

Engine Performance Testing and Analysis on a Honda Engine

The aim of this test is to determine the power and torque of a Honda engine throughout a set range of RPM. To do this we will attach an engine to a calibrated dynamometer, record the force and the engine speed, and then use the engine specs to calculate the torque and power. We will then plot graphs of these against the RPM and compare that to what is the stock power and torque at the time of production.

The piston area of the engine is 4417.86 mm², this was calculated using the equation $A = \frac{\pi d^2}{4}$ and a bore and stroke of 75mm and 90mm respectively, I got these numbers from (Source 1)

From the calculated results (Fig 1,2,3) we can see that the engine is failing to reach peak power, and peak torque.

Peak torque is expected to be 152NM at 4300RPM (Source 1) however the engine only ever reached 131NM at 3050RPM (Fig 1,2), given the age of the engine some loss of torque is expected however the 1250 RPM difference is unexpected, this could be due to either engine age and poor maintenance, or an error on my end. Torque was calculated using the equation $T = WR$

Peak power is expected to be 81KW at 5600RPM however the engine peaked at 55.82KW at 4300RPM. This is a substantial difference in both RPM and power this again is likely due to poor care and age, however given the scale of the difference it is likely an error in my math that I have yet been unable to find. Power was calculated with the equation $BP = \frac{2\pi NT}{60}$ and then corrected for

pressure and temperature using the equation $\frac{P_s}{BP} = \frac{1.01325}{p_a} \sqrt{\frac{T_a}{293}}$ the reason power increases as RPM increases is there are more power impulses per second.

I calculated the BMEP for the engine to be 10.94 Bar, according to (Source 1) it is expected to be 12 Bar. This again shows that the engine is not performing properly as the pressure in the cylinders is far less than expected.

The equation I used to calculate BMEP is $BMEP = \frac{4\pi \times T}{L \times A \times n}$ I derived this equation from

equation $\frac{2\pi NT}{60} = \frac{BMEP \times L \times A \times N \times n}{60 \times 2}$ this equation is a combination of the simple equation for

power $BP = \frac{2\pi NT}{60}$ and the more complex equation for power $BP = \frac{B.M.E.P \times L \times A \times N \times n}{60 \times 2}$

Overall the testing was interesting, and I feel like I did that part well. However I'm not so confident about my performance in interpreting the results given the stark difference between the expected results and the calculated observed results, I feel there are 3 possible reasons for this, the engine is just performing weird and poorly due to its nature of being an old engine that's constantly abused by students, the data I found online is for the wrong engine, or most likely I made some massive error somewhere.

Fig 1.

Force (N)	RPM	Torque	BP	BP adj	ADJ kw
130.037	1000	106.0769	11108.35	11250.154	11.25015
130.61	1050	106.5443	11715.16	11864.714	11.86471
131.485	1100	107.2581	12355.25	12512.971	12.51297
132.641	1150	108.2011	13030.41	13196.755	13.19676
133.729	1200	109.0886	13708.48	13883.481	13.88348
135.143	1250	110.2421	14430.66	14614.875	14.61487
136.396	1300	111.2642	15147	15340.394	15.34039
137.723	1350	112.3467	15882.64	16085.397	16.0854
139.186	1400	113.5401	16645.85	16858.352	16.85835
140.496	1450	114.6088	17402.61	17624.771	17.62477
141.522	1500	115.4457	18134.17	18365.669	18.36567
142.271	1550	116.0567	18837.82	19078.297	19.0783
143.07	1600	116.7085	19554.7	19804.327	19.80433
143.631	1650	117.1661	20244.85	20503.295	20.50329
143.895	1700	117.3815	20896.67	21163.435	21.16343
143.984	1750	117.4541	21524.59	21799.363	21.79936
143.769	1800	117.2787	22106.51	22388.721	22.38872
143.411	1850	116.9867	22664	22953.331	22.95333
143.045	1900	116.6881	23217.14	23513.529	23.51353
142.816	1950	116.5013	23790	24093.673	24.09367
142.873	2000	116.5478	24409.71	24721.322	24.72132
143.19	2050	116.8064	25075.47	25395.577	25.39558
143.772	2100	117.2811	25791.47	26120.72	26.12072
144.551	2150	117.9166	26548.63	26887.541	26.88754
145.344	2200	118.5635	27315.07	27663.767	27.66377
146.106	2250	119.1851	28082.33	28440.819	28.44082
146.954	2300	119.8768	28873	29241.576	29.24158
147.835	2350	120.5955	29677.52	30056.379	30.05638
148.72	2400	121.3174	30490.4	30879.634	30.87963
149.675	2450	122.0965	31325.49	31725.383	31.72538
150.825	2500	123.0346	32210.38	32621.571	32.62157
152.138	2550	124.1057	33140.6	33563.668	33.56367
153.556	2600	125.2624	34105.36	34540.742	34.54074
155.005	2650	126.4444	35089.25	35537.192	35.53719
156.482	2700	127.6493	36092	36552.718	36.55272
157.786	2750	128.713	37066.68	37539.863	37.53986
158.838	2800	129.5711	37992.24	38477.245	38.47725
159.646	2850	130.2303	38867.39	39363.566	39.36357
160.156	2900	130.6463	39675.62	40182.11	40.18211
160.53	2950	130.9514	40453.93	40970.357	40.97036
160.755	3000	131.1349	41197.25	41723.168	41.72317
160.772	3050	131.1488	41888.3	42423.04	42.42304
160.64	3100	131.0411	42540	43083.097	43.0831
160.269	3150	130.7385	43126.34	43676.88	43.67688
159.847	3200	130.3942	43695.53	44253.334	44.25333
159.295	3250	129.9439	44225	44789.584	44.78958
158.657	3300	129.4235	44725.55	45296.506	45.29651
158.007	3350	128.8933	45217.2	45794.43	45.79443
157.267	3400	128.2896	45677.15	46260.258	46.26026
156.714	3450	127.8385	46185.9	46775.498	46.7755
156.031	3500	127.2814	46651.05	47246.589	47.24659
155.394	3550	126.7617	47124.32	47725.9	47.7259
154.841	3600	126.3106	47618	48225.862	48.22586
154.283	3650	125.8554	48105.36	48719.46	48.71946
153.895	3700	125.5389	48641.7	49262.649	49.26265
153.537	3750	125.2469	49184.34	49812.214	49.81221
153.207	3800	124.9777	49733	50367.887	50.36789
152.982	3850	124.7941	50313.39	50955.679	50.95568
152.81	3900	124.6538	50909.51	51559.407	51.55941
152.686	3950	124.5527	51520.35	52178.05	52.17805
152.585	4000	124.4703	52138	52803.579	52.80358
152.443	4050	124.3545	52740.59	53413.869	53.41387
152.235	4100	124.1848	53318.86	53999.52	53.99952
151.91	4150	123.9197	53853.88	54541.363	54.54136
151.399	4200	123.5028	54319.38	55012.81	55.01281
150.827	4250	123.0362	54758.37	55457.406	55.45741
150.068	4300	122.4171	55123.79	55827.487	55.82749
149.154	4350	121.6715	55425.12	56132.669	56.13267
148.116	4400	120.8247	55672	56382.74	56.38274
147.008	4450	119.9209	55883.49	56596.882	56.59688
145.914	4500	119.0285	56090.85	56806.889	56.80689
144.832	4550	118.1458	56293.52	57012.154	57.01215
143.855	4600	117.3489	56528.22	57249.846	57.24985
142.954	4650	116.6139	56784.76	57509.659	57.50966
141.876	4700	115.7345	56962.53	57689.705	57.68971
140.982	4750	115.0052	57205.76	57936.04	57.93604
140.028	4800	114.227	57416.75	58149.723	58.14972
139.039	4850	113.4202	57605.09	58340.467	58.34047
137.983	4900	112.5588	57756.94	58494.252	58.49425
136.865	4950	111.6468	57873.55	58612.349	58.61235
135.733	5000	110.7234	57974.63	58714.718	58.71472
134.623	5050	109.8179	58075.53	58816.905	58.81691
133.253	5100	108.7003	58053.67	58794.77	58.79477
131.742	5150	107.4677	57958.08	58697.96	58.69796
129.994	5200	106.0418	57744.3	58481.456	58.48146
128.245	5250	104.6151	57515.15	58249.375	58.24938
126.542	5300	103.2259	57291.88	58023.255	58.02326
125.13	5350	102.074	57187.06	57917.093	57.91709
123.554	5400	100.7884	56994.52	57722.097	57.7221
122.083	5450	99.58847	56837.4	57562.974	57.56297
121.004	5500	98.70829	56851.89	57577.651	57.57765

Fig 2.

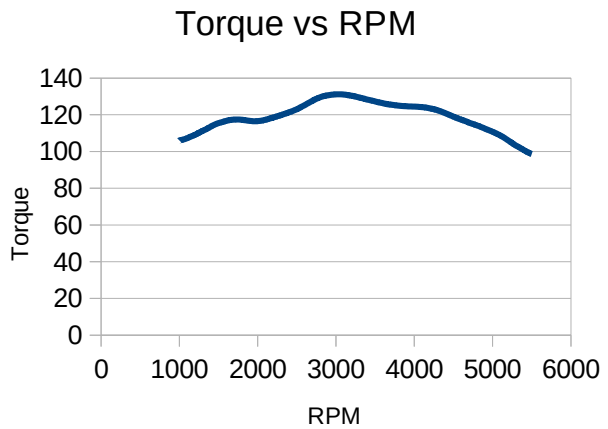
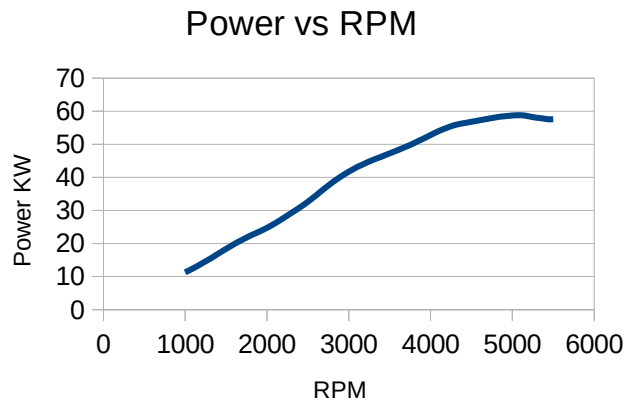


Fig 3.



Source 1:

encycarpedia. 2018. Honda Civic 1.6i - Specifications (2001-2005). [ONLINE] Available at: <https://www.encycarpedia.com/honda/01-civic-1-6i-hatch>.