3. Understanding ECU maps Part 1

Understanding ECU maps.

VAG owners can use a device and program called VCDS (formally Vagcom) to see and log the ECU engine data.

If a diesel engine has lambda sensors it is able to make accurate assessments about fuelling. Bosch Injector PD tdi engines do not have lambda sensors and so are unable to calculate the efficiency of their own fuelling. This means that VCDS figures about fuelling are ECU request figures not actual outcome figures.
So a car with a worn camshaft or worn injectors could have messed up fuelling and the ECU will never know. This is why real chip tuning/remapping should be done on a rolling road with sensors measuring the Air/Fuel ratio.

Map changes without a rolling road and Air/fuel ratio measurements have to assume that the engine is in perfect, unworn condition.
The information below is mostly based on a VW 100 bhp pd tdi engine and EDC15 ecu.

Looking at maps.

The Basics.

For the engine to run it will need a Quantity of fuel (IQ) injected at a time when adequate air is available for the fuel to burn.

This leaves the Engine ECU with a number of factors to consider.
The driver's requirement (drivers wish).
The current engine speed.
The amount of air available. (MAF and MAP)
The engine/coolant temperature.
The fuel temperature.
The intake air temperature.

To protect the engine against mechanical damage and prevent black smoke, there are limitations on the quantity of fuel injected (IQ).
The engine control unit therefore calculates a limited final value based on a number of limiting factors.

Limiting factors include:
The air mass available (MAF) via Smoke map.
The air pressure (MAP) this is via boost and boost limiter. (A MAP based smoke limiter may exist in some ECU's).
The Absolute air pressure (Torque map)
The engine speed. (All maps)

I will start with Drivers wish.

1. Drivers Wish PD 100 bhp
This map converts the drivers accelerator pedal pressing (%) into an Injection Quantity (IQ) of fuel.

This is raw hexdump data.
Rows are rpm, 0 to 5355.
Columns are accelerator % position, 0 to 100%
Table data is Injection Quantity, mg/stroke. 0 to 66.00mg/stroke

	Accelerator pedal %							
RPM	**00100**	**00400**	**01000**	**02300**	**04500**	**06500**	**08500**	**10000**
00000	01720	02420	03010	03700	04440	05120	06000	06600
00399	00680	01040	01940	02580	03500	04560	05500	06200
00609	00000	00610	01570	02190	03080	04338	05275	06000
00900	00000	00350	01060	01770	02700	04060	05047	05800
01008	00000	00270	00846	01556	02516	03926	04943	05700
01491	00000	00140	00350	01090	02040	03610	04695	05400
01995	00000	00000	00250	00850	01800	03400	04480	05200
02499	00000	00000	00200	00750	01700	03250	04280	05000
03003	00000	00000	00150	00700	01630	03100	04090	04850
03990	00000	00000	00060	00600	01540	02930	03750	04550
04998	00000	00000	00000	00500	01360	02800	03475	04300
05355	00000	00000	00000	00140	00200	00600	01500	03400

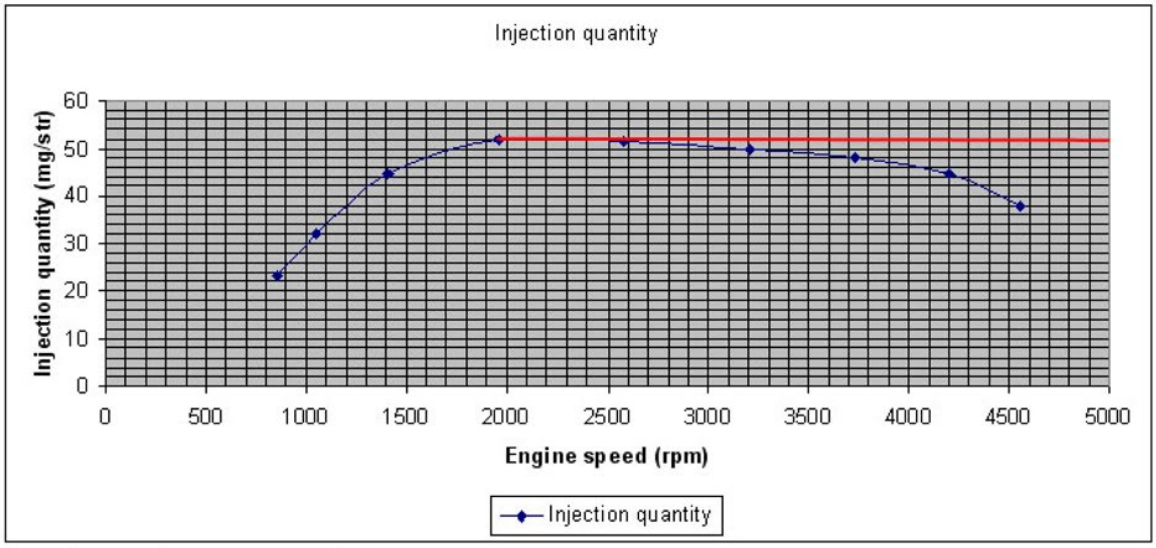
and with factors applied

	Accelerator pedal %							
RPM	**1**	**4**	**10**	**23**	**45**	**65**	**85**	**100**
0	17.20	24.20	30.10	37.00	44.40	51.20	60.00	66.00
399	6.80	10.40	19.40	25.80	35.00	45.60	55.00	62.00
609	0.00	6.10	15.70	21.90	30.80	43.38	52.75	60.00
900	0.00	3.50	10.60	17.70	27.00	40.60	50.47	58.00
1008	0.00	2.70	8.46	15.56	25.16	39.26	49.43	57.00
1491	0.00	1.40	3.50	10.90	20.40	36.10	46.95	54.00
1995	0.00	0.00	2.50	8.50	18.00	34.00	44.80	52.00
2499	0.00	0.00	2.00	7.50	17.00	32.50	42.80	50.00
3003	0.00	0.00	1.50	7.00	16.30	31.00	40.90	48.50
3990	0.00	0.00	0.60	6.00	15.40	29.30	37.50	45.50
4998	0.00	0.00	0.00	5.00	13.60	28.00	34.75	43.00
5355	0.00	0.00	0.00	1.40	2.00	6.00	15.00	34.00

900 rpm and below the drivers wish map is not functioning. Idle control is via the idle control map.
The red highlighted squares show data roughly in line an accelerating engine (rpm steadily rising).
At 1491 rpm the ECU is injecting 54mg of fuel. The maximum theoretical value for this engine based on available air flow is about 63mg.
An examination of the boost map will confirm that full boost is available from roughly 1500 rpm on these engines and full boost gives maximum available airflow so 1491 rpm for 54mg IQ makes sense.
As engine rpm continue to rise, the amount of IQ needed for the increased rpm starts to fall from 54mg to 52mg to 48.5mg etc.
This might seem odd but only if you are thinking of acceleration.
Once you reach the required engine rpm and speed, you don't want to continue accelerating. That would be a waste of fuel.
The ECU is doing what you do naturally when you drive at constant speed. It is finding the least amount of fuel needed to keep that speed.
This drivers wish shows that with the right gearing it should be possible to maintain 5355 rpm using only 34mg of fuel per stroke.

Below is the same information recorded from the ECU using VCDS.

This is a graph showing injection quantity (IQ) varying with engine speed (rpm)



From the graph you can see that;
850 rpm is using an IQ of 23mg of fuel.
1050 rpm is using an IQ of 32mg.
1400 rpm is using an IQ of 44mg.
2000 rpm is using an IQ of 52mg.
2600 rpm is using an IQ of 52mg. On this example the maximum IQ is 52mg.
3200 rpm is using an IQ of 50mg.
3750 rpm is using an IQ of 49mg.
4200 rpm is using an IQ of 45mg.
4550 rpm is using an IQ of 38mg.

As on the drivers wish map, the IQ value maximum of 52mg at 2000 rpm steadily falls as the rpm continue to rise.
On this example 4550 rpm is using 38mg/stroke.

The ECU has a number of inbuilt limiting factors preventing drivers wish being converted directly into Injection Quantity.
So although the drivers wish may have a realistic 100% peak request of 60mg/stroke, it will not happen because of limiting factors.

2. Smoke map IQ limit by MAF
The smoke map limits the Injection Quantity according to the amount of air available for the burning of the fuel.
This is raw hexdump data.
Rows are rpm, 0 to 5355.
Columns are Mass Air Flow in mg/stroke (300 – 1000mg/stroke)
Table data is Injection Quantity, mg/stroke.

	Mass Air Flow												
RPM	**03000**	**03500**	**04000**	**04500**	**05030**	**05500**	**06000**	**06500**	**07000**	**07500**	**08500**	**10000**
00861	02180	02350	02540	02750	02930	03080	03220	03300	03300	03300	03300	03300
00924	02200	02360	02580	02810	02980	03150	03280	03410	03450	03480	03530	03640	03640
01008	02200	02370	02610	02860	03070	03240	03380	03540	03600	03670	03800	04050	04050
01100	02180	02370	02610	02870	03100	03320	03490	03660	03770	03870	04050	04370	04370
01200	02160	02360	02590	02840	03080	03340	03620	03800	03930	04100	04300	04560	04560
01300	02150	02350	02580	02820	03050	03310	03620	03900	04090	04260	04440	04670	04720
01400	02150	02340	02570	02790	03030	03290	03580	03900	04200	04390	04570	04770	04820
01500	02140	02340	02570	02780	03020	03270	03550	03840	04210	04490	04710	04840	04900
01600	02140	02340	02560	02780	03020	03270	03540	03810	04130	04480	04760	04870	04940
01750	02140	02330	02550	02780	03010	03260	03520	03780	04090	04430	04750	04880	**04960**
02000	02140	02330	02550	02780	03000	03250	03500	03750	04040	04360	04690	04850	04950
02500	02130	02330	02530	02750	02980	03220	03450	03700	03960	04240	04530	04760	04860
03000	02130	02310	02510	02720	02940	03180	03400	03650	03880	04110	04350	04580	04690
03500	02090	02280	02480	02680	02880	03120	03340	03580	03800	03990	04170	04320	04470
04042	02010	02190	02380	02580	02790	03030	03240	03460	03660	03810	03940	04040	04160
05355	01590	01770	01960	02170	02400	02600	02800	02960	03090	03200	03280	03370	03460

and with factors applied

	Mass Air Flow												
RPM	**300**	**350**	**400**	**450**	**503**	**550**	**600**	**650**	**700**	**750**	**800**	**850**	**1000**
861	21.80	23.50	25.40	27.50	29.30	30.80	32.20	33.00	33.00	33.00	33.00	33.00	33.00
924	22.00	23.60	25.80	28.10	29.80	31.50	32.80	34.10	34.50	34.80	35.30	36.40	36.40
1008	22.00	23.70	26.10	28.60	30.70	32.40	33.80	35.40	36.00	36.70	38.00	40.50	40.50
1100	21.80	23.70	26.10	28.70	31.00	33.20	34.90	36.60	37.70	38.70	40.50	43.70	43.70
1200	21.60	23.60	25.90	28.40	30.80	33.40	36.20	38.00	39.30	41.00	43.00	45.60	45.60
1300	21.50	23.50	25.80	28.20	30.50	33.10	36.20	39.00	40.90	42.60	44.40	46.70	47.20
1400	21.50	23.40	25.70	27.90	30.30	32.90	35.80	39.00	42.00	43.90	45.70	47.70	48.20
1500	21.40	23.40	25.70	27.80	30.20	32.70	35.50	38.40	42.10	44.90	47.10	48.40	49.00
1600	21.40	23.40	25.60	27.80	30.20	32.70	35.40	38.10	41.30	44.80	47.60	48.70	49.40
1750	21.40	23.30	25.50	27.80	30.10	32.60	35.20	37.80	40.90	44.30	47.50	48.80	49.60
2000	21.40	23.30	25.50	27.80	30.00	32.50	35.00	37.50	40.40	43.60	46.90	48.50	49.50
2500	21.30	23.30	25.30	27.50	29.80	32.20	34.50	37.00	39.60	42.40	45.30	47.60	48.60
3000	21.30	23.10	25.10	27.20	29.40	31.80	34.00	36.50	38.80	41.10	43.50	45.80	46.90
3500	20.90	22.80	24.80	26.80	28.80	31.20	33.40	35.80	38.00	39.90	41.70	43.20	44.70
4042	20.10	21.90	23.80	25.80	27.90	30.30	32.40	34.60	36.60	38.10	39.40	40.40	41.60
5355	15.90	17.70	19.60	21.70	24.00	26.00	28.00	29.60	30.90	32.00	32.80	33.70	34.60

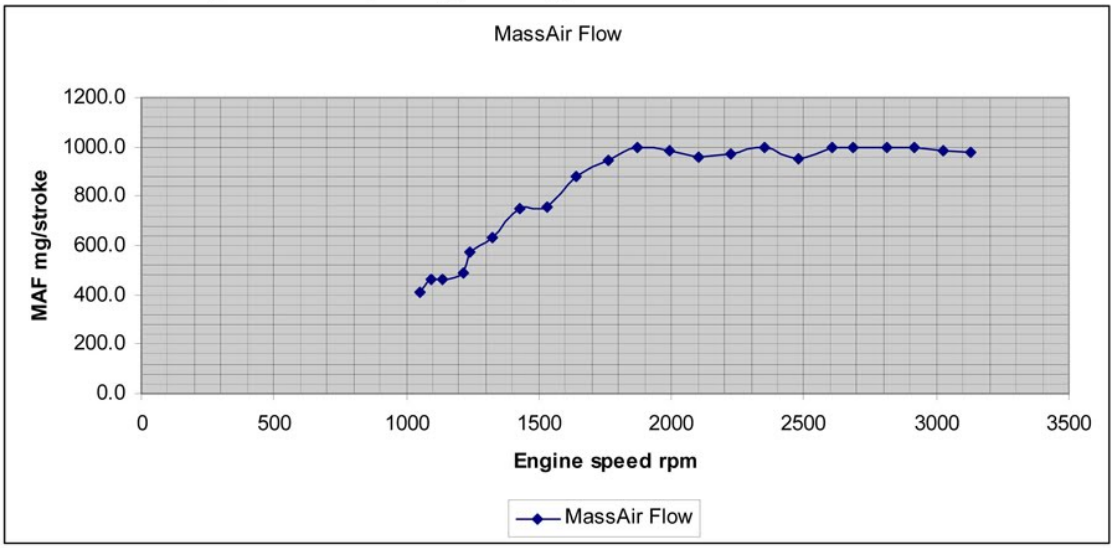
The basic MAF value without any turbocharger assistance is 474mg/stoke. The two columns highlighted in RED are roughly this value. (450-503 mg/stroke).
Full boost value (about 2000mbar) will give a MAF value of 948 mg/stroke (2 x 474). The two columns highlighted in BLUE are roughly this value. (850-1000 mg/stroke).
For any given rpm and MAF value there is a calculation for IQ preventing too much fuel being injected for that MAF value.
The maximum IQ that this map is allowing is 49.6 mg/stroke.
So the drivers wish map may have a top request of 60 mg/stroke but in real life it probably tops out at 54mg/stroke.
The smoke map is limiting this 54mg/stroke to 49.6 mg/stroke.

The smoke map only allows a specific IQ request if enough air is available for that amount of fuel to burn correctly.
In diesel engines the MAF value must exceed the required figure by 10 – 20% to ensure no smoke. This gives a Lambda reading of 1.1 – 1.2 which can be confusing if you are used to the expected lambda of 1.0 on a petrol engine.

The column highlighted in Orange shows the default MAF value of 550 mg/stroke that many ECU's use if the MAF sensor fails.

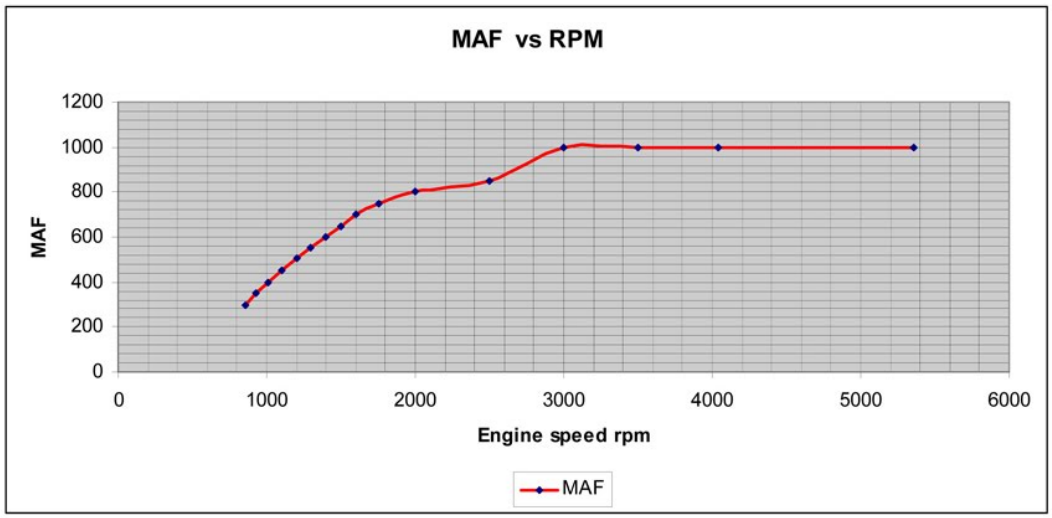
Below is the MAF information recorded from the ECU using VCDS.

This is a graph showing Mass Air Flow (MAF) varying with engine speed (rpm)
This is what the engine is actually doing (vcds log)



The MAF value rises steeply from about 1050- 1850 rpm due to the fact that the turbo vanes are positioned for maximum boost.
Peak air flow is available at about 1850 rpm on this graph but 800 mg/stroke is good enough for higher IQ requests so the engine is 'on song' from about 1500 rpm. From now on, as the engine rpm rise the boost will stay steady at this value so the MAF value will stay steady at this value too. This is made possible by the turbocharger vanes closing as engine rpm rise. If the vanes did not start to close, boost would continue to rise with engine rpm and 'over boost' would occur. On a traditional turbocharger set up the waste gate or dump valve would reduce boost rather than the turbo vane solution used on vnt turbochargers in VAG diesel engines.
With maximum boost of 1950 mbar you would expect peak MAF to be about 925 mg/stroke (1.95 x 474) which it roughly is on the graph above.

This is the same graph showing MAF specified values. (This is what you want the engine to do. ECU data)



3. Torque limiter
This is raw hexdump data.
Rows are Atmospheric air pressure in mbar. 800 – 1000mbar
Columns rpm, 0 to 5355 rpm
Table data is Injection Quantity, mg/stroke.

	00000	00550	00551	01000	01250	01500	01750	01900	02000	02250	02500	02750	03000	03250	03500	03800	04000	04200	04500	05000
00800	00000	00000	02750	03310	03890	04430	04510	04620	04530	04450	04420	04260	04160	04010	03895	03700	03550	03290	02760	00000
00900	00000	00000	02750	03310	03890	04430	04510	04620	04530	04450	04420	04260	04160	04130	04000	03820	03700	03590	03060	00000
01000	00000	00000	02750	03310	03890	04430	04510	04620	04530	04450	04420	04260	04160	04130	04000	03820	03700	03590	03060	00000

and with factors applied

Press	0	550	551	1000	1250	1500	1750	1900	2000	2250	2500	2750	3000	3250	3500	3800	4000	4200	4500	5000
800	0.00	0.00	27.50	33.10	38.90	44.30	45.10	46.20	45.30	44.50	44.20	42.60	41.60	40.10	38.95	37.00	35.50	32.90	27.60	0.00
900	0.00	0.00	27.50	33.10	38.90	44.30	45.10	46.20	45.30	44.50	44.20	42.60	41.60	41.30	40.00	38.20	37.00	35.90	30.60	0.00
1000	0.00	0.00	27.50	33.10	38.90	44.30	45.10	46.20	45.30	44.50	44.20	42.60	41.60	41.30	40.00	38.20	37.00	35.90	30.60	0.00

Looking at the torque map you can see that 1900 rpm is the point of maximum IQ at any atmospheric air pressure.
The torque limiter is limiting the IQ. The smoke map may have allowed a maximum IQ of 49.6 but the torque limiter is only
allowing a maximum IQ of 46.2 mg/stroke
The torque limit map helps to protect the turbocharger when atmospheric air pressure is low (below 1000 mbar) and protects the engine drive train (clutch, gearbox etc) from excessive torque at the wrong time. (Although some people like wheel spin)

4. Boost

Without boost the maximum IQ for our 474 cm^3 cylinder would be about 32mg/stroke. The boost map allows the
turbocharger to increase the amount of air and therefore allow an increase in IQ.
This is raw hexdump data.
Rows are engine speed. 0 – 4494 rpm.
Columns are IQ. 0 – 45 mg/stroke.
Table data is Boost. 0 – 1950 mbar.

Injection Quantity. IQ.										
rpm	**00000**	**00500**	**01000**	**01500**	**02000**	**02500**	**03000**	**03500**	**04000**	**04500**
00000	00198	00198	00198	00198	00238	00198	00198	00198	00198	00198
00021	01002	01002	01002	01041	01100	01324	01400	01470	01470	01470
01008	01002	01002	01012	01061	01120	01348	01415	01519	01519	01519
01260	01002	01002	01041	01091	01149	01377	01473	01600	01600	01600
01491	01002	01002	01060	01120	01182	01414	01551	01718	01750	01750
01743	01002	01012	01081	01145	01263	01572	01699	01850	01850	01850
01911	01002	01032	01091	01175	01318	01617	01778	01950	01950	01950
02058	01002	01041	01100	01219	01368	01629	01794	01950	01950	01950
02247	01012	01051	01110	01268	01408	01644	01800	01950	01950	01950
02499	01021	01061	01120	01308	01438	01652	01800	01950	01950	01950
03003	01050	01091	01160	01317	01441	01682	01804	01950	01950	01950
03507	01070	01130	01200	01321	01441	01677	01798	01950	01950	01950
03990	01090	01160	01240	01335	01454	01655	01798	01950	01950	01950
04242	01100	01190	01259	01355	01473	01639	01758	01835	01914	01914
04494	01149	01219	01278	01384	01482	01600	01708	01718	01806	01806
04746	01198	01256	01316	01404	01492	01590	01669	01700	01700	01700

and with factors applied.

Injection Quantity. IQ										
rpm	**0.00**	**5.00**	**10.00**	**15.00**	**20.00**	**25.00**	**30.00**	**35.00**	**40.00**	**45.00**
0	198	198	198	198	238	198	198	198	198	198
21	1002	1002	1002	1041	1100	1324	1400	1470	1470	1470
1008	1002	1002	1012	1061	1120	1348	1415	1519	1519	1519
1260	1002	1002	1041	1091	1149	1377	1473	1600	1600	1600
1491	1002	1002	1060	1120	1182	1414	1551	1718	1750	1750
1743	1002	1012	1081	1145	1263	1572	1699	1850	1850	1850
1911	1002	1032	1091	1175	1318	1617	1778	1950	1950	1950
2058	1002	1041	1100	1219	1368	1629	1794	1950	1950	1950
2247	1012	1051	1110	1268	1408	1644	1800	1950	1950	1950
2499	1021	1061	1120	1308	1438	1652	1800	1950	1950	1950
3003	1050	1091	1160	1317	1441	1682	1804	1950	1950	1950
3507	1070	1130	1200	1321	1441	1677	1798	1950	1950	1950
3990	1090	1160	1240	1335	1454	1655	1798	1950	1950	1950
4242	1100	1190	1259	1355	1473	1639	1758	1835	1914	1914
4494	1149	1219	1278	1384	1482	1600	1708	1718	1806	1806
4746	1198	1256	1316	1404	1492	1590	1669	1700	1700	1700

Maximum boost available from the boost map is 1950 mbar. If we assume our 474 cm^3 cylinder holds 474 mg of air at
normal atmospheric pressure (1000 mbar), it will hold 924.3 mg of air at 1950 mbar. (1.950 x 474).

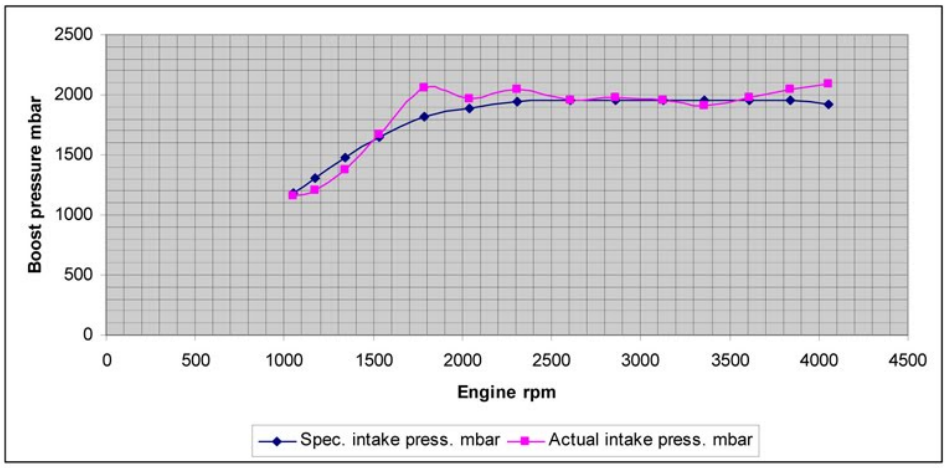
With an air/fuel ratio of 14.6 **:** 1, 924.3 mg of air can correctly burn 63.3 mg of fuel (924.3/14.6). The boost of 1950 mbar gives plenty of air for the highest IQ on this map which is 45.0 mg.

More boost does not mean more power. More boost with more IQ means more power. The IQ and Boost must match.

Notice that for the higher IQ levels the boost reduces slightly at the highest engine speeds. The boost is being limited.
Don't forget. You can't ask for more Boost than the turbocharger can actually produce.

Below is the same information recorded from the ECU using VCDS.

This is a graph showing Specified intake pressure (blue line) and Actual intake pressure (pink line) varying with engine
speed (rpm)



The blue line is a direct representation of the boost map data. The pink line is boost pressure as measured by the Manifold Absolute Pressure (MAP) sensor. It is the shape of the blue line that would be changed if the ECU boost map were altered.
Don't forget…Everyone talks about 'more boost' but what fuel needs is more Air to burn so what we actually want is more MAF and the way to get more MAF is to increase boost.

5. Boost limiter.

Boost needs limiting for a couple of reasons. Too much boost will provide too much air for the amount of IQ that is available.
This could make the engine run too lean and cause problems.
Boost also needs limiting when atmospheric pressure drops. At lower atmospheric pressure the air is 'thinner' and the turbocharger may spin too fast and break.

This is raw hexdump data.
Rows are Atmospheric Air pressure. 626 – 1100 mbar.
Columns are engine speed. 0 – 4494 rpm.
Table data is Boost. 0 – 2050 mbar.

Engine speed rpm										
At Pre	**01490**	**01743**	**01911**	**02247**	**02499**	**03003**	**03507**	**03990**	**04242**	**04494**
00626	01530	01570	01590	01590	01590	01550	01520	01390	01300	01220
00676	01630	01680	01710	01710	01710	01660	01620	01450	01340	01270
00715	01730	01800	01830	01830	01830	01770	01710	01500	01390	01320
00760	01840	01910	01950	01950	01950	01880	01800	01580	01480	01360
00805	01950	01990	02010	02010	02010	01970	01910	01690	01590	01500
00860	02050	02050	02050	02050	02050	02050	02050	01880	01780	01655
00909	02050	02050	02050	02050	02050	02050	02050	02050	01950	01853
00964	02050	02050	02050	02050	02050	02050	02050	02050	02050	02050
01024	02050	02050	02050	02050	02050	02050	02050	02050	02050	02050
01100	02050	02050	02050	02050	02050	02050	02050	02050	02050	02050

and with factors applied.

Engine speed rpm										
At Pre	**1490**	**1743**	**1911**	**2247**	**2499**	**3003**	**3507**	**3990**	**4242**	**4494**
626	1530	1570	1590	1590	1590	1550	1520	1390	1300	1220
676	1630	1680	1710	1710	1710	1660	1620	1450	1340	1270
715	1730	1800	1830	1830	1830	1770	1710	1500	1390	1320
760	1840	1910	1950	1950	1950	1880	1800	1580	1480	1360
805	1950	1990	2010	2010	2010	1970	1910	1690	1590	1500
860	2050	2050	2050	2050	2050	2050	2050	1880	1780	1655
909	2050	2050	2050	2050	2050	2050	2050	2050	1950	1853
964	2050	2050	2050	2050	2050	2050	2050	2050	2050	2050
1024	2050	2050	2050	2050	2050	2050	2050	2050	2050	2050
1100	2050	2050	2050	2050	2050	2050	2050	2050	2050	2050

A car operating near sea level will probably only experience atmospheric air pressure in the range 964 – 1100 because
ordinary weather patterns don't cause extreme changes in atmospheric air pressure.
This means that the boost will be limited to 2050 mbar which is slightly higher than the boost map provides for.
So under normal circumstances there will be no limiting of boost by the boost limiter.
Driving up a small mountain will cause the atmospheric pressure to drop. At an atmospheric pressure of 909 mbar the turbo charger still gives full boost up to 3990 rpm. At 4242 boost is limited to 1950 which is still full boost on the boost map.
So only at 4494 rpm is the boost being limited to 1853 mbar.

6. Boost control…N75 Duty cycle.
The function of the N75 map is to convert the boost map information into electrical signals that control the N75 valve.
The N75 valve is sometimes described as a vacuum waste gate.

This is raw hexdump data.
Rows are Engine speed. 760 – 4240 rpm.
Columns are IQ. 0 – 45 mg/stroke.
Table data is Percent opening of N75 valve. 24% - 75%

Warning. The N75 figures show percentage opening falling from roughly 80% to 20% as the rpm rise. Earlier ECU's were based on MAP sensor input and so the figures are reversed and run from 20% to 80%.
The meaning is the same so 80% on an early ECU is equivalent to 20% on this one.

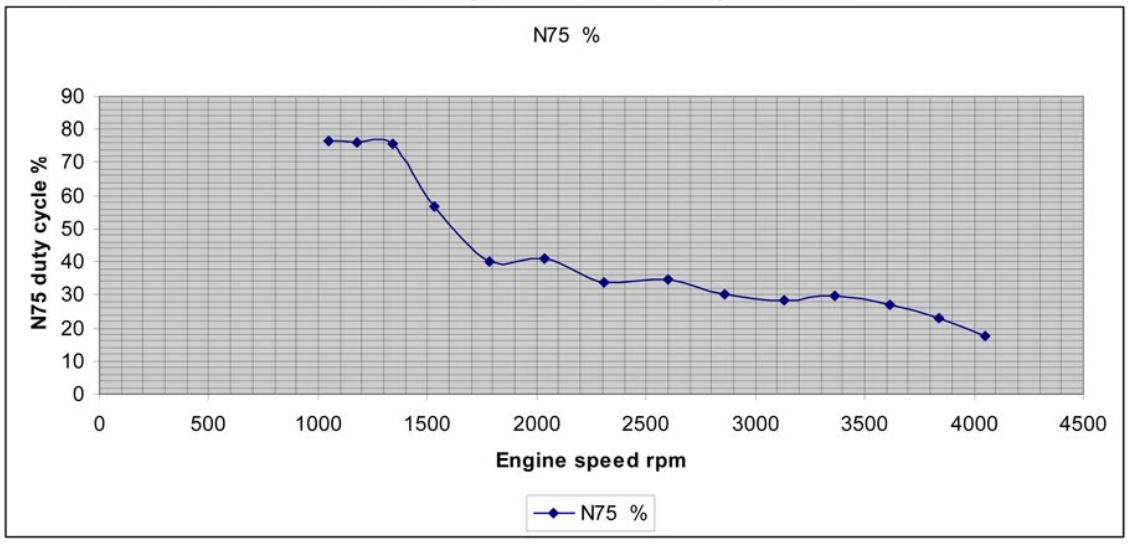
Injection Quantity. IQ													
rpm	00000	00600	01000	01200	01500	02000	02600	02900	03400	03600	03800	04000	04500
00760	00000	00000	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500
00780	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500
00950	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500
01050	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500
01200	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500	07500
01260	05000	05000	05400	06250	06322	06600	07292	07270	07100	06793	06380	06100	06000
01491	04800	04800	05362	06200	06282	05900	06152	06242	06031	05590	05200	05000	04800
01743	04600	04600	05112	05300	05442	05600	05592	05642	05531	05200	04800	04700	04300
01911	04500	04500	04800	05100	05100	05000	05200	05300	05200	04900	04600	04400	04200
02058	04500	04500	04358	04780	04770	04800	04800	04900	05000	04700	04100	04000	03900
02247	04500	04500	04302	04500	04500	04500	04600	04700	04700	04400	04000	03700	03600
02499	04300	04300	04172	04250	04200	04200	04200	04300	04300	04100	03600	03600	03400
03003	04000	04000	04100	03900	03800	03900	03900	03800	03800	03700	03500	03300	03000
03507	04000	04000	04000	03600	03500	03500	03700	03600	03600	03300	03100	02900	02800
03990	04000	04000	04000	03500	03300	03200	03200	03200	03200	03000	02900	02600	02600
04242	04000	04000	04000	03500	03300	03200	03100	03100	03100	02900	02800	02500	02400

and with factors applied.

Injection Quantity. IQ													
rpm	0.00	6.00	10.00	12.00	15.00	20.00	26.00	29.00	34.00	36.00	38.00	40.00	45.00
760	0.0	0.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
780	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
950	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
1050	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
1200	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
1260	50.0	50.0	54.0	62.5	63.2	66.0	72.9	72.7	71.0	67.9	63.8	61.0	60.0
1491	48.0	48.0	53.6	62.0	62.8	59.0	61.5	62.4	60.3	55.9	52.0	50.0	48.0
1743	46.0	46.0	51.1	53.0	54.4	56.0	55.9	56.4	55.3	52.0	48.0	47.0	43.0
1911	45.0	45.0	48.0	51.0	51.0	50.0	52.0	53.0	52.0	49.0	46.0	44.0	42.0
2058	45.0	45.0	43.6	47.8	47.7	48.0	48.0	49.0	50.0	47.0	41.0	40.0	39.0
2247	45.0	45.0	43.0	45.0	45.0	45.0	46.0	47.0	47.0	44.0	40.0	37.0	36.0
2499	43.0	43.0	41.7	42.5	42.0	42.0	42.0	43.0	43.0	41.0	36.0	36.0	34.0
3003	40.0	40.0	41.0	39.0	38.0	39.0	39.0	38.0	38.0	37.0	35.0	33.0	30.0
3507	40.0	40.0	40.0	36.0	35.0	35.0	37.0	36.0	36.0	33.0	31.0	29.0	28.0
3990	40.0	40.0	40.0	35.0	33.0	32.0	32.0	32.0	32.0	30.0	29.0	26.0	26.0
4242	40.0	40.0	40.0	35.0	33.0	32.0	31.0	31.0	31.0	29.0	28.0	25.0	24.0

It is important to notice that the N75 valve is 75% open as soon as the engine starts, even at idle. (look at the first few rows).

Below is an N75% VCDS readout showing how the N75 is being controlled.



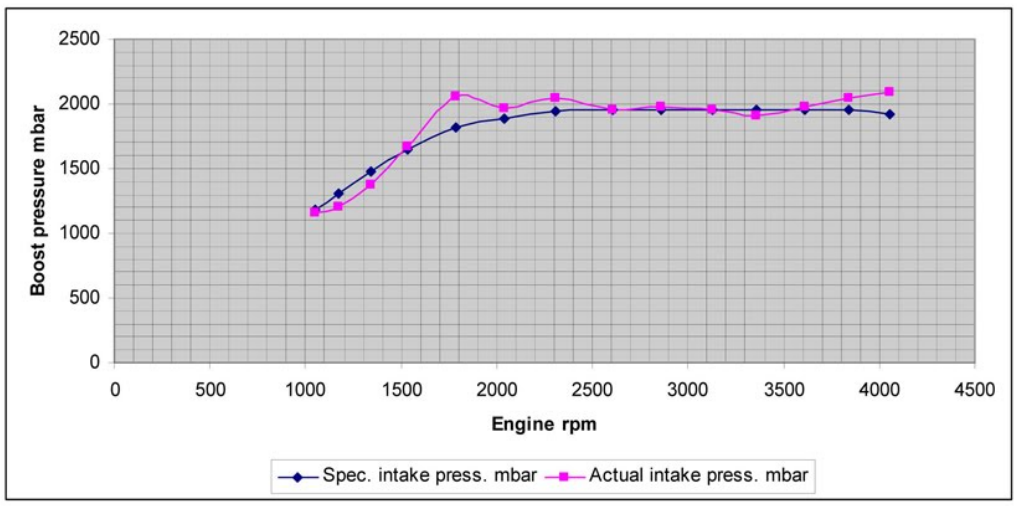
A brief explanation of the N75 valve function might help.
When the engine starts the N75 map requests 75% opening.
75% opening is enough vacuum for the turbocharger actuator to fully actuate. The turbocharger vanes are positioned for maximum boost. This allows boost to rise quickly.
This might sound good but the ECU wants to maintain maximum boost, not an ever increasing amount of boost.
To prevent boost becoming too high the ECU uses the N75 map to steadily REDUCE its opening and so reduce vacuum to the turbocharger actuator. So as the rpm rise the N75% falls steadily to a minimum opening of 24% at 4242 rpm. At this point vacuum to the turbocharger actuator is much less and the turbocharger vanes are configured to give less boost.

When the N75 reduces its opening and reduces vacuum it 'dumps' vacuum to the air filter. (lets air in).

The N75 map is matched to the turbocharger and so does not need changing unless it seems to be closing a little too early for the required boost. If this is the case, only tiny changes are needed.

Below is the same information recorded from the ECU using VCDS as boost.

This is a graph showing Specified intake pressure (blue line) and Actual intake pressure (pink line) varying with engine
speed (rpm)



The blue line represents the Boost map data. The pink line is the N75 and turbocharger trying to replicate the boost map data in real life. So if the boost map were changed slightly to give a little more boost, the N75 map might need tweaking a little to keep actual boost (pink line) in line with specified boost.

Video Guides are here:

EGR map https://www.youtube.com/watch?v=AcClr1GLVuQ

Drivers wish map http://www.youtube.com/watch?v=g4S27Fkzg1Q

Torque map http://www.youtube.com/watch?v=3ofeOsdlNW0