

vehicle system 2

by Subith Joseph

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BSc/HND Automotive and Motorsport Engineering

Vehicle System

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Introduction

Aim:

The Aim of the report,  to compare and contrast vehicle chassis and suspension design features which achieve specific vehicle behavioural characteristics. This report will be split up into three sections; Research, Excel Graphs and spreadsheet, Analysis.

Research

For this section you are to research what effects the handling and comfort of a vehicle and discuss the set-up choices that can influence these. Consider how the handling and comfort balance of a race vehicle, supercar and road vehicle may differ and why this would be acceptable in each case?

Chassis

Chassis are the main component of a vehicle. Each chassis design has different purposes for example for a utility vehicle a ladder chassis would be the most appropriate due to its stiffness, durability and that is it cost affective and convenient to repair if damaged.

Ladder Frame chassis



<https://images.cdn.circlesix.co/image/1/700/0/uploads/posts/2018/11/85ofc56d2ob55c9e041ab3af5c94583c.jpg>  4

Ladder frame chassis are common on vehicle which are designed to carrying heavy load and even off-road capable vehicle. Due to its material choice mainly steel they are heavy but also having this the vehicle will be very strong and durable. For comfort the ladder chassis is not the most comfortable, due to its stiffness all forces and vibration are transferred across the whole vehicle. For handling the Ladder chassis is great when it comes to off road or when used for utility purposes for example heavy goods. Ladder Chassis are commonly used in various vehicle for an example Range rover line ups, this is due to its simplicity and also its structure rigidity and also the cost 

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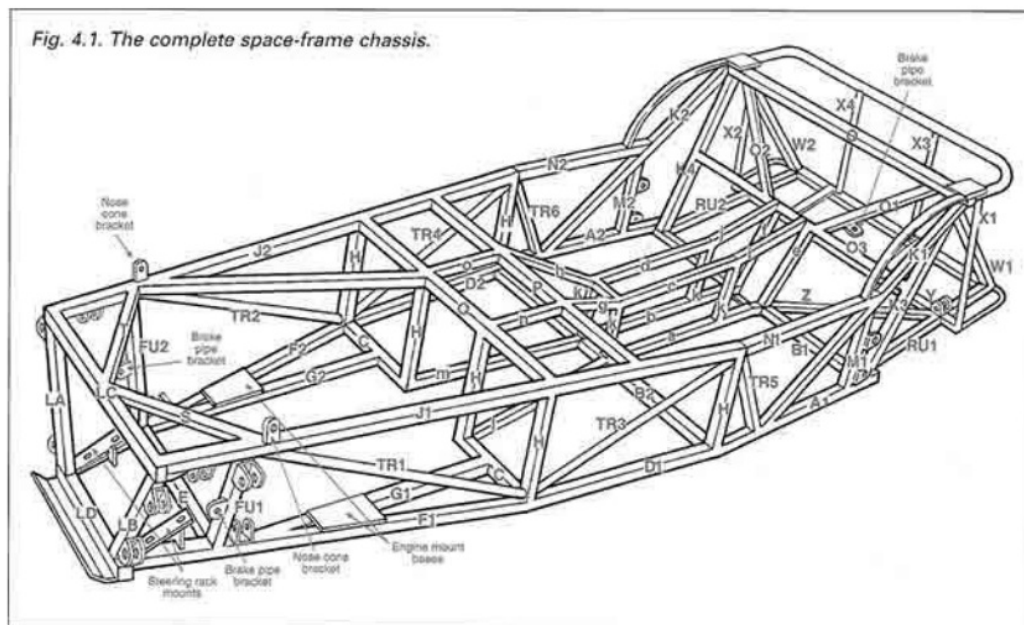
Monocoque Chassis



<https://3.bp.blogspot.com/-xQLNBjihDlG/UafFXGvHfXI/AAAAAAAAIvA/swBEPvSfR9c/s1600/Monocoque-Chassis.jpg>

Monocoque Chassis is the most commonly used chassis design on a modern vehicle, this is due to its fast manufacturing process as almost everything is done by robots. Monocoque chassis are the standard when it comes to modern vehicle, this is due to its excellent crash rating. when developing an monocoque chassis it can be expensive due to everything being developed in CAD (computer Aided Design). The handling characteristic on a monocoque chassis are very impressive as the chassis are designed to meet regulations which needs to meet up to certain standard. the problems with this the monocoque design are that it is not suitable for small batch production since the development cost are high and also setting up the infostructure can be very expensive.

Carbon fibre monocoque design is widely used in super/ exotic vehicles, they are extremely rigid and also strong, they are widely used for vehicle used for motorsports applications due to the lightweights. Examples of vehicles that use carbon fibre monocoque are various modern Lamborghini.



(n/a, 2020)

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integrity. The Advantage of a tubular chassis are they can be very lightweight but also extremely strong.



Suspension

The suspension is in charge of hold the sprung mass (mass which is held by the shock absorbers), dealing with bumps on the road and the weight transfer of the vehicle and also in charge of how the wheel reacts to bumps and control the tyre contact patch.



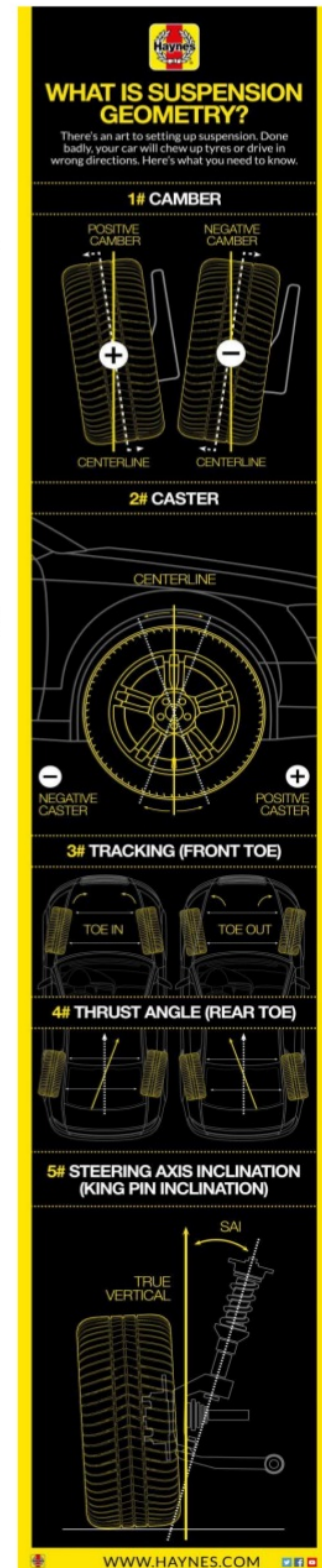
Camber

‘Camber is the inclination of the wheel on the vertical in relation to the ground. It can be measured as positive or negative. In the case of positive camber, the top of the wheel would tuck into the car. In the case of negative camber, the top would pull out from the top of the car.

The amount of camber can drastically change the way a car drives. If you have a lot of positive camber, the car would be more stable in a straight line, but awful in the corners, as the force of cornering would push more weight over the wheel, which would already be at an adverse angle to the road.

If you have negative camber, you get the opposite result. When cornering, the wheel is pushed straight in relation to the vertical, and as more load is put on it, more of the tyre can touch the road, so more grip.

As such, a nettle bit of negative camber is never a bad thing. But even so, setting it up is something best left to the professionals.’



(Understanding your car's suspension geometry, 2020) https://d32ptomnhieuv.cloudfront.net/en-gb/sites/default/files/styles/haynes_medium/public/info_Suspension%20geometry.jpg?itok=GH_yGQbF×tamp=1528194258

Caster

'This is the backward or forward inclination of the suspension. Positive caster would be to swing the suspension forward, while negative would be to pull it back into the car.

Positive caster is the way to go, as you'll get greater steering feel, improved turn-in response and greater stability when at speed.

By having too much negative caster, you're already pulling the suspension back into the car, so when the car is moving, the forces are amplified, and the suspension/tyres are put under much more strain.

You'll also lose a lot of the car's handling ability as the wheels will in effect tilting into the ground when you steer.' (Understanding your car's suspension geometry, 2020)

King Pin Inclination



'King pin inclination, or KPI, is the angle determined by looking at the angle of the steering axis perpendicular to the ground, or in the case of a car, the contact patch of the tyre.

The more positive the KIP, the further into the car the uppermost point of the steering axis/steering arm is, the more negative the KPI, the further out the steering axis is pushed.

The benefit in having a greater positive KPI is the you're get more steering feel and feedback, and provided you don't go mad, you'll get better stability, too.

But you have to be careful, as the KPI can alter the camber and caster, throwing out any good their respective setting may have offered.'

Tracking (front toe)

‘This is the most common suspension term, and it’s probably something you have had altered on your own car at some point. It’s measured by toe-in and toe-out. And the best way to think if it is to indeed use your toes.

Imagine your feet are your front wheels. Now keep your heels together and twist your toes away from each other. That’s toe-in. Needless to say, the opposite, with your toes touching and your heels apart, is toe out.

This is something that can need altering after you clip a curb or hit a particularly unforgiving pothole.

Thankfully, unlike Caster and Camber, you adjust the tracking on even the most basic of cars by winding the track rod ends in or out. ‘ (Understanding your car’s suspension geometry, 2020)

Thrust angle (rear toe)

‘This is like tracking, but for the back wheels. The trust angle is determined by the toe-in and toe-out of the rear wheels. However, unlike the front wheels, which you can steer, the rear wheels are fixes, so if the suspension adjustment is out, you can be thrust in the wrong direction. Hence the name.’ (Understanding your car’s suspension geometry, 2020)

Results

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Table 1 Vehicle information

Mass	628	kg			
Wheelbase	2.8	m			
Centre of Gravity Height	0.36	m			
Static Weight Distribution (Front)	0.47	% Front		0.53	% Rear
Static Weight Distribution (Left)	0.51	% Left		0.49	% Right
CI	0.62				
A	1.2	m ²			
Air Density	1.22	kg/m ³			
Centre of Pressure	0.42	% Front			
Average Track	1.62	m			
Maximum G	1.5	G			

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Front Static loads	VALUE	UNIT
Front Left	1476.714996	N
Front Right	1418.804604	N

Rear Static loads	Value	Unit
Rear Left	1665.231804	N
Rear Right	1599.928596	N

Longitudinal G-Force									
Front Left	Long G-Force	Lat G-Force	Velocity m/s ²	Weight	Front Right	Long G-Force	Lat G-Force	Velocity m/s ²	Weight Transfer
0.1	0	30	150.148141	0	0.1	0	30	148.818641	64.4095311
0.2	0	30	151.731289	0	0.2	0	30	148.268407	71.0286142
0.3	0	30	151.709446	0	0.3	0	30	147.947071	77.5877131
0.4	0	30	150.402181	0	0.4	0	30	147.623276	84.1468164
0.5	0	30	150.178729	0	0.5	0	30	147.104278	90.7094756
0.6	0	30	150.09818	0	0.6	0	30	146.828817	97.2650587
0.7	0	30	150.438023	0	0.7	0	30	146.614813	103.824108
0.8	0	30	150.778109	0	0.8	0	30	146.400889	110.3831829
0.9	0	30	150.712633	0	0.9	0	30	146.018604	116.942392
1	0	30	150.474463	0	1	0	30	145.97296	123.501503
1.1	0	30	150.888959	0	1.1	0	30	145.178895	130.0606142
1.2	0	30	150.168756	0	1.2	0	30	145.614031	136.619723
1.3	0	30	150.058903	0	1.3	0	30	144.713106	143.1788364
1.4	0	30	150.1835048	0	1.4	0	30	144.411782	149.7379476
1.5	0	30	150.7205196	0	1.5	0	30	144.6908137	156.297059
Rear Left	Long G-Force	Lat G-Force	Velocity m/s ²	Weight	Rear Right	Long G-Force	Lat G-Force	Velocity m/s ²	Weight Transfer
0.1	0	30	179.111991	0	0.1	0	30	166.612138	72.8995144
0.2	0	30	174.088177	0	0.2	0	30	162.8888	80.0902989
0.3	0	30	174.932519	0	0.3	0	30	161.918131	87.4024131
0.4	0	30	175.028551	0	0.4	0	30	161.573955	94.88898178
0.5	0	30	175.400737	0	0.5	0	30	161.211507	102.2854302
0.6	0	30	175.812738	0	0.6	0	30	160.8491089	109.6818747
0.7	0	30	176.146111	0	0.7	0	30	160.486792	117.0781212
0.8	0	30	176.572729	0	0.8	0	30	161.242534	124.4747616
0.9	0	30	176.948484	0	0.9	0	30	161.768876	131.871208
1	0	30	177.126571	0	1	0	30	161.9394018	139.267524
1.1	0	30	177.038871	0	1.1	0	30	161.8	146.6640969
1.2	0	30	176.806044	0	1.2	0	30	162.674503	154.0007413
1.3	0	30	178.457821	0	1.3	0	30	162.112145	161.4369886
1.4	0	30	178.132417	0	1.4	0	30	161.8490987	168.8314302
1.5	0	30	178.123068	0	1.5	0	30	161.872723	176.248879
Lateral G-Force									
Front Left	Long G-Force	Lat G-Force	Velocity m/s ²	Weight	Front Right	Long G-Force	Lat G-Force	Velocity m/s ²	Weight Transfer
0	0.1	30	154.938402	0	0	0.1	30	148.7131036	61.7035629
0.2	0	30	150.888959	0	0.2	0	30	148.139188	68.3002105
0.3	0	30	151.282925	0	0.3	0	30	148.153408	75.9151486
0.4	0	30	150.478662	0	0.4	0	30	148.1625372	83.5300891
0.5	0	30	150.178729	0	0.5	0	30	147.855584	91.1450343
0.6	0	30	150.638434	0	0.6	0	30	147.105565	98.7599772
0.7	0	30	150.57084	0	0.7	0	30	147.096048	106.37492
0.8	0	30	150.558246	0	0.8	0	30	147.242654	113.990029
0.9	0	30	150.444463	0	0.9	0	30	147.271031	121.6051057
1	0	30	150.677099	0	1	0	30	147.015754	129.220186
1.1	0	30	150.812485	0	1.1	0	30	146.858016	136.835267
1.2	0	30	150.247871	0	1.2	0	30	146.789508	144.450343
1.3	0	30	152.181278	0	1.3	0	30	146.8	152.061272
1.4	0	30	152.118884	0	1.4	0	30	146.107982	159.676392
1.5	0	30	151.05409	0	1.5	0	30	146.119984	167.291063
Rear Left	Long G-Force	Lat G-Force	Velocity m/s ²	Weight	Rear Right	Long G-Force	Lat G-Force	Velocity m/s ²	Weight Transfer
0	0.1	30	171.221281	0	0	0.1	30	166.113204	69.3825791
0.2	0	30	171.908763	0	0.2	0	30	166.042812	76.9975086
0.3	0	30	172.087242	0	0.3	0	30	166.94392	84.6122229
0.4	0	30	174.287722	0	0.4	0	30	166.188928	92.229372
0.5	0	30	174.452205	0	0.5	0	30	165.752136	99.846524
0.6	0	30	174.636581	0	0.6	0	30	165.755244	107.461627
0.7	0	30	176.8178	0	0.7	0	30	165.55832	115.076808
0.8	0	30	175.298889	0	0.8	0	30	163.46146	122.691791
0.9	0	30	175.181119	0	0.9	0	30	163.136648	130.306929
1	0	30	175.364598	0	1	0	30	164.267676	137.922121
1.1	0	30	175.547038	0	1.1	0	30	164.7120784	145.537292
1.2	0	30	176.129519	0	1.2	0	30	164.071889	153.152465
1.3	0	30	176.112017	0	1.3	0	30	164.97	160.765366
1.4	0	30	176.094516	0	1.4	0	30	164.880308	168.380408
1.5	0	30	176.276995	0	1.5	0	30	163.783216	175.991794
Velocity									
Front Left	Long G-Force	Lat G-Force	Velocity m/s ²	Weight	Front Right	Long G-Force	Lat G-Force	Velocity m/s ²	Weight Transfer
0	0	1	147.02836	0	0	0	1	141.852424	58.380392
0	0	2	147.267136	0	0	0	2	141.888784	58.380392
0	0	3	147.657776	0	0	0	3	141.277384	58.380392
0	0	4	147.820436	0	0	0	4	141.824224	58.380392
0	0	5	147.907696	0	0	0	5	142.0527304	58.380392
0	0	6	147.975705	0	0	0	6	142.138624	58.380392
0	0	7	148.128136	0	0	0	7	142.140284	58.380392
0	0	8	148.1954136	0	0	0	8	142.1571984	58.380392
0	0	9	148.128248	0	0	0	9	142.4502024	58.380392
0	0	10	148.278596	0	0	0	10	142.138354	58.380392
0	0	11	148.407228	0	0	0	11	142.0582424	58.380392
0	0	12	148.228936	0	0	0	12	142.823184	58.380392
0	0	13	148.136936	0	0	0	13	143.1736384	58.380392
0	0	14	148.218272	0	0	0	14	143.188624	58.380392
0	0	15	148.151646	0	0	0	15	143.151824	58.380392
0	0	16	148.951436	0	0	0	16	143.8573024	58.380392
0	0	17	148.538136	0	0	0	17	144.1150984	58.380392
0	0	18	150.248576	0	0	0	18	144.188584	58.380392
0	0	19	150.138608	0	0	0	19	144.6775624	58.380392
0	0	20	150.820296	0	0	0	20	144.822304	58.380392
0	0	21	151.140568	0	0	0	21	145.102524	58.380392
0	0	22	151.474776	0	0	0	22	145.184384	58.380392
0	0	23	151.828136	0	0	0	23	145.899784	58.380392
0	0	24	152.191836	0	0	0	24	146.3571424	58.380392
0	0	25	152.577968	0	0	0	25	146.739304	58.380392
0	0	26	152.76818	0	0	0	26	147.1181424	58.380392
0	0	27	153.1908136	0	0	0	27	147.5523784	58.380392
0	0	28	153.820776	0	0	0	28	147.820384	58.380392
0	0	29	154.653636	0	0	0	29	148.4713224	58.380392
0	0	30	154.735096	0	0	0	30	148.8582304	58.380392
Velocity									
Rear Left	Long G-Force	Lat G-Force	Velocity m/s ²	Weight	Rear Right	Long G-Force	Lat G-Force	Velocity m/s ²	Weight Transfer
0	0	1	160.580224	0	0	0	1	159.747016	61.831208
0	0	2	160.5824584	0	0	0	2	159.981376	61.831208
0	0	3	160.6205184	0	0	0	3	160.031976	61.831208
0	0	4	160.6752024	0	0	0	4	160.098816	61.831208
0	0	5	160.7435104	0	0	0	5	160.1621896	61.831208
0	0	6	160.8114424	0	0	0	6	160.2482116	61.831208
0	0	7	160.129984	0	0	0	7	160.1496776	61.831208
0	0	8	160.505784	0	0	0	8	160.468576	61.831208
0	0	9	160.182924	0	0	0	9	160.596616	61.831208
0	0	10	160.131104	0	0	0	10	160.748896	61.831208
0	0	11	160.4956384	0	0	0	11	160.9125416	61.831208
0	0	12	160.791384	0	0	0	12	161.0938776	61.831208
0	0	13	160.7208384	0	0	0	13	161.2871276	61.831208
0	0	14	160.810624	0	0	0	14	161.490416	61.831208
0	0	15	160.1075104	0	0	0	15	161.7245896	61.831208
0	0	16	160.550824	0	0	0	16	161.9667616	61.831208
0	0	17	160.807884	0	0	0	17	162.2245576	61.831208
0	0	18	160.810596	0	0	0	18	162.497776	61.831208
0	0	19	160.1708424	0	0	0	19	162.7870216	61.831208
0	0	20	160.6792104	0	0	0	20	163.0936896	61.831208
0	0	21	160.9595024	0	0	0	21	163.4119816	61.831208
0	0	22	170.1121384	0	0	0	22	163.7489716	61.831208
0	0	23	170.827584	0	0	0	23	164.0994776	61.831208
0	0	24	171.0499224	0	0	0	24	164.466016	61.831208
0	0	25	171.4327104	0	0	0	25	164.8491896	61.831208
0	0	26	171.1121224	0	0	0	26	165.2478016	61.831208
0	0	27	172.451584	0	0	0	27	165.6618776	61.831208
0	0								

Analysis

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- What do the initial graphs show about how load transfers around a vehicle undergoing acceleration?

The graph shows the higher longitudinal (acceleration forces) the higher the weight transfer. This shows that under acceleration the vehicle weight shifts to the rear, this can be seen by looking at the weight of the vehicle comparing from front to back as the rear become heavier while the front becomes lighter

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- What type of effect is the aerodynamic load having on the vehicle?

As the vehicle speeds up the aerodynamic forces that are acting on the vehicle is much greater, this is due to the flow of air flow increased speed also varying the air density

- Explain why 1.5G can't be achieved in both the longitudinal and lateral directions at the same time?

The vehicle cannot achieve 1.5G in both longitudinal and lateral due to the tyres having a limit to its frictional coefficient.

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- How do chassis and suspension changes affect vehicle characteristics?

From different suspension designs, you can change how progressive the wheel is when reacting to bumps, while the vehicle changes its height, the wheel geometry changes. The chassis can dramatically change the vehicle characteristic as some chassis can flex and also be heavy when other can be rigid and lightweight.

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Longitudinal G-Force									
Front Left	Long G-Force	Lat G-Force	Velocity m/s ²	Weight	Front Right	Long G-Force	Lat G-Force	Velocity m/s ²	Weight
0.1	0	0	30	1590.84843	0.1	0	0	30	1483.88864
0.2	0	0	30	1553.713289	0.2	0	0	30	1482.684676
0.3	0	0	30	1557.058436	0.3	0	0	30	1479.40711
0.4	0	0	30	1540.401783	0.4	0	0	30	1476.267746
0.5	0	0	30	1540.748729	0.5	0	0	30	1473.047292
0.6	0	0	30	1547.098676	0.6	0	0	30	1469.828817
0.7	0	0	30	1530.439023	0.7	0	0	30	1466.614853
0.8	0	0	30	1573.784565	0.8	0	0	30	1463.400888
0.9	0	0	30	1577.128165	0.9	0	0	30	1460.265924
1	0	0	30	1580.474463	1	0	0	30	1456.972796
1.1	0	0	30	1583.819609	1.1	0	0	30	1453.789796
1.2	0	0	30	1587.164756	1.2	0	0	30	1450.545031
1.3	0	0	30	1590.509903	1.3	0	0	30	1447.311086
1.4	0	0	30	1593.855049	1.4	0	0	30	1444.127102
1.5	0	0	30	1597.200196	1.5	0	0	30	1440.903137
Rear Left	Long G-Force	Lat G-Force	Velocity m/s ²	Weight	Rear Right	Long G-Force	Lat G-Force	Velocity m/s ²	Weight
0.1	0	0	30	1785.113991	0.1	0	0	30	1666.612188
0.2	0	0	30	1743.084177	0.2	0	0	30	1652.18889
0.3	0	0	30	1746.856364	0.3	0	0	30	1659.363823
0.4	0	0	30	1730.628551	0.4	0	0	30	1655.795565
0.5	0	0	30	1754.403717	0.5	0	0	30	1652.115307
0.6	0	0	30	1758.172624	0.6	0	0	30	1648.810048
0.7	0	0	30	1762.945111	0.7	0	0	30	1644.866790
0.8	0	0	30	1766.712977	0.8	0	0	30	1641.242534
0.9	0	0	30	1769.489484	0.9	0	0	30	1637.638276
1	0	0	30	1773.262772	1	0	0	30	1633.964038
1.1	0	0	30	1777.03857	1.1	0	0	30	1630.36976
1.2	0	0	30	1780.806044	1.2	0	0	30	1626.745503
1.3	0	0	30	1784.578311	1.3	0	0	30	1623.121246
1.4	0	0	30	1788.350417	1.4	0	0	30	1619.496987
1.5	0	0	30	1792.124604	1.5	0	0	30	1615.872729
Lateral G-Force									
Front Left	Long G-Force	Lat G-Force	Velocity m/s ²	Weight	Front Right	Long G-Force	Lat G-Force	Velocity m/s ²	Weight
0	0.1	0	30	1548.958602	0	0.1	0	30	1487.533096
0	0.2	0	30	1550.893809	0	0.2	0	30	1485.30358
0	0.3	0	30	1552.829215	0	0.3	0	30	1483.53408
0	0.4	0	30	1554.764621	0	0.4	0	30	1481.674572
0	0.5	0	30	1556.700027	0	0.5	0	30	1479.815064
0	0.6	0	30	1558.635434	0	0.6	0	30	1477.955556
0	0.7	0	30	1560.57084	0	0.7	0	30	1476.096048
0	0.8	0	30	1562.506246	0	0.8	0	30	1474.23654
0	0.9	0	30	1564.441653	0	0.9	0	30	1472.377032
0	1	0	30	1566.377055	0	1	0	30	1470.517524
0	1.1	0	30	1568.312465	0	1.1	0	30	1468.660036
0	1.2	0	30	1570.247871	0	1.2	0	30	1466.798508
0	1.3	0	30	1572.183278	0	1.3	0	30	1464.939
0	1.4	0	30	1574.118684	0	1.4	0	30	1463.079492
0	1.5	0	30	1576.05409	0	1.5	0	30	1461.219984
Rear Left	Long G-Force	Lat G-Force	Velocity m/s ²	Weight	Rear Right	Long G-Force	Lat G-Force	Velocity m/s ²	Weight
0	0.1	0	30	1737.722283	0	0.1	0	30	1668.189704
0	0.2	0	30	1739.904763	0	0.2	0	30	1666.042812
0	0.3	0	30	1742.087242	0	0.3	0	30	1663.94509
0	0.4	0	30	1744.269722	0	0.4	0	30	1661.849026
0	0.5	0	30	1746.452202	0	0.5	0	30	1659.752136
0	0.6	0	30	1748.634681	0	0.6	0	30	1657.655244
0	0.7	0	30	1750.81716	0	0.7	0	30	1655.558152
0	0.8	0	30	1752.999639	0	0.8	0	30	1653.461148
0	0.9	0	30	1755.182119	0	0.9	0	30	1651.364568
0	1	0	30	1757.364598	0	1	0	30	1649.267676
0	1.1	0	30	1759.547078	0	1.1	0	30	1647.170784
0	1.2	0	30	1761.729557	0	1.2	0	30	1645.073892
0	1.3	0	30	1763.912037	0	1.3	0	30	1642.977
0	1.4	0	30	1766.094516	0	1.4	0	30	1640.880108
0	1.5	0	30	1768.276995	0	1.5	0	30	1638.783236
Velocity									
Front Left	Long G-Force	Lat G-Force	Velocity m/s ²	Weight	Front Right	Long G-Force	Lat G-Force	Velocity m/s ²	Weight
0	0	0	1	1477.032816	0	0	0	1	1418.652424
0	0	0	2	1477.267176	0	0	0	2	1418.866784
0	0	0	3	1477.501775	0	0	0	3	1419.077384
0	0	0	4	1478.046166	0	0	0	4	1419.284724
0	0	0	5	1478.907696	0	0	0	5	1420.527104
0	0	0	6	1479.763016	0	0	0	6	1421.866624
0	0	0	7	1480.782576	0	0	0	7	1422.402184
0	0	0	8	1483.254576	0	0	0	8	1423.571984
0	0	0	9	1488.282416	0	0	0	9	1424.902024
0	0	0	10	1484.766696	0	0	0	10	1426.366304
0	0	0	11	1486.407216	0	0	0	11	1428.06824
0	0	0	12	1488.203776	0	0	0	12	1429.821584
0	0	0	13	1490.158976	0	0	0	13	1431.776584
0	0	0	14	1492.26216	0	0	0	14	1433.885824
0	0	0	15	1494.533696	0	0	0	15	1436.351304
0	0	0	16	1496.953816	0	0	0	16	1438.970304
0	0	0	17	1499.531276	0	0	0	17	1441.800984
0	0	0	18	1502.265576	0	0	0	18	1443.885184
0	0	0	19	1505.158016	0	0	0	19	1446.775624
0	0	0	20	1508.202896	0	0	0	20	1449.822304
0	0	0	21	1511.429616	0	0	0	21	1453.052724
0	0	0	22	1514.764776	0	0	0	22	1456.384184
0	0	0	23	1518.280576	0	0	0	23	1459.899784
0	0	0	24	1521.953816	0	0	0	24	1463.571424
0	0	0	25	1525.778696	0	0	0	25	1467.399104
0	0	0	26	1529.763616	0	0	0	26	1471.38424
0	0	0	27	1533.904576	0	0	0	27	1475.523784
0	0	0	28	1538.200776	0	0	0	28	1479.820384
0	0	0	29	1542.653616	0	0	0	29	1484.273224
0	0	0	30	1547.263696	0	0	0	30	1488.862304
Rear Left	Long G-Force	Lat G-Force	Velocity m/s ²	Weight	Rear Right	Long G-Force	Lat G-Force	Velocity m/s ²	Weight
0	0	0	1	1666.580224	0	0	0	1	1599.747036
0	0	0	2	1668.814684	0	0	0	2	1599.981176
0	0	0	3	1669.205184	0	0	0	3	1600.711976
0	0	0	4	1666.793204	0	0	0	4	1600.918836
0	0	0	5	1667.455104	0	0	0	5	1601.621896
0	0	0	6	1668.114424	0	0	0	6	1602.481236
0	0	0	7	1669.129884	0	0	0	7	1603.469776
0	0	0	8	1670.507384	0	0	0	8	1604.666576
0	0	0	9	1671.829824	0	0	0	9	1605.966636
0	0	0	10	1673.144104	0	0	0	10	1607.480896
0	0	0	11	1674.954624	0	0	0	11	1609.121436
0	0	0	12	1676.751884	0	0	0	12	1610.981176
0	0	0	13	1678.704884	0	0	0	13	1612.871176
0	0	0	14	1680.813624	0	0	0	14	1614.980436
0	0	0	15	1683.079904	0	0	0	15	1617.245896
0	0	0	16	1685.608224	0	0	0	16	1619.676736
0	0	0	17	1688.078784	0	0	0	17	1622.245576
0	0	0	18	1690.812984	0	0	0	18	1624.979776
0	0	0	19	1693.703424	0	0	0	19	1627.870236
0	0	0	20	1696.765004	0	0	0	20	1630.968496
0	0	0	21	1699.958024	0	0	0	21	1634.198736
0	0	0	22	1703.121884	0	0	0	22	1637.478976
0	0	0	23	1706.827584	0	0	0	23	1640.994376
0	0	0	24	1710.499224	0	0	0	24	1644.666036
0	0	0	25	1714.127104	0	0	0	25	1648.493896
0	0	0	26	1718.112224	0	0	0	26	1652.478036
0	0	0	27	1722.452884	0	0	0	27	1656.618376
0	0	0	28	1726.748884	0	0	0	28	1660.914976
0	0	0	29	1731.303204	0	0	0	29	1665.367836
0	0	0	30	1736.810504	0	0	0	30	1669.976896

Table 2 vehicle measurement 13

Bibliography 23

n/a. (2020, March 18). *Chassis Space Frame Diagram*. Retrieved from Build your own race

 24 car: https://www.buildyourownracecar.com/wp-content/uploads/Chassis_SpaceframeDiagram.jpg

Understanding your car's suspension geometry. (2020, march 18). Retrieved from Haynes:

 25 <https://haynes.com/en-gb/tips-tutorials/understanding-your-car-s-suspension-geometry>

FINAL GRADE

28/70

GENERAL COMMENTS

Instructor

There are only two references on your reference list, I would expect more for a report of this length. The reference list is not in the correct Harvard Referencing Conventions. Use the UWTSD Harvard Referencing Guide in the future. Citations are correct when included.

It is clear that you have done research for this report, however it generally lacks depth and doesn't always go back to the aim and assignment brief. As the majority of the suspension section is copied from source I am not able to determine your personal level of knowledge and understanding on this topic.

No graphs included in the report even though there are some on your Excel spread sheet

The analysis is very limited and is not all correct or answering what is being asked accurately.

There are numerous issues with the formatting of this report. Changes in font type and size are present. Your Figure list is near the end instead of after the contents list. There is a random repeat of a table near the end. There is no conclusion to summarise what you have learnt doing the report.



Comment 1 | K & U Subject

This is a very short introduction. I would expect you to include more information about the subject. What specific vehicle behavioural characteristics are you looking for? What applications?

This is not quite the aim of the coursework in the way you have written it.



Comment 2 | Prof Prac

You should be writing in a technical manner using third person, so there shouldn't be any you, I , we etc.



Comment 3 | Prof Prac

Try to maintain the same font and font size throughout your report, as this looks much more professional.



Comment 4 | Literature

References for images should be produced in the same way and included in the reference list.



Comment 5 | K & U Subject

Good to see chassis linked to comfort and handling but more detail could have been included.



Comment 6 | Prof Prac

Full stop missing.



Comment 7 | K & U Subject

This is correct but lacks depth - which regulations, what are they trying to achieve?



Comment 8 | Prof Prac

Capital letter missing



Comment 9 | K & U Subject

In terms of characteristics why is this favourable for super cars and motorsport applications - what do you see in those applications you don't see on a road car.



Comment 10 | K & U Subject

How do these link to the comfort and handling behavioural characteristics?



Comment 11 | K & U Subject

Everything below this introduction to suspension, has been copied from source. This means I am not able to know what your personal level of understanding is.

DO NOT COPY AND PASTE from sources. You need to be putting the information into your own words by using paraphrasing.



Comment 12 | K & U Subject

This appears to be all one long quote, as it has quotation marks. However there is no citation.



Comment 13 | C&I Skills

Would have been good to have a short introduction to this chapter.

Also explain the information included in Table 1 was provided in the assignment brief.



Comment 14 | Prof Prac

These appear to be separate tables and should have been labelled and numbered.



Comment 15 | C&I Skills

The information in this table is far too small to read.

In this chapter, you only needed to include the graphs and not the tables.



Comment 16 | Prof Prac

Table number and title should go above a table in a technical report.

PAGE 14



Comment 17 | C&I Skills

The questions in the assignment brief were there as a suggestion and it was expected that you would write this section in paragraphs. The idea was not to just put the questions in and answer them.



Comment 18 | C&I Skills

What about the effect of accelerating around the corner?



Comment 19 | C&I Skills

True but would have been better to explain using traction circle.



Comment 20 | C&I Skills

This question was about wheelbase, track width and COG height and how those change the characteristics.

PAGE 15



Comment 21 | Prof Prac

This should go after the contents page.

PAGE 16



Comment 22 | Prof Prac

Why is the table repeated?

PAGE 17

PAGE 18



Comment 23 | Literature

Should be a reference list - bibliography is something different.



Comment 24 | Literature

For this onw the author would be Build your own race car. You should also put what date you accessed the website.



Comment 25

Remember that references should be;

Author (Year) *Title* Publisher, URL, Access date

LITERATURE

Unsatisfactory
30-39%

(including reading, referencing, academic conventions and academic honesty)

OUTRIGHT FAIL 0-29%	Little or no evidence of reading and/or reliance on inappropriate sources. Views and findings mostly unsupported and non-authoritative. Referencing conventions used incoherently or largely absent.
UNSATISFACTORY 30-39%	Poor engagement with essential reading. No evidence of wider reading. Reliance on inappropriate sources, and/or indiscriminate use of sources. Heavily reliant on information gained through class contact. Inconsistent and weak use of referencing.
SATISFACTORY 40-49%	Engagement with a limited range of mostly relevant and credible sources but with some reliance on information gained through class contact. Some omissions and minor errors. Referencing conventions evident though not always applied accurately or consistently.
GOOD 50-59%	Engagement with an appropriate range of literature, including sources retrieved independently. Some over-reliance on texts rather than other sources. Referencing may show minor inaccuracies or inconsistencies.
VERY GOOD 60-69%	Engagement with a wide range of literature, including sources retrieved independently. Selection of relevant and credible sources. Generally sound referencing, with no/very few inaccuracies or inconsistencies.
EXCELLENT 70-84%	Engagement with an extensive range of relevant and credible literature. Consistently accurate application of referencing.
EXCEPTIONAL 85-100%	Exceptional engagement with an extensive range of relevant and credible literature. High-level referencing skills consistently applied.

K & U SUBJECT

Satisfactory 40-49%

Knowledge and Understanding of Subject. Extent of knowledge and understanding of concepts and underlying principles associated with the discipline.

OUTRIGHT FAIL 0-29%	Major gaps in knowledge and understanding of the basic underlying concepts and principles of the subject matter. Inclusion of irrelevant material. Substantial inaccuracies
UNSATISFACTORY 30-39%	Gaps in knowledge of the basic underlying concepts and principles, with flawed or superficial understanding. Some significant inaccuracies and/or irrelevant material.
SATISFACTORY 40-49%	Limited knowledge and understanding of the basic underlying concepts and principles within the subject area. Some elements may be missing
GOOD 50-59%	Knowledge of the basic underlying concepts and principles is accurate with a good understanding of the field of study but lacks depth and/or breadth.
VERY GOOD 60-69%	Competent knowledge of the basic underlying concepts and principles. Exhibits very good understanding

EXCELLENT 70-84%	Excellent knowledge and understanding of the basic underlying concepts and principles of the subject.
EXCEPTIONAL 85-100%	Exceptional, detailed knowledge and understanding of the basic underlying concepts and principles

C&I SKILLS

Unsatisfactory
30-39%

(Evaluate underlying concepts and principles of a subject and interpret qualitative and quantitative data in order to develop lines of argument and make sound judgements.)

OUTRIGHT FAIL 0-29%	Wholly or almost wholly descriptive work. Little or no evaluation of the underlying concepts and principles. Failure to develop arguments, leading to illogical or invalid judgements. Minimal or no use of evidence to back up views.
UNSATISFACTORY 30-39%	Largely descriptive work, with superficial evaluation of the underlying concepts and principles. Weak interpretation of data, flawed development of arguments and judgements. Information accepted uncritically, uses generalised statements made with scant evidence and unsubstantiated opinions. Ideas sometimes illogical and contradictory
SATISFACTORY 40-49%	Limited attempt at evaluation of the underlying concepts and principles, tending towards description. Can interpret qualitative and quantitative data but with some errors. Some evidence to support emerging arguments and judgements but these may be underdeveloped or with a little inconsistency / mis-interpretation.
GOOD 50-59%	Good evaluation of the underlying concepts and principles. Can interpret qualitative and quantitative data, with minor errors. An emerging ability to use evidence to support the argument. Mostly valid arguments and logical judgements.
VERY GOOD 60-69%	Sound evaluation of the underlying concepts and principles. Can interpret qualitative and quantitative data accurately. Ability to devise arguments using evidence to make mostly appropriate and valid judgements.
EXCELLENT 70-84%	Excellent evaluation of the underlying concepts and principles. Can interpret qualitative and quantitative data accurately and with some insight. Excellent ability to devise arguments using evidence and make appropriate and valid judgements
EXCEPTIONAL 85-100%	Exceptional evaluation of the underlying concepts and principles based evidence. Outstanding interpretation of qualitative and quantitative data. Exceptional ability to devise arguments using evidence and make wholly appropriate and valid judgements

PROF PRAC

Satisfactory 40-49%

(Communicate the results of their study/work accurately and reliably, and with structured and coherent arguments; the qualities needed for employment requiring the exercise of some personal responsibility within a structured and managed environment.)

OUTRIGHT FAIL 0-29%	Work is poorly structured, disorganised, inaccurate and/or confusingly expressed. Very weak use of language and/or very inappropriate style. Failure to work effectively individual or as part of a group. Little or no evidence of the skills for employment requiring the
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exercise of some personal responsibility.

UNSATISFACTORY 30-39%	Work is poorly presented in a disjointed manner. It is loosely, and at times incoherently, structured, with information and ideas often poorly expressed. Weak use of language and/or inappropriate style. Flawed approach to individual or group work, meeting only partial obligations to others. Limited evidence of the skills for employment requiring the exercise of some personal responsibility.
SATISFACTORY 40-49%	Mostly ordered presentation and structure in which relevant ideas / concepts are reasonably expressed. Work may lack coherence and/or accuracy in places. Can work as part of a group, meeting most obligations to others but perhaps with limited involvement in group activities. Demonstrates the basic skills for employment requiring the exercise of some personal responsibility, with some areas of minor weakness.
GOOD 50-59%	Mostly coherent, organised and accurate work, in a suitable structure and is for the most part clearly expressed. Can work effectively independently and/or as part of a team, with clear contribution to group activities. Demonstrates the skills for employment requiring the exercise of some personal responsibility, with some areas of strength and some of minor weakness.
VERY GOOD 60-69%	Work is accurate, coherent, fluent, well-structured and organised. Can work effectively independently and/or as part of a team, with very good contribution to group activities. Demonstrates very good skills for employment requiring the exercise of some personal responsibility, with just occasional minor weakness.
EXCELLENT 70-84%	Work is coherent, very fluent and is presented professionally. Can work effectively independently and/or as part of a team, with an excellent contribution to group activities. Demonstrates excellent skills for employment requiring the exercise of some personal responsibility with an appetite for further development.
EXCEPTIONAL 85-100%	Work is accurate, exceptionally coherent, very fluent and presented well. Can work effectively independently and/or as part of a team, with an exceptional contribution to group activities. Demonstrates exceptional skills for employment requiring the exercise of some personal responsibility with an appetite for further development