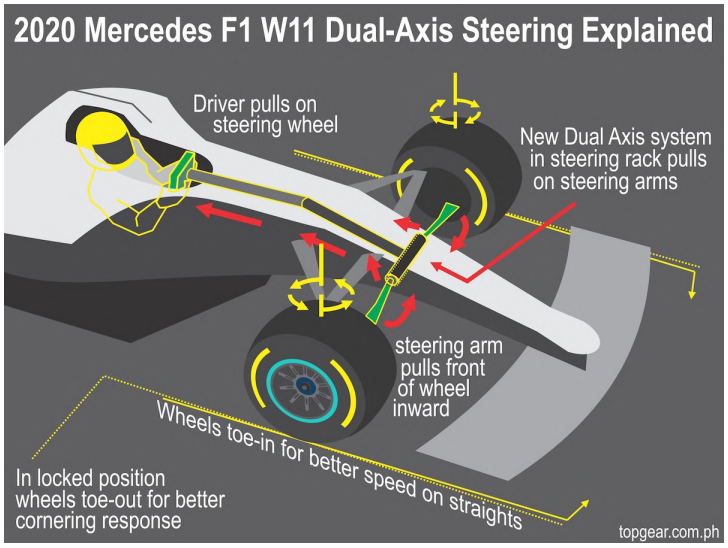


Image courtesy: TopGear.com

Mercedes DAS system

Mercedes is now able to use the Dual Axis Steering to change the toe angle while driving. **The Mercedes drivers can pull or push the steering wheel** to create a negative or positive toe setting. This will help the team greatly with reducing the tire wear, increasing the straight-line speed and increasing the cornering speed. Secondly, the Mercedes team could use the system to **balance the temperature in the tires.** They could use the DAS system to pull the tires outwards while driving behind a safety car or during an out-lap to create more drag on the tires and thus getting more temperature in them. Something both Mercedes drivers complained about a lot.

Temporary System

The Dual-Axis Steering will be a temporary system for Mercedes. The current regulations would say is it's legal to use it. While there is currently some discussion that it could break the Parc-Ferme rules, the system is currently legal. **But in the 2021 rules, this system has been banned** as the steering wheel can only be moved to left or right.

Deep Dive - Differentials

What happens when any vehicle has to traverse a corner or make a turn? What is the internal mechanism involved when it comes to cornering?

If you look carefully into this picture of the Mercedes AMG F1 trying to cut a corner, you will also notice that the car seems to have 'rolled' – A very interesting phenomenon in itself.

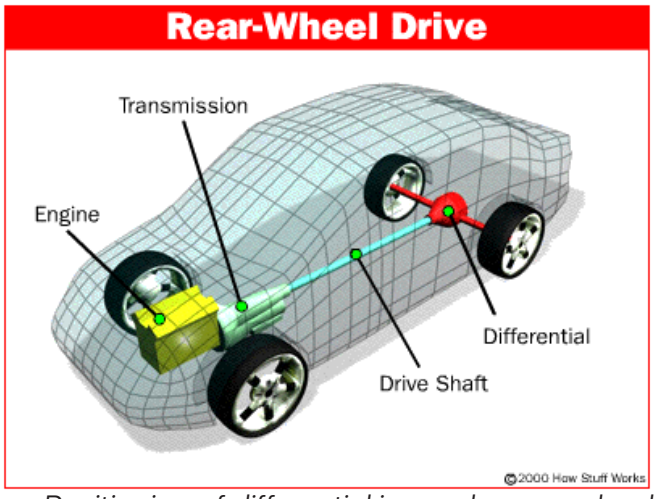
Chances are that most of the people without any exposure to the field of automotive engineering give the reply of the above question in terms of the steering system. However, there is one very important component at work here which often tends to be neglected by most everyday drivers; that component is the **Differential**. Differentials is that component where the power, in most cars, makes its last stop before spinning the wheels.

The differential has three jobs:

- To aim the engine power at the wheels
- To act as the final gear reduction in the vehicle, slowing the rotational speed of the transmission one final time before it hits the wheels
- To transmit the power to the wheels while allowing them to rotate at different speeds (This is the one that earned the differential its name.)

Need for a differential

If you've watched any sort of race on an oval track, you may have noticed a certain strategy. Whether they're Olympic runners, NASCAR drivers or jockeys, the competitors usually fight for the inside lane. This is because if you're in an outside lane, you're essentially running around a bigger, longer track. It's the same with the path your car's tires take when you're turning. The outside wheel has to travel farther than the inside wheel. So, for proper handling, it also has to move faster than the inner wheel to cover a longer distance in the same amount of time.



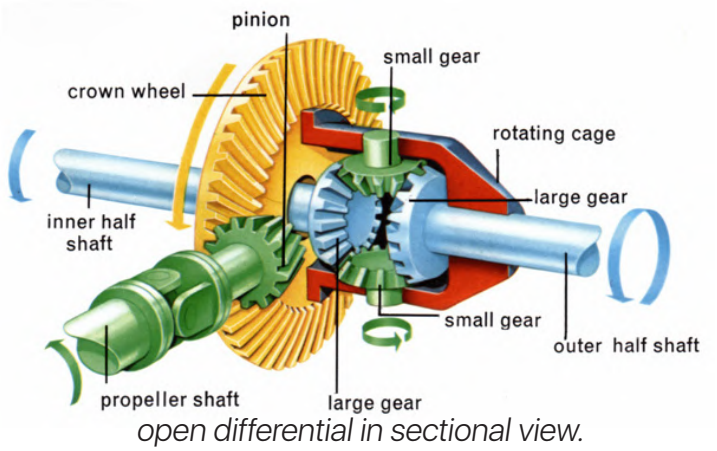
Positioning of differential in regular rear-wheel drive cars.

For the non-driven wheels on your car this is not an issue. There is no connection between them, so they spin independently. But the driven wheels are linked together so that a single engine and transmission can turn both wheels. If your car did not have a differential, the wheels would have to be locked together, forced to spin at the same speed. This would make turning difficult and hard on your car: For the car to be able to turn, one tire would have to slip.

In a car, it is the differential which adjusts the speed of the driven wheels to make sure that happens.

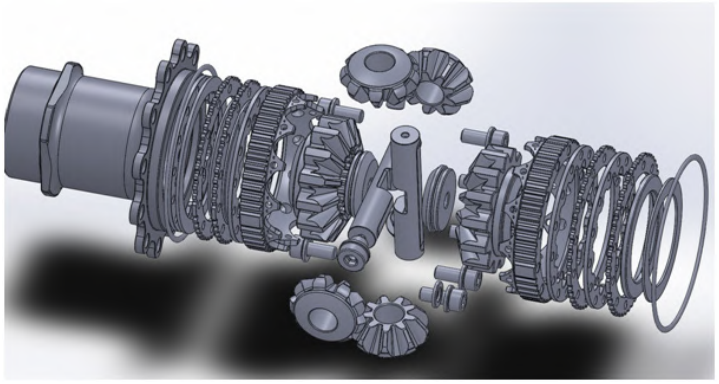
Common Types of Differentials

1.Open Differential:



open differential in sectional view.

An "open differential" is typical for most cars. It's the least expensive and least complicated type of differential, and it lets the wheels rotate pretty much independently of each other.
The problem with open differentials is that they get this done by sending more power to the wheel that's easiest to rotate. That's fine when you're turning on a smooth, dry road, but it can create problems on slippery roadways. If one wheel hits a puddle or patch of ice and starts to lose grip, the open differential sends the power in that direction, because that wheel is already spinning so easily. Needless to say, this won't necessarily help with traction. The wheel may just spin faster since it can't get a grip on the road. In these situations, you'd rather have a differential that sends more power to the wheel that already has traction.
The solution to these problems is the limited slip differential (LSD), sometimes called positraction.


Exploded view of the Drexler FSAE LSD that is utilized by Team Defianz Racing on its RWD Racecar.

2.Limited Slip Differential:

A limited-slip differential minimizes the difference in speed between the driving wheels. If one tire loses grip and begins spinning more quickly than the other, the differential locks the two axle shafts so they spin together. The effect is to send more torque to the wheel with the most traction.
With this in mind, a limited-slip differential also is a great choice for performance vehicles.
At the dragstrip, a locking differential helps the driving wheels spin in concert for both controlled, powerful acceleration and smoky two-wheel burnouts. It also leaves room for some differences in wheel speed. That gives it the flexibility to boost performance in the turns as well.

So the next time while you're negotiating a corner on your vehicle during your everyday commute, do remember that one component at wok there which is allowing the process to be done effortlessly.

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Featured Sponsor

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Holding us together

We welcome **Xtra Precision Screws** on board as our FASTENER SUPPLIERS for the season!

Holding us together- quite literally, we thank XPS for their generous support to the team.

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