NEDC is OK

(but nog enough)

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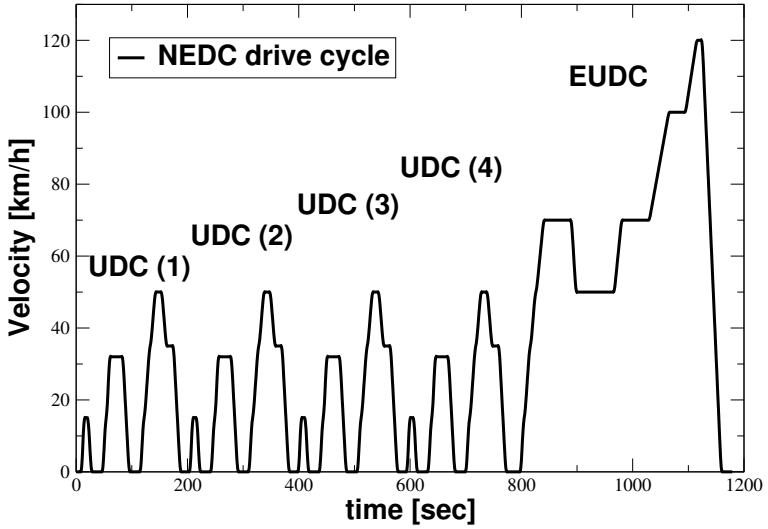

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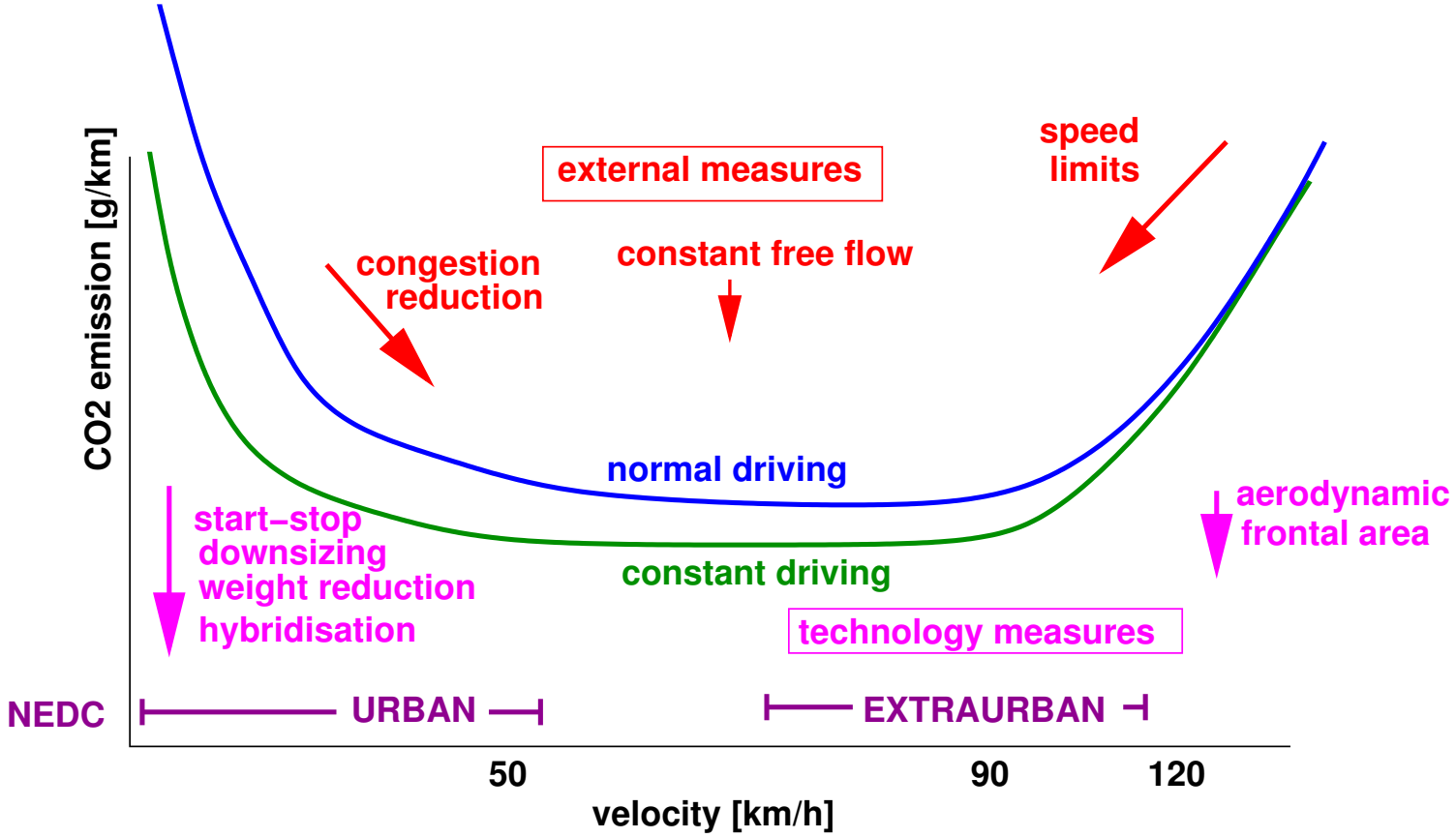
passenger cars

In a lifetime:

- **40 ± 20 ton exhaust CO_2**
- **∼ 16 years, and increasing**
- **∼ 200 000 kilometres, and increasing**

"± 20 ton CO_2", that is about 100% uncertainty

the generic CO_2 bath tub



unknowns in real-world driving conditions

- extra weight, passengers
- use of airconditioning, lights, electric equipment
- (late) gear shifting
- cold starts per kilometre
- higher velocities
- more congestion

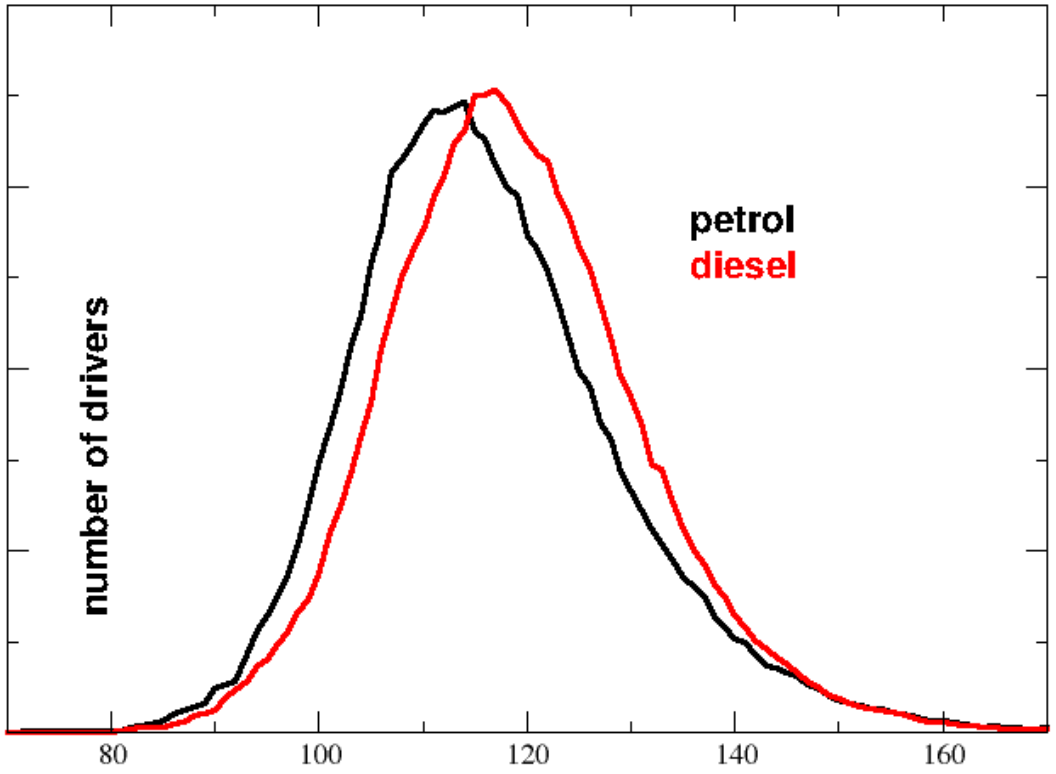
Travelcard study

- **200 000+ modern cars (all brands and types)**
- **multiple years (initial 2007-2008, and ongoing)**
- **every refueling (amount, distance, date/time)**
- **employer paid the fuel, ownership is mixed (lease and private)**

a lot of data (analysis) on several millions of transactions

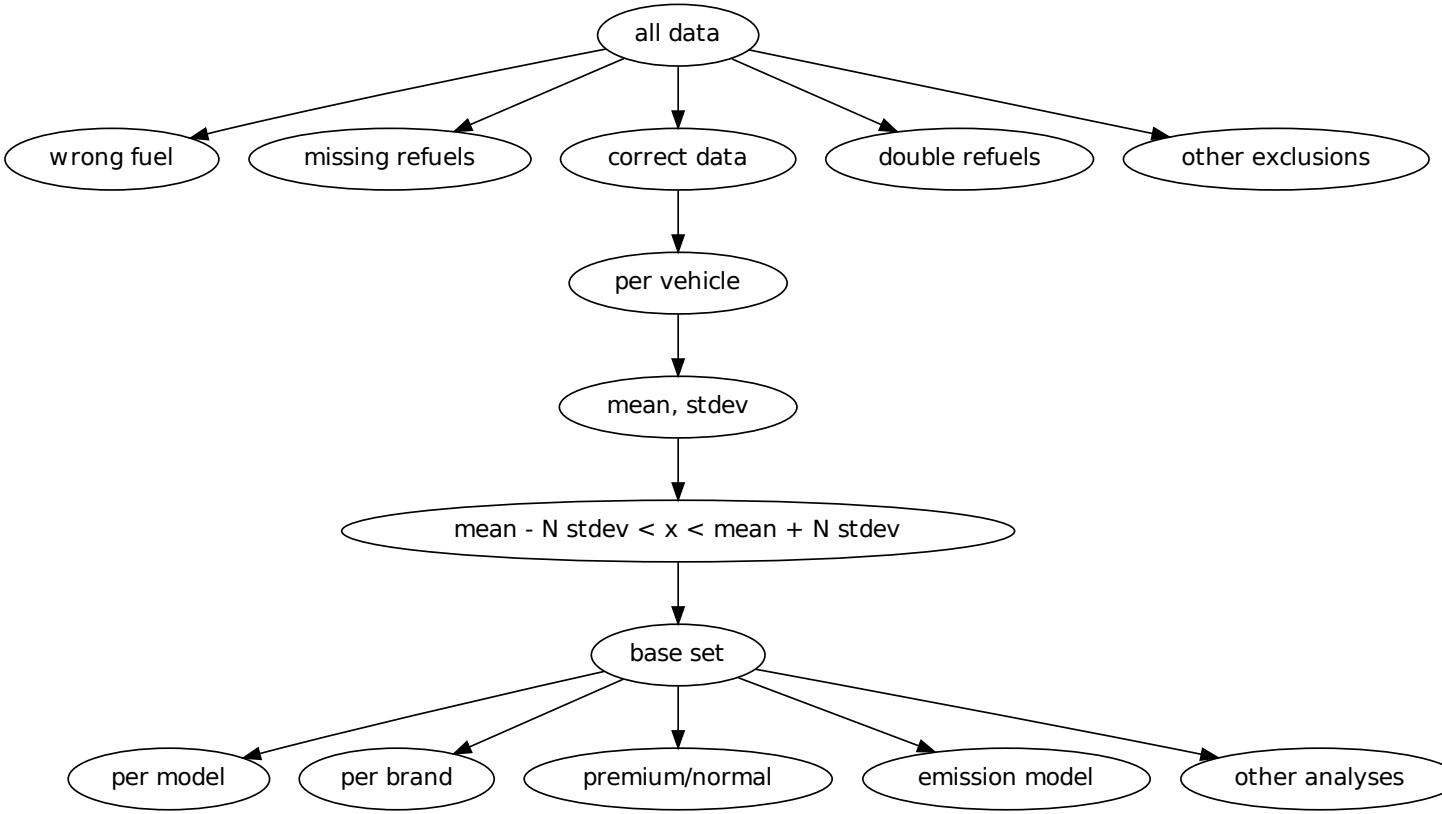
real-world fuel consumption, driving, including the unknow effects, but with possible bias (more business?, more motorway?)

Variation among drivers and cars



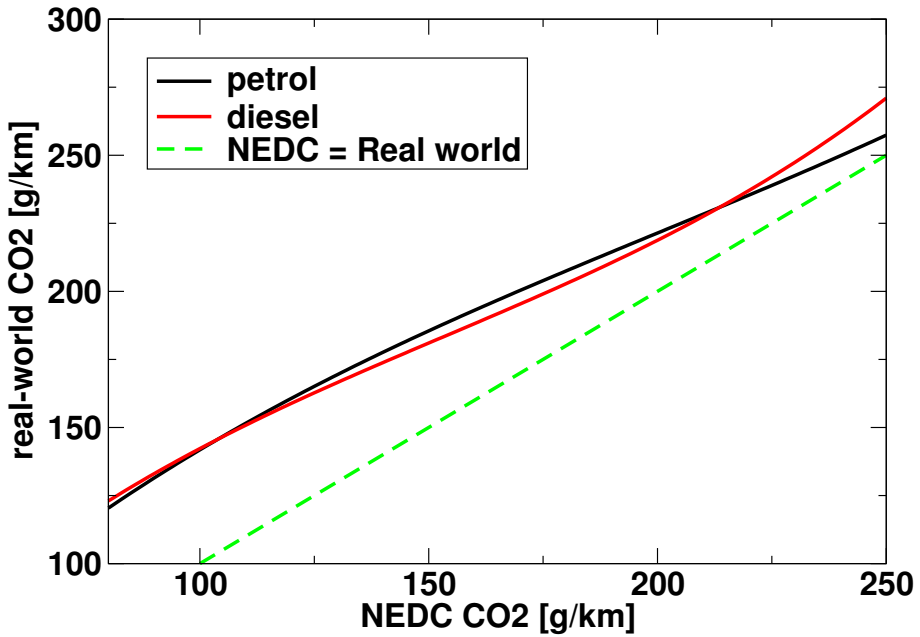
% with respect to norm value

Lengthy process of cleaning the data sets
(mileage entered manually by drivers)



difference between real-world and norm increases with lower CO_2 emission

norm reduction has limited effect for real-world emission



on average: add <u>a litre</u> fuel to [litre-per-100km] norm value for efficient vehicles (i.e. around 120 g/km)

(<u>half a litre</u> for less efficient cars, e.g. 190 g/km)

Some other results

- **Variation of ± 20 % between different drivers in the same car**
- **Recent gain in efficiency is mainly in the urban part of the NEDC**
- **Diesel engines have smaller difference between urban and extra-urban than petrol**
- **Little effect of usage (i.e. 100 km/per day versus 30km/per day)**
- **Both “sportive” and “family” cars follow the same trend**
- **Only SUV’s deviate from the trend: higher fuel consumption than expected from (already large) norm value**

Some nice-to-knowns

- **Premium fuels: 1% more efficient for petrol, 0.5% for diesel**
- **No effect of season (temperature) found**
- **"Business cars" same average norm value as national sales, but more diesel cars among them (effect Dutch tax laws)**
- **Annual mileage only very weakly dependent on norm value**
- **No regional effects found**
- **"Litres fuel" instead of "CO_2" show larger difference between petrol and diesel.**

Conclusions

- **Reduction of CO_2 on the norm yields only limited effect in CO_2 emission reduction in real world**
- **Variation in usage dominant in the total variation *(same car, other drivers, different trips)***
- **Urban, Extra-Urban useful, separate parts of NEDC**
- ***From NEDC:* Extra-Urban most *representative* for Diesel cars, *NEDC total* for Petrol cars**
- ***But also needed:* Motorway, Cold-start, Constant velocities (e.g. 50, 90, 120, 140 km/h) *(for make-your-own combined cycle)***
- ***Moreover:* weight effect (+200 kg), auxiliaries (lights, AC, etc.)**