THINKING
FOR
TOMORROW

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The European Handbook of Emission Factor for Road Transport (HBEFA)

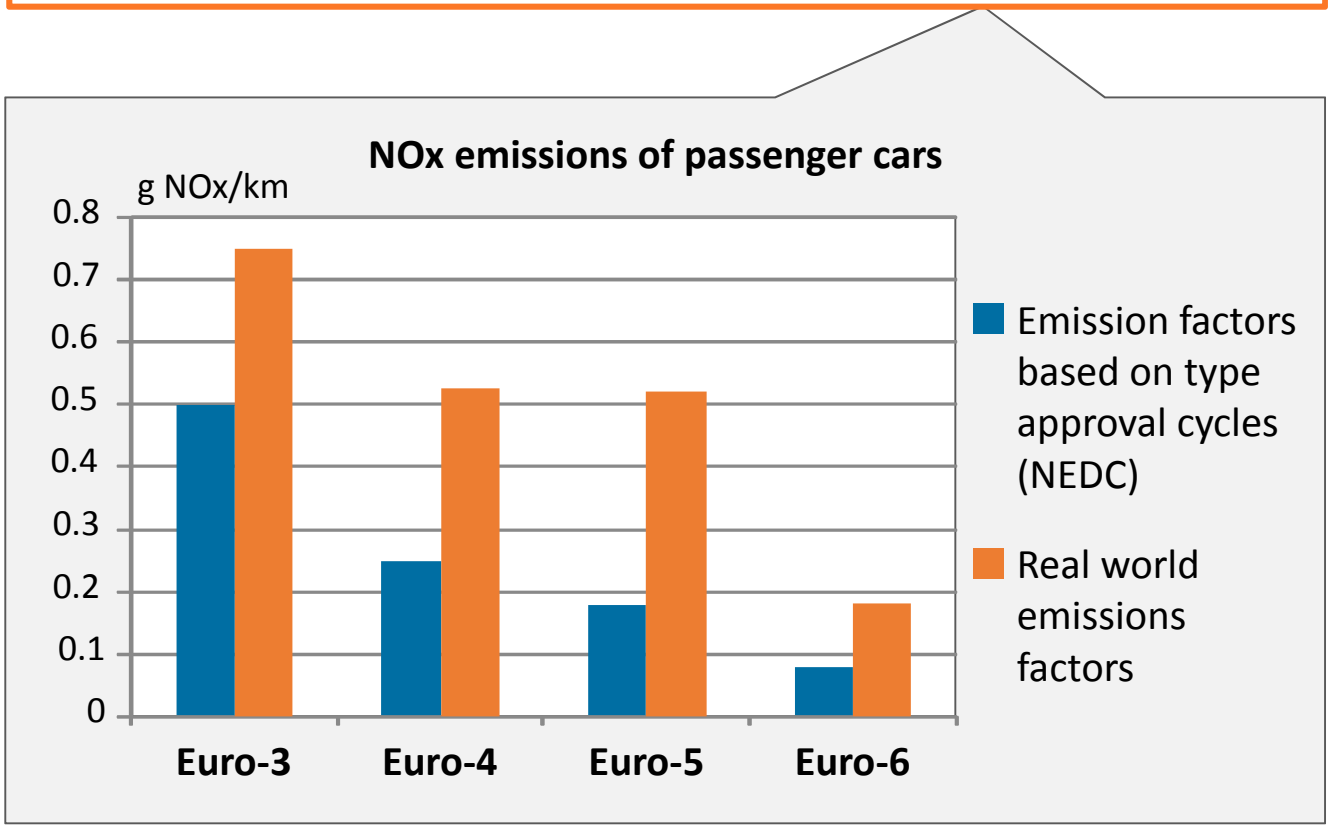
Leipzig, 19th of May 2014

Agenda

1. **HBEFA: Brief introduction**
2. Traffic situation approach of HBEFA
3. HBEFA in context of other emission models

Emission factors influence strongly the quality of quantification of traffic-related emissions

Emission = Traffic Activity (vkm) x Emission Factor (g/vkm)



HandBook on Emission FActors for Road Transport (= HBEFA)

- **HBEFA** is **emission factor database** for road transport which is developed on behalf of several European countries (e.g. Germany, Switzerland, Austria, Sweden, Norway, France)
- in **1995** the **first version** of HBEFA was published, since there it was **continuously enhanced**
- HBEFA provides **emission factors** (**hot, cold start, evaporation**) for **all regulated** and **important non-regulated air pollutants** as well as for **fuel consumption** and **CO_2 emission**

Dependency of traffic activities and emission factors

Emission = Traffic Activity (vkm) x Emission Factor (g/vkm)

Dependency

- emission factors have to fit to the traffic activity data and vice versa
- traffic data should ideally be given for:
  - vehicle category
  - vehicle size
  - fuel type
  - technology (emission standards)/age
  - load factor (trucks)
  - road gradient
  - traffic situation/driving cycles

Ideally differentiation of emission factors

HBEFA provides emission factors for different sub-segments

Vehicle categories	Vehicle size	Fuel types	Emission Standards	Reduction technologies
Passenger Car	PC < 1.4 L	Gasoline	Pre Euro 1	Particle filter
Motorcycle	PC 1.4-2.0 L	Diesel	Euro 1	SCR
Urban bus	PC > 2.0 L	LPG	Euro 2	EGR
Coaches	Truck ≤ 7.5 t	CNG	Euro 3	…
Light duty veh.	Truck 7.5-12 t	FFV	Euro 4	
Single truck	Truck 12-14 t		Euro 5	
Truck trailer[1)]	…		Euro 6	

Average values also included

Abbreviations: PC = Passenger car; LPG = Liquefied Petroleum Gas; CNG = Compressed Natural Gas; FFV = Flexible Fuel Vehicles; SCR = Selective Catalytic Reduction; EGR = Exhaust Gas Recirculation

[1)] Including articulated vehicles.

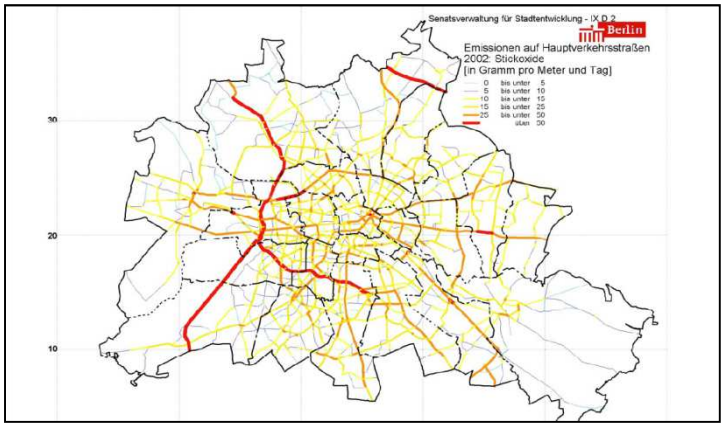
HBEFA is often data source for GHG emission inventories of Germany cities

	Bremen	Region Hannover	Braun-schweig	Leipzig	Cologne	Frankfurt /Main	Tübingen	Munich
Fuel consumption and direct GHG emission factors								
Road	MOBILEV (HBEFA)	HBEFA	HBEFA	HBEFA	[WWF 2009]	TREMOD	HBEFA at VISUM	HBEFA
Public transport	PT operator	PT operator	PT operator	PT operator	PT operator	TREMOD	PT operator	PT operator
Rail	-	German railways	German railways	UBA[1]	TREMOD	TREMOD	-	German railways
Inland navigation	-	UBA[1]	UBA[1]	-	LANUV[2]	-	-	-
Air transport	-	conclusions by analogy	-	LfULG[2]	Airport Köln-Bonn	-	-	-

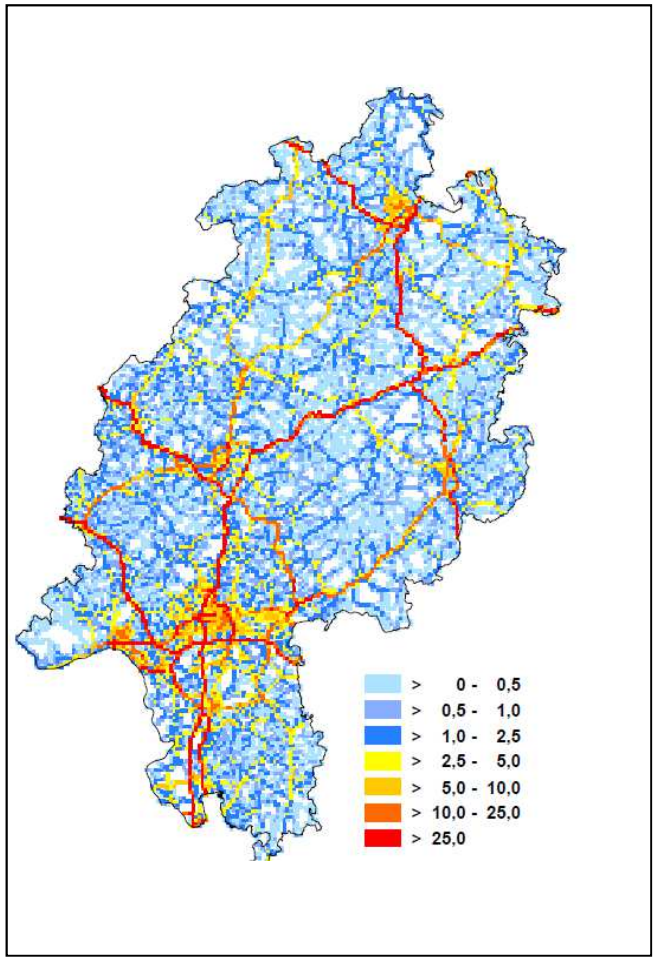
⇨ **HBEFA is central database for emission calculation on city level in Germany**

HBEFA can be connected with link wise data from transport demand models

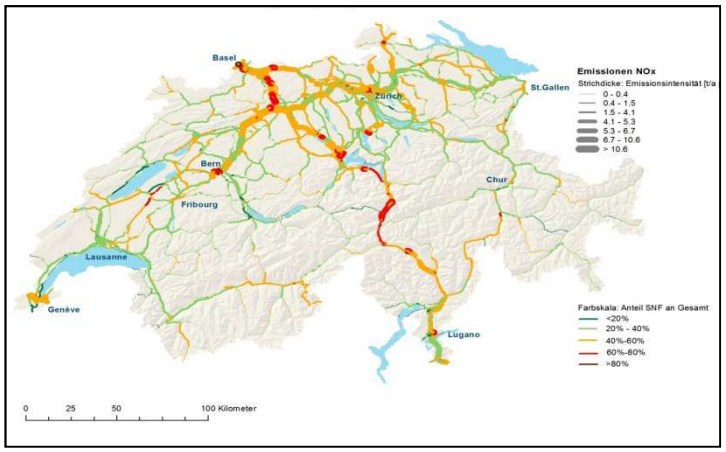
Berlin



Federal state Hessen

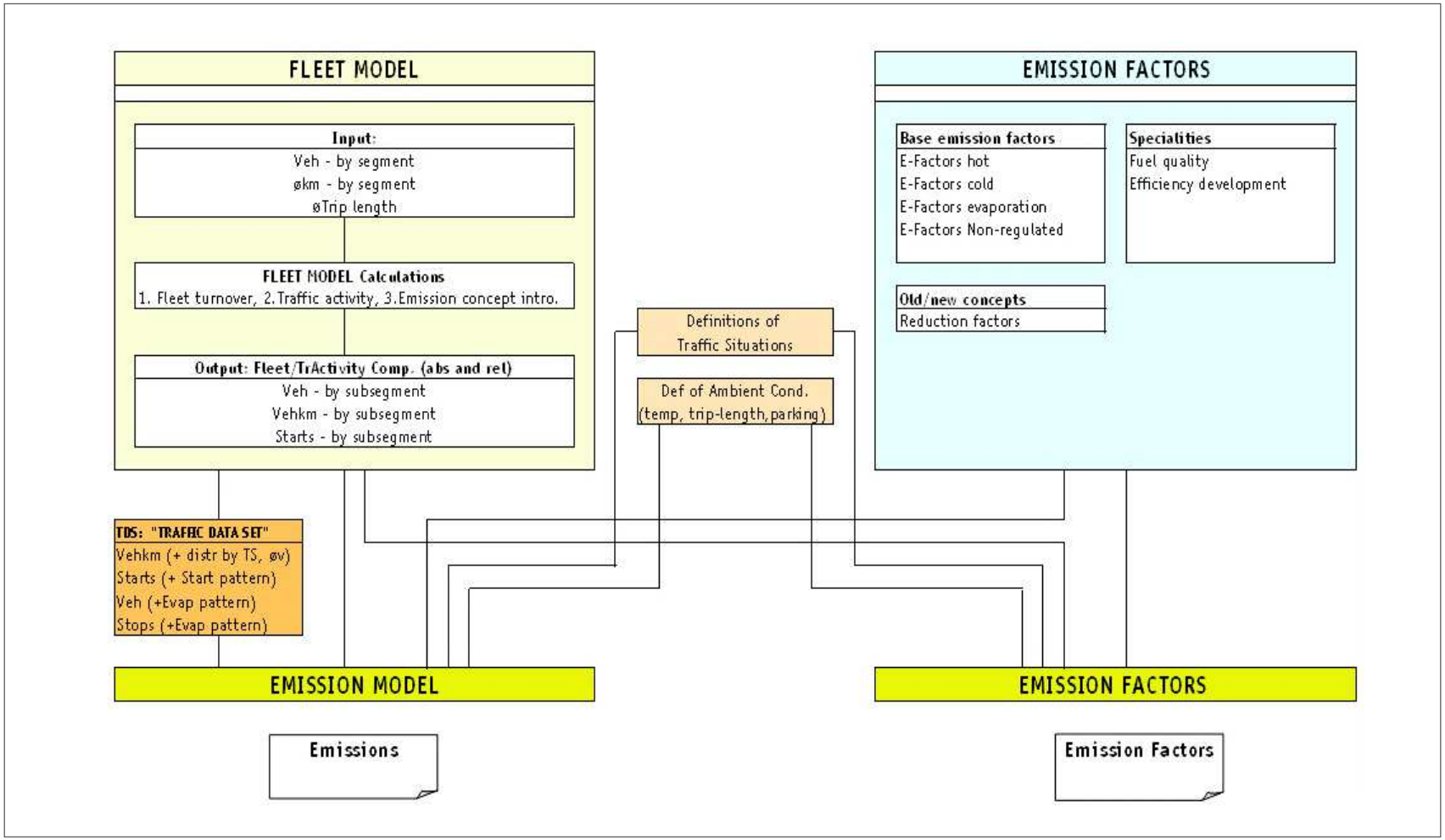


Switzerland (only freight)



Handbook on Emission Factors for Road Transport (HBEFA) Expert Version

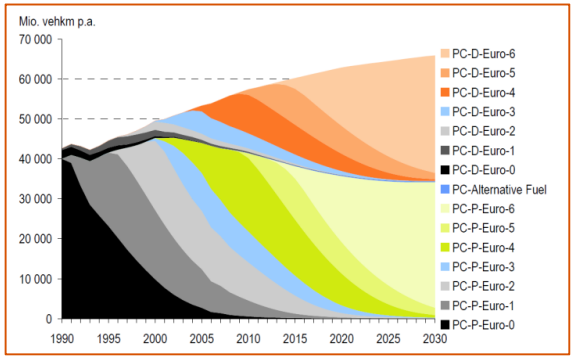
Modules of the HBEFA Expert Version for the calculation of traffic-related emissions (1)



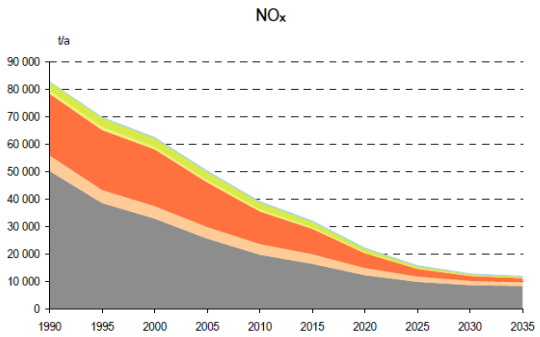
Modules of the HBEFA Expert Version for the calculation of traffic-related emissions (2)

HBEFA Expert Version

Fleet model



Emission model



Emission factor database

Agenda

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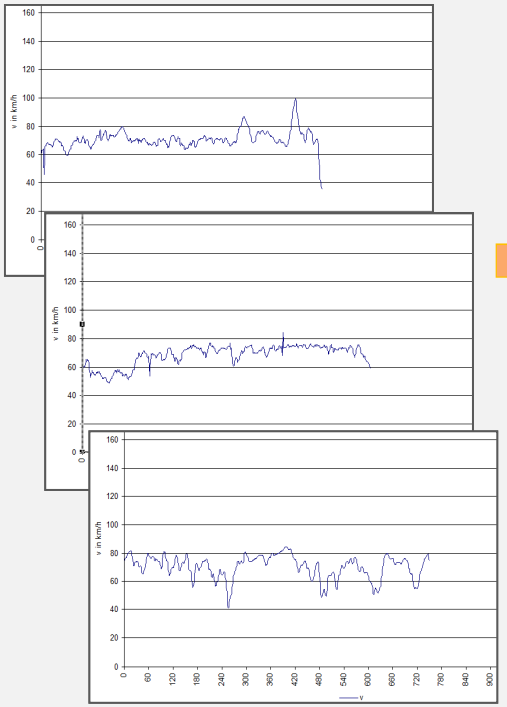
Development of emissions factors based on typical traffic situations

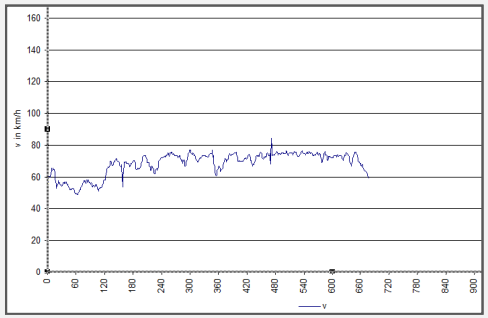
Analyses of real world driving patterns:



Choise of typical driving pattern = traffic situation:

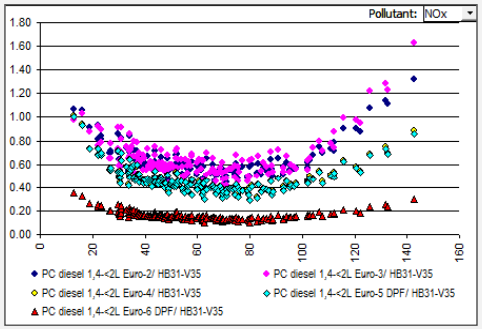
Typical for:

- Area (urban/rural)
- Road type
- Speed limit
- Level of service



Emission factors based on traffic situations

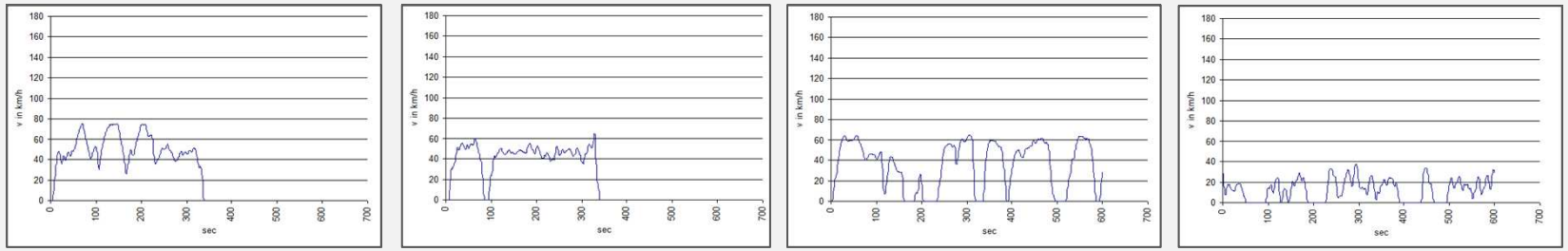
- Emission factors for 276 different traffic situations
- more than 120 for urban areas



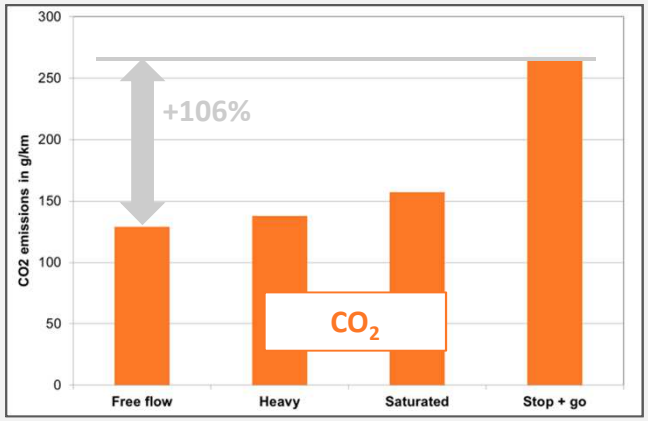
Traffic situations enable analyses of transport demand management measures

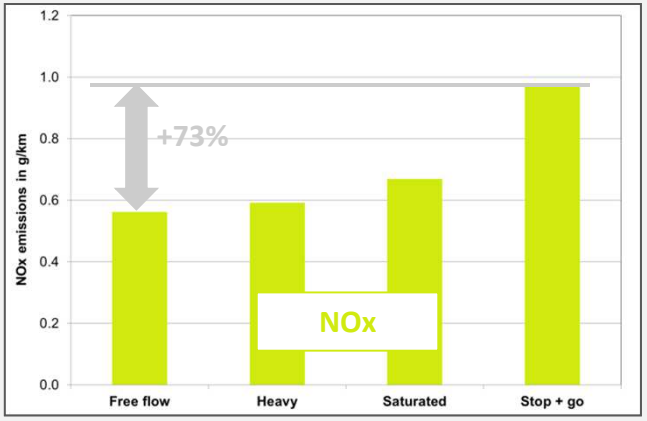
Trunk road city – 50 km/h

Freeflow | **Heavy** | **Saturated** | **Stop + Go**



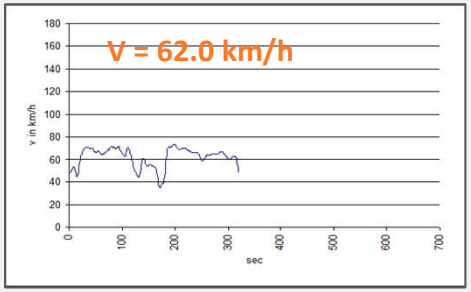
Passenger car: diesel, 1.4-2.0 l, Euro 3



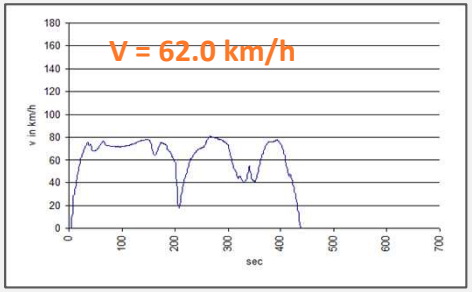


Emission factors only based on average speed are not sufficient for detailed analyses

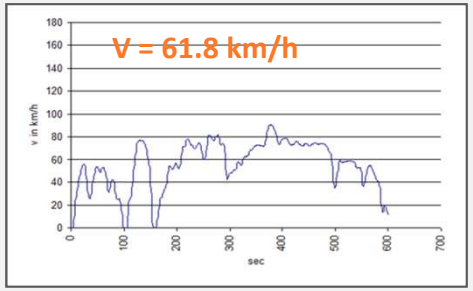
Rural: Trunk road: 60 km/h, free flow



Rural: Distributor: 80 km/h, heavy



Rural: Distributor: 100 km/h, saturated



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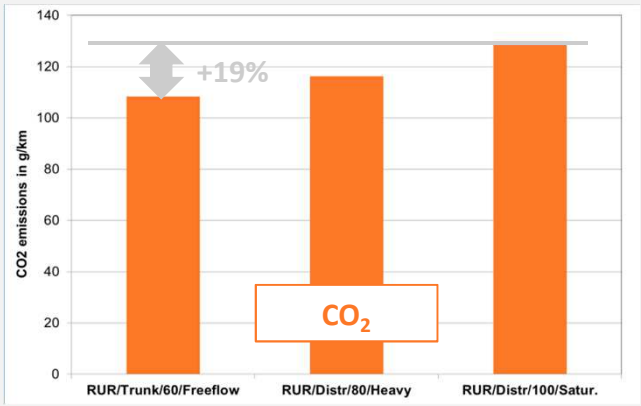
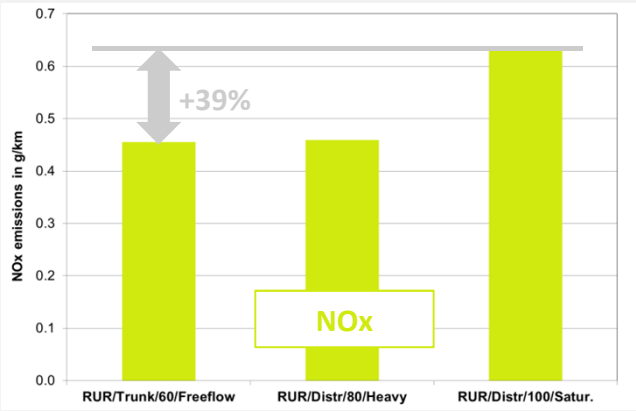
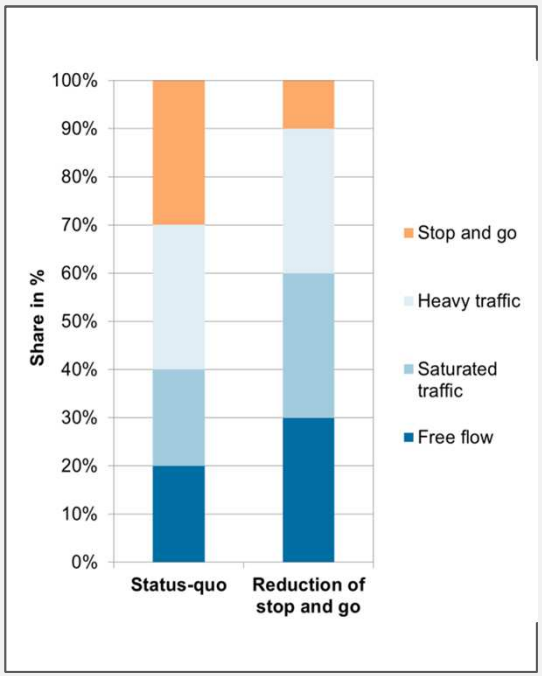




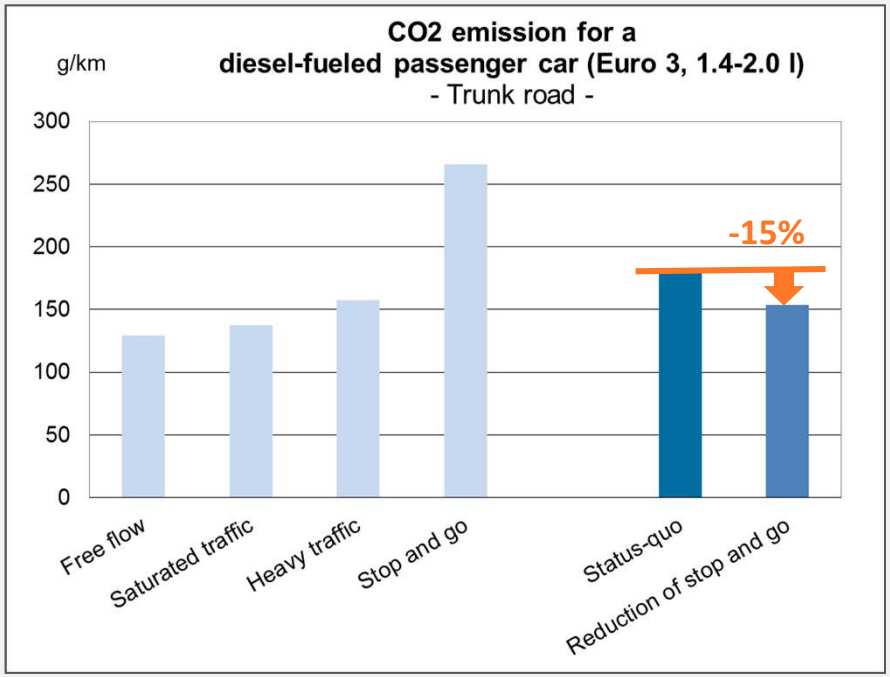
HBEFA enables user to analyse transport demand measures

Fictive example for trunk road: Reduction of stop + go traffic

Shares of traffic situation for trunk road



CO_2 emission for diesel fueled passenger car for trunk road



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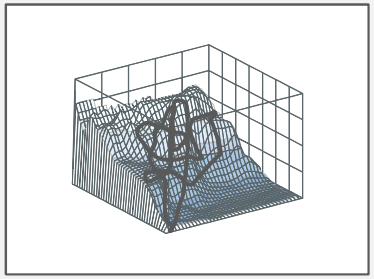
3. **HBEFA in context of other emission models**

Overview of existing models used for the calculation of traffic-related emissions

Handbook Emission Factors FOR Road Transport (HBEFA)

Passenger car and Heavy duty Emission Model (PHEM)

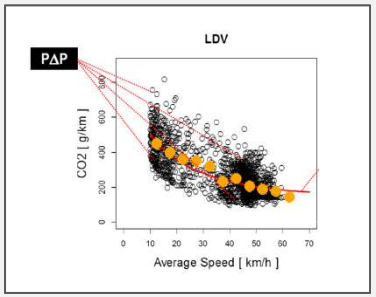


Motor Vehicle Emission Simulator (MOVES)

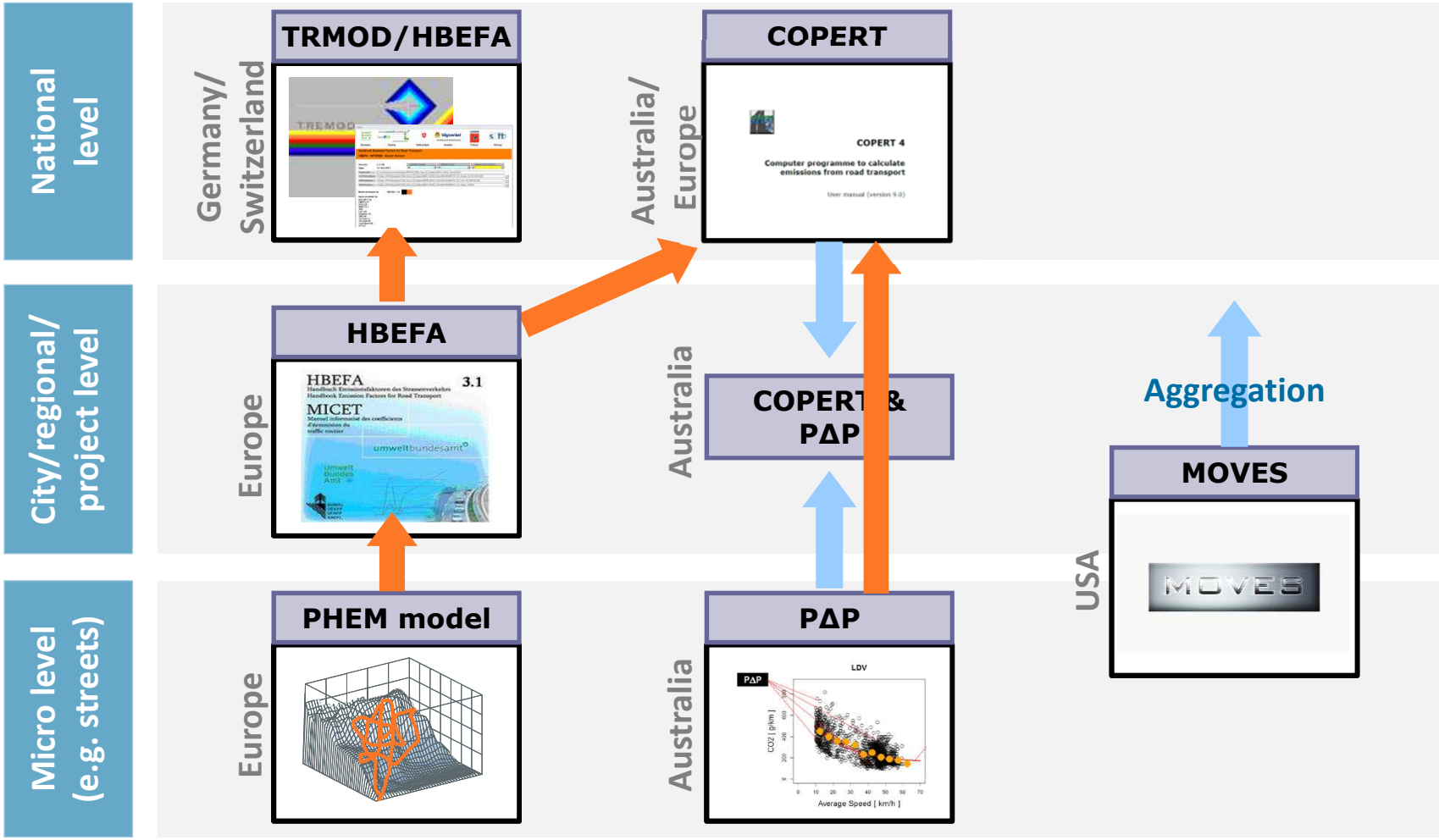
Transport Emission Model (TREMOD)

Computer Programme to calculate Emissions from Road Transport (COPERT)

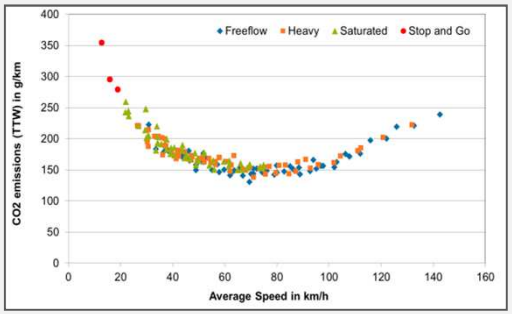
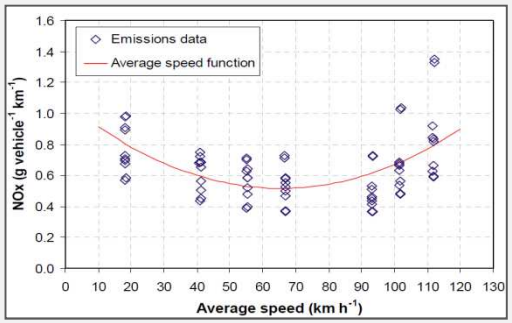
Power-Delta-Power Model (PΔP)



Overview of existing models used for the calculation of traffic-related emissions



Comparison of traffic situation and average speed approach

Model	Approach	Application
HBEFA	**Traffic situation approach** 	**Main focus:** ▪ City/local level ▪ Regional level ▪ Project level ▪ Comprehensive analyses of measures and scenarios
COPERT	**Average speed approach** 	**Main focus:** ▪ National level ▪ Analyses of measures and scenarios on aggregated level

Based on HBEFA emission factors

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Thank you for your attention

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