CITA

INTERNATIONAL MOTOR VEHICLE INSPECTION COMMITTEE

CONFERENCE 2009

Analysis of OBD(E) trouble codes

Mr Pascal Buekenhoudt

Project Office Manager and Head of R&D AKCT, GOCA, Belgium

Hosted by BILPROVNINGEN

ANALYSIS OF THE (E)OBD TROUBLE CODES

Results from 1,25 million inspections of second hand vehicles

Buekenhoudt Pascal

2009 – CITA Conference Göteborg

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Results after the implementation of the (E)OBD test in Belgium

- Framework of the (E)OBD test
- Elaborated Concept
- Analysis of the test results
- Conclusions

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Framework of the (E)OBD test

- The GOCA members have been authorised to e.g.:
  - Carry out PTI
  - Carry out an inspection on passenger cars before being sold and registered by a new owner
- Adapted second hand inspection, including (E)OBD started on the 15th November 2006

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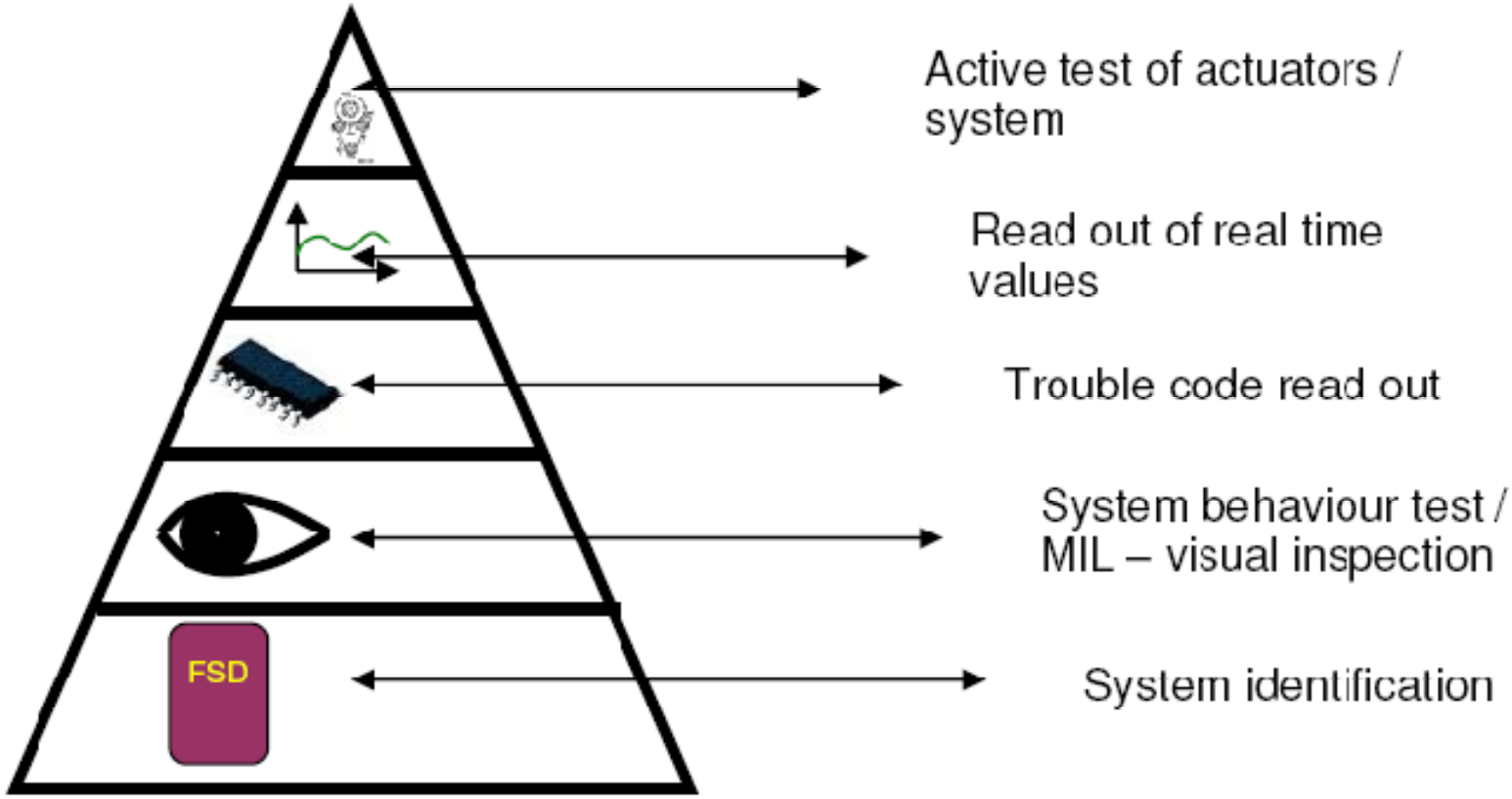
Framework of the (E)OBD test

- The Belgian(E)OBD test is based on the concept to test electronical systems:
  - Developed during the **IDELSY** project (2004-2005 and report 2005)
  - Concept also mentioned in the **AUTOFORE** Project (2005-2007)

Framework of the (E)OBD test



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Elaborated concept

- 16-pin EOBD connector
- ECU's to be checked :
  - ECU related to safety
    - ABS, ESP, …
    - Restraint systems (Airbags, …)
    - Xenon Light
  - ECU related to emissions
    - EOBD
    - Motormanagement
  - ECU related to Airco

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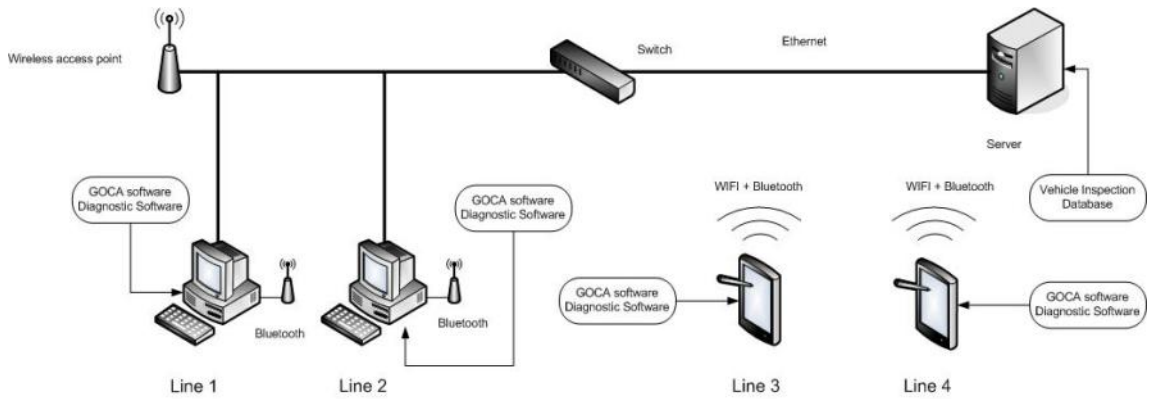
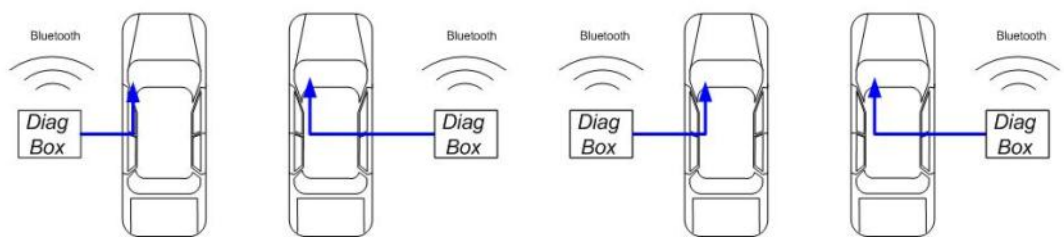
Elaborated concept

- Hardware architecture (point to point)





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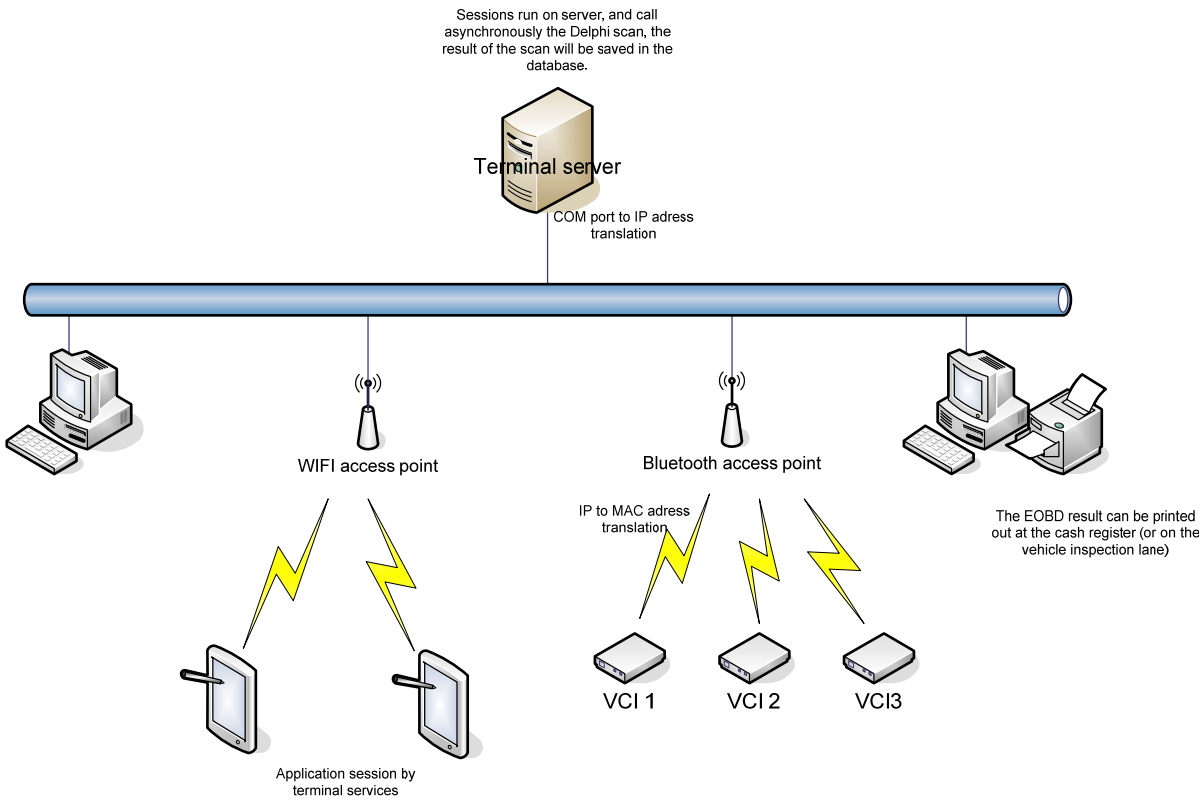
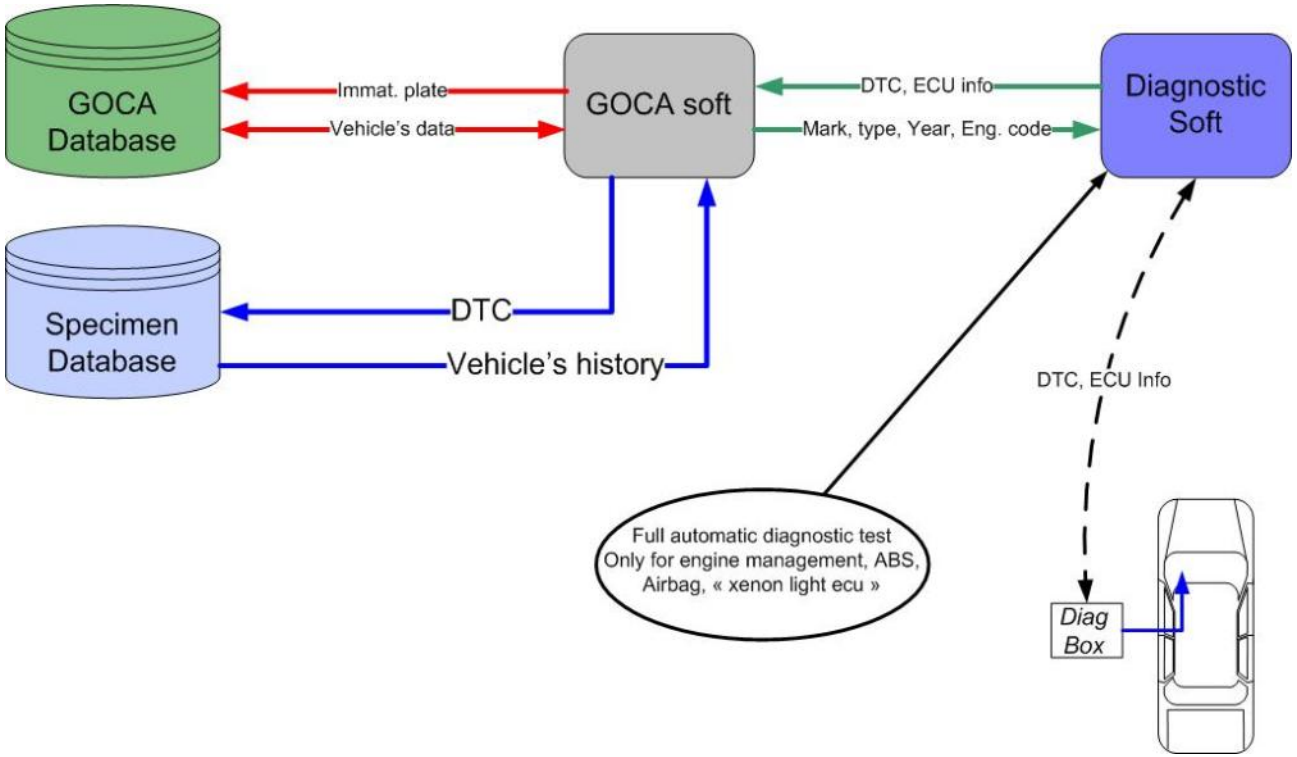
Elaborated concept

- Hardware architecture (Thin client)



Elaborated concept

- Software architecture



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Analysis of the test results

- Test results for the inspections 2007 - 2008
  - 1.372.403 second hand inspections
  - **159.584 (E)OBD scans**

  - General results for the tested vehicles

ECU	#	%
airco	6.601	4,14
braking	7.684	4,82
airbag	8.293	5,20
engine	15.573	9,76
no trouble codes	130.093	81,52

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Analysis of the test results

- Test results for the inspections 2007 – 2008
  - General results for the number of trouble codes

ECU	#	%
airco	11.845	15,46
braking	12.939	16,89
airbag	15.326	20,01
engine	36.489	47,64
# trouble codes	**76.599**	100

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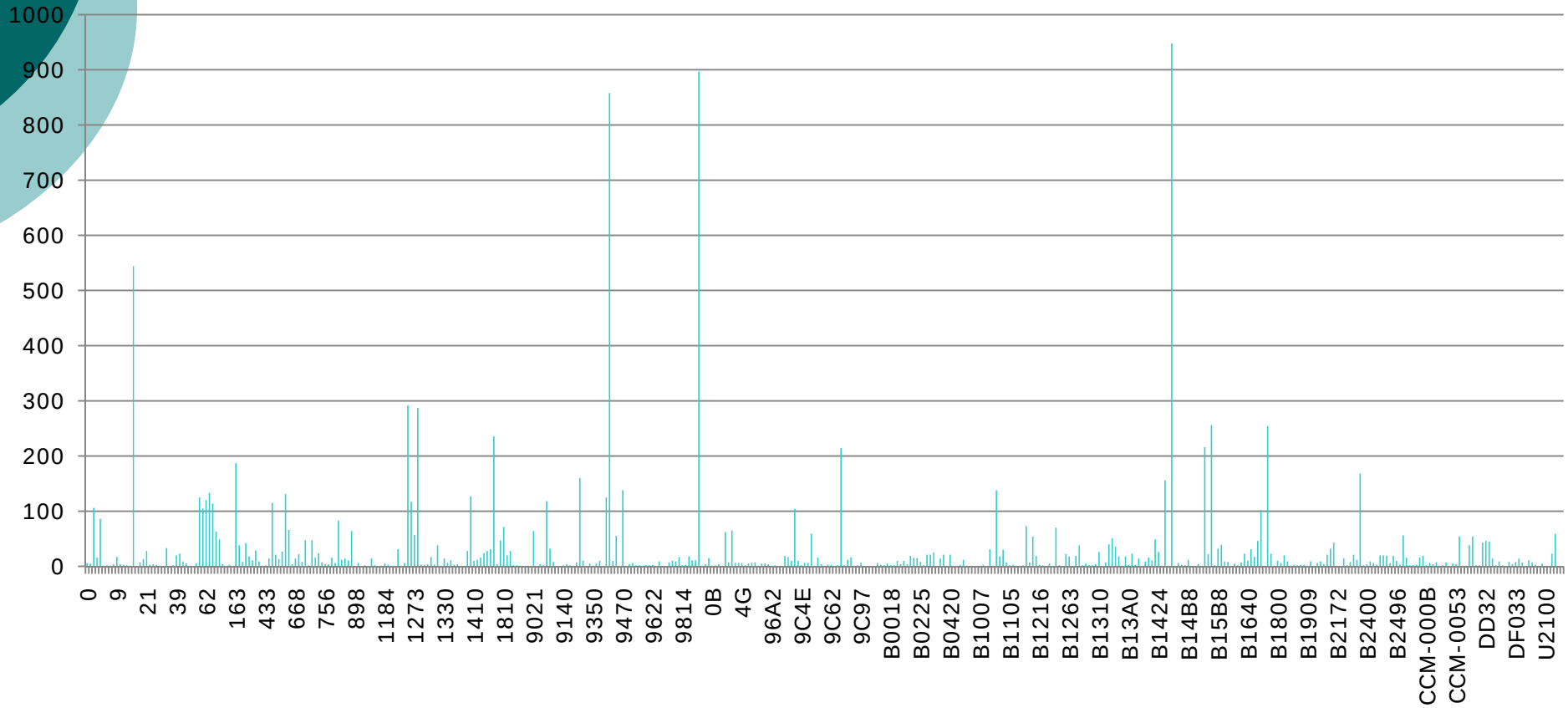
Analysis of the test results

- Trouble codes Airco



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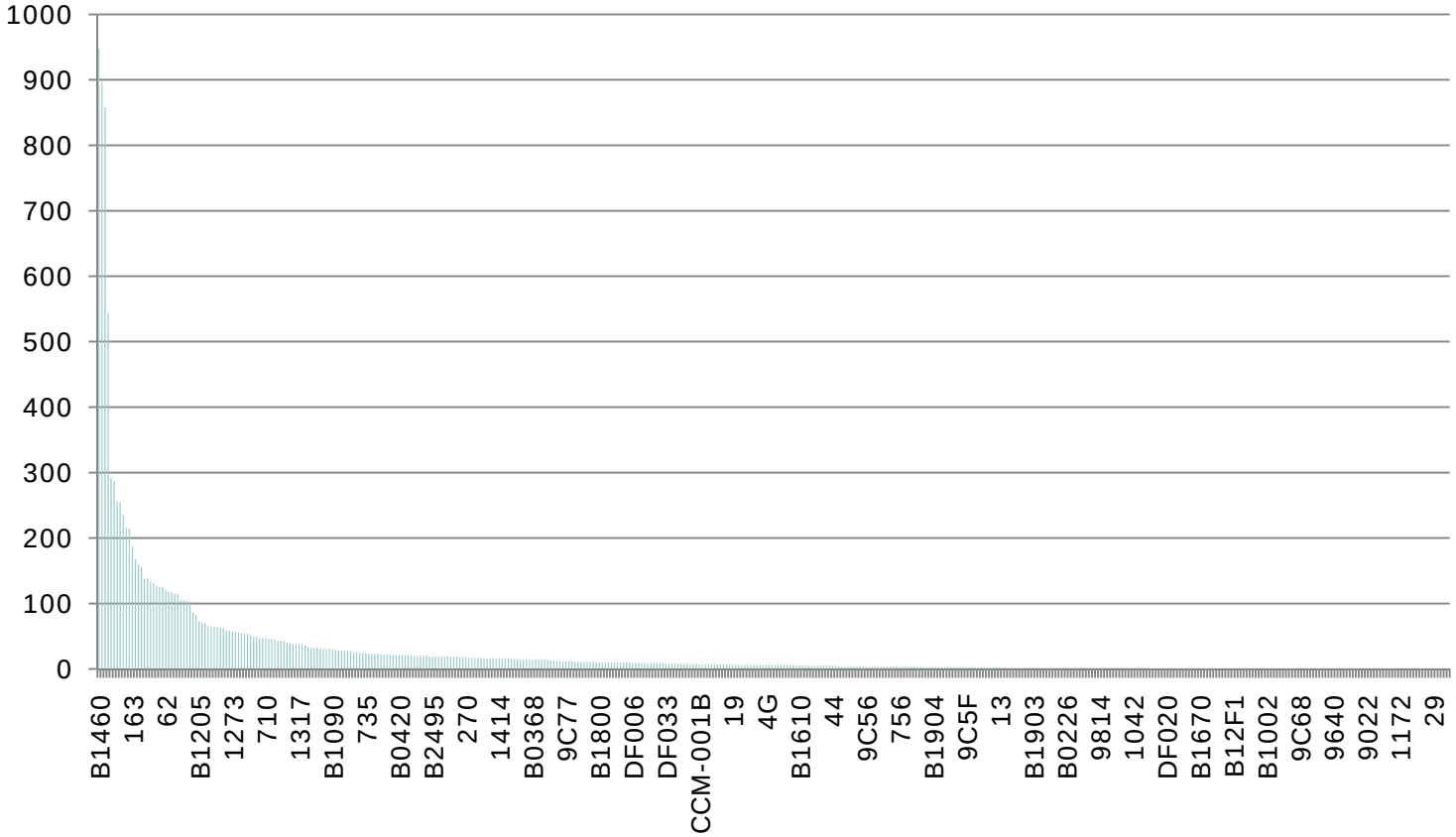
Analysis of the test results

- Trouble codes Airco – Pareto analyse



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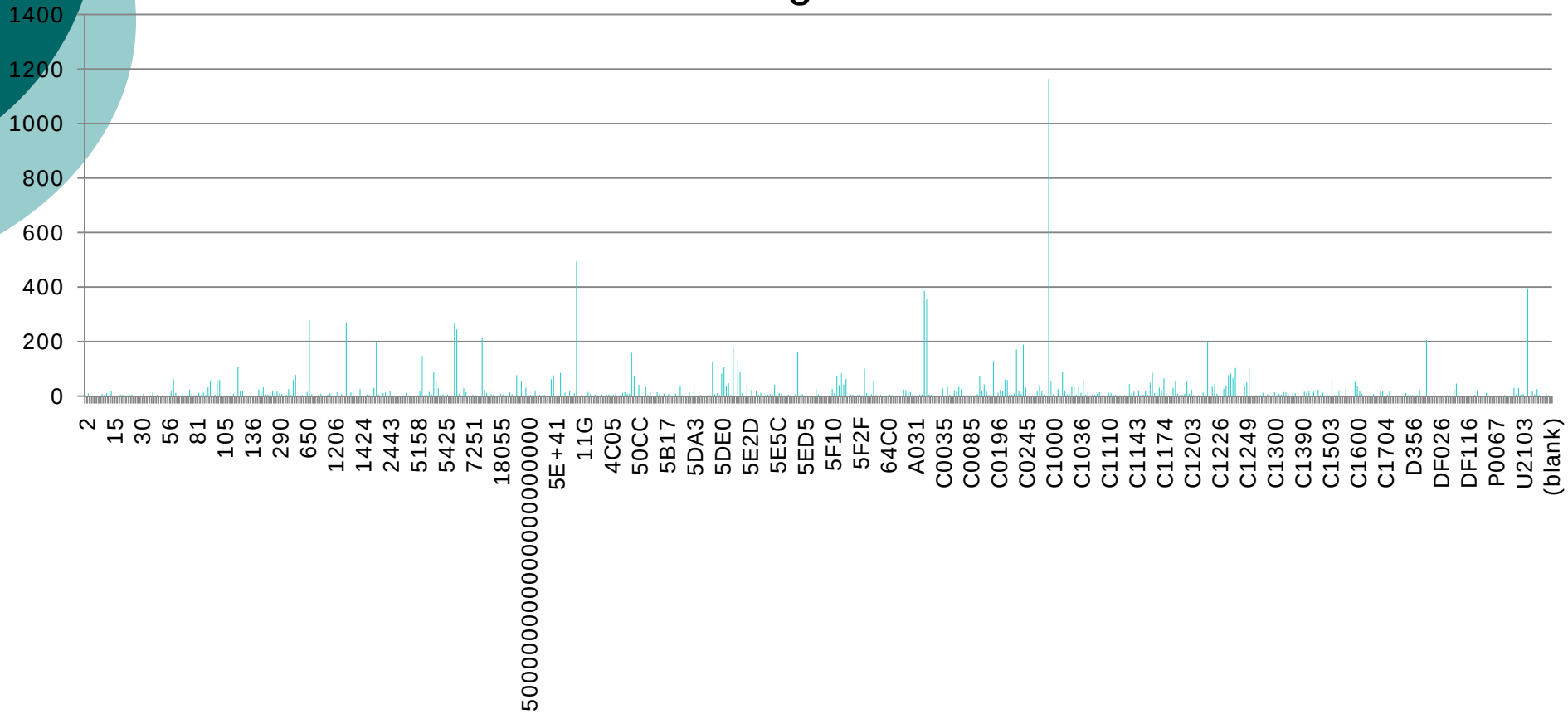
Analysis of the test results

- Top 10 Airco DTC-codes

Code	General Function	#	% Airco-codes
B1460	Cabin ventilation / disrupted Wiper Washer Pump Motor Relay Coil Circuit Short To Battery	948	8,00
-	random	897	7,57
9.460	Heater Blower Motor	858	7,24
17	Auxiliary waterpump , short to negative / rpm signal / missing	544	4,59
1.271	Damping stepper motor from temperature valve	292	2,47
1.274	Damping stepper motor from speedometer	287	2,42
B15A8	Ground valve / ground valve; left and right closed /stiff / disrupted	256	2,16
B1676	Battery Voltage out of range	254	2,14
1.596	Positioning motor, fresh air and circulation damper	236	1,99
B1598	Driver's Seat Seatback Autoglide Rearward Switch Circuit Short to Ground	216	1,82

Analysis of the test results

- Trouble codes braking



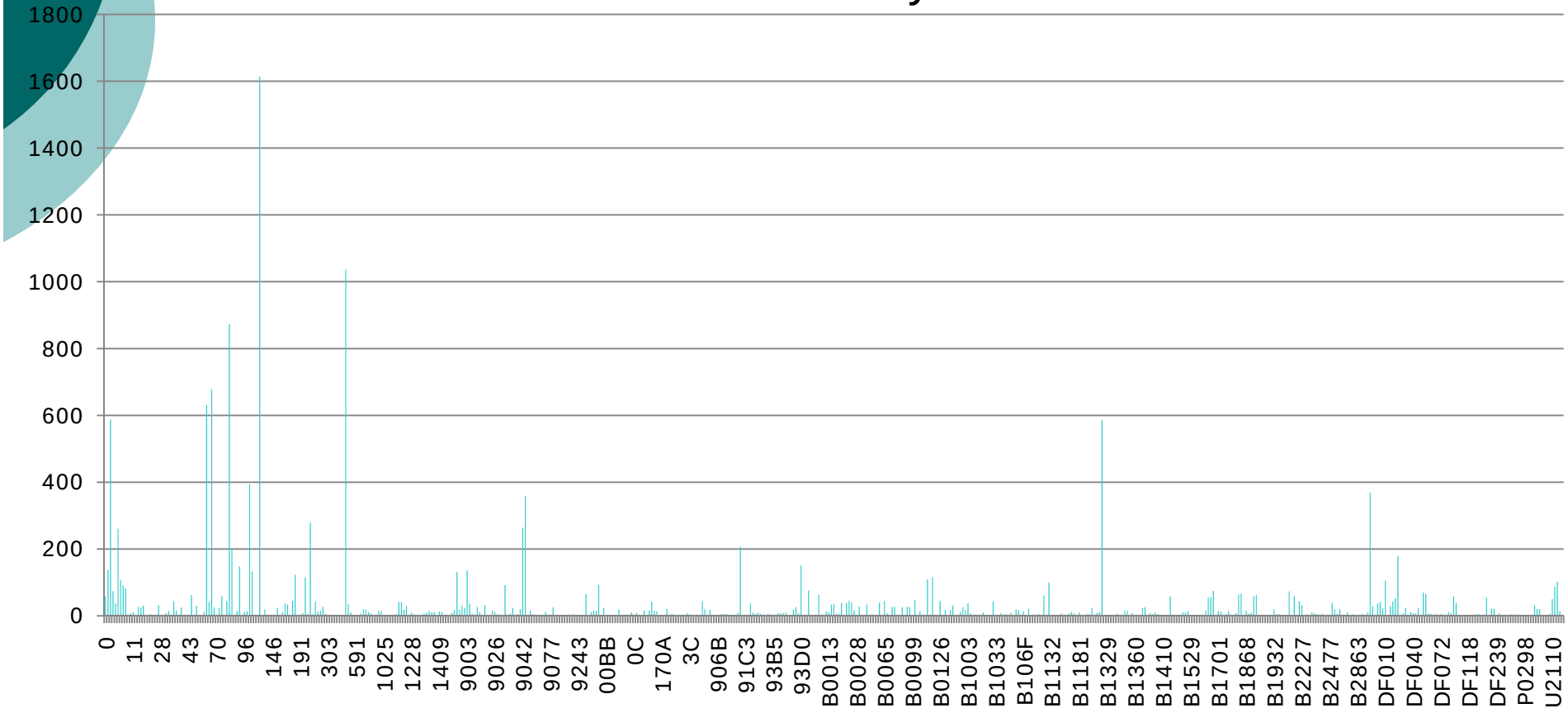
Analysis of the test results

- Top 10 Brake DTC-codes

Code	General Function	#	% Brake-codes
C0800	System Voltage Low / disrupted / Power supply control unit, value too low / battery voltage	1.164	9,00
-	Random	494	3,82
U2105	CAN Bus Error ECM (CAN no communication)	395	3,05
B1317	Battery voltage High	386	2,98
B1318	Battery voltage low	358	2,77
668	+30 voltage, not reliable / disrupted	280	2,16
1.314	CAN : no communication/ disrupted / fault codes in motor control unit	271	2,09
6.210	ABS regulation system / permanent	266	2,06
6.230	ESP operation / permanent	245	1,89
9.001	Power supply voltage too low	215	1,66

Analysis of the test results

- Trouble codes Restraint systems



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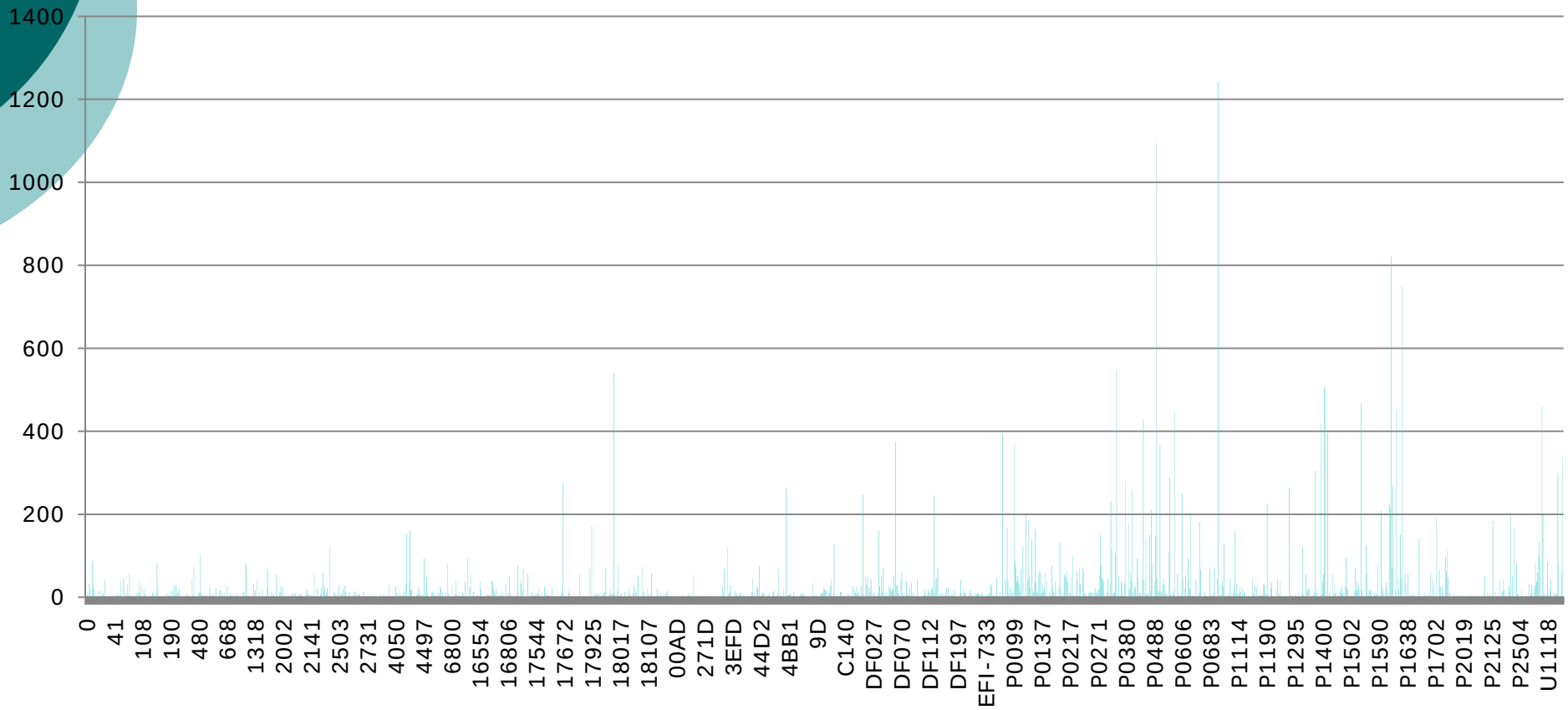
Analysis of the test results

- Top 10 Restraint System DTC-codes

Code	General Function	#	% Rest.sy-codes
111	Passenger airbag turned off / disrupted / present	1.614	10,42
532	Power supply voltage	1.036	6,69
80	Voltage VAN (Vehicle Area Network) too low	873	5,64
66	Vehicle speed information / disrupted	678	4,38
64	Voltage VAN (Vehicle Area Network) too low	631	4,07
2	Ignition circuit driver step 2, open circuit / disrupted / present / power supply control unit, value too low	587	3,79
B1318	Battery Voltage Too Low	586	3,78
98	Passenger airbag exclusion warning light / disrupted	394	2,54
DF002	Voltage computer too high	369	2,38
9.050	Multiplexed network; start multiplexed network fault detection procedure / disrupted	358	2,31

Analysis of the test results

- Trouble codes Motormanagement



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Analysis of the test results

- Trouble codes motor management
  - Not all motormanagement trouble codes are OBD related (P-codes)

# trouble codes motor management	**39.535**	**%**
# P0 trouble codes	13.804	34,92
#P1 trouble codes	10.130	25,62
# other P trouble codes	1.145	2,90

Analysis of the test results

- Trouble codes motor management

Top 10 of the P trouble codes					
Code	**General Function**	**Function**	**Type**	**#**	**% P-codes**
P0704	P07XX Transmission	Clutch Switch input Circuit	Malfunction	1.241	4,95
P0500	P05XX Vehicle Speed, Idle Control, and Auxiliary Inputs	Vehicle speed sensor	defect	1.095	4,37
P1614	P16XX Computer and auxiliary outputs			821	3,27
P1632	P16XX Computer and auxiliary outputs			751	2,99
P0341	P03XX Ignition system or misfire	Camshaft Position Sensor “A” Circuit	Range Performance	548	2,19
P1403	P14XX Auxiliary Emission Controls			505	2,01
P1404	P14XX Auxiliary Emission Controls			498	1,99
P1525	P15XX Vehicle Speed, Idle Control, and Auxiliairy Inputs			468	1,87
P1622	P16XX Computer and auxiliary outputs			452	1,80
P0571	P16XX Computer and auxiliary outputs	Cruise control brake Switch “A” Circuit	Malfunction	446	1,78

Analysis of the test results

- Trouble codes motor management

Top 10 of the P0 trouble codes					
Code	**General Function**	**Function**	**Type**	**#**	**% P-codes**
P0704	P07XX Transmission	Clutch Switch input Circuit	Malfunction	1241	4,95
P0500	P05XX Vehicle Speed, Idle Control, and Auxiliary Inputs	Vehicle speed sensor	defect	1095	4,37
P0341	P03XX Ignition system or misfire	Camshaft Position Sensor “A” Circuit	Range Performance	548	2,19
P0571	P16XX Computer and auxiliary outputs	Cruise control brake Switch “A” Circuit	Malfunction	446	1,78
P0460	P04XX Auxiliary emission controls	Fuel Level Sensor Circuit	defect	429	1,71
P0070	P00XX Fuel and air metering and auxiliary emission controls	Ambient air temperature sensor circuit	defect	396	1,58
P0100	P01XX Fuel and air metering	Mass or Volume air flow Circuit	defect	368	1,47
P0504	P05XX Vehicle Speed, Idle Control, and Auxiliary Inputs	Brake Switch Circuit 1-2 Correlation	Malfunction	368	1,47
P0562	P05XX Vehicle Speed, Idle Control, and Auxiliary Inputs	System voltage low	To high	289	1,15
P0380	P03XX Ignition system or misfire	Glow plug/ Heater Circuit “A”	defect	282	1,12

Analysis of the test results

- Definition of **P1632** is proper to the car brand or the manufacturing group

Audi:	Acceleration Pedal Position Sensor 1 Power Supply Malfunction
BMW:	Throttle Valve Adaptation; Adaptation Conditions Not Met
Buick:	Theft Deterrent Fuel Disable Signal Received
Cadillac:	Theft Deterrent Fuel Disable Signal Received
Chevrolet:	Theft Deterrent Fuel Disable Signal Received
Chrysler:	TCM Internal - Test Internal Watchdog Performance
Dodge:	TCM Internal - Test Internal Watchdog Performance
Ford:	Smart Alternator Faults Sensor / Circuit
GMC:	Theft Deterrent Fuel Disable Signal Received
Isuzu:	Theft Deterrent Fuel Disable Signal Received
Jaguar:	CAN message implausible
Jeep:	TCM Internal - Test Internal Watchdog Performance
Kia:	Battery Voltage Detection Circuit For Alternator Regulator (1.8L)
Land Rover:	Electronic throttle monitoring/self-test - limp home position not adapted.Last occurrence - plausibility
Lincoln:	Smart Alternator Faults Sensor / Circuit
Mazda:	Battery Voltage Monitor Circuit
Mercedes:	ECM
Mercury:	Smart Alternator Faults Sensor / Circuit
Oldsmobile:	Theft Deterrent Fuel Disable Signal Received
Pontiac:	Theft Deterrent Fuel Disable Signal Received
Saab:	Internal Control Module Malfunction
Saturn:	Theft Deterrent Fuel Disable Signal Received
Volkswagen:	Acceleration Pedal Position Sensor 1 Power Supply Malfunction
Volvo:	RTC

Analysis of the test results

- Trouble codes motor management

Code	General Function	#	% Rest.sy-codes
17.978	ECU / motor regulation unit blocked	541	3,74
U0422	Invalid Data Received From Body Control Module	460	3,18
DF061	Heater plug circuit	374	2,59
U2510	CAN - Communication error between the instrument cluster and the PCM (no response)	342	2,37
U2108	CAN: Can bus error ABS	299	2,07
17.664	Temperature sensor cooling liquid : open/short to positive / cooling liquid temperature sensor	274	1,90
4B90	Rail pressure control at start / Control rail pressure: rail pressure too low during engine start	262	1,81
DF014	Fuel reservoir venting magnetic valve circuit, open circuit or short / permanent / disrupted	247	1,71
DF120	OBD lighting circuit, open circuit or short / permanent / disrupted	245	1,69
U0423	Invalid Data Received From Instrument Panel Control Module	199	1,38

Analysis of the test results

- There is no relation between the non–P motor management DTC and the EOBD P-codes,
- CAN bus error codes UXXXX give also some P error codes in the system;

Conclusions : general

- 18,5% of the tested vehicles did have some trouble codes : still active ?
- Most of the OBD DTC are related to a specific vehicule manufactor
- Not all motor management DTC are EOBD P-codes

Conclusions : Future

- Acquired know-how will be used to improve the current inspections
- Study on Emission testing via EOBD
- Adapt 2e hand inspection by using VIN number
  - key : VIN number -> no input of the inspector at all during (E)OBD test
  - Additional inspection to fraude (verification of VIN number between EOBD data, data of the proper database, vehicle papers (COC) and chassis number on the vehicle)
- Detailed analysis of the (E)OBD error codes in order to introduce (E)OBD in PTI

ANALYSIS OF THE (E)OBD TROUBLE CODES

Thank you for your attention

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