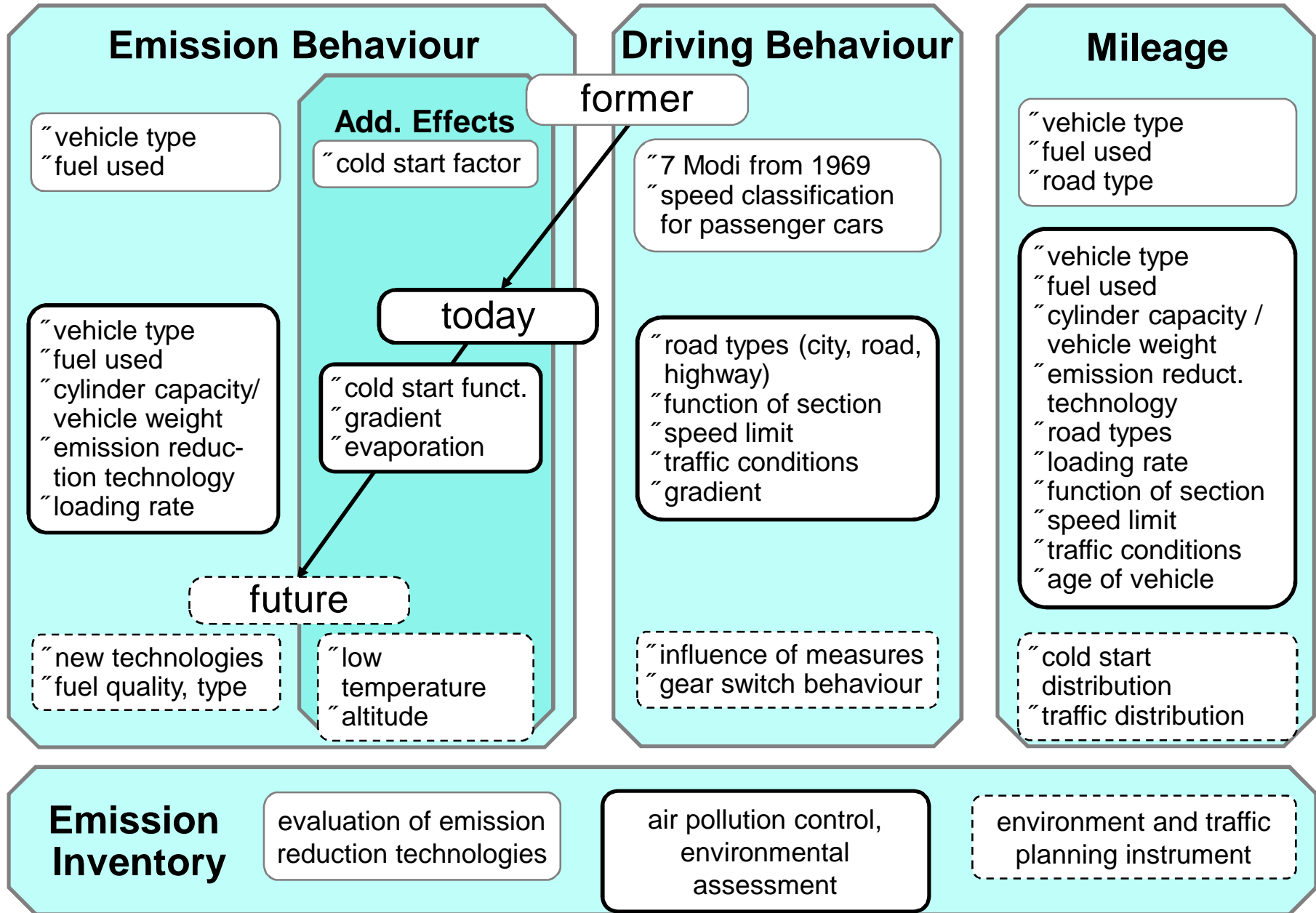


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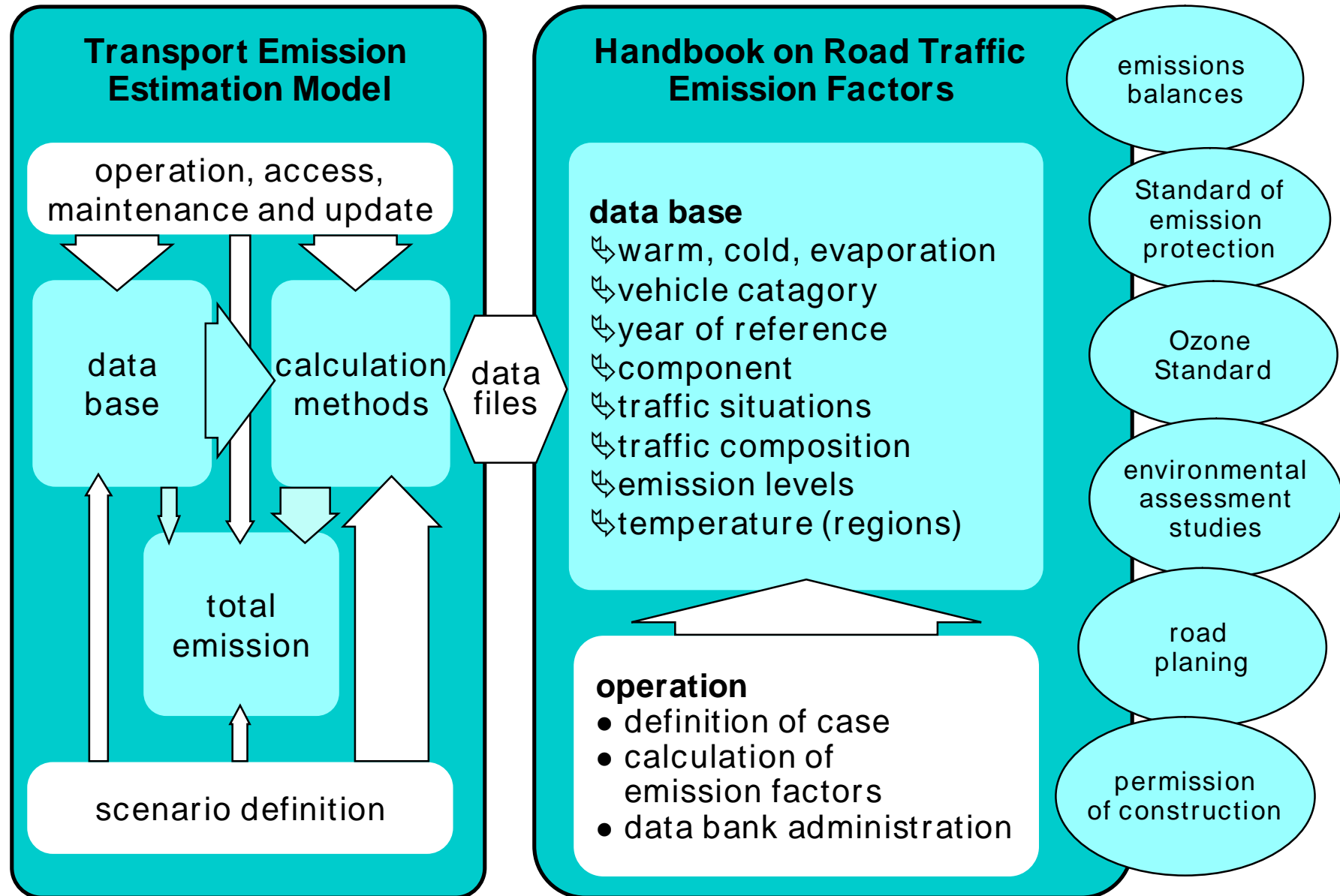
# Emission Inventories for the Transport Sector

Dr. Axel Friedrich

# Parameters for Traffic Emission Inventories



# Traffic emission inventories



# Consolidation of the data base for the German Emission Inventory Methodology

## Generation of Data

Emission Factors

Mileage

Traffic Data

Traffic Structure

Auxiliary Data

## Processing of the Data Base

- Parameter definition and differentiation
- Data base definition
- Development of methodologies
  - ↳ Cold Start
  - ↳ Evaporation
  - ↳ Projection of traffic data
  - ↳ geographic / time scale resolution

## Application

National and local environmental politics

Standard of Immission Protection

Construction of Traffic Plants

Environmental Assessment Studies

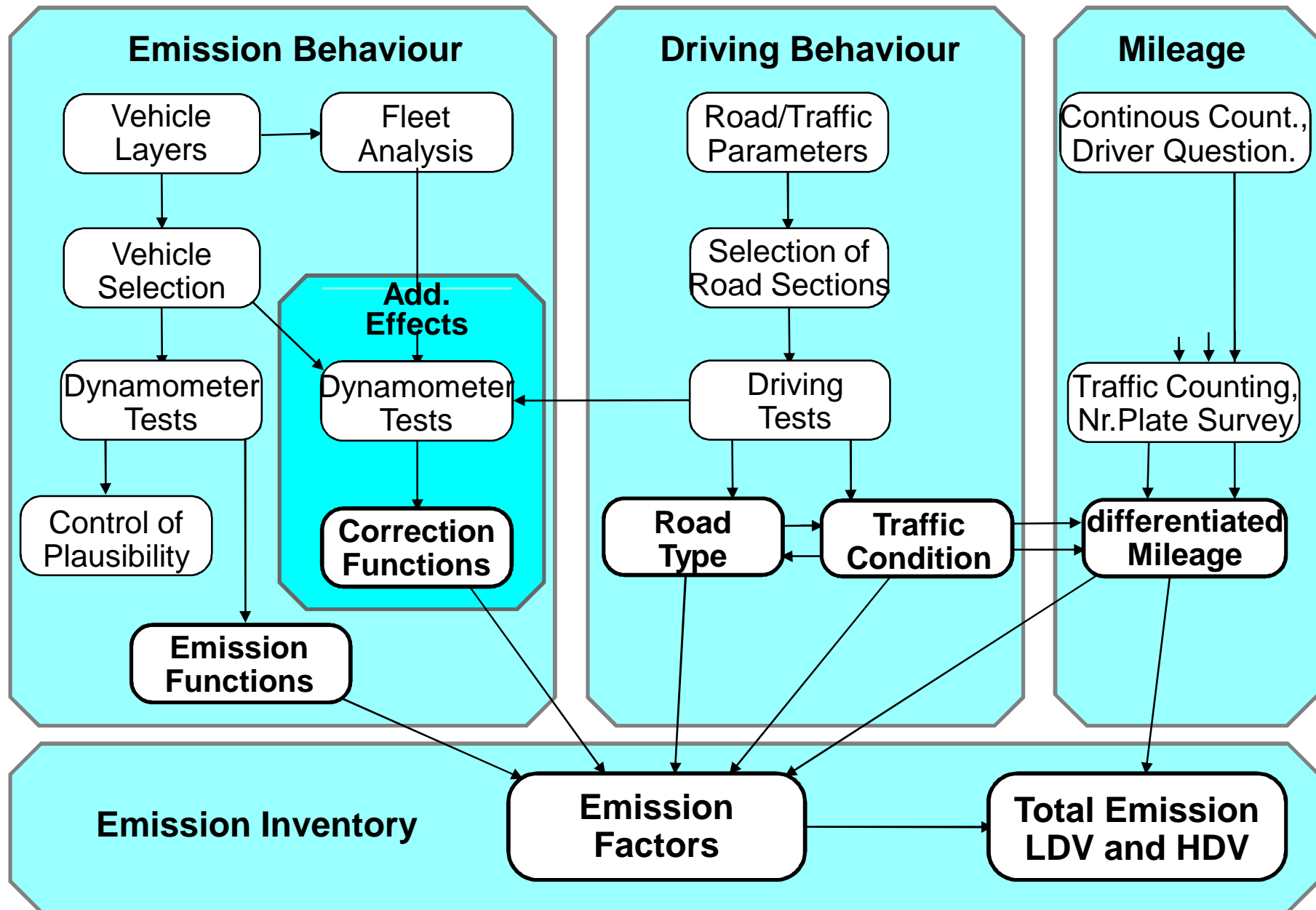
## Maintenance and Update

**differentiate**  
data according to necessities

**integrate**  
data bases and methodologies

**harmonize**  
further fields of application

# Procedure for Calculating Emission Factors



Messparcours Aachen - Verlautenheide  
ausgewählte Fahrten, Abschnitte 8-10

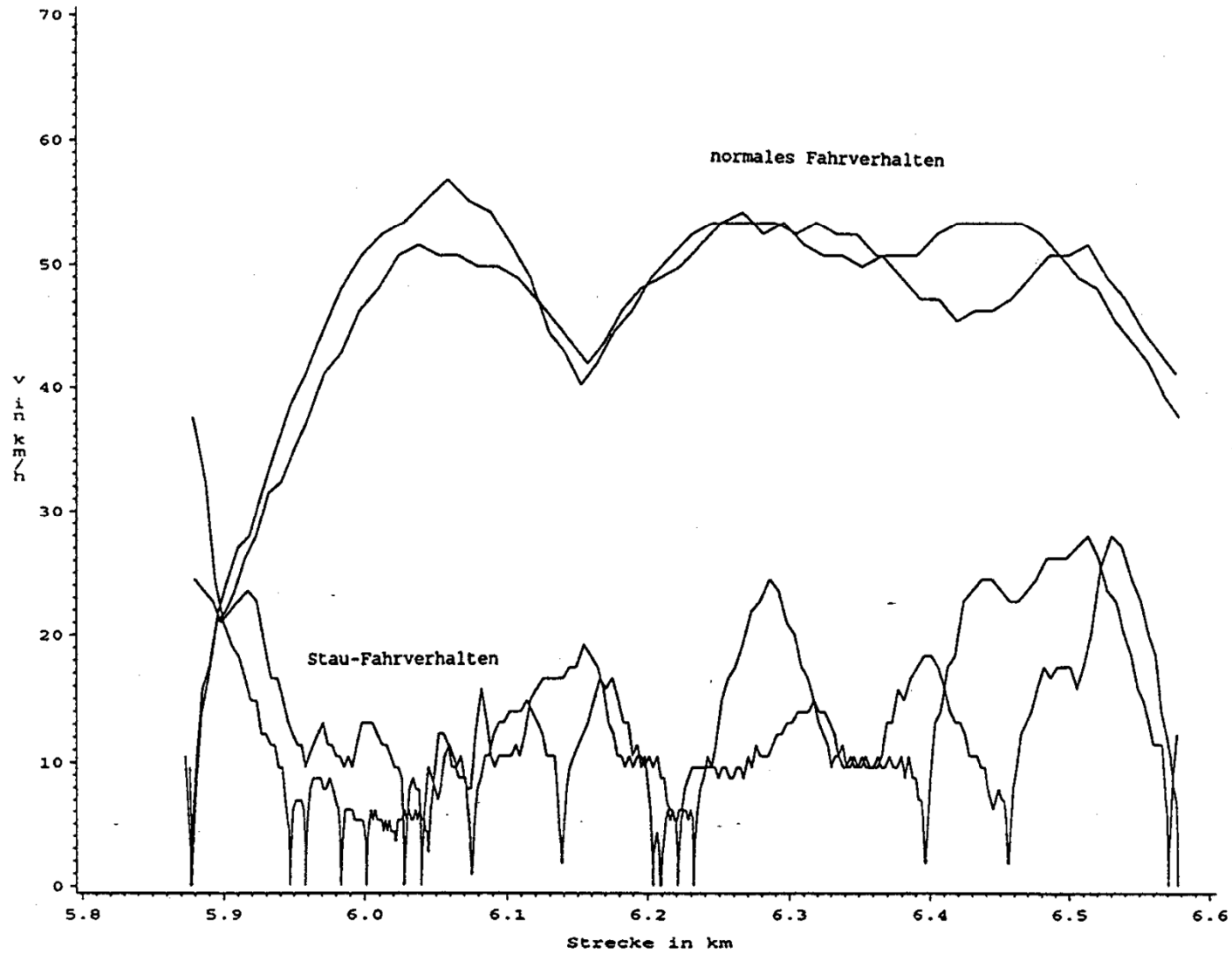
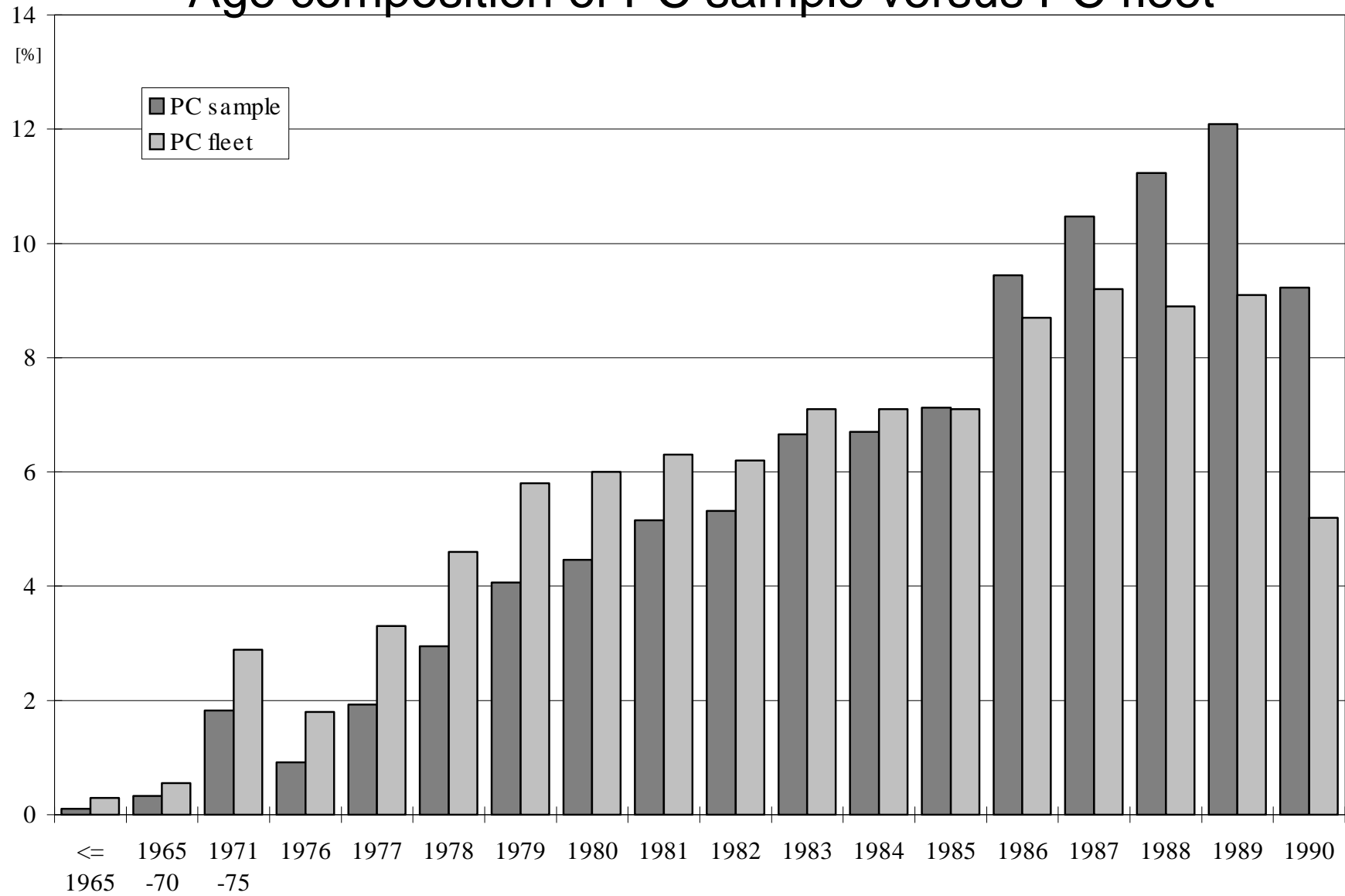


Bild 6-1: Beispiel von Fahrkurven im Vergleich "Stau" und "normales" Fahrverhalten

# Passenger Car Driving Patterns - Urban, Rural and Slope

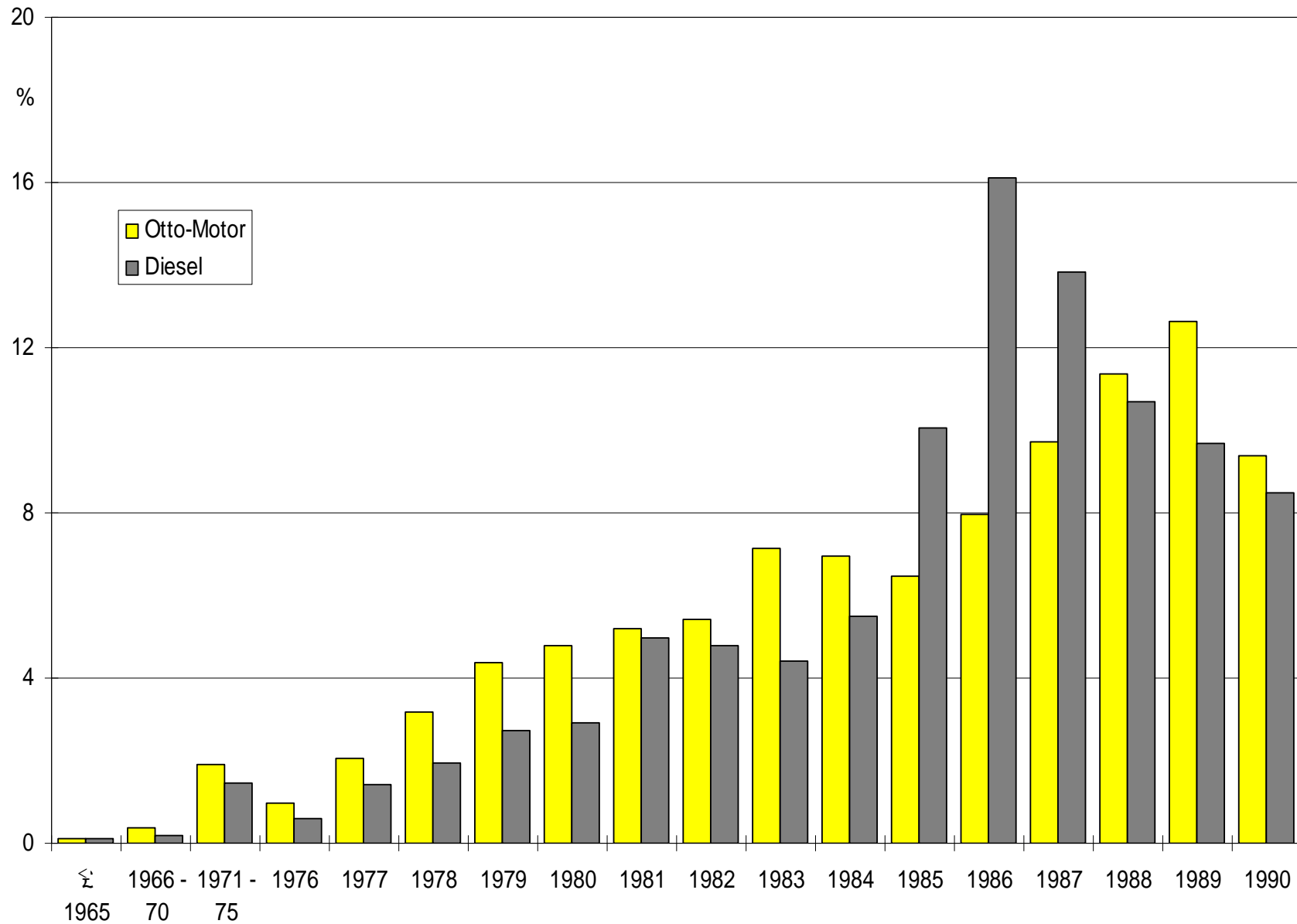
Roads in built-up areas/outside built-up areas//levels:	
DP1	Area sources, $v = 18,6$ km/h
DP2	Line sources with unco-ordinated TLS, highly developed structure, centre, $v = 19,8$ km/h
DP3	Line sources with unco-ordinated TLS, poor development structure, $v = 32,0$ km/h
DP4	Local through roads with bottlenecks, $v = 37,5$ km/h
DP5	Line sources, with priority., poor development structure, continuous driving on $\mu_{green} > 50$ , developed local through roads, $v = 46,2$ km/h
DP6	Secondary roads, changeable $v = 60,6$ km/h
DP7	Secondary roads, narrow, line sources, continuous driving on $\mu_{green} < 50$ , development-free local through roads, $v = 58,4$ km/h
DP8	Secondary roads, continuous, with acceleration (e.g. local through roads), $v = 78,3$ km/h
DP9	Secondary roads, continuous, with delays (e.g. local entry roads), $v = 72,0$ km/h
DP10	Secondary roads, continuous, non-uniform structure line sources ( $v = 76,7$ km/h)
STGO IBA	IBA, traffic jam, $v = 5.3$ km/h
Roads in built-up areas // slope or incline:	
LG 1	OBA, slope, continuous to narrow, $v = 60.9$ km/h
LG 2	OBA, slope, narrow to changeable, $v = 51.2$ km/h
LG 3	OBA, slope, changeable, $v = 49.9$ km/h
LS 1	OBA, incline, continuous to narrow, $v = 59.8$ km/h
LS 2	OBA, incline, narrow, changeable, $v = 49.2$ km/h
LS 3	OBA, incline, continuous to changeable, $v = 46.2$ km/h

# Age composition of PC sample versus PC fleet

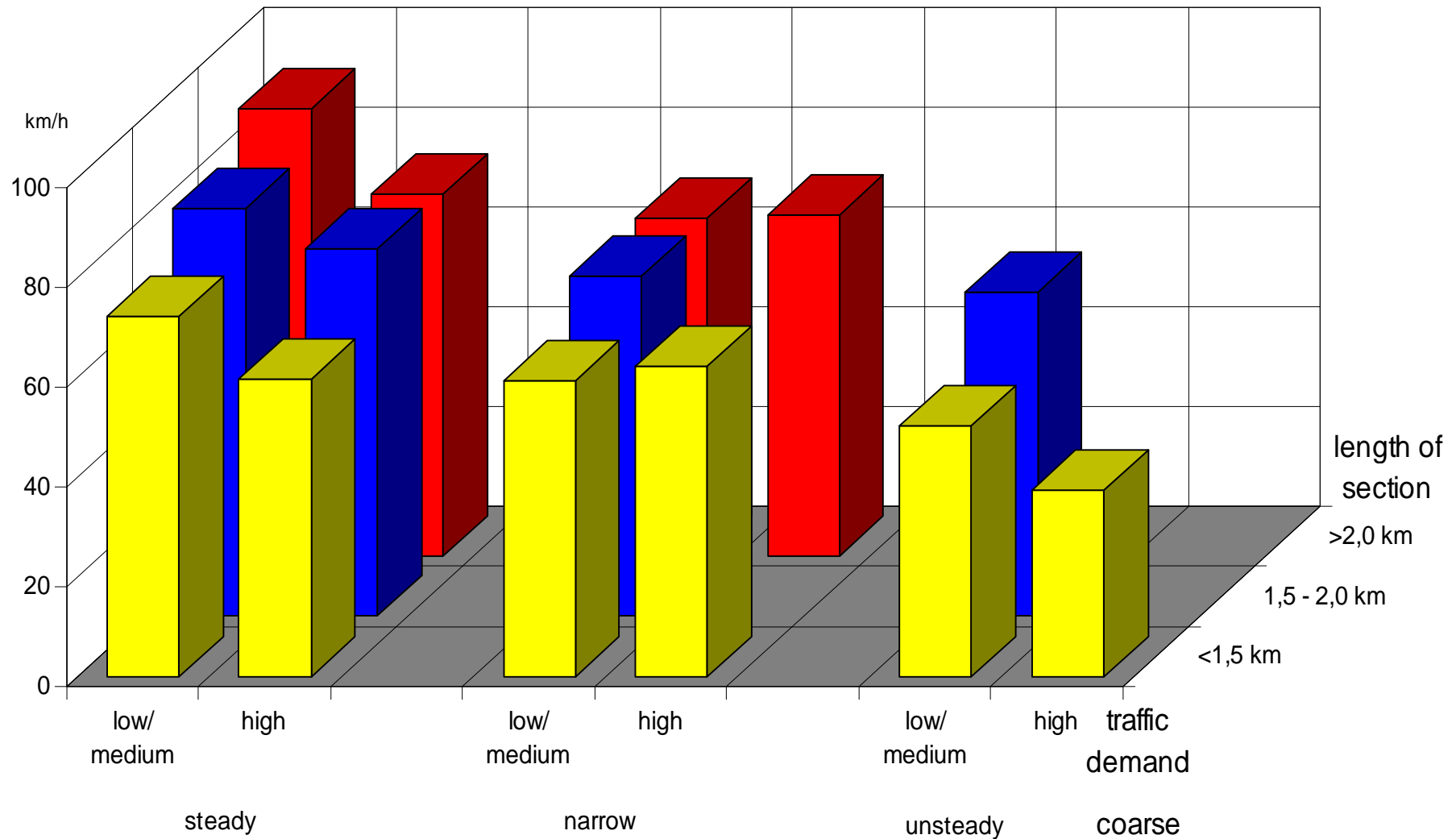




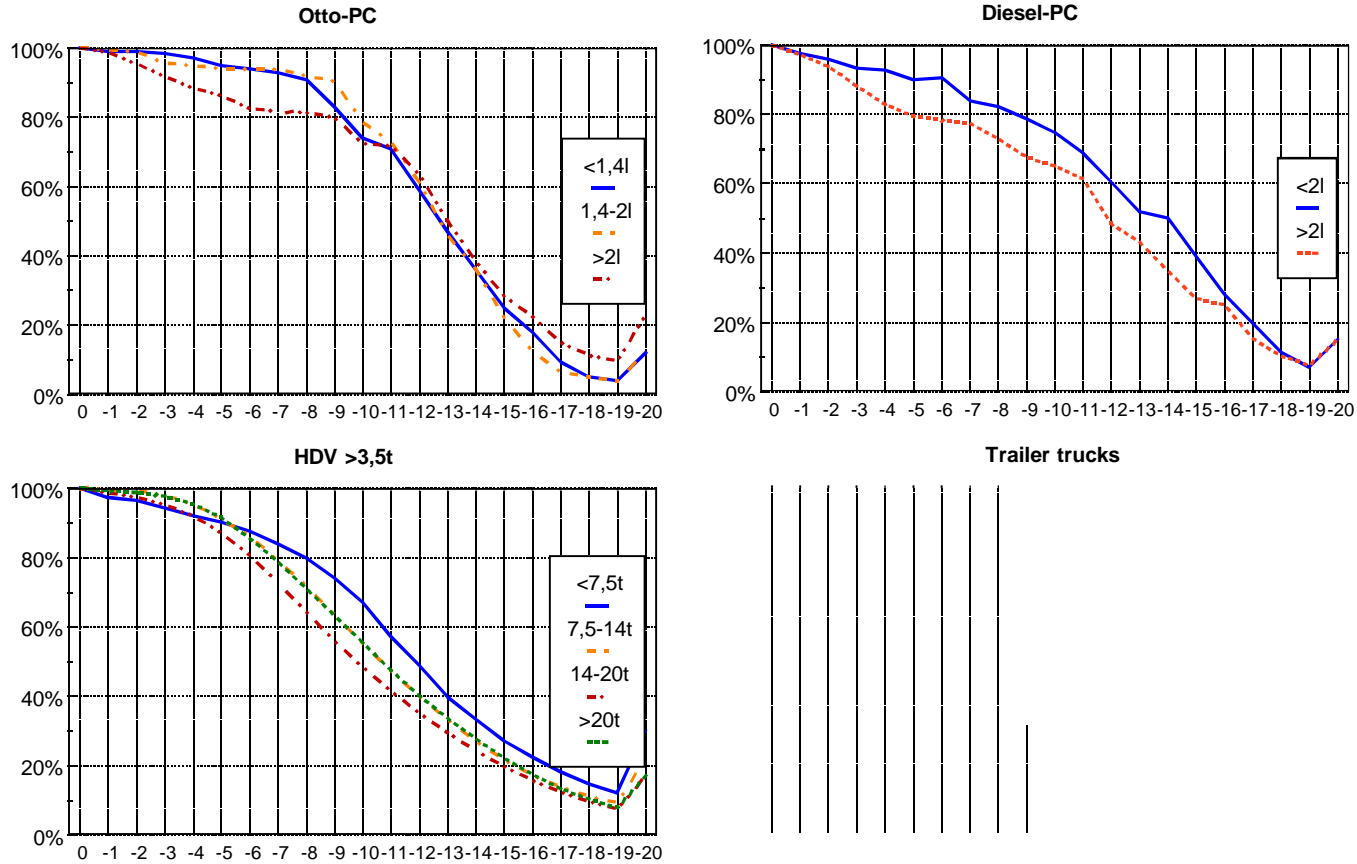
# Fleet composition per engine category and age



# Average vehicle speed according to section characteristics



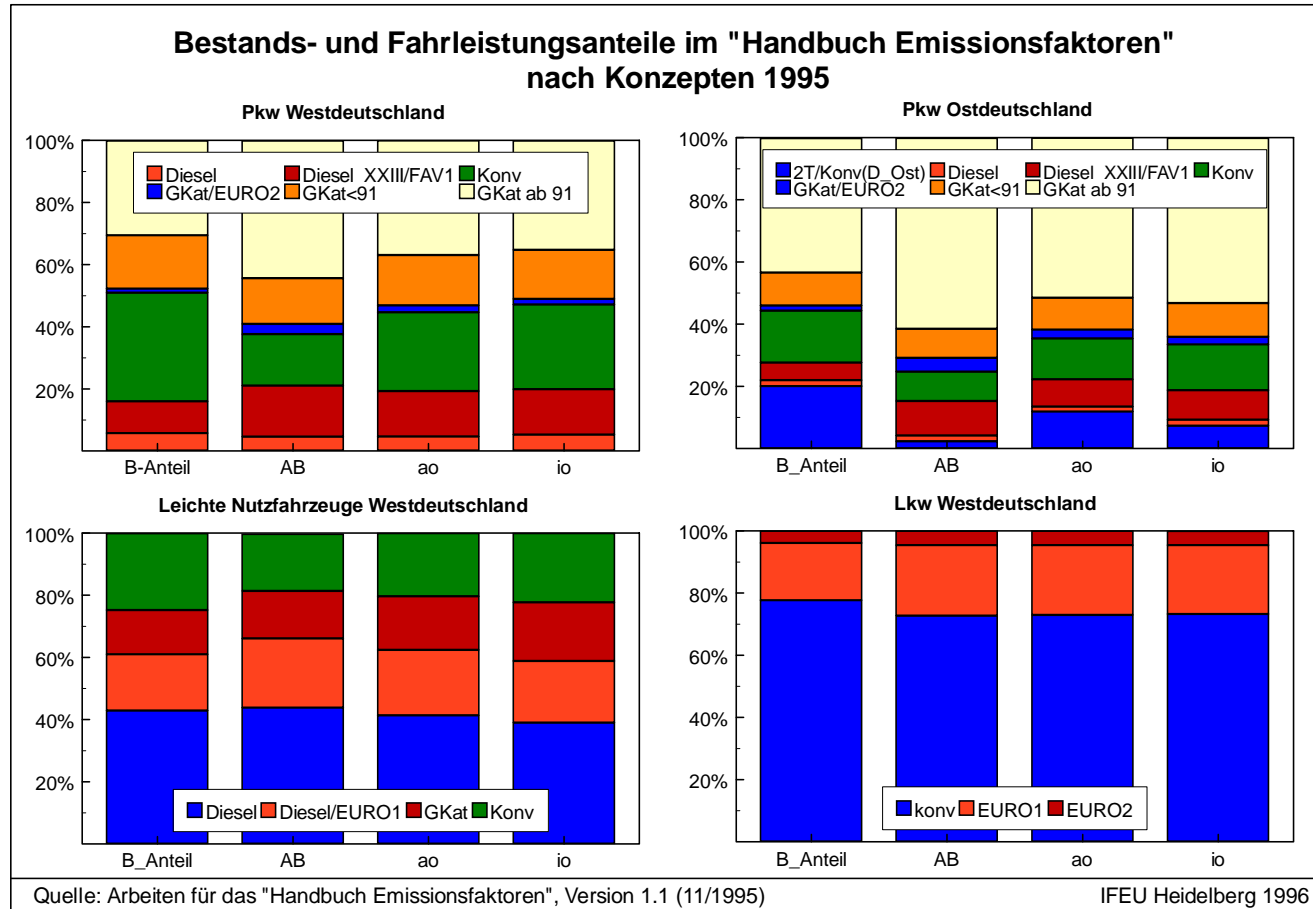
## Survival curves in "Handbuch Emissionsfaktoren" für Westdeutschland ab 1994



Source: Arbeiten für das "Handbuch Emissionsfaktoren", Version 1.1 (11/1995)

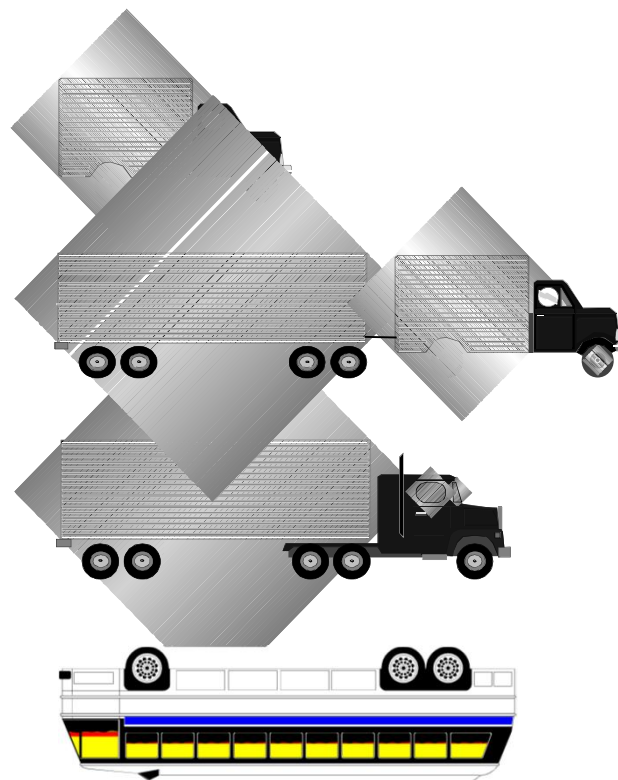
IFEU Heidelberg 1996

# Fleet composition and mileage share of vehicle categories



# HDV

## Structure of Vehicle Categories and Layers in the UBA Estimation Model



	Mass Class	Emission Standard
Lorries	< 7,5 t	< 1990
Trucks	7,5 - 14 t	Euro 1
	14 - 20 t	Euro 2
	20 - 28 t	Euro 3
Road Trains	< 20 t	
Trailer Trucks	20 - 28 t	
	28 - 32 t	
	> 32 t	
Articulated Combinations	< 32 t	
	> 32 t	
Semitrailer Trucks	< 20 t	
	> 20 t	
Coaches	< 20 t	
	> 20 t	
Busses	< 20 t	
	> 20 t	

Remarks: Vehicle categories by TÜV Rheinland; basis used in the project: "Daten- und Rechenmodell - Schadstoffemissionen aus dem motorisierten Verkehr in Deutschland 1980 - 2010", prepared under contract with Umweltbundesamt (UFOPLAN-Nr. 105 06 057);

Sources: TÜV Rheinland

IFEU Heidelberg

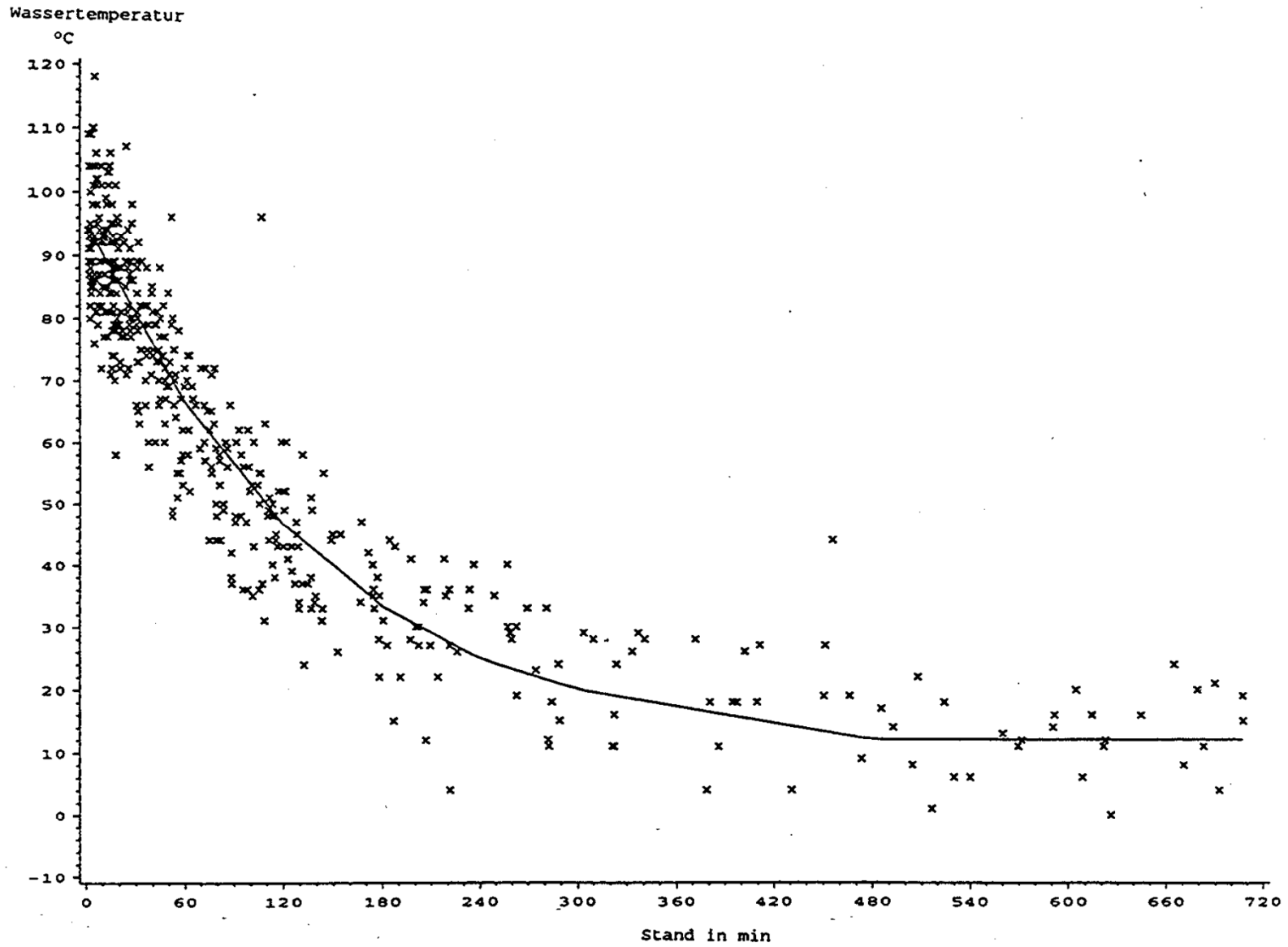
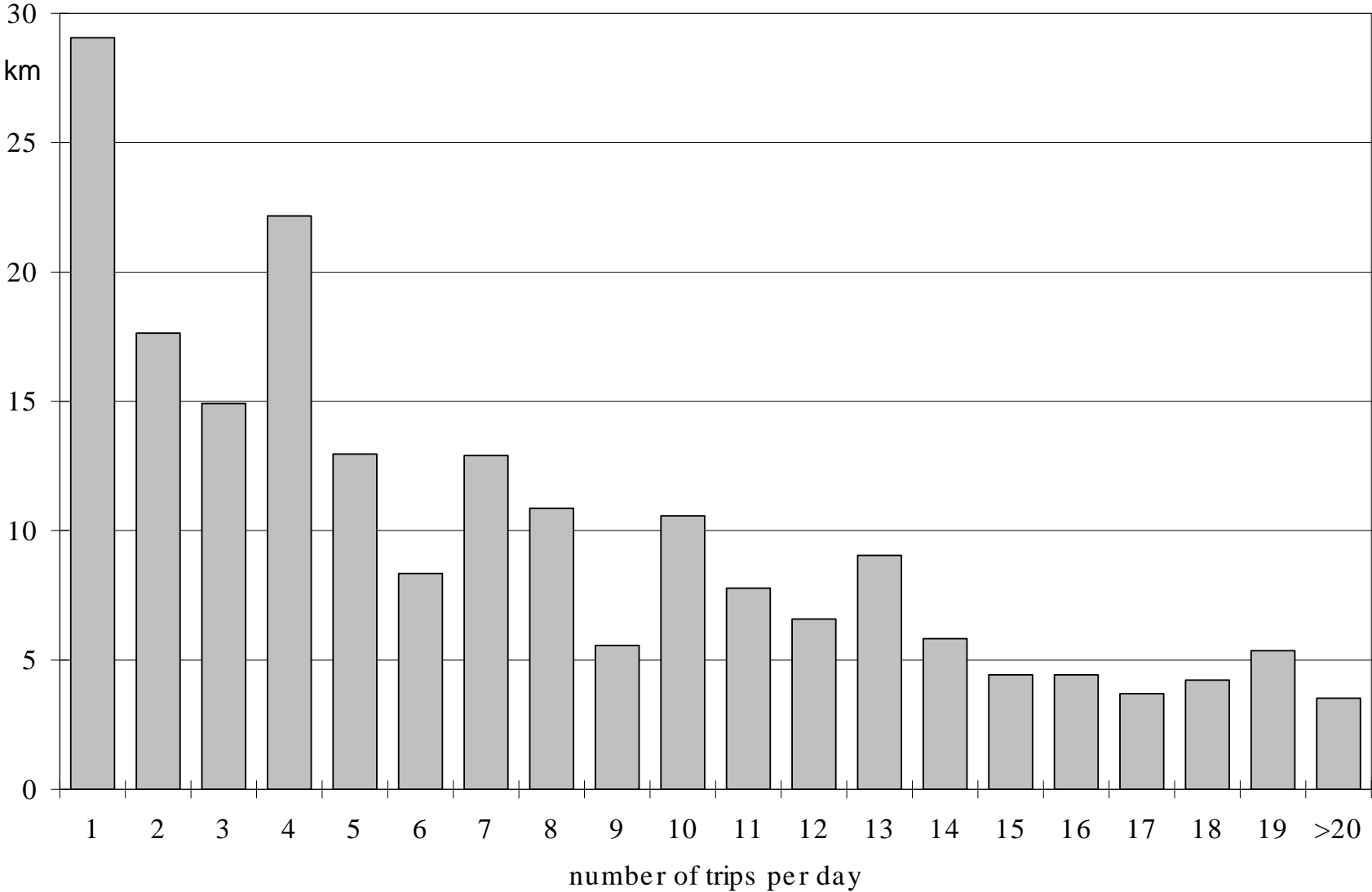


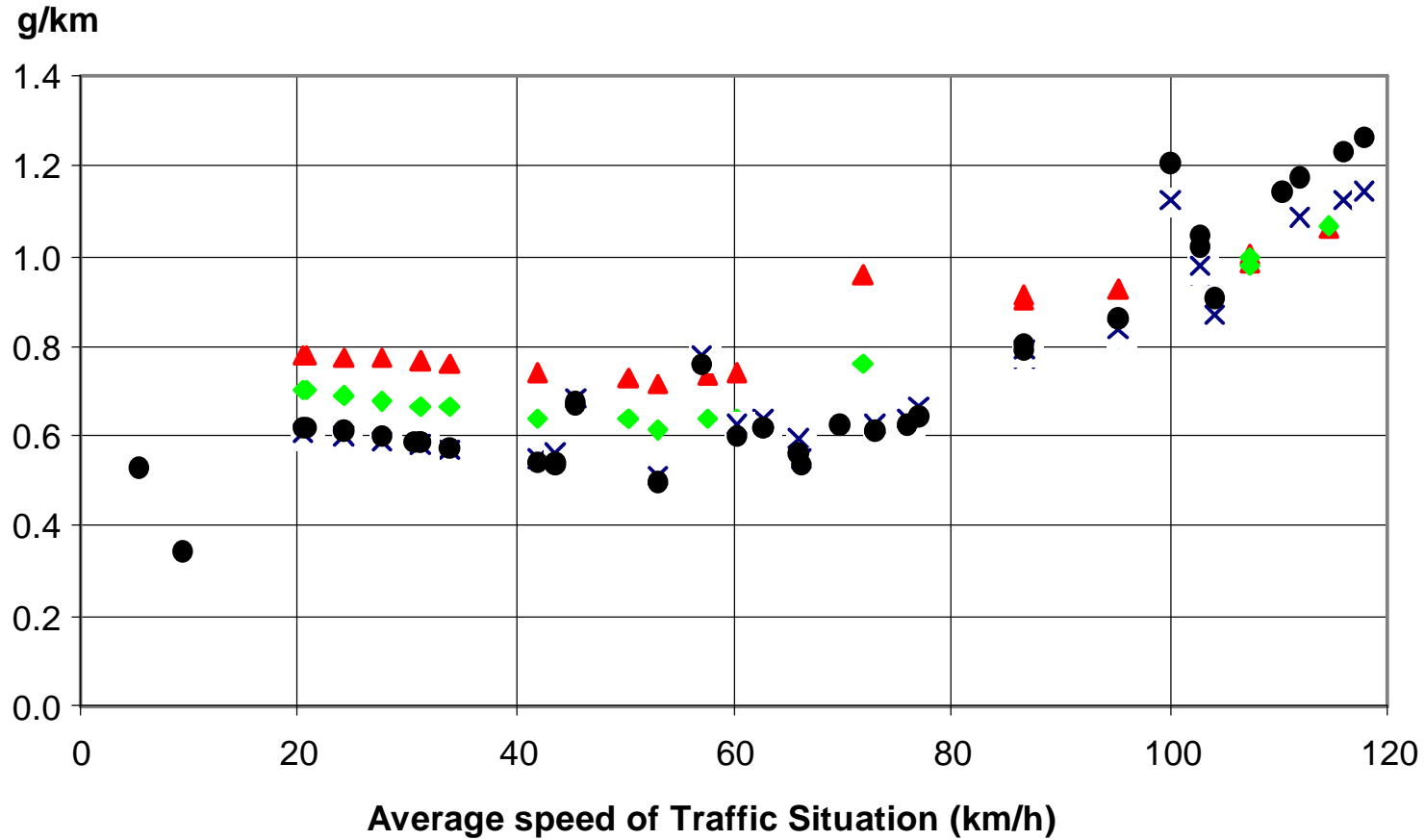
Bild 5-9: Darstellung des Abkühlvorganges: Starttemperatur nach Standzeit

# Average trip length versus number of trips per day



# Influence of gradient on emission

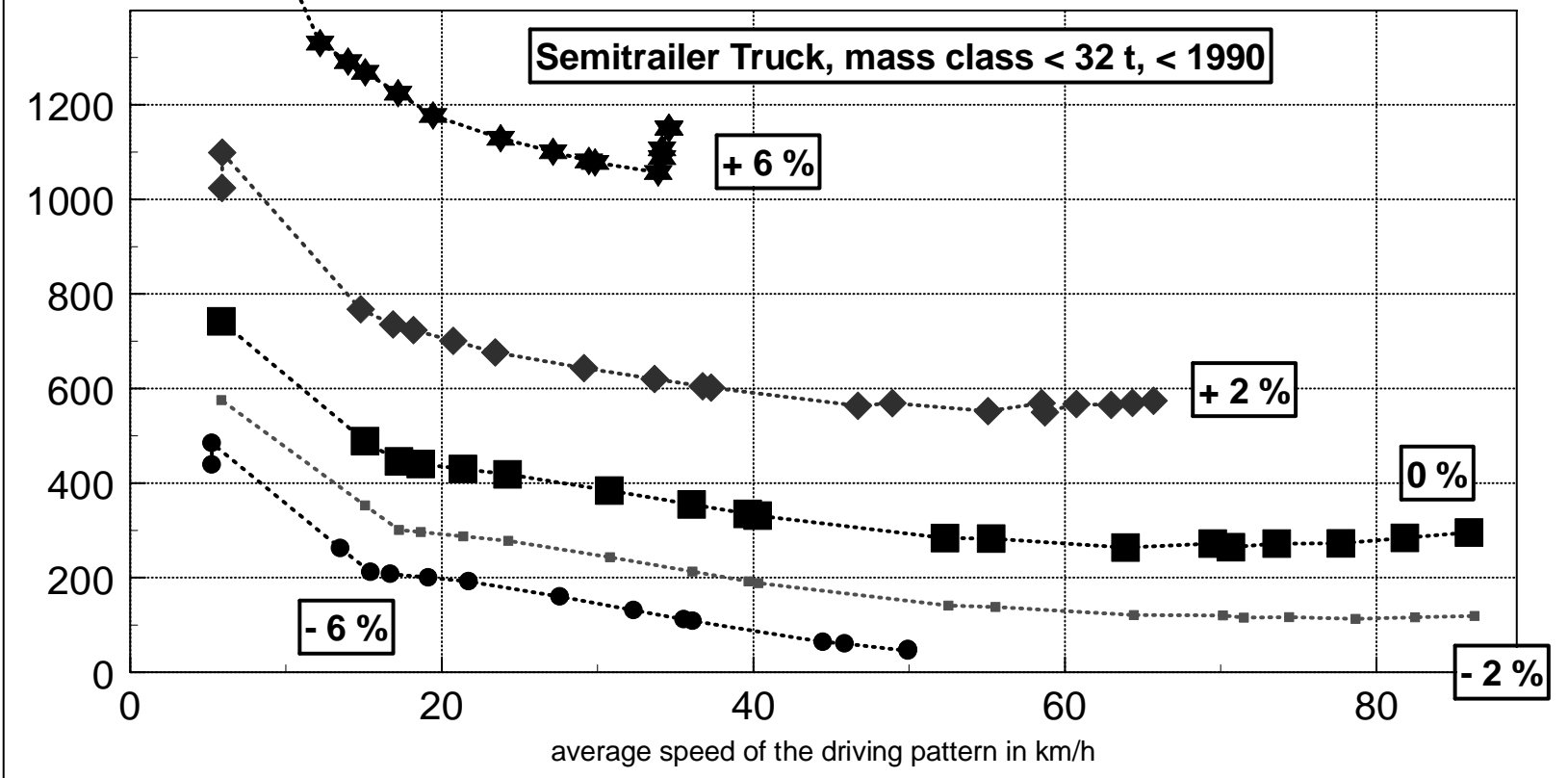
## NO<sub>x</sub> Emission Factors of Passenger Cars (g/km)





# Emission Factors of HDV in Germany, 1990

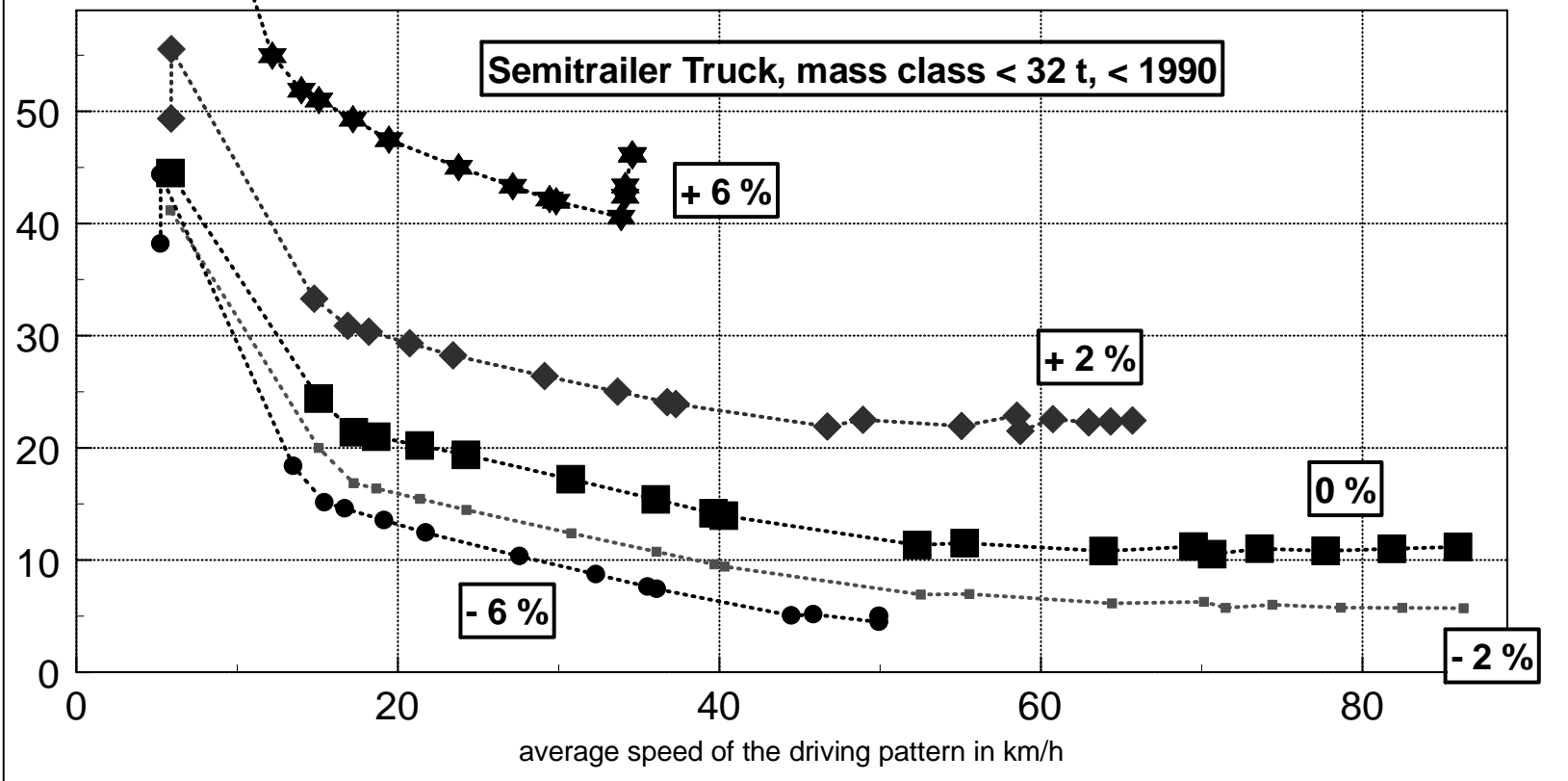
Fuel consumption for different driving patterns and different gradients (g/km)



Remarks: Emission factors according to TÜV Rheinland; driving patterns are dependent of traffic situation and gradient of the street; lines between data points don't represent a speed dependency of emission factors; data are not suitable for estimation of speed limit effects;  
 Sources: TÜV Rheinland; INFRAS: Handbuch der Emissionsfaktoren  
 IFEU Heidelberg

# Emission Factors of HDV in Germany, 1990

NOx Emissions for different driving patterns and different gradients (g/km)



Remarks: Emission factors according to TÜV Rheinland; driving patterns are dependent of traffic situation and gradient of the street; lines between data points don't represent a speed dependency of emission factors; data are not suitable for estimation of speed limit effects;

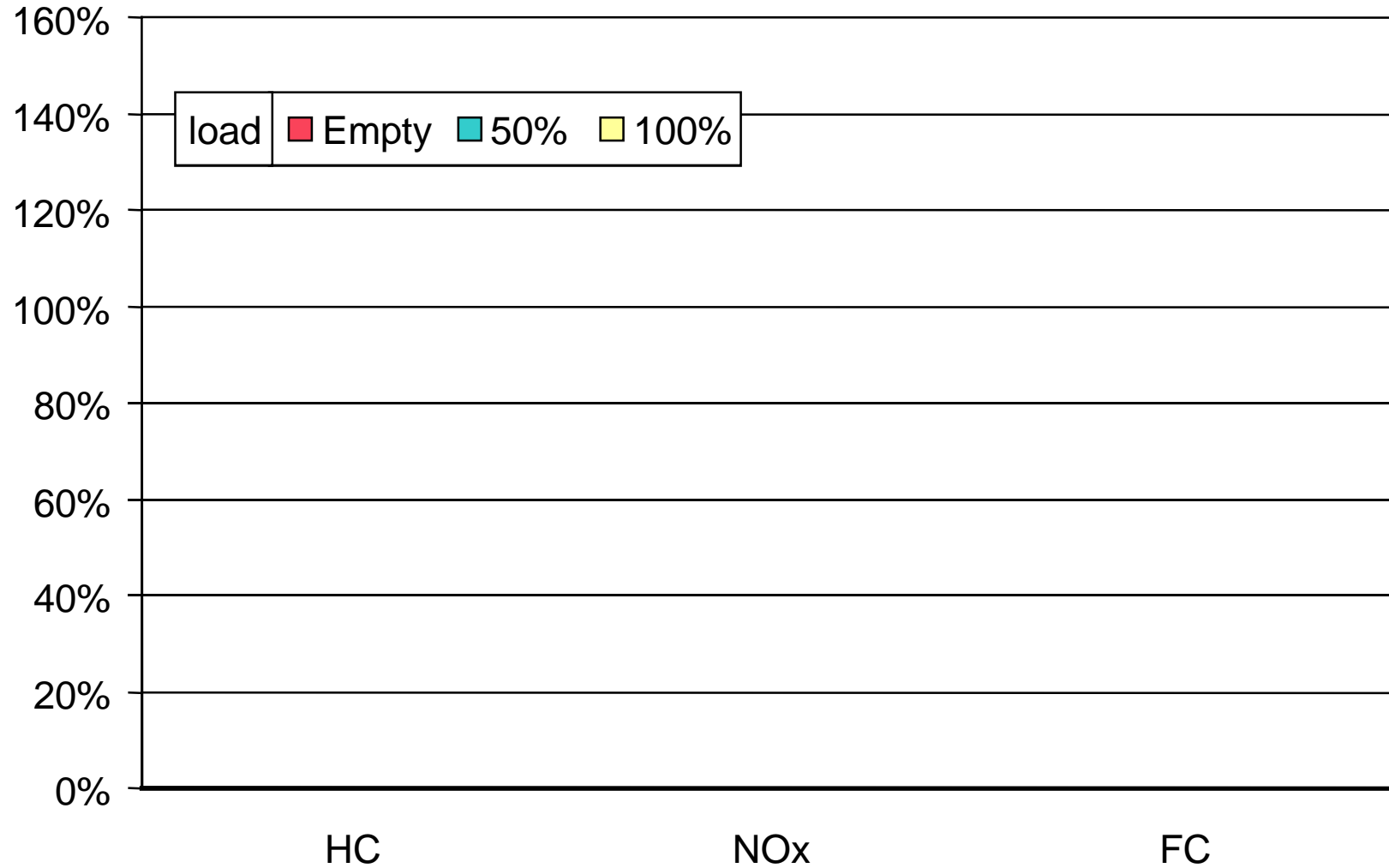
Sources: TÜV Rheinland; INFRAS: Handbuch der Emissionsfaktoren

IFEU Heidelberg

# Emissions and FC of HDV (HB-EFA 1.1)

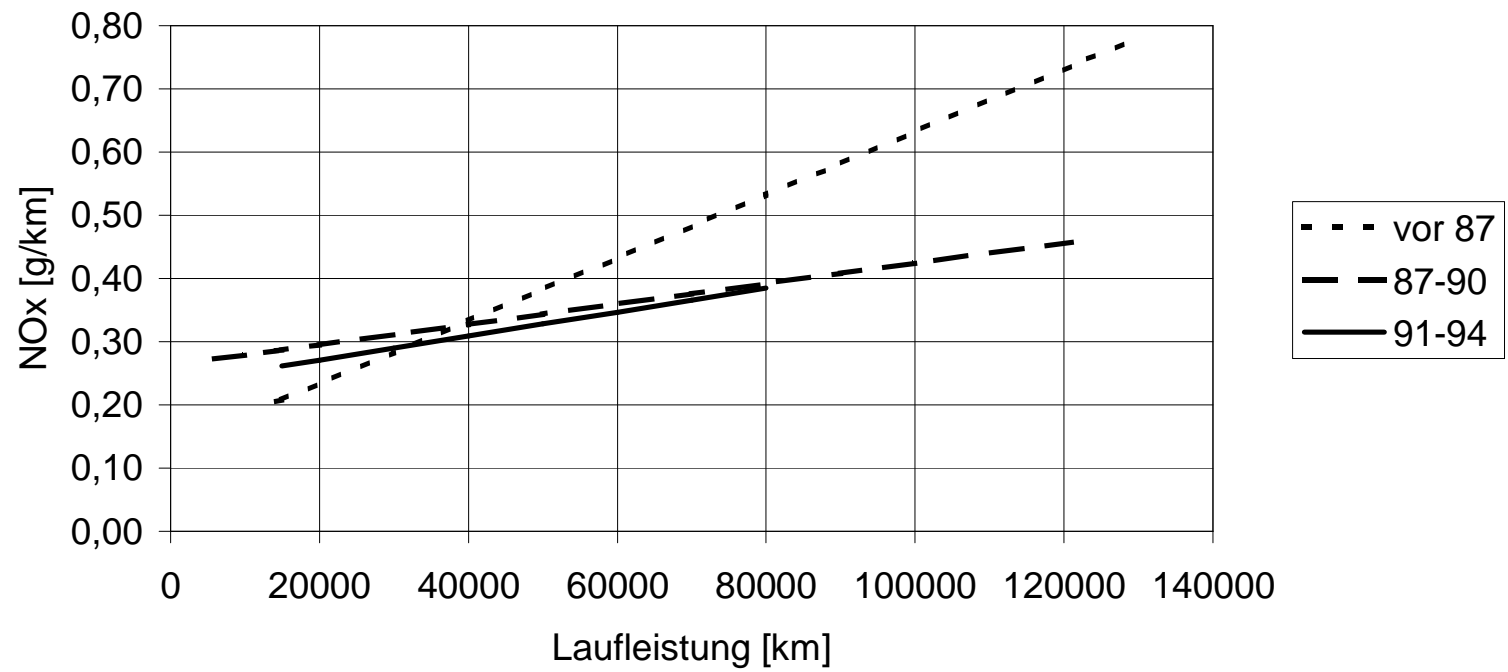
Average  $\pm 6\%$  versus 0% gradient at various loads

trailer truck 28-32 t, highway, speed limit 100 km/h

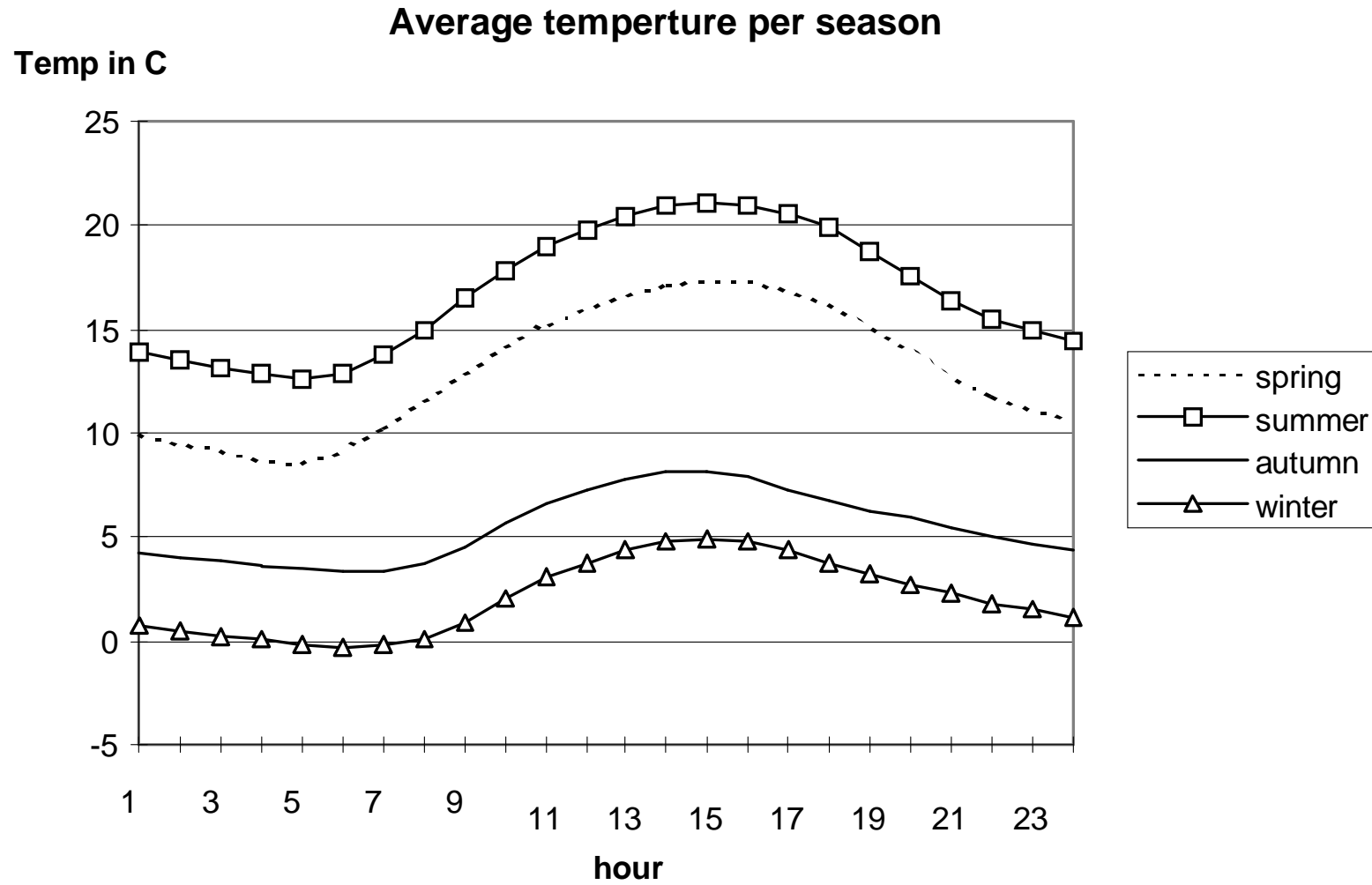


# Mileage deterioration effect - NOx emission of PC

US-Test-75

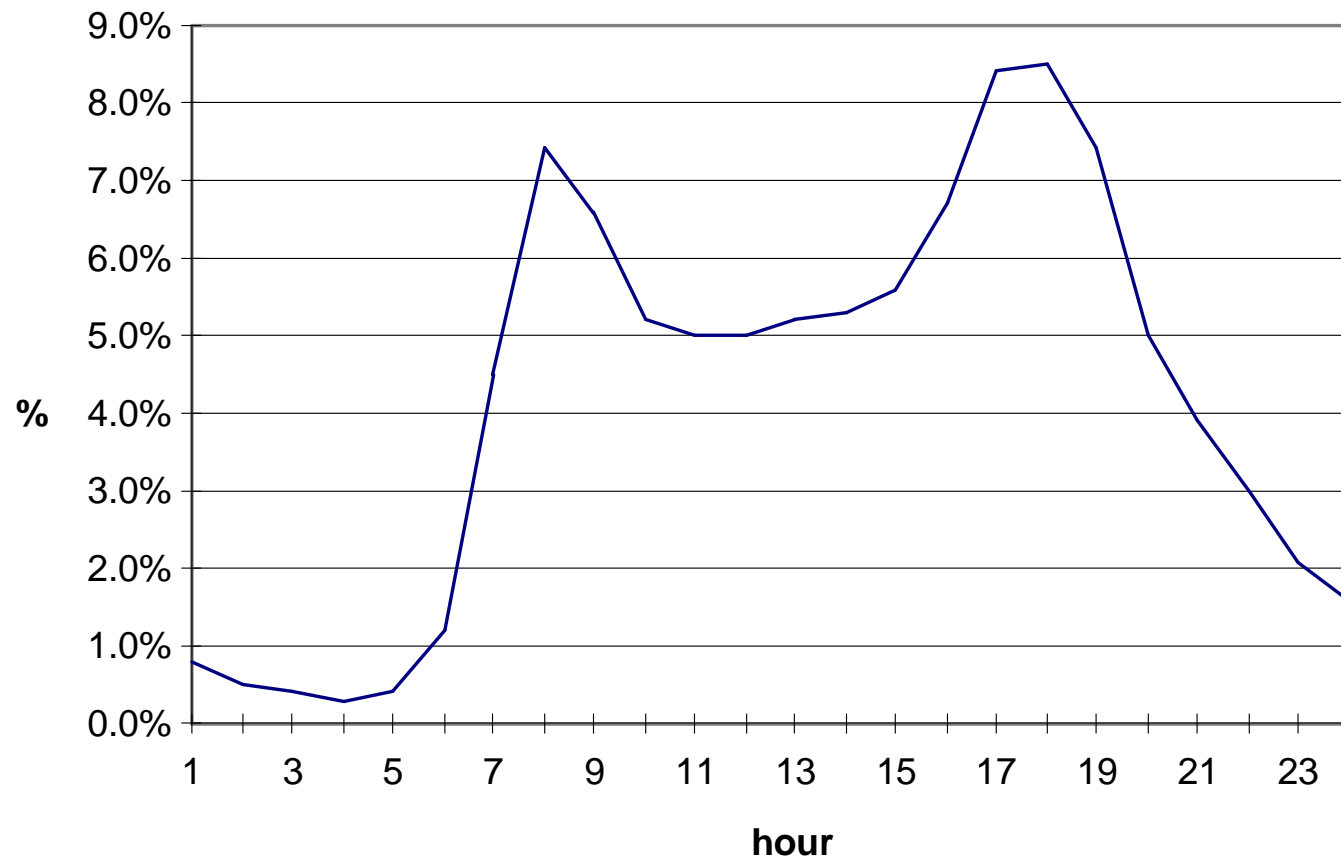


# Traffic parameters for cold start and evaporative emissions

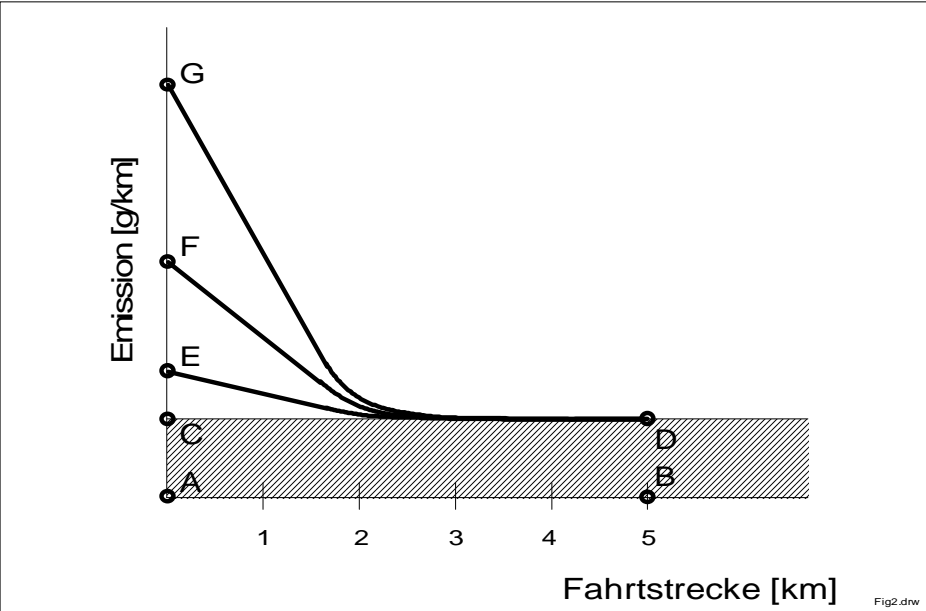


# Traffic parameters for cold start and evaporative emissions

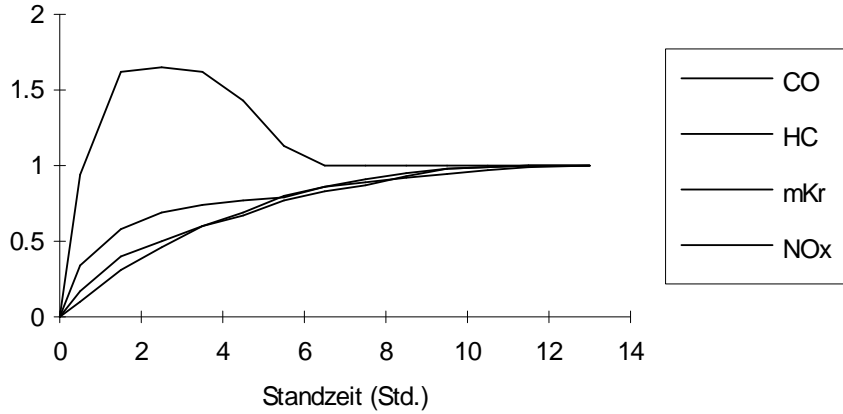
**Average daily traffic flow (FRG, city, tuesday to thursday)**



# Cold start extra emission



Abminderungsfaktoren für Kühlstarts (PW/GKat91ff)



# Traffic parameters for cold start and evaporative emissions

## Distribution of parking time - average for Germany

Parking time (h)	1	2	3	4	5	6	7	8	>8
share	41,6 %	10,6 %	6,5 %	4,2 %	2,45 %	2,45 %	1,4 %	1,4 %	29,4 %
Quelle: Heusch-Boesefeldt <span style="float: right;">IFEU 1995</span>									

## Distribution of trip length - average for Germany

<b>Driving distance</b>	<b>&lt;1 km</b>	<b>1 - 2 km</b>	<b>2 - 3 km</b>	<b>3 - 4 km</b>	<b>&gt; 4 km</b>
share	10,3%	13,4%	10,9%	7,1%	58,3%
Quelle: Heusch-Boesefeldt <span style="float: right;">IFEU 1995</span>					



# Comparison of Measurements and Emission Calculation at the Autobahn A4

