Fuel Economy Measurements: Malaysia and Beyond

Methods, Challenges, Lessons

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Focus Applied Technologies

Outline

- Transportation Data required
- Various Data Collection Methods:

  NEW USED IN-USE
- Bottom Up data Collection
- Crowd Sourcing Data
- Lessons from Malaysian Study
- Ramifications for ASEAN

We need to agree on common indicators and methodologies for measuring and analyzing average new light duty vehicle fuel economy and develop the fuel economy baseline data to ensure that ASEAN member states have sufficient information and data to develop, enact and monitor fuel economy policies.

Good POLICY starts with Good DATA

What data do we need?

Trip purpose

Where people live, where they work, school, shop, etc.

What goods are produced where, Where they are processed, distributed, sold

Passenger (or freight) centric data:

Passenger km per year per vehicle (Car, motor, bus, taxi, train)

Modal Split: Car vs. motorcycle vs. bus

Vehicle centric data:

Fuel Consumption per km (or per passenger km)

Emissions

Fuel Consumed per ton-km of freight

Traffic Data:

Traffic concentration, flow rates, speeds

We can make changes to:

City layout, transportation infrastructure, vehicle types, fuel tariffs

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For FE Policy

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How do we get it?

Top Down

Oil Companies know their annual volumes
Governments know the “registered” vehicle fleets

Road Side Measurements

Counting vehicle types, occupancy rates, speeds

Individual Vehicle Data Logging – Dyno Measurements

Tracking vehicles in traffic for speed, location, FC, Emissions
Testing road vehicles on a dynamometer for FC, Emissions

Surveys

Vehicle types, Annual mileages, trip purposes, Fuel cost

Crowd Sourced Data

Massive amounts of data on speed, location, start/stop points

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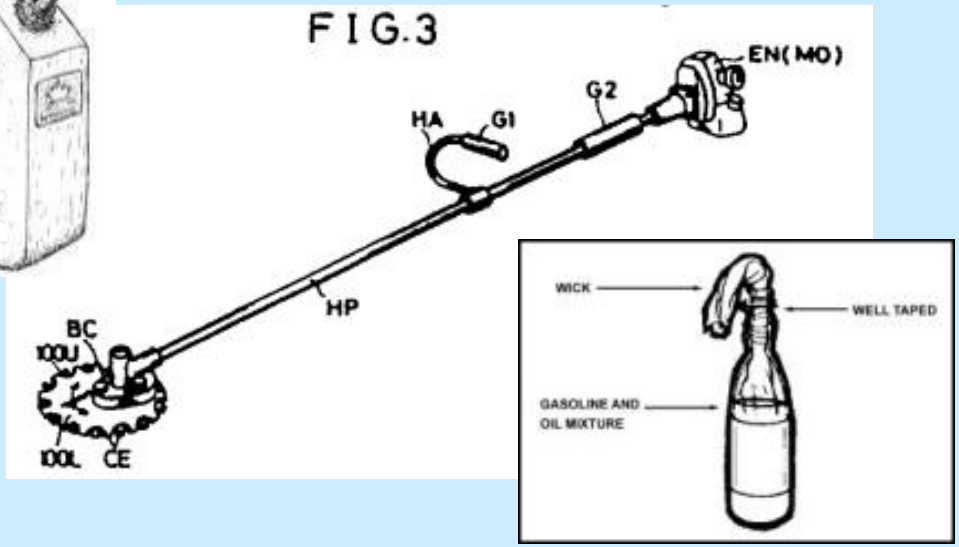
Top Down Oil Consumption

+ Good stats as there are few companies, and data is carefully tracked
- Mode split to various modes, and vehicles is difficult
- “Leakage” to other uses

Leakage (Petrol):
Grass Trimmers
Small Gen Sets, Pumps
Unregistered Vehicles
Outboard Engine Boats
Cross-Border Smuggling
Molotov Cocktails

Leakage (Diesel):
Gensets, Pumps
Marine Applications
Agricultural equipment



Top Down Fleet Data

Fuel Economy:

+ All car manufacturers have FE numbers on their vehicles for most major drive cycles (FTP, ECE, etc.)

- Some times they cheat!

Vehicle Fleet Data from Registrations, Road Tax and etc.:

Number, type, fuel type

- Misses “unregistered” vehicles

Vehicle Mileage: Inspections (Annual, at time of re-sell)

Passenger load: May have upper legal limit per body type

- Not realistic estimate

Vehicle Usage: Some vehicles restricted to some activities

-Not generally realistic

Bottom Up Measurements

Individual Vehicle Statistics

Total km traveled per year / Total Fuel Consumed (per year) Good but averaged over 1 year of trips (Work/School Commute? Going to store? Weekend outings?)

Individual tank measurements

Good average data, but significant single tank variation at pump.
Requires many fill-ups to give realistic numbers.
Multi-trips means different purposes.

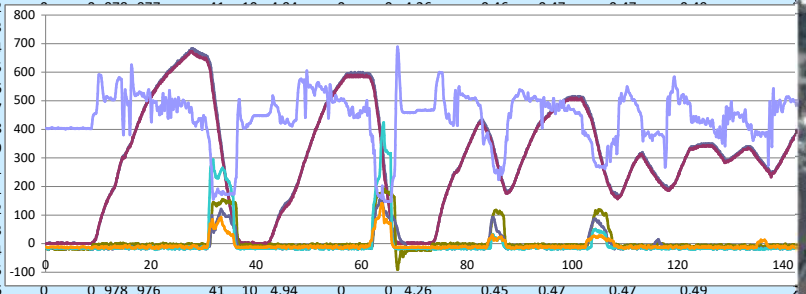
Instrumented Vehicles

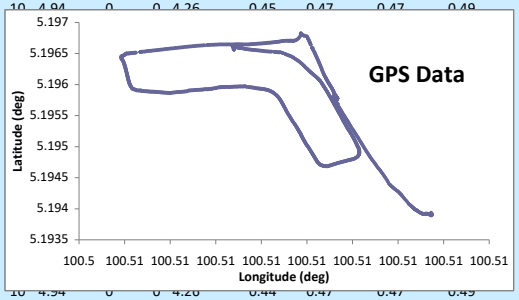
Determine Drive Cycle (speed, FC, emissions…)
Trip Purpose: From Origin/Destination
Passenger load: Suspension Load Sensor

- One vehicle at a time, slow

FOCUS APPLIED TECHNOLOGIS 2016
DATA LOGGER VER2.0
Data From LT00017

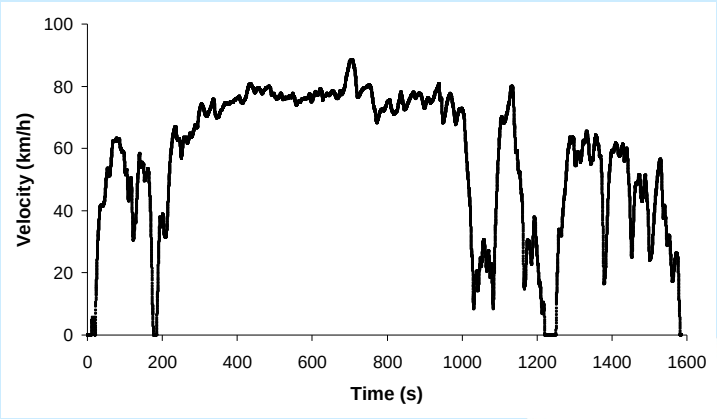
Time (sec)	RPM1 (rpm)	RPM2 (rpm)	TC1 (C)	TC2 (C)	IRtherm (C)	Th2 (C)	MAP (V)	Vdiv1 (V)	Vdiv2 (V)	LC (V)	FrontTorq (V)	Handle (V)	RearTorq (V)	LegPedal (V)	Displacement (V)	AccelX (mg)	Avg Acc	AccelY (mg)	AccelZ (mg)	Lat (deg N)	Lon (deg W)
0.1	0	0	979	977	41	10	4.94	0	0	4.26	0.47	0.47	0.47	0.49		2.8	621	579.83	11	814	5.1939001	100.5083700
0.2																					
0.3																					
0.4																					
0.5																					
0.6																					
0.7																					
0.8																					
0.9																					
1																					
1.1																					
1.2																					
1.3																					
1.4																					
1.5																					
1.6	0	0	978	976	41	10	4.94	0	0	4.26	0.45	0.47	0.47	0.49							
1.7	0	0	979	977	41	10	4.94	0	0	4.26	0.45	0.47	0.47	0.49							
1.8	0	0	979	976	40											2.79	612	582.33	29	799	5.1938998	100.5083633
1.9	0	0	979	977	40											2.8	626	571.6	18	899	5.1938993	100.5083625
2	0	0	979	977	41											2.8	464	560.57	3	916	5.193897	100.5083616
2.1	0	3	979	977	41											2.8	555	566.17	6	921	5.1938954	100.5083608
2.2	3	0	979	978	41											2.8	483	565.63	38	895	5.1938948	100.5083595
2.3	0	3	979	978	41											2.8	652	567.43	29	803	5.1938964	100.5083562
2.4	3	3	980	977	41											2.81	615	565.53	32	743	5.1939015	100.5083517
2.5	3	0	979	978	41											2.8	531	563.3	6	822	5.1939055	100.5083468
2.6	0	0	978	978	40											2.8	596	563.07	18	857	5.1939093	100.5083418
2.7	0	0	978	977	40											2.8	501	565.43	158	924	5.1939119	100.5083377
2.8	0	3	977	978	40											2.8	545	571.93	109	903	5.1939151	100.5083333
2.9	0	0	978	979	40											2.8	600	577.1	65	851	5.193917	100.5083288
3	3	3	978	978	40											2.8	747	577.4	115	732	5.193919	100.508324
3.1	0	3	978	976	41											2.8	670	574.63	129	739	5.1939201	100.50832

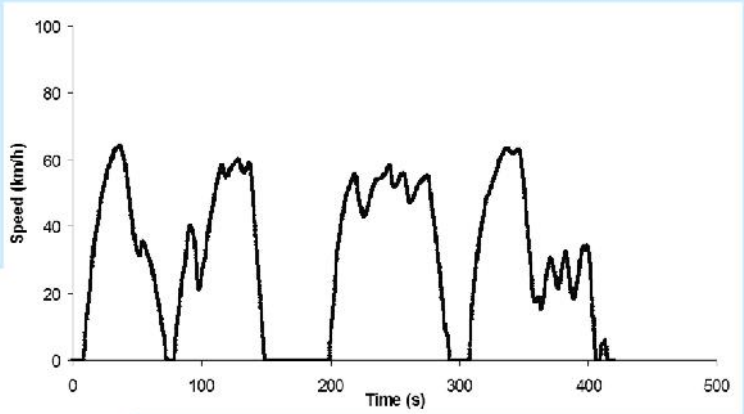


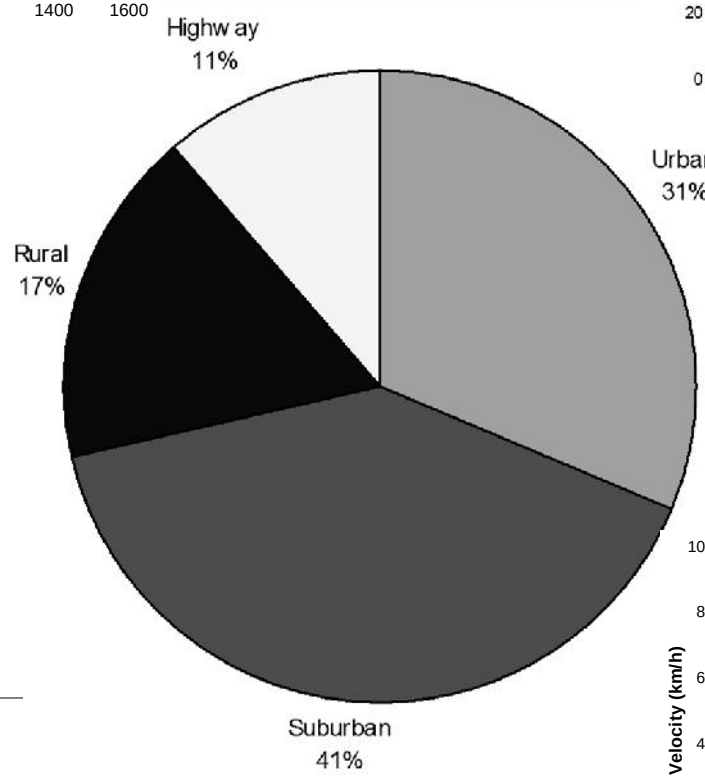


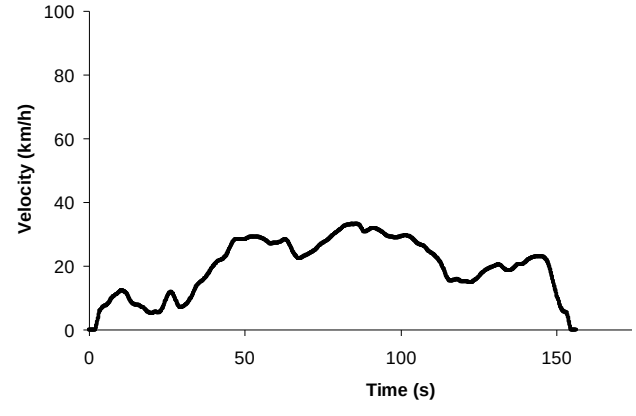
Bottom Up Measurements

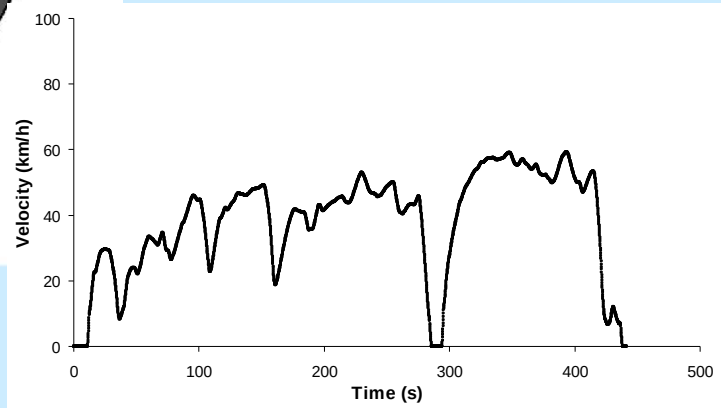
In Malaysia we determined four different drive cycles for motorcycles:











Real-World, but labor/time intensive.

Bottom Up Measurements

Petrol Station Survey: Good annual mileage numbers

Problem: Proton Odometers fail at 14-16 years

	Date:	1/15/2016	Friday			Time:	11.30am		Tech:	Leo					
	Loc:	Petron Jln Pmtg. Tok Mahat, Parit Buntar				RM/l:	2								
										17062	**km/year**		**13**	**km/liter**	
	Observation					ODO (km)		Fill			Annual	Stated	Calc	Filt	
	TYPE	**BRAND**	**PLATE**	**PAX**	**YEAR**	**1000's**	**RM/FILL**	**per mo**	**Age**	**KM/Year**	**Fuel RM**	**km/l**	**km/l**	**km/l**	**Purpose**
1	PC	BMW	PEW 333	1	2001	327	60	4	14	23357	240	15	16.2	16.2	
2	PC	Proton	PJE 8019	1	2009	212	50	12	6	35333	600	9	9.8	9.8	Comute to Work
3	PC	Toyota MPV	PFT 135	1	2003	327	130	3	12	27250	390		11.6	11.6	
4	PC	VIVA	AJK 2204	2	2013	28	40	3	2	14000	120		19.4	19.4	Send Kids to School
5	PC	CHARADE AU	PBV 6364	3	1985	236	30	4	30	7867	120		10.9	10.9	
7	PC	Waja	WKU 5288	3	2006	107	20	14	9	11889	280		7.1	7.1	
8	PC	Wira	PHA 2255	1	2005	140	20	8	10	14000	160		14.6	14.6	
9	PC	Camry	WER 8336	2	1996	455	70	1	19	23947	70		57.0		RM70-100 every day, due to working lumut
11	PC	Honda City	PCW 6126	1	2005	210			10	21000	0				not her car
12	PC	Kenari	PCGX 786	2	2006	141	50	4	9	15667	200		13.1	13.1	
13	PC	Myvi	PHA 7337	1	2009	103			6	17167	0				car for sell
14	PC	Alza	PKQ6667	1	2012	44	50	3	3	14667	150		16.3	16.3	
15	PC	Almera	PLU 1862	1	2014	19	70	3	1	19000	210		15.1	15.1	
16	PC	Iswara	JFL 5290	1	2003	134	30	4	12	11167	120		15.5	15.5	
18	PC	Kancil	PER 7877	1	2000	326	40	10	15	21733	400		9.1	9.1	
19	PC	Almera	PLG 2240	1	2013	19	50	1	2	9500	50		31.7		
20	PC	Myvi	PLS 5047	1	2013	17	50	2	2	8500	100		14.2	14.2	
21	PC	Myvi	PGX 6477	1	2010	106	30	4	5	21200	120		29.4		
22	PC	Myvi	ATB 5152	2	2009	90	50	4	6	15000	200		12.5	12.5	
23	MPV		PGL 2804	1	2014	9	100	1	1	9000	100		15.0	15.0	

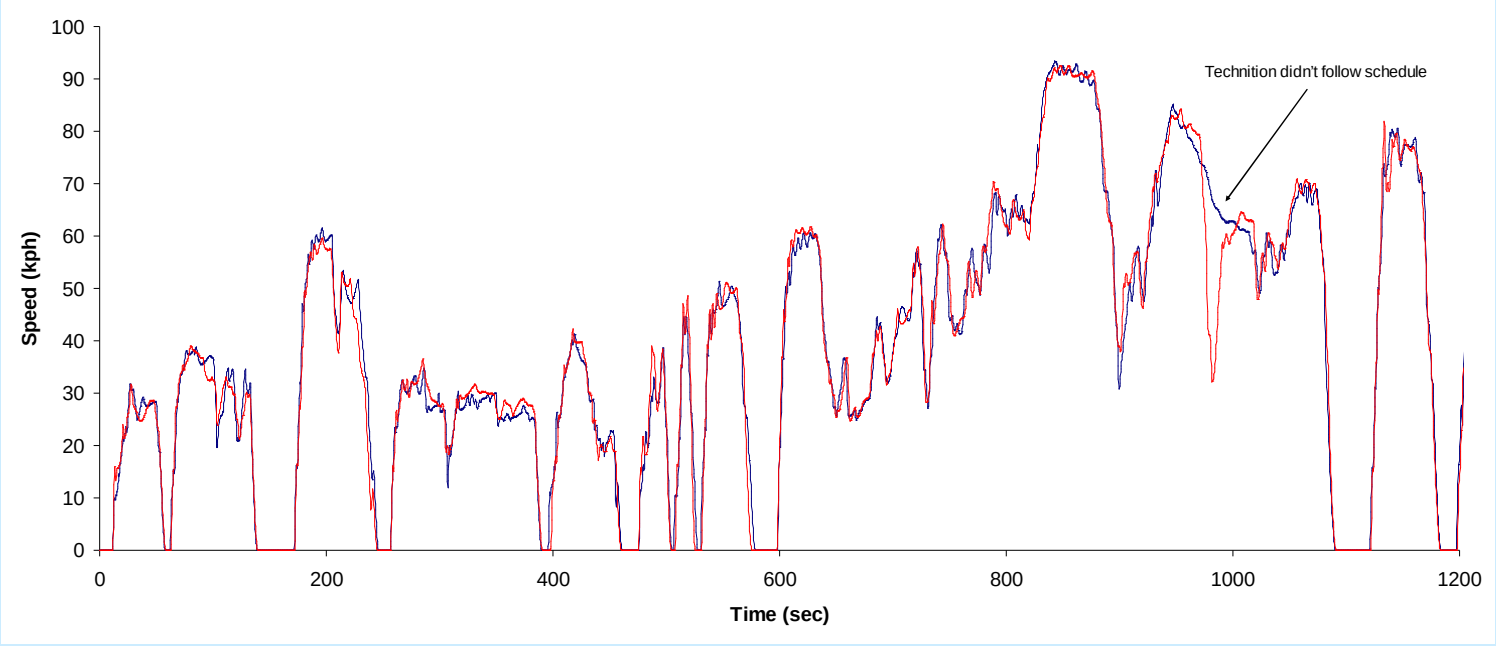
Vehicle Sequestration Measurements

Pulling vehicle from road for Weight or Dyno test:

+ Excellent Weight, Emissions, FC, Vehicle Technology

- Slow

- Invasive



Dynamometer Measurements

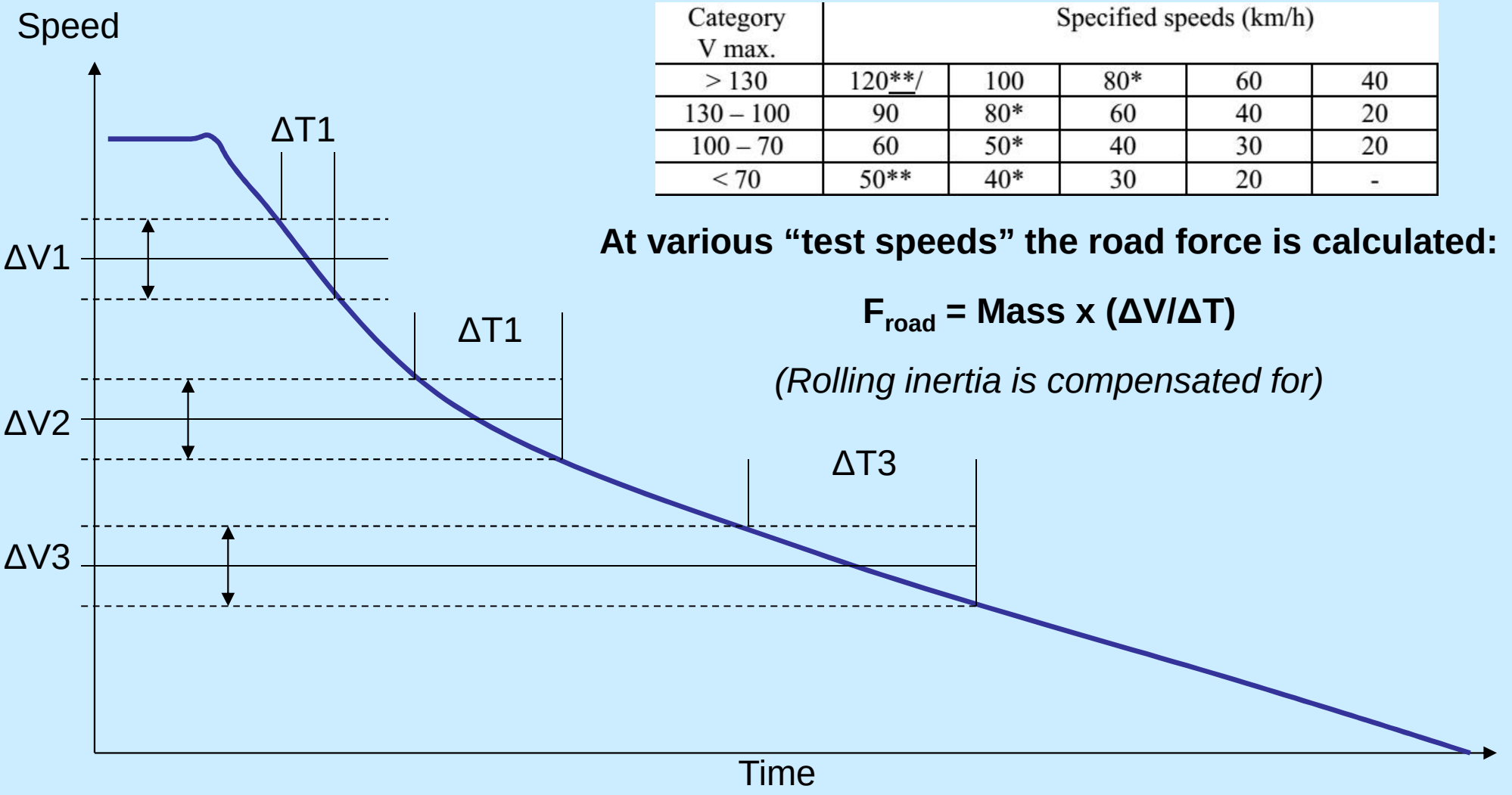
Operator drives vehicle to follow drive cycle.
Emissions are measured from exhaust and calculated to gm/km.
Fuel consumption can be measured gravimetrically or volumetrically from special tank or burette, or from the CO2, CO and HC emissions.

Dyno measurements require careful calibration of the load and emissions measurement equipment.

Dynamometer Calibration

Calibration begins by measuring the vehicles "spin down" speed profile on a flat road. Multiple measurements are made in a short period of time to insure "warm" bearings and tires.

Category V max.	Specified speeds (km/h)				
> 130	120**/	100	80*	60	40
130 – 100	90	80*	60	40	20
100 – 70	60	50*	40	30	20
< 70	50**	40*	30	20	-



At various "test speeds" the road force is calculated:

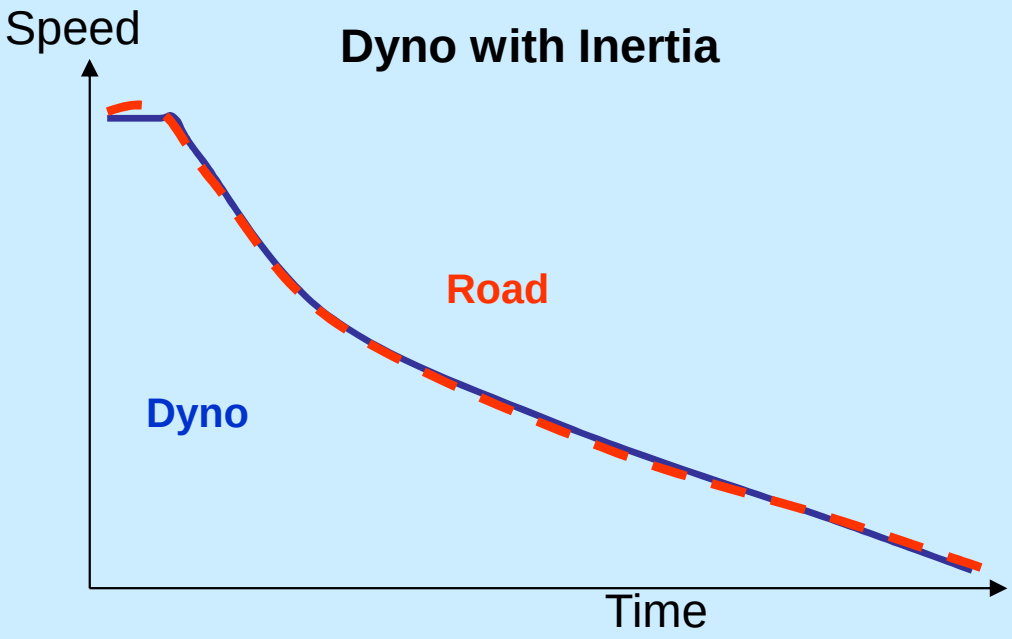
$$F_{road} = Mass \times (\Delta V/\Delta T)$$

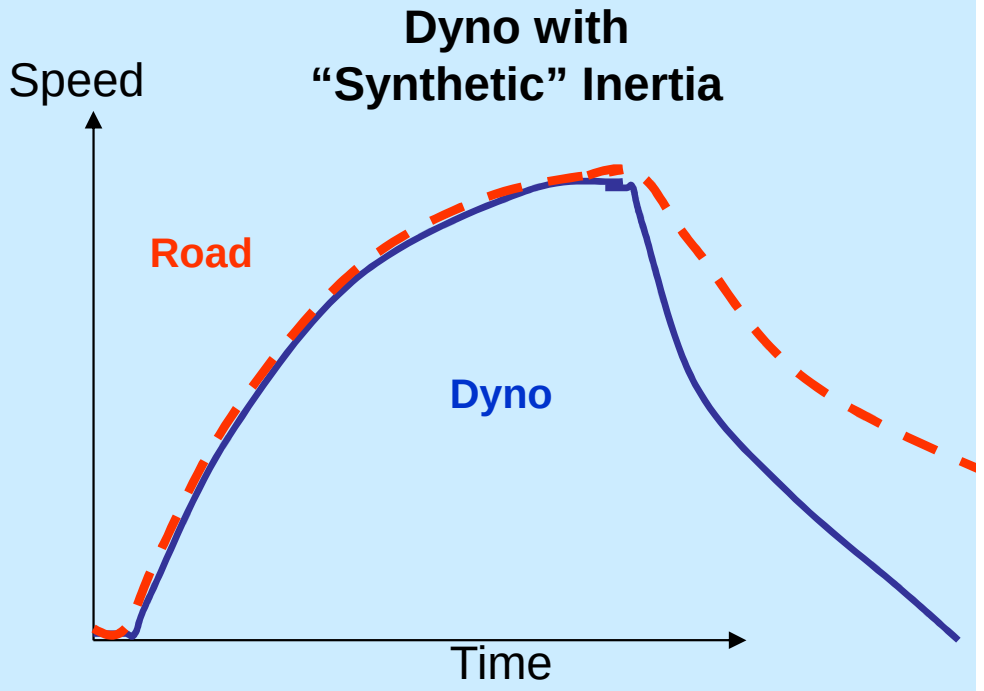
(Rolling inertia is compensated for)

Dynamometer Calibration

Inertial dyno's have the inertia adjusted to agree with the vehicles mass. Verification of dyno calibration can be done via a dyno "spin down" test, looking at the .

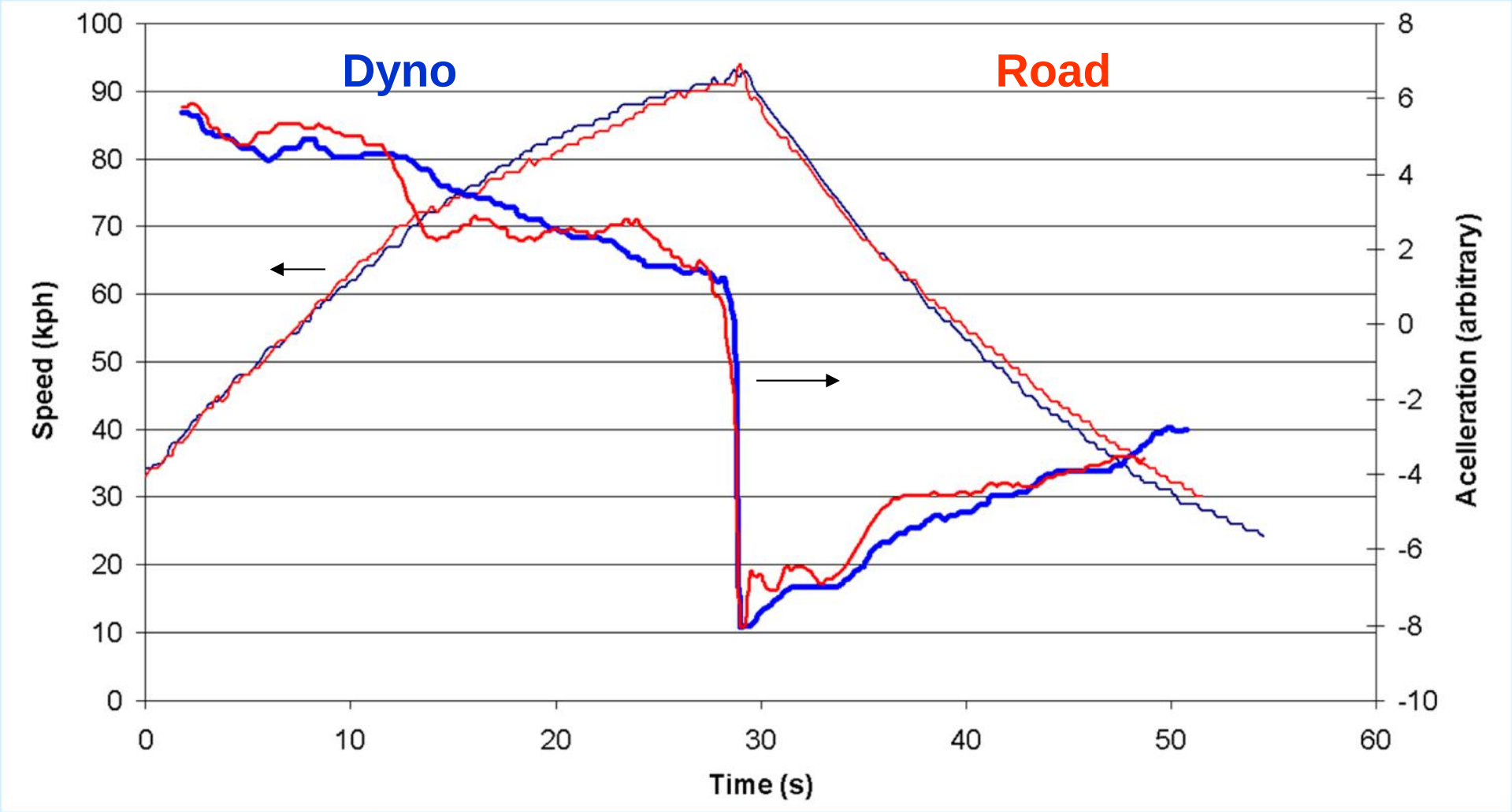
Non-inertial dynos can mimic inertia via acceleration proportional load. This is easier verified with an acceleration test.





Dynamometer Measurements

In the end the dyno power has to match the road load to within 5%.



Dynamometer FC from Emissions

CO2, CO and HC's are measured in gm/km, then fuel consumption is calculated as follows:

$$FC = (0.1155 / D) \cdot [(0.866 \cdot HC) + (0.429 \cdot CO) + (0.273 \cdot CO_2)]$$

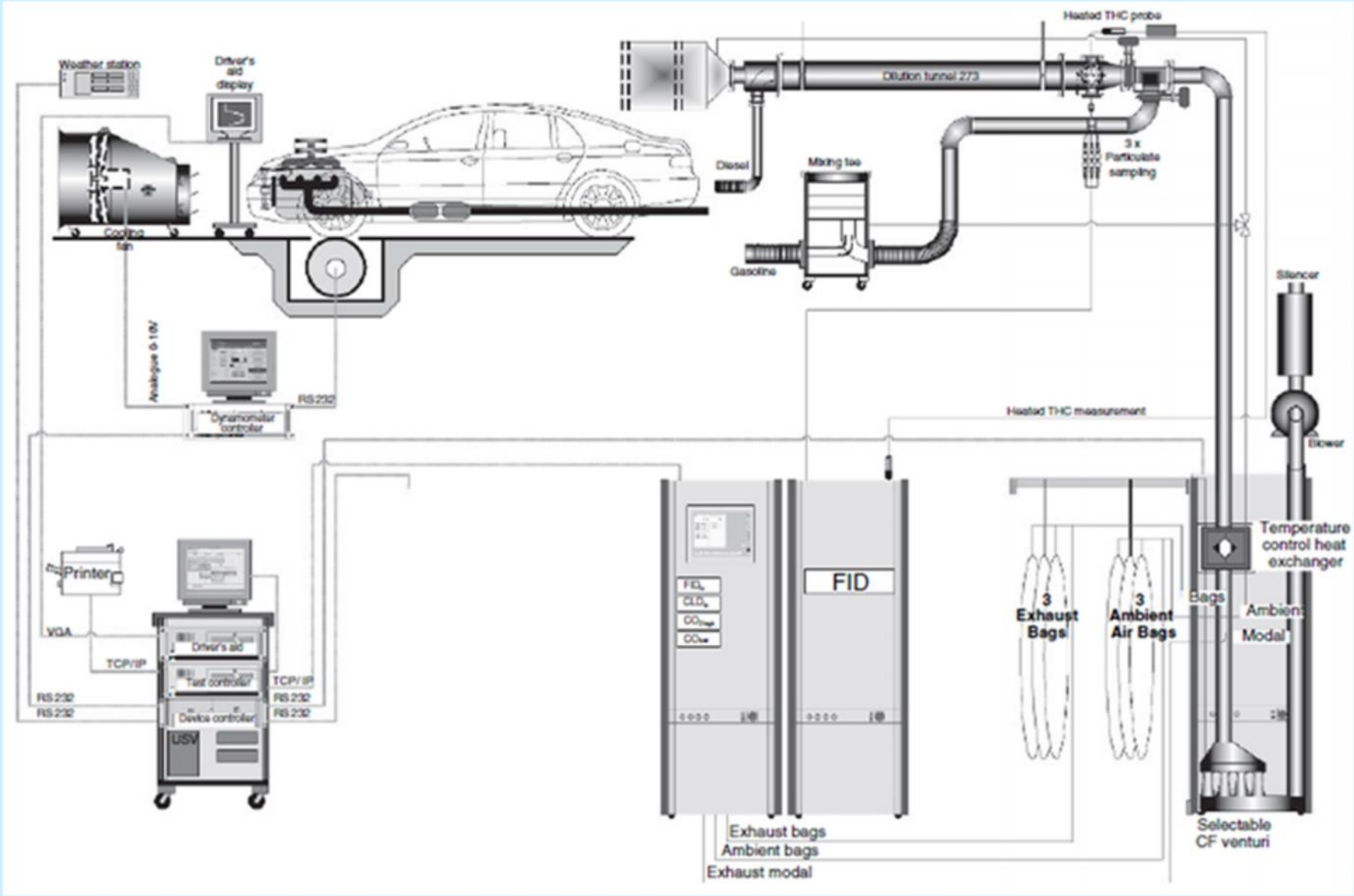
In these formulae:

FC	=	the fuel consumption in litre per 100 km (in the case of petrol, LPG or diesel) or in m^3 per 100 km (in the case of natural gas)
HC	=	the measured emission of hydrocarbons in g/km
CO	=	the measured emission of carbon monoxide in g/km
CO_2	=	the measured emission of carbon dioxide in g/km
D	=	the density of the test fuel.

LPG, CNG and other fuels have a slightly different formula based on the chemistry and density of the fuel.

Dynamometer FC from Emissions

Continuous Volume Sampling (CVS) systems are fairly expensive.



Dynamometer Standard Measurements

Standard fuel consumption and emissions data can be measured from the chosen drive cycle:

Measures	Description	Unit
Fuel consumption	Litres of gasoline equivalent per 100 kilometers	Lge/100km
CO_2 emissions	Grams CO_2 per kilometer	gCO_2/km
Energy	Litres of gasoline equivalent	Lge
Indicators	**Description**	**Unit**
Energy efficiency of the new LDV fleet	Sales weighted average of tested new LDV fuel consumption	Lge/100km
Carbon intensity of the new LDV fleet	Sales weighted average of tested new LDV CO_2 emissions	gCO_2/km
Conversion factors	**Description**	**Unit**
Fuel specific energy content	Litres of gasoline equivalent	Lge
Fuel specific carbon dioxide emissions	Grams CO_2 per litre of gasoline equivalent	gCO_2/Lge
Methodologies	**Description**	
Fuel consumtpion measurements	New European Driving Cycle, World Light duty vehicle Test Cycle	
Pollutant emission measurements	Euro I to VI	
Fuel quality measurements	Euro I to VI	

Using standard units make it easier to compare vehicles and standards.

Dynamometer Measurement Issues

Dynamometers are pretty straight forward, but they do have to be carefully calibrated. Inertia matching is usually only approximate, but modern controllers can compensate for inertia precisely.

Fuel consumption is easy to measure gravimetrically or volumetrically, but requires modification of the vehicle for and external fuel supply (and often a pump). Alternatively fuel flow sensors can be used, usually requiring 2 sensors :Supply and Return.

Emissions based FC measurements generally depends on an expensive and elaborate CVS system. A less expensive system involves measuring the air flow and tail pipe emissions, then calculating the grams of emissions from airflow and nitrogen balance.

Drive Cycles: NEDC

New Euro Drive Cycle is ECE-15 (or UDC) plus the Extra-Urban Drive Cycle

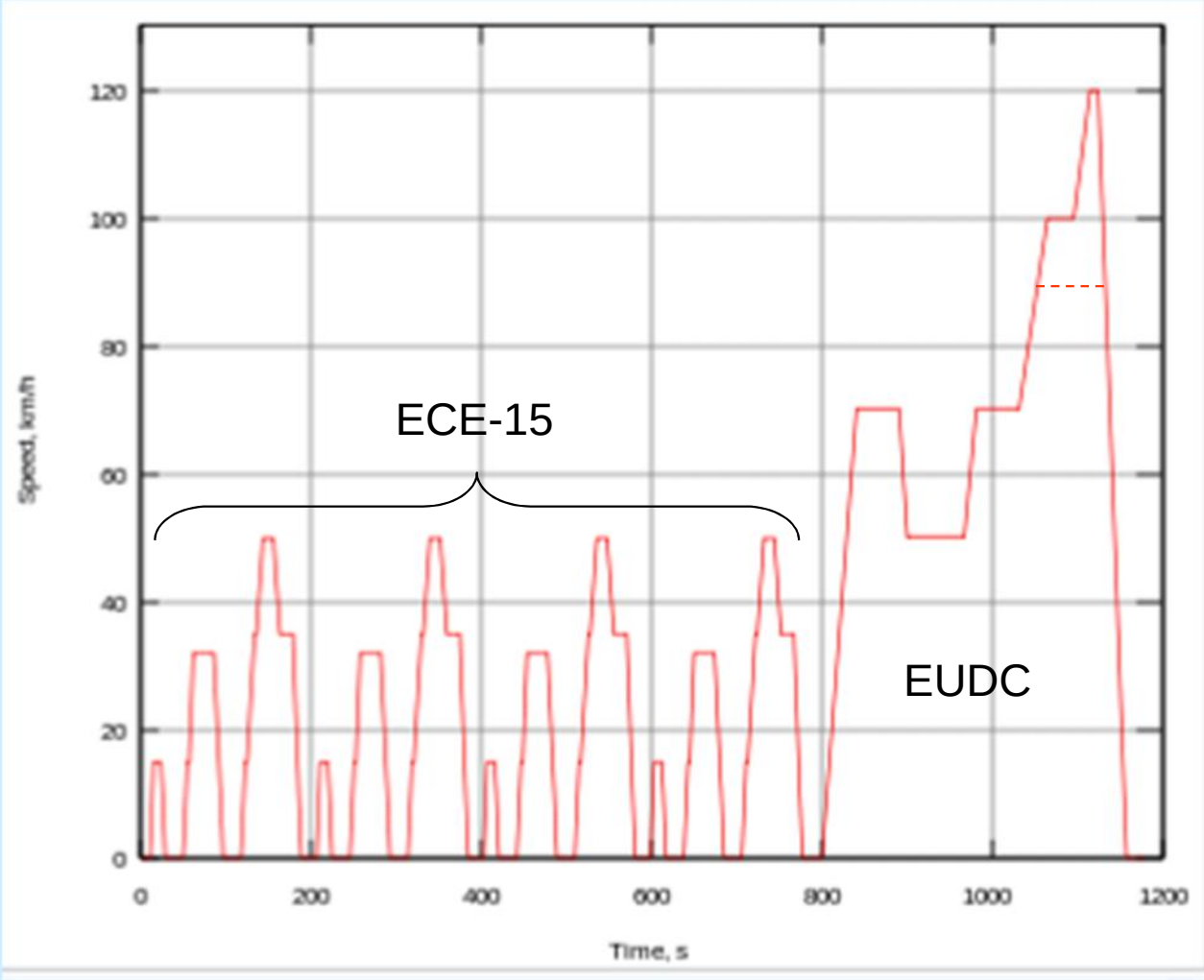
Lower power vehicles limit top speed to 90kpk, rather than the 120kph EUDC

Unrealistic low-acceleration

Doesn't correlate very well with real world driving, FC or Emissions

There are also concerns that manufacturers "cheat" on the vehicle configuration body parts, tire pressure…

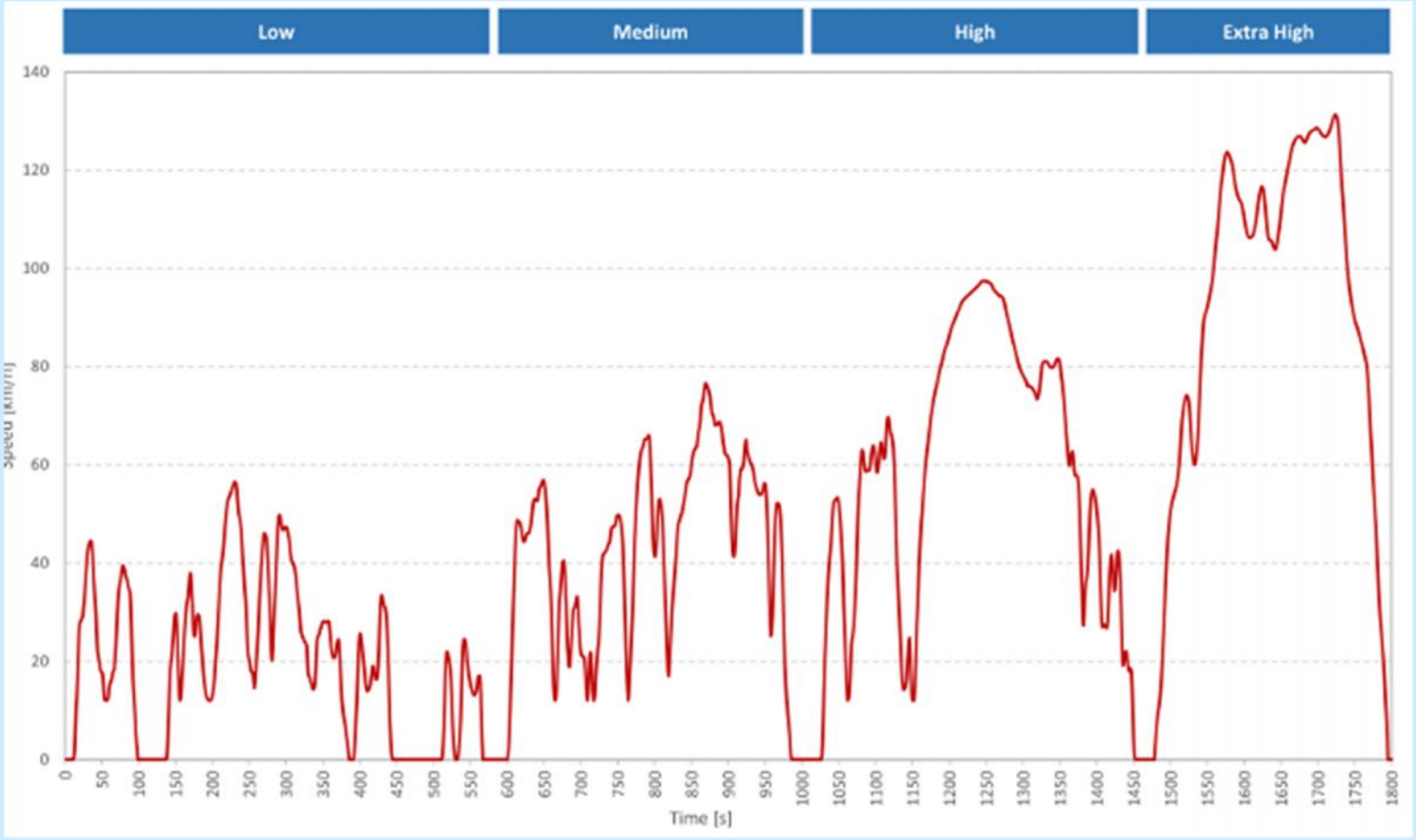
Many countries (inc. M'sia) follow this test pattern.



Drive Cycles: WLTP

World Light vehicle Test Procedure has different drive cycles based on the vehicle power to weight ratio. Shown here is the passenger car cycle.

Although the speeds and variations are more realistic, accelerations are still low.



Drive Cycles: General Issues

While drive cycle testing is a good way to compare vehicles it can be quite deceptive for two main reasons:

1) The drive cycle may not reflect real-world conditions
Actual traffic speeds, accelerations, durations and hill climb are all highly variable and localized parameters.

For example a Honda Civic rated at 16km/l (drive cycle) gets 5km/l in Manila

2) Vehicle to Vehicle differences can be greatly effected by the drive cycle. Hybrid power systems have basically no advantage when running on highway modes, which they can show significant improvements on "stop and go" urban cycles.

NOTE: Hybrid Vehicles are usually smaller, lighter and more expensive than "equivalent" conventional vehicles, and this may give the vehicle some advantages, but a truly similar size and weight vehicle may out perform the hybrid.

Drive Cycles: General Issues

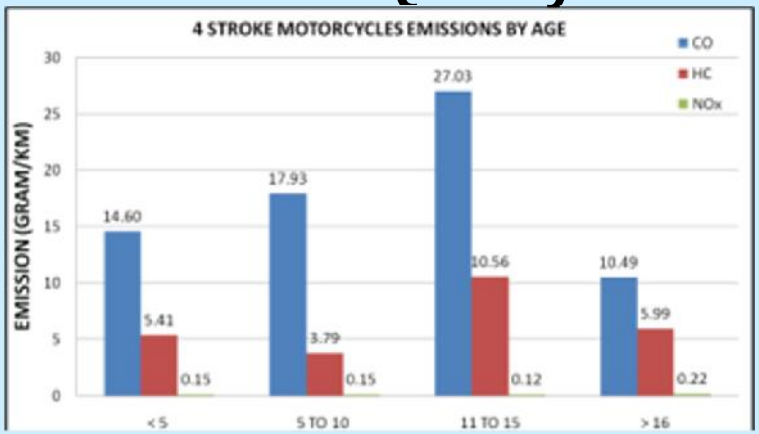
BMW 320Ed
161hp
25.7km/liter

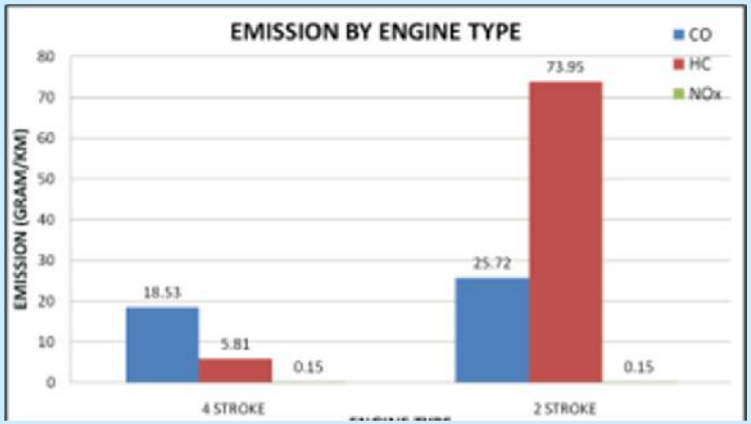
Toyota Prius
134hp
24.6km/liter

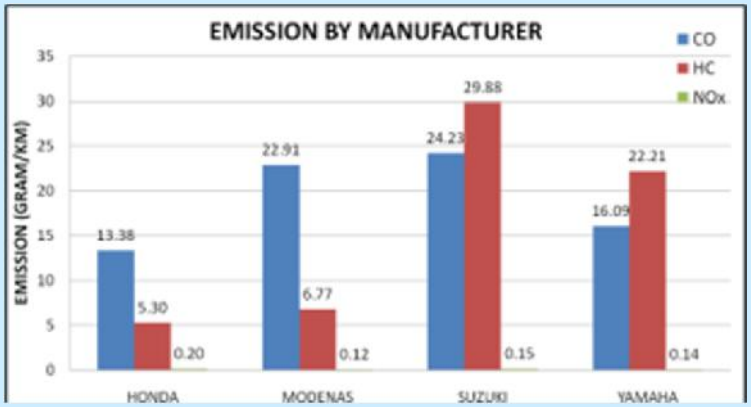
Normal Road Mileage

IN USE Vehicle Measurements

Slow to get this data
But *Excellent* Quality Data





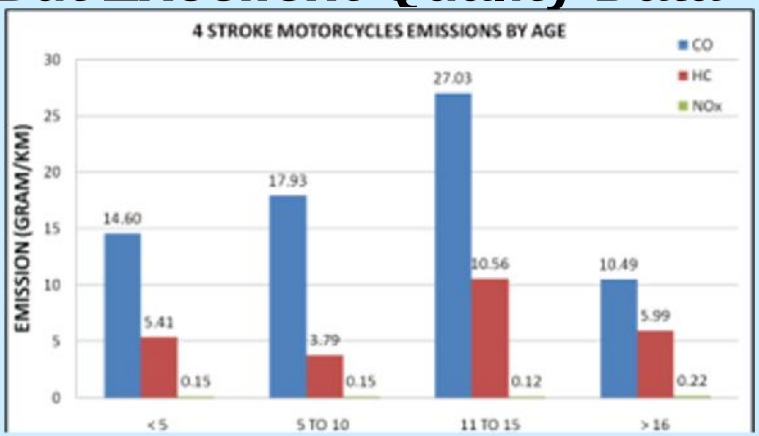


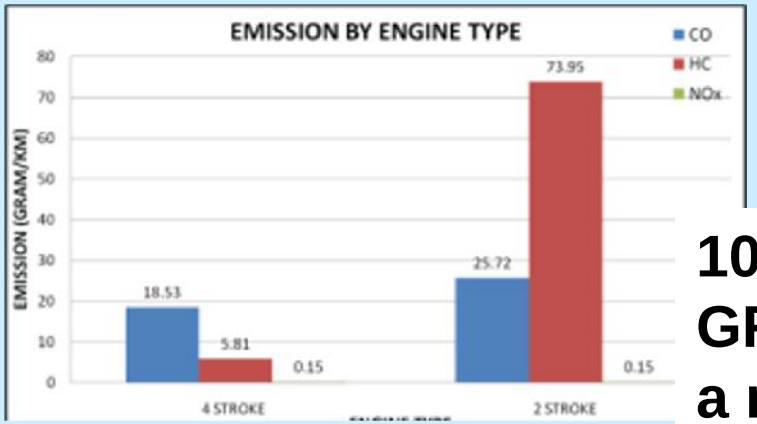
EMISSION STANDARDS (gram/km) FOR 4 STROKE MOTORCYCLES (TESTED WITH ECER40)							
MOTORCYCLE MODEL	TYPE	REGISTRATION NUM	NUM OF YEARS	CO2	CO	HC	Nox
< 5 YEARS							
YAMAHA LAGENDA 110Z	4 Stroke	PJG9152	3 month	48.05	12.86	1.48	0.13
YAMAHA LAGENDA 110Z	4 Stroke	AGS4586	1	47.3	13.96	1.94	0.15
HONDA WAVE125	4 Stroke	PGT5609	2	45.2	13.96	3.34	0.09
YAMAHA EGO SCOOTER	4 Stroke	WQY8290	2	74.43	18.25	1.17	0.18
YAMAHA 135LC SUPER SPORTS	4 Stroke	JKG4342	3	NOT AVAILABLE			
HONDA WAVE100	4 Stroke	AFM244	4	46.41	7.86	1.78	0.22
MODENAS KRISS100	4 Stroke	PGP6592	4	41.05	13.96	19.14	0.18
5 TO 10 YEARS							
HONDA WAVE100	4 Stroke	KBM3972	6	49.46	9.68	3.08	0.24
MODENAS KRISTAR	4 Stroke	PGG3191	5	43.03	18.67	3.51	0.06
SUZUKI SMASH 110	4 Stroke	AFG6350	6	61.03	14.96	2.47	0.16
SUZUKI SMASH	4 Stroke	AFJ6093	6	44.68	25.06	2.98	0.18
MODENAS KRISS 1	4 Stroke	AEN9450	4	55.39	24.97	3.68	0.11
MODENAS KRISS 1	4 Stroke	AEN7854	7	39.49	23.91	2.77	0.06
MODENAS KRISS SG	4 Stroke	AEN9885	8	58.1	17.69	2.21	0.06
MODENAS KRISS 1	4 Stroke	AEB3498	8	39.78	13.96	1.83	0.09
HONDA EX-5	4 Stroke	PFK4258	8	44	10.76	2.34	0.17
SUZUKI FX110	4 Stroke	AEN8275	8	45.06	17.93	3.98	0.14
HONDA EX-5	4 Stroke	TAH5874	9	232.72	27.09	13.54	0.25
HONDA EX-5	4 Stroke	PFC4559	10	53.64	11.17	2.82	0.23
11 TO 15 YEARS							
MODENAS KRISS110	4 Stroke	PEJ3793	12	53.66	15.89	1.23	0.18
SUZUKI FX110	4 Stroke	PEY6903	11	52.02	22.98	3.16	0.08
MODENAS KRISS110	4 Stroke	PEJ3793	12	67.23	28.4	2.98	0.16
MODENAS KRISS110	4 Stroke	ADR5227	12	44.3	45.56	19.47	0.11
MODENAS KRISS110	4 Stroke	ADR5227	12	34.15	23.88	4.55	0.08
YAMAHA SPORTS 100 Cdi	4 Stroke	KAJ8301	15	52.44	21.4	24.58	0.05
> 16 YEARS							
HONDA C70 DELUXE	4 Stroke	ACM2337	16	44.3	4.05	2.53	0.18
HONDA C70	4 Stroke	DR3893	22	42.05	16.93	9.45	0.25

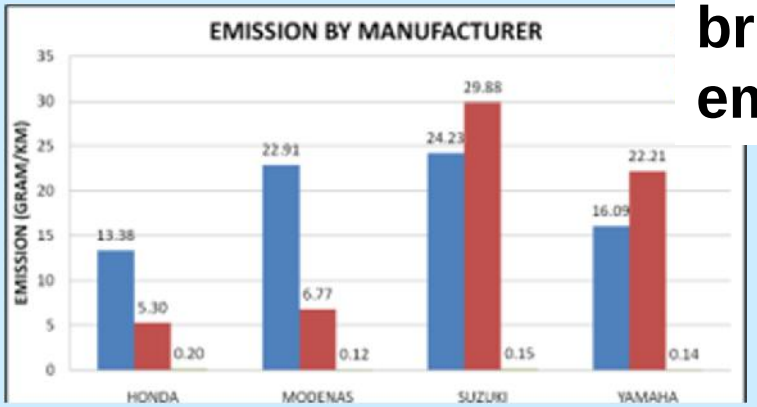
IN USE Vehicle Measurements

Slow to get this data

But *Excellent* Quality Data







10% of in-use vehicles were GROSS failures. In each chase a relatively minor repair brought them back to typical emissions.

EMISSION STANDARDS (gram/km) FOR 4 STROKE MOTORCYCLES (TESTED WITH ECER40)							
MOTORCYCLE MODEL	TYPE	REGISTRATION NUM	NUM OF YEARS	CO2	CO	HC	Nox
< 5 YEARS							
YAMAHA LAGENDA 110Z	4 Stroke	PJG9152	3 month	48.05	12.86	1.48	0.13
YAMAHA LAGENDA 110Z	4 Stroke	AGS4586	1	47.3	13.96	1.94	0.15
HONDA WAVE125	4 Stroke	PGT5609	2	45.2	13.96	3.34	0.09
YAMAHA EGO SCOOTER	4 Stroke	WQY8290	2	74.43	18.25	1.17	0.18
YAMAHA 135LC SUPER SPORTS	4 Stroke	JKG4342	3	NOT AVAILABLE			
HONDA WAVE100	4 Stroke	AFM244	4	46.41	7.86	1.78	0.22
MODENAS KRISS100	4 Stroke	PGP6592	4	41.05	13.96	19.14	0.18
5 TO 10 YEARS							
HONDA WAVE100	4 Stroke	KBM3972	6	49.46	9.68	3.08	0.24
MODENAS KRISTAR	4 Stroke	PGG3191	5	43.03	18.67	3.51	0.06
SUZUKI SMASH 110	4 Stroke	AFG6350	6	61.03	14.96	2.47	0.16
SUZUKI SMASH	4 Stroke	AFJ6093	6	44.68	25.06	2.98	0.18
MODENAS KRISS 1	4 Stroke	AEN9450	4	55.39	24.97	3.68	0.11
			7	39.49	23.91	2.77	0.06
			8	58.1	17.69	2.21	0.06
			8	39.78	13.96	1.83	0.09
			8	44	10.76	2.34	0.17
			8	45.06	17.93	3.98	0.14
			9	232.72	27.09	13.54	0.25
			10	53.64	11.17	2.82	0.23
			12	53.66	15.89	1.23	0.18
			11	52.02	22.98	3.16	0.08
MODENAS KRISS110	4 Stroke	PEJ3793	12	67.23	28.4	2.98	0.16
MODENAS KRISS110	4 Stroke	ADR5227	12	44.3	45.56	19.47	0.11
MODENAS KRISS110	4 Stroke	ADR5227	12	34.15	23.88	4.55	0.08
YAMAHA SPORTS 100 Cdi	4 Stroke	KAJ8301	15	52.44	21.4	24.58	0.05
> 16 YEARS							
HONDA C70 DELUXE	4 Stroke	ACM2337	16	44.3	4.05	2.53	0.18
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IN USE Vehicle Measurements

Slow to get this data

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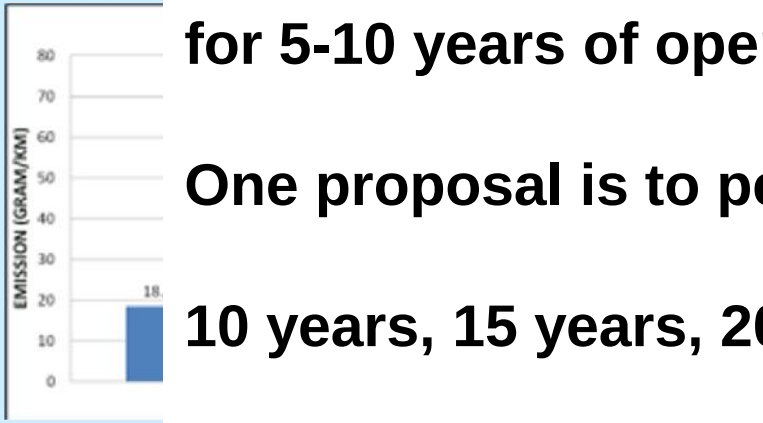

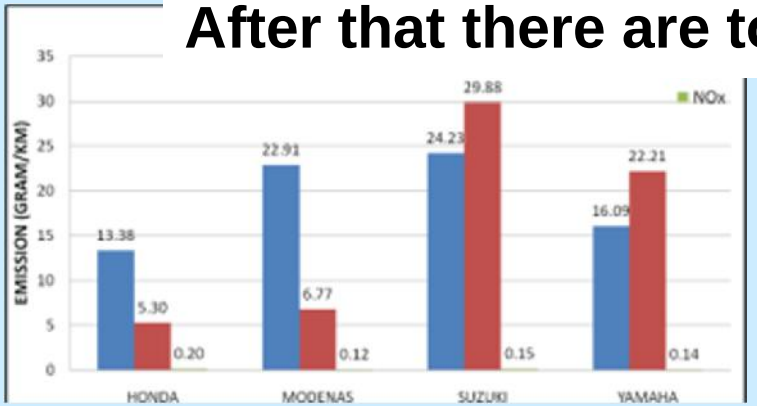

It is probably unrealistic to try to get this data on an annual basis on all cars.

Most modern cars should remain in emissions compliance for 5-10 years of operation.

One proposal is to perform this testing on this schedule:

10 years, 15 years, 20 years

After that there are too few vehicles left to bother with

EMISSION STANDARDS (gram/km) FOR 4 STROKE MOTORCYCLES (TESTED WITH ECER40)							
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							0.09
							0.18
							E
							0.22
							0.18
							0.24
							0.06
							0.16
							0.18
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							0.06
							0.06
							0.09
							0.17
							0.14
							0.25
							0.23
MODENAS KRISS110	4 Stroke	PEJ3793	12	53.66	15.89	1.23	0.18
SUZUKI FX110	4 Stroke	PEY6903	11	52.02	22.98	3.16	0.08
MODENAS KRISS110	4 Stroke	PEJ3793	12	67.23	28.4	2.98	0.16
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Crowd Sourced Data: Traffic

Gather massive amounts of data from Handfones, Cars, or other “smart” devises associated with people or goods as they are transported.

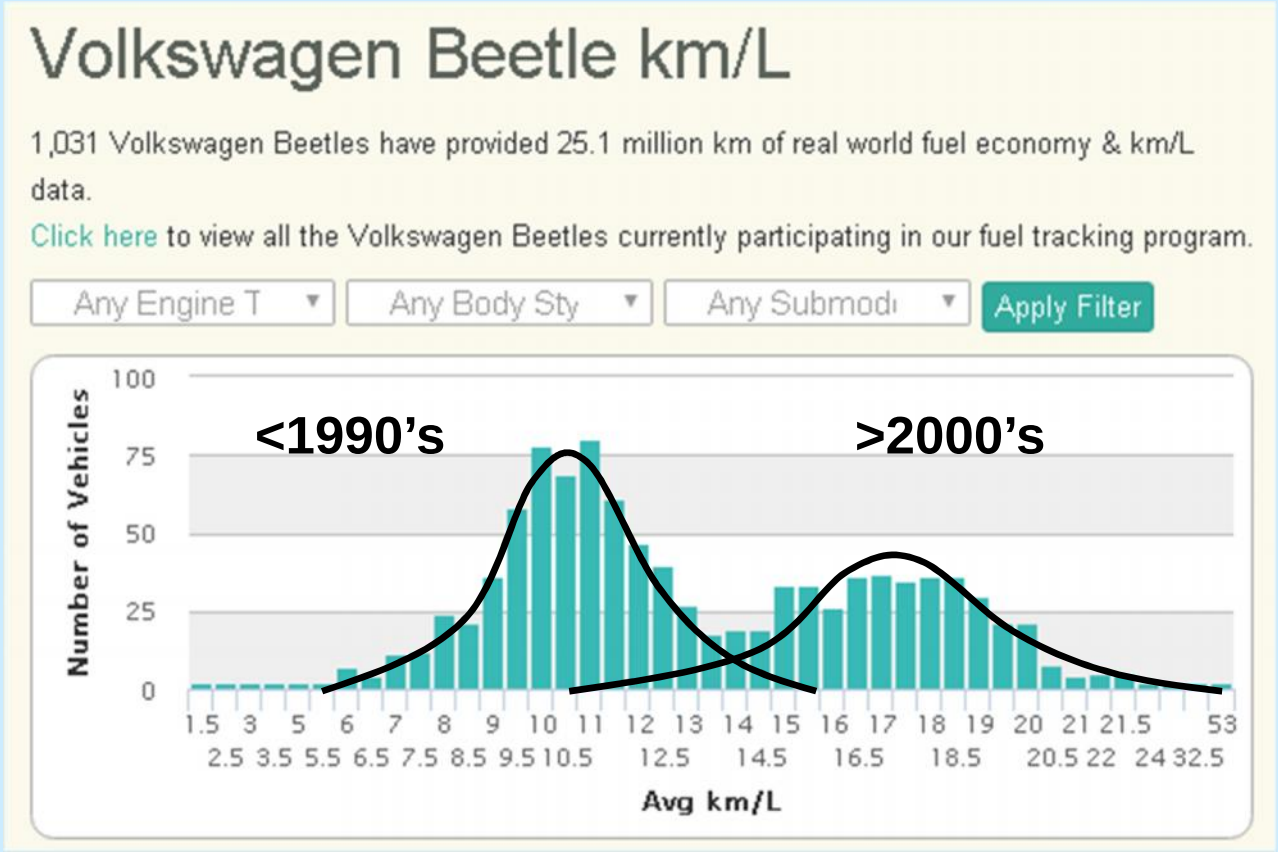
Policy Makers need this data: Where should the LRT line go? What Stations?

Good for:
Origin, Destination
Approximate Distance
Speed

Not so Good for:
Fuel Consumption, Emissions
Passenger Loads
Mode depends on how data is collected

Crowd Sourced Data: Fuel Economy

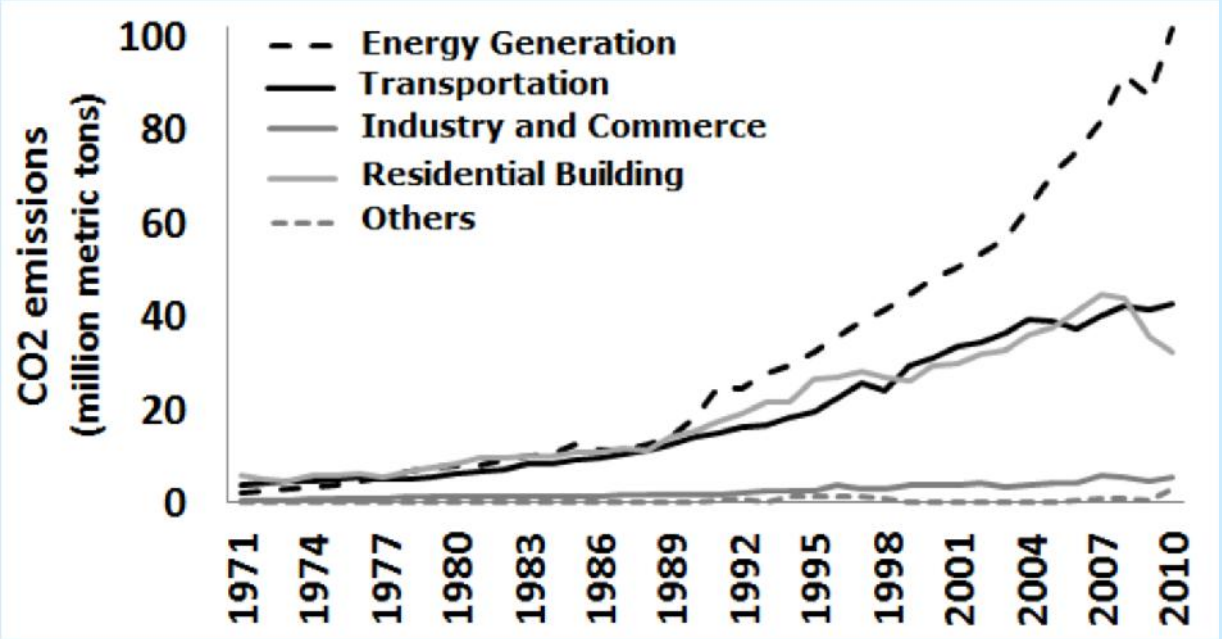
Fuelly.com allows users to submit Odometer reading and fill-up liters and tracks mileage. Good "average" number, but doesn't track differences in traffic, driving style and mode, etc.



Bi-Modal distribution is due to older air-cooled versions vs. the newer generation of vehicles

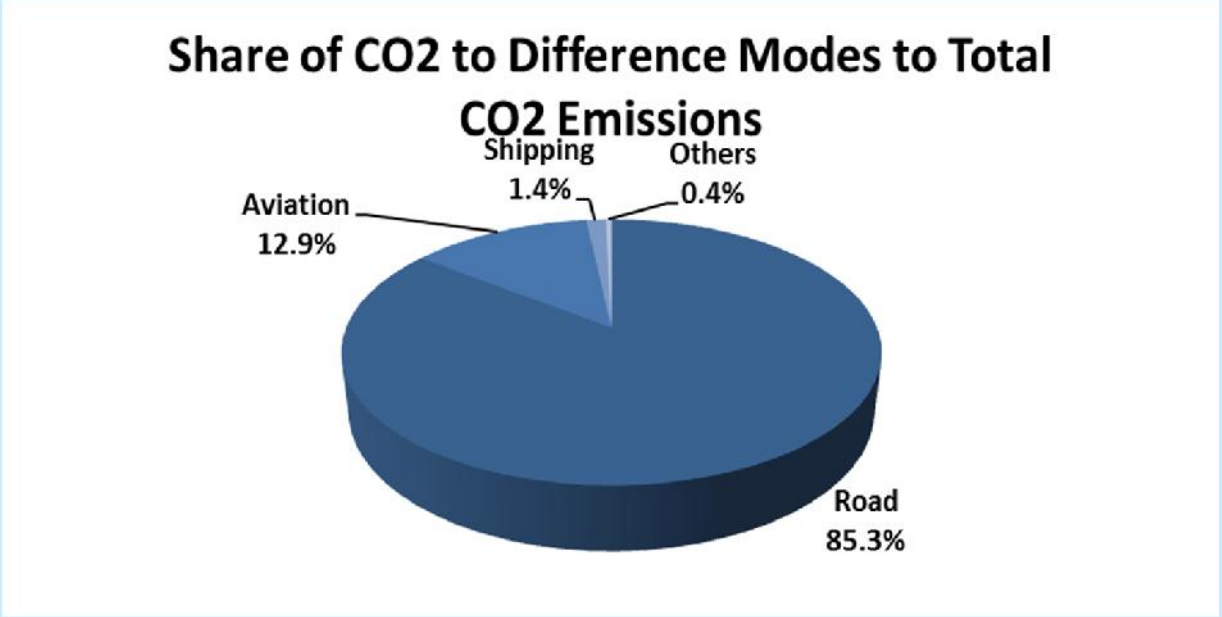
Example: Malaysia Emissions

Emissions by Sector
Transport is ~25%



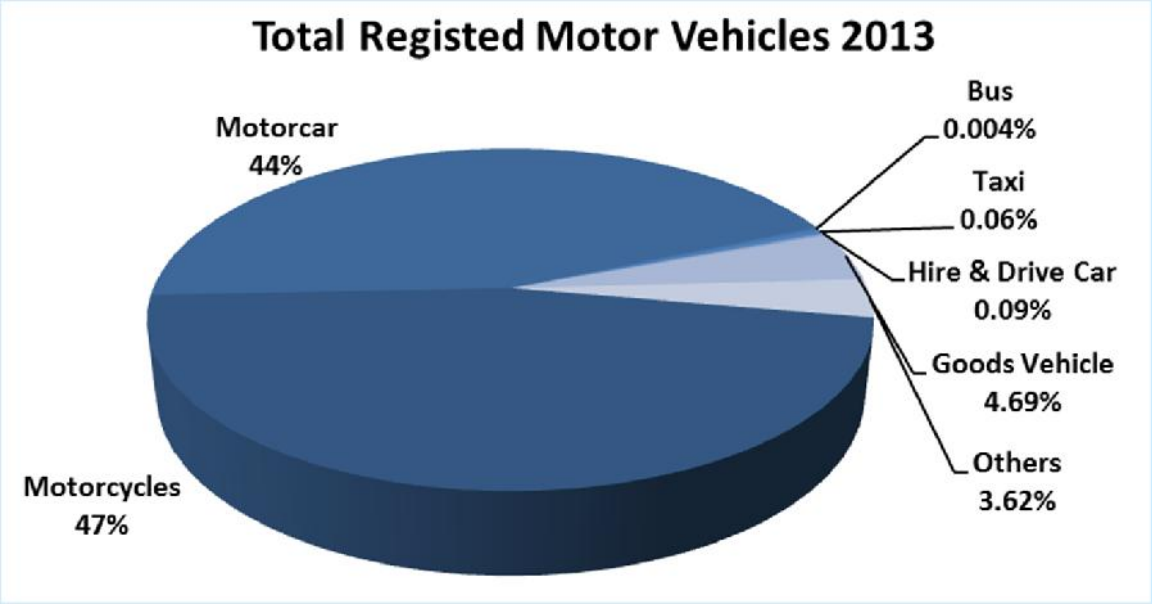
Transport Emission by Mode

Most comes from Road

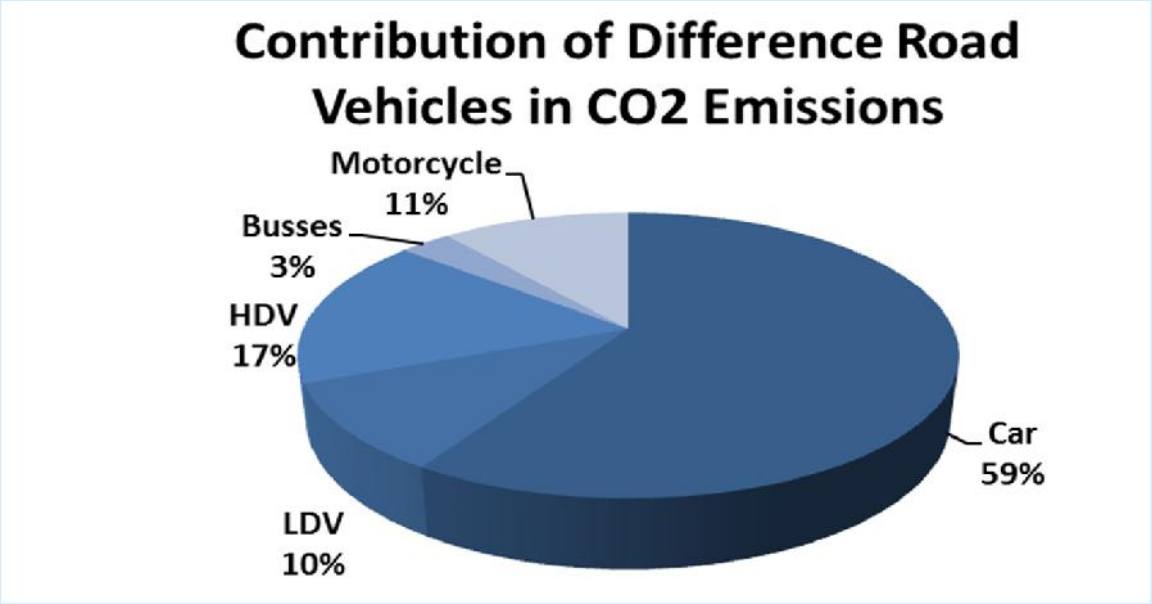


Example: Malaysia Road Emissions

Roughly equal number of motorcycle and cars



But cars consume the bulk of the fuel



Example: Malaysia

“Top Down” (petrol sales) gives an annual passenger car consumption of:

12.3 Mtoe

Double Checking this number from available sources:

Number of Passenger Cars (road tax):	**10.5M in 2013**
Typical Fuel Consumption (University Study):	**9.5 km/liter**
Number of Passenger km/year (govt. inspection):	**24k km/year**

Total Fuel Consumed = 10.5M x (24k km / 9.5km/liter) x .720toe/1000liter

= 19 Mtoe

Oops! That’s a 54% error!

Example: Malaysia

Fleet size is about right. Fuel mileage number is about right.

The governmental number for annual mileage comes from vehicle inspections. *These inspections are not mandatory*, and the only passenger cars that routinely get inspected are *government fleet vehicles*, which experience unusually high usage.

A quick survey (petrol station) determined the following:
Typical annual mileage (personal car): 16,500km/year
Typical fuel mileage: 10km/liter

10.5M x (16.5k km / 10km/liter) x .720toe/1000liter = 12.4 Mtoe (Bottom up)

This compares nicely with the previously estimated 12.3 Mtoe

MORAL: Be careful how you use official numbers, and always reality check results with "bottom up" data.

Conclusions

•There are a number of different ways to get the required fuel efficiency and emissions numbers, and every source has it's advantages and disadvantages.

•IN USE vehicles have to be tested individually.

•In the end different methods are required to "counter check" numbers from other sources.

•There is potentially a HUGE opportunity to "crowd source" vehicle information and fill in many blanks: Distances and routs traveled, Speeds, Start/End points…

Conclusions

•Because local situations have very different driving patterns there can never be a “one size fits all” drive cycle

•Within ASEAN we need to adopt a single method for comparing fuel efficiency.

• A standard cycle and united approach to Fuel Economy measurement will strengthen ASEAN leverage over automobile manufacturers and reduce redundency.

End of Main Presentation

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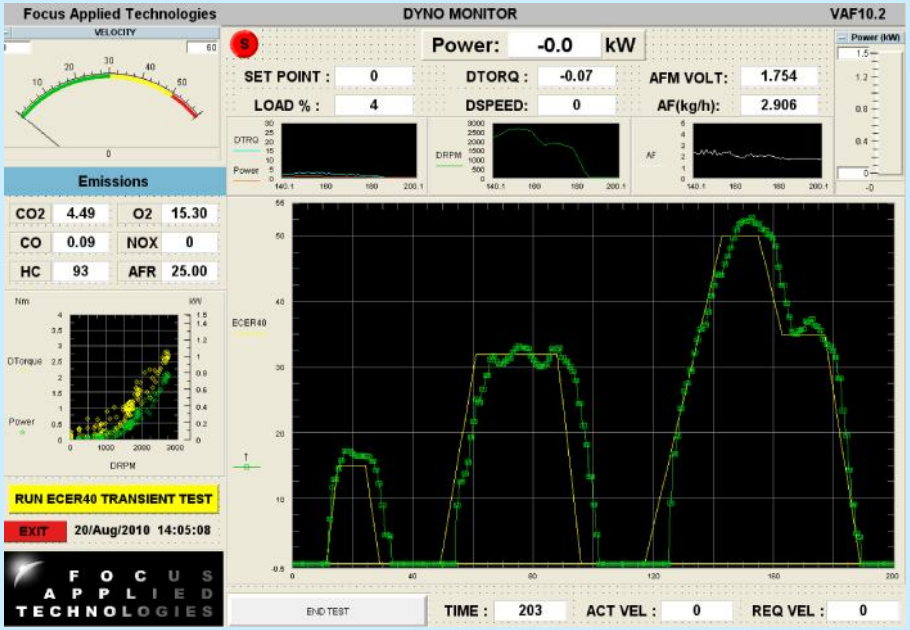


Association of SE Asian Nations

Within SE Asia there are some unique environmental and socio-economic factors. ASEAN countries are homogenizing standards and regulations to have a greater impact by acting as a trading block of 650M people, rather than 10 “little” countries.

How about we start *Really* working together?

Malaysia

Vietnam

Cambodia

ASEAN Transport Data Team

We all need the same type of data, but currently many countries are “under represented” in terms of data coverage.

Instead of *reacting*, and collecting data piece-meal, why don’t we put together a team with the right tools and training, and *systematically* collect the data for all of ASEAN?

Team would travel to countries as required, survey traffic, instrument vehicles, take and compile data.

The data would all be made publically accessible.

The team can train local personnel on tools and techniques for future

Consumer Surveys

Door to door questioning:

Trip Purpose
Origin, Destination
Approximate Distance
Approximate FC
Approximate Passenger Loads
Approximate Mode Breakdown
Costing info
+ Lots of (otherwise) hard to get data
-Subjective and systematically underestimates some information
- Needs to be updated periodically

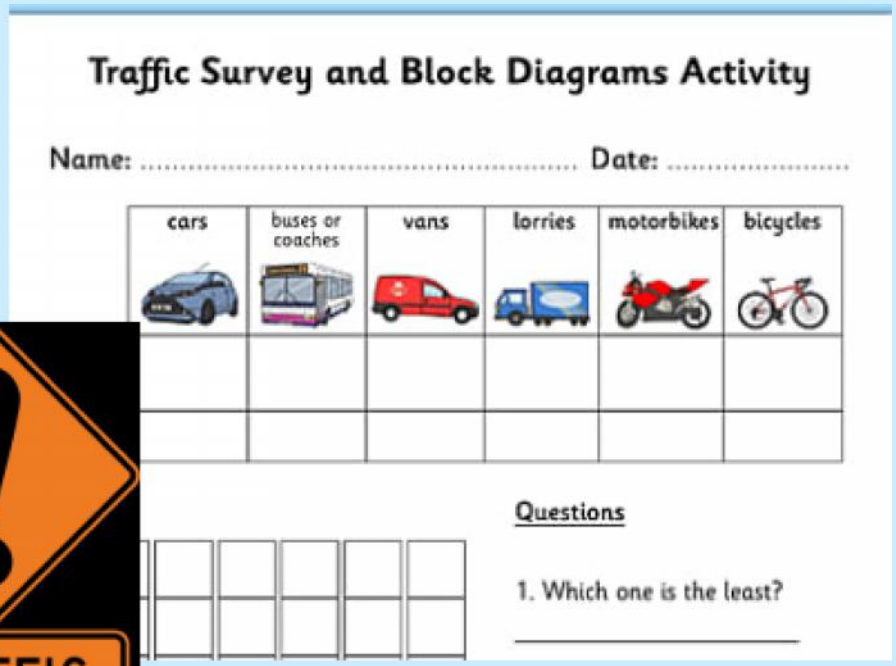
While individual consumer surveys are very useful, the tend to systematically underestimate number of trips (eg. they only give the mandatory trips, forgetting discretionary trips)

QUESTION:
How can we get this data voluntarily submitted from commuters?

Bottom Up Measurements

Parking lot survey: Some idea of destination (but not purpose),
Fleet/age info
Vehicle Mix, age, ridership?

Road Side surveys: Vehicle Mix, Speed
Purpose? Distance?
+ Multiple Vehicles **- One location at a time**



Road Side Measurements

Speed, Vehicle Speed, Size, Type and # of passengers
With special equipment you can estimate emissions (if site is chosen well)
+ Fast, precise data
- Single point
- No info on purpose,
destination, …