

Engine performance characteristics

Introduction

As a practical side of this assignment we first had to carry out a practical dyno lab test, where we had to work out the engine performance characteristics for a Honda engine after an hour of individually completing an engine dynamometer test, we achieved an accurate set of results. This test was completed by having a Honda civic engine in a concealed room, in a separate room we had a big window where we could watch and hear the test happening. In our room there were 2 sets of computers, one showing the dyno speed of the engine in rpm and the other showing the load in Newtons. To complete the test we went in pairs with one person on each computer where we would start the engine by using the computer, one of us would increase the dyno speed the other would have to increase the load, this meant we had to communicate and bounce back and forth off each other, if say the load was a lot lower than the dyno speed this could cause the engine to stall. There were a few incidents with a lack of communication in the groups which lead to the pair stalling.

Load	Dyno Speed	Fuel Flow Rate	Lambda
Newtons	rpm	l/min	Lambda
108.366	1000	0.0704	1.30942
108.717	1050	0.0724	1.30366
109.571	1100	0.0737	1.29294
111.098	1150	0.0728	1.27711
113.109	1200	0.0744	1.26074
115.336	1250	0.07895	1.24451
117.903	1300	0.079	1.22724
120.828	1350	0.0796	1.20757
123.86	1400	0.0835	1.1931
126.419	1450	0.0847	1.18486
128.13	1500	0.08865	1.17942
129.345	1550	0.0932	1.17953
130.257	1600	0.0959	1.1852
130.889	1650	0.09875	1.19185
131.264	1700	0.10005	1.19885
131.456	1750	0.10305	1.20563
131.636	1800	0.1093	1.2097
131.525	1850	0.11415	1.20995
131.916	1900	0.11745	1.20642
132.77	1950	0.12055	1.20033
133.987	2000	0.12555	1.1943
134.913	2050	0.12785	1.18908
135.65	2100	0.1309	1.18558
136.331	2150	0.13435	1.18312
137.097	2200	0.1377	1.17937

137.486	2250	0.14105	1.17362
138.075	2300	0.14495	1.16666
138.715	2350	0.14985	1.15908
138.954	2400	0.1537	1.15132
139.221	2450	0.15565	1.14569
139.299	2500	0.1596	1.14114
139.339	2550	0.1626	1.1368
139.393	2600	0.16805	1.13563
139.135	2650	0.17145	1.13364
138.772	2700	0.17465	1.13233
138.741	2750	0.1784	1.12769
138.904	2800	0.18005	1.12073
139.148	2850	0.1831	1.11391
139.146	2900	0.1879	1.10783
138.897	2950	0.19255	1.10134
138.963	3000	0.199	1.0951
138.837	3050	0.20605	1.08794
139.217	3100	0.21005	1.08038
139.461	3150	0.21605	1.07102
139.633	3200	0.21795	1.06185
140.053	3250	0.22305	1.05491
140.338	3300	0.2255	1.0489
140.511	3350	0.2285	1.04268
140.802	3400	0.2342	1.03697
141.325	3450	0.23605	1.03068
141.738	3500	0.24195	1.0264
141.734	3550	0.24545	1.02145
141.467	3600	0.25505	1.01677
141.362	3650	0.25755	1.01337
141.001	3700	0.26445	1.01249
140.483	3750	0.2651	1.01208
140.049	3800	0.2693	1.01206
139.699	3850	0.27375	1.01243
139.121	3900	0.2759	1.01326
138.419	3950	0.28285	1.0147
137.656	4000	0.28455	1.01515
136.927	4050	0.2871	1.01656
136.392	4100	0.28895	1.01733
135.945	4150	0.29305	1.0176
135.324	4200	0.2949	1.01741
134.975	4250	0.29715	1.01673
135.045	4300	0.3022	1.01544
134.843	4350	0.30605	1.01328
134.343	4400	0.3092	1.00986
133.791	4450	0.3099	1.00641
133.247	4500	0.31445	1.00418

132.449	4550	0.3171	1.00084
131.419	4600	0.3194	0.99955
130.576	4650	0.32055	0.998174
129.379	4700	0.3207	0.998338
127.916	4750	0.32485	0.998189
126.878	4800	0.32455	0.997699
125.285	4850	0.3257	0.998659

Looking at the data shown in the table above we can see that the load was at its lowest point at 108.366 Newtons then it slowly increased to where it peaked at 141.738 Newton and slowly begins to decrease again. The ambient temperature was at 25°C throughout the test.

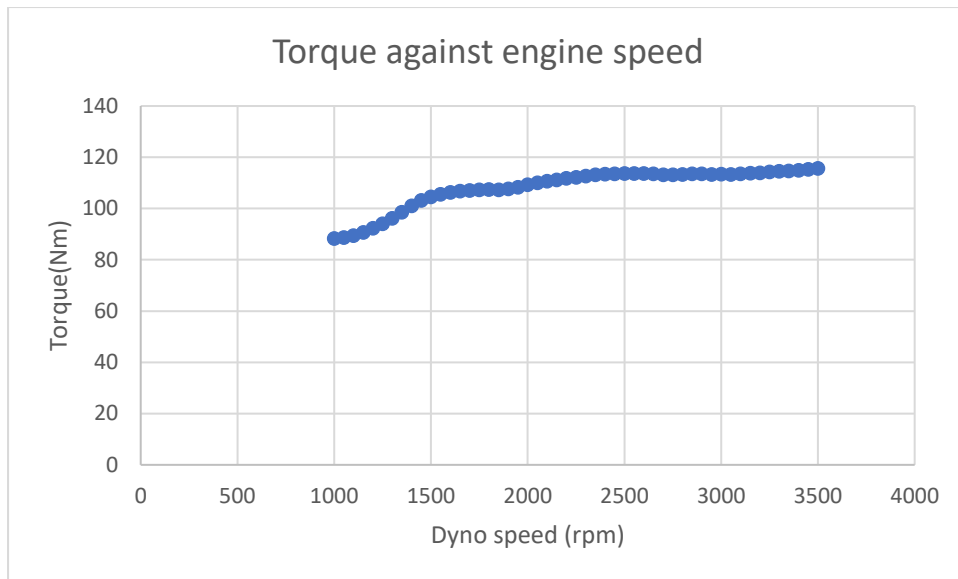
To calculate the torque throughout the test I have used the formula $\text{Torque} = \text{Distance} \times \text{Load}$, with the distance being 0.815776 the table shown below are the torque results received from the lowest load to where it reached its peak.

Load New- tons	Torque Nm
108.366	88.29402
108.717	88.68872
109.571	89.38539
111.098	90.63108
113.109	92.27161
115.336	94.08834
117.903	96.18244
120.828	98.56858
123.86	101.042
126.419	103.1296
128.13	104.5254
129.345	105.5165
130.257	106.2605
130.889	106.7761
131.264	107.082
131.456	107.2386
131.636	107.3855
131.525	107.2949
131.916	107.6139
132.77	108.3106
133.987	109.3034
134.913	110.0588
135.65	110.66
136.331	111.2156

137.097	111.8404
137.486	112.1578
138.075	112.6383
138.715	113.1604
138.954	113.3553
139.221	113.5732
139.299	113.6368
139.339	113.6694
139.393	113.7135
139.135	113.503
138.772	113.2069
138.741	113.1816
138.904	113.3145
139.148	113.5136
139.146	113.512
138.897	113.3088
138.963	113.3627
138.837	113.2599
139.217	113.5699
139.461	113.7689
139.633	113.9093
140.053	114.2519
140.338	114.4844
140.511	114.6255
140.802	114.8629
141.325	115.2895
141.738	115.6265

The table shown above shows how the torque increased when the load was increased, by adding the lowest load and the peak load and dividing it by 2 we get with an average load of 125.052 Newtons, again if we take the torque calculated from the highest load and the lowest load, we get an average torque reading of 101.96026Nm.

Using the results from the first table and the results received from the Torque calculations I then went to make a graph of these 2 sets of results.



Looking at the graph shown above it shows that the increase in torque is a lot faster between the dyno speeds 1000 to 1500 for every 50rpm the dyno speed is increased by the torque is increasing by 1-2Nm each time, but as the dyno speed hits around the 2000rpm mark the change in Torque is near to nothing it even decreases slightly every so often.

To calculate the power, we used the formula $BP = \frac{2\pi NT}{60}$, by putting our data into the formula we get this equation, $BP = (2)(\pi)(125.052)(101.96026) \div 60$

$$BP = 1334.92\text{kW}$$

Conclusion

As this experiment was completed it gave me a deep insight of the engines statistics, comparing the Torque as the as the speed was increased and showed that the change in torque was a lot smaller the higher the speed. It has also proven to me that if the speed was increased this would also cause the fuel flow rate to increase ever so slightly.

Evaluation

Personally i think the test itself came out very successful without any errors being made, I think the biggest issue for me was not taking enough notes whilst doing the experiment. I left out some key points that the tutor was telling us during the test which lead to me finding it very hard to complete write up of these results. The tutor had told us the radius of the Torque arm and the weight but I did not write them down thinking I would remember them. If I was to redo this test I would focus more on writing down the points that the tutor was telling us to ensure that I knew a lot better of what I was doing during the write up. I struggled to calculate specific things like 'time', I couldn't find a way of working out 't' using the data we had. The time was a very important piece of data because we needed this in order to calculate the specific fuel consumption.

