



# Air Quality and Particulate Matter in the City of Zurich

Rainer Zah, Geschäftsbereich Umwelt



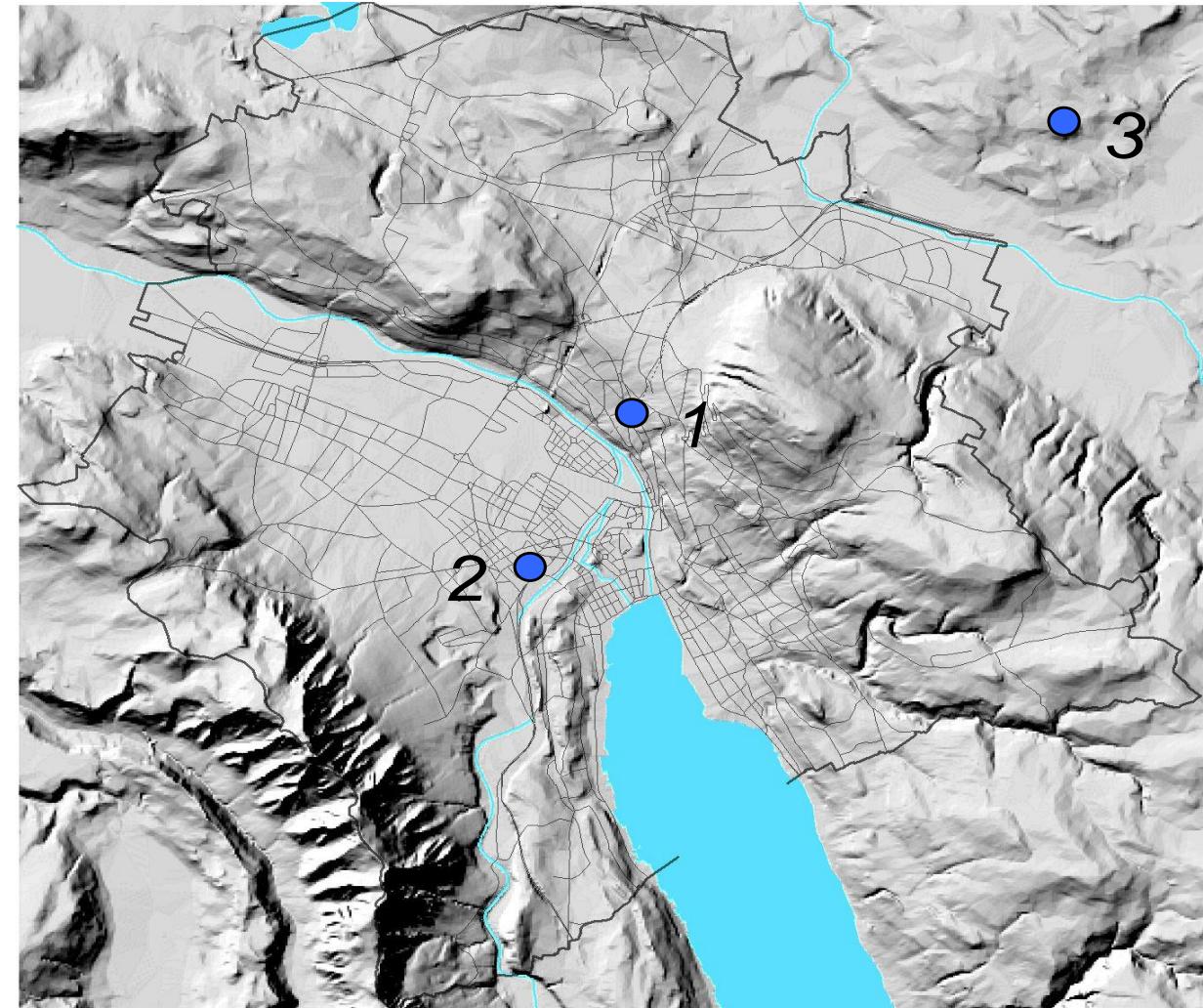
# The City of Zurich – geographical facts



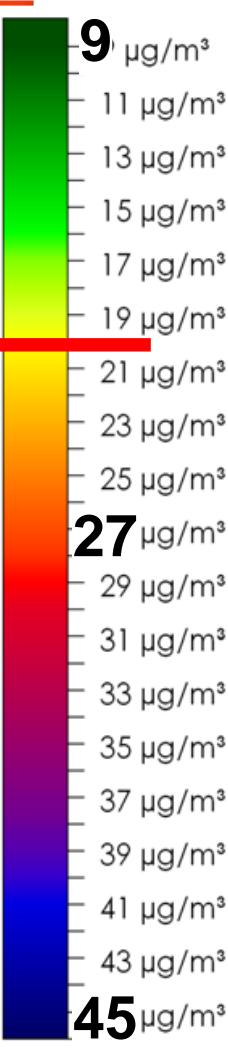
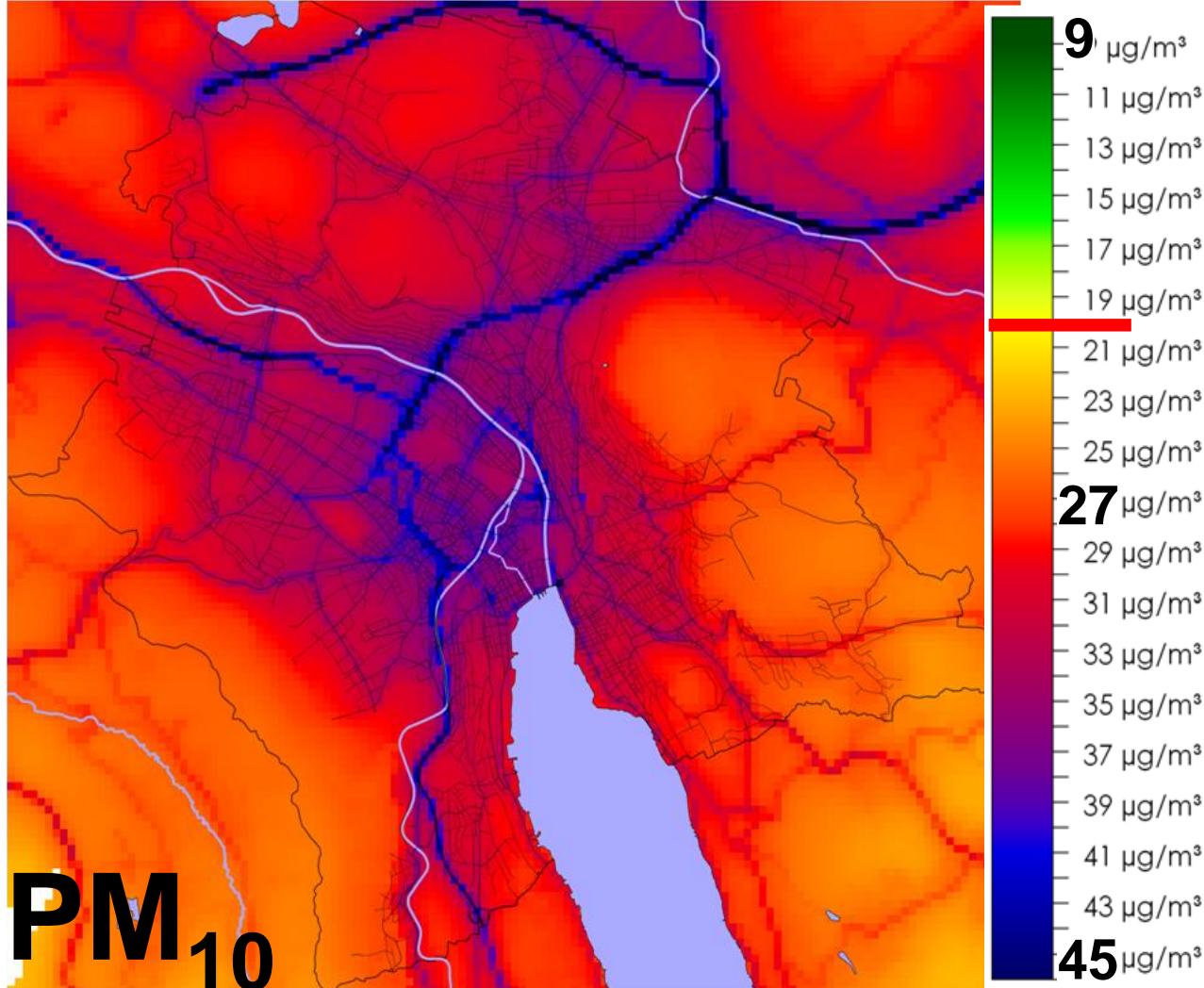
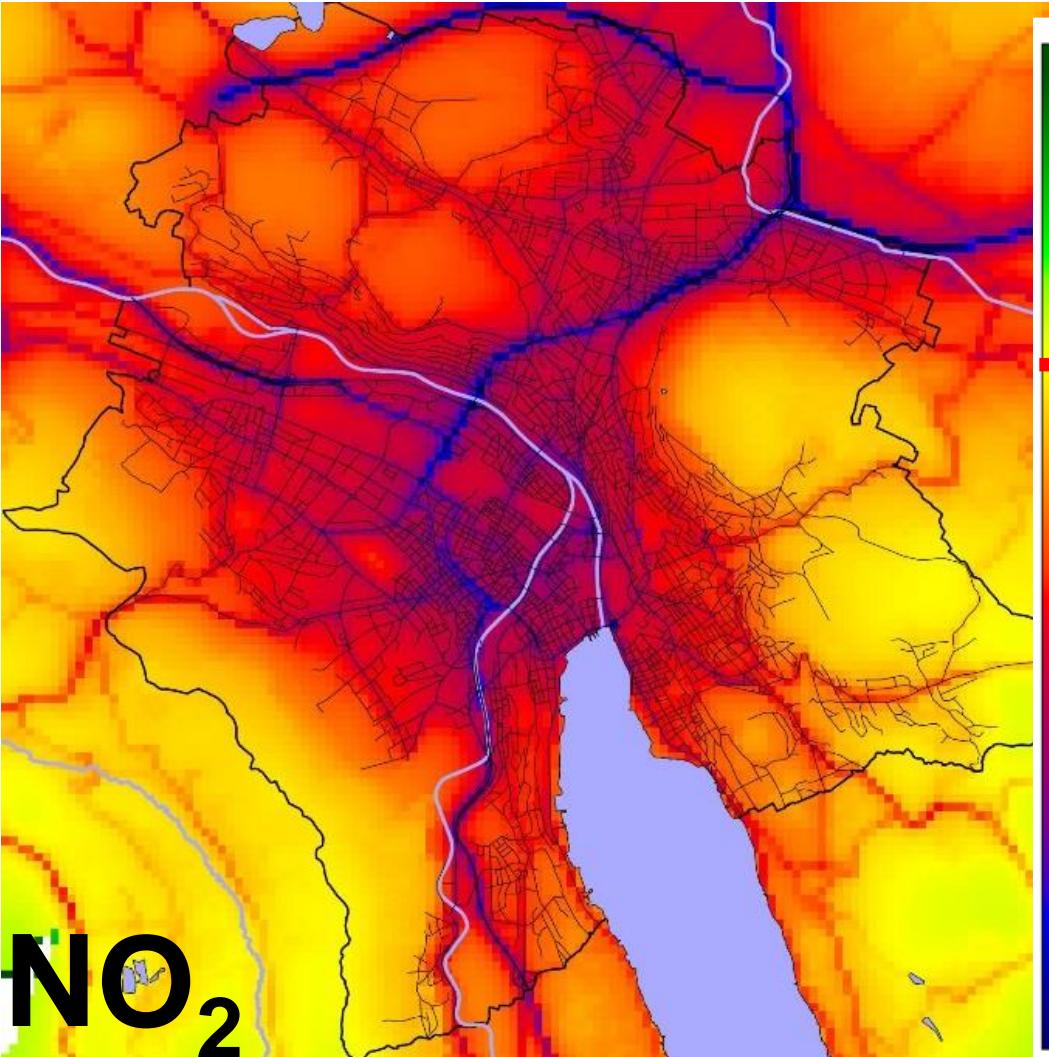
Population (2018): 428'737

Area: 91.9 km<sup>2</sup>

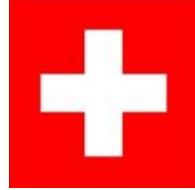
Altitude: 392 – 871 m a.s.l.



# Nitrogen Dioxide ( $\text{NO}_2$ ) & Particulate Matter $\text{PM}_{10}$ in 1990



# Measures of Confederation, Canton und City



**Swiss Confederation**

Environmental Protection Act (EPA)

Ordinance of Air Pollution Control (OAPC)



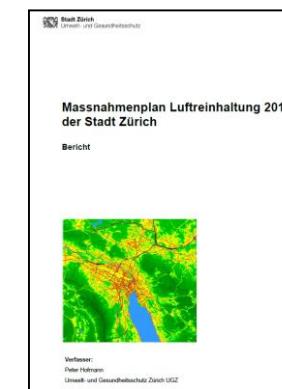
**Canton of Zurich**

Clean Air Action Plan 2016



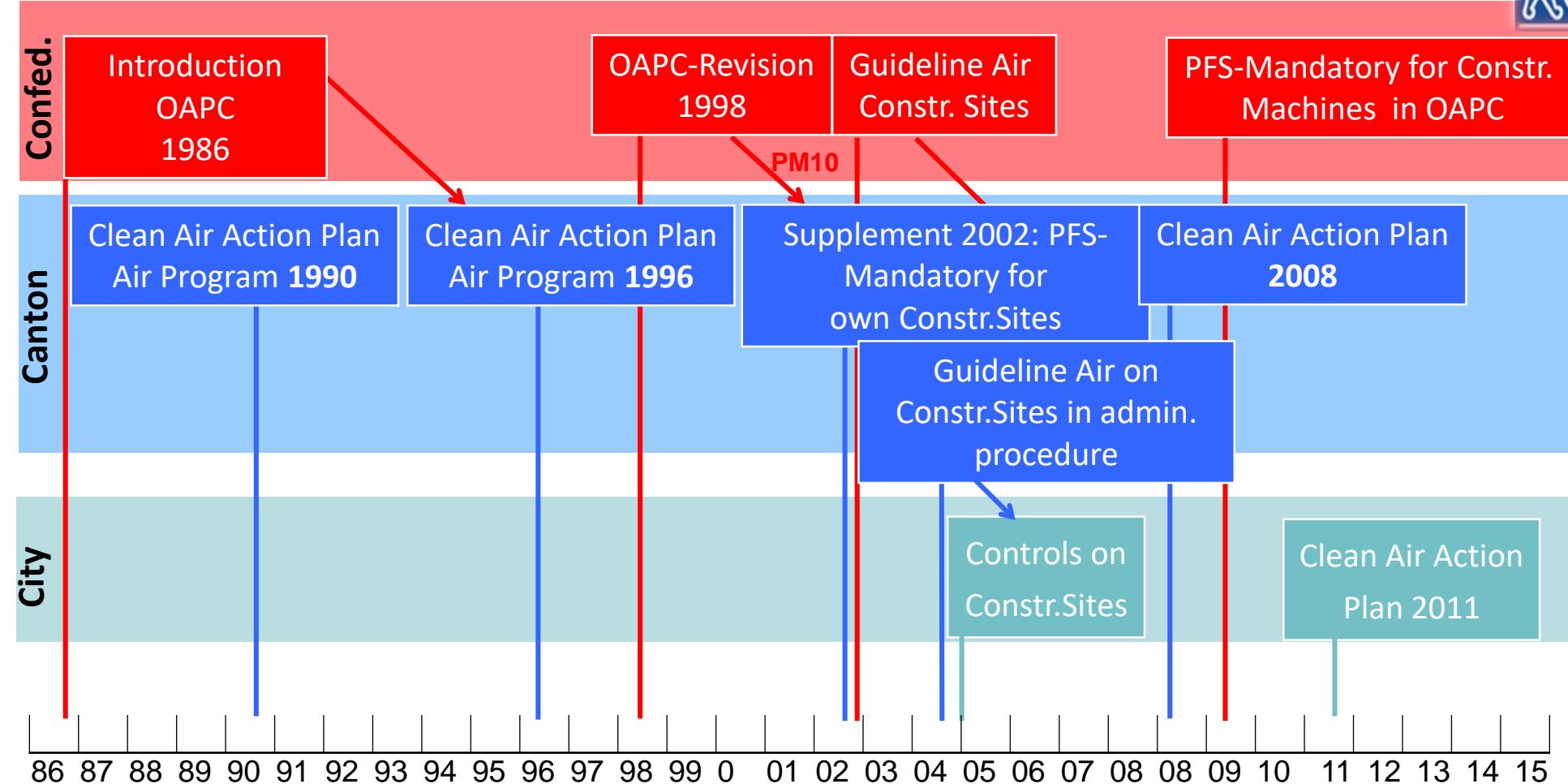
**City of Zurich**

Clean Air Action Plan 2011

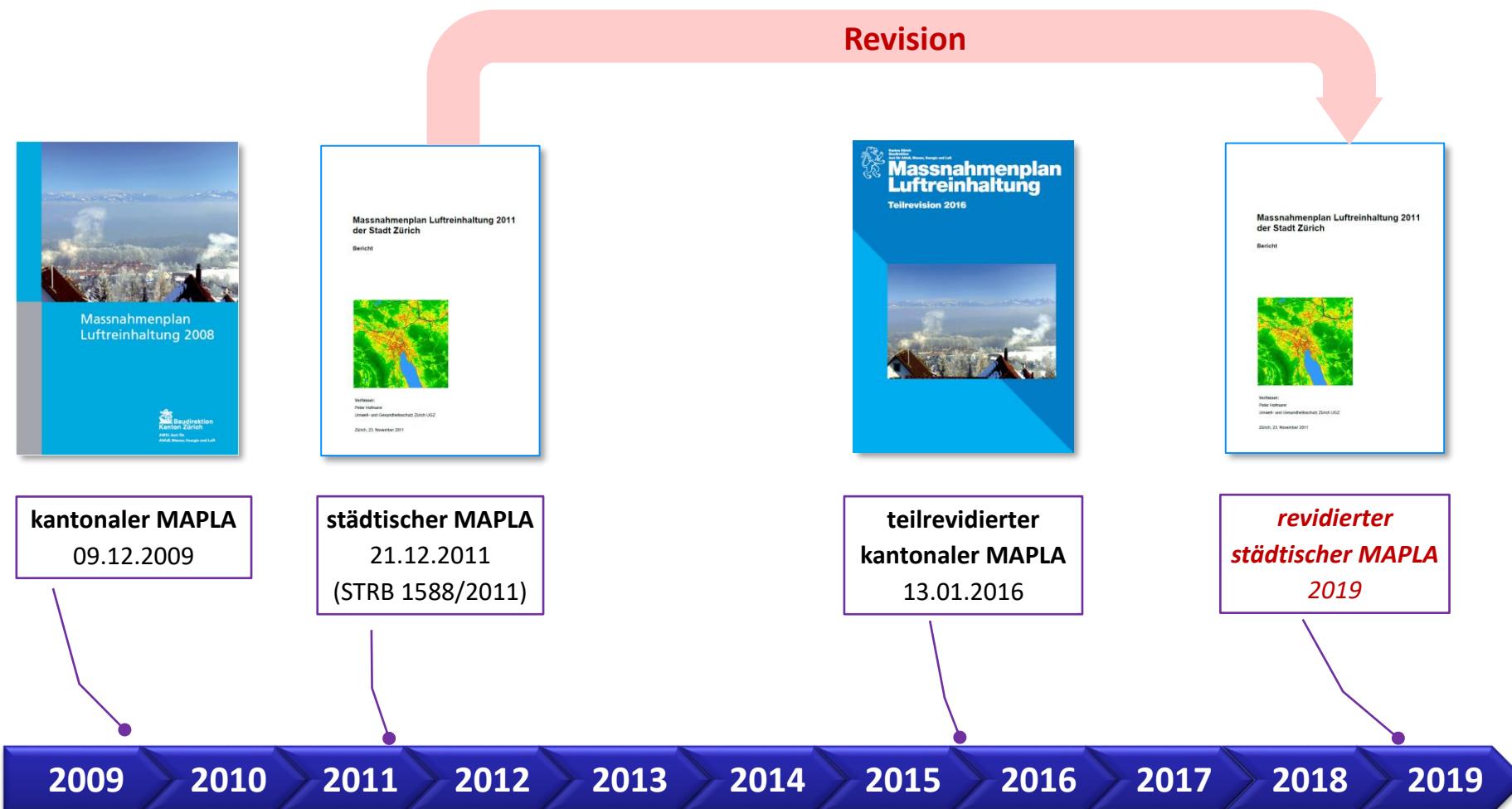




# Measures against air pollution, PM<sub>10</sub> and Diesel soot



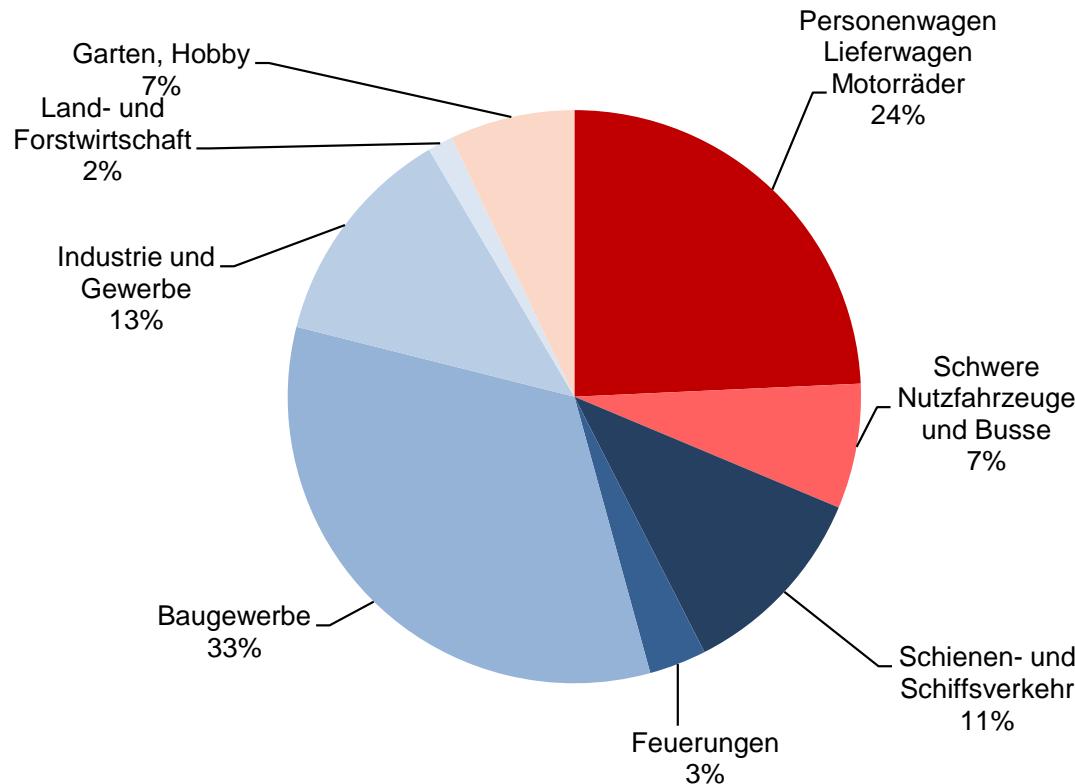
# Massnahmenpläne Luftreinhaltung ab 2009



# Main Emission Sources of Air Pollution

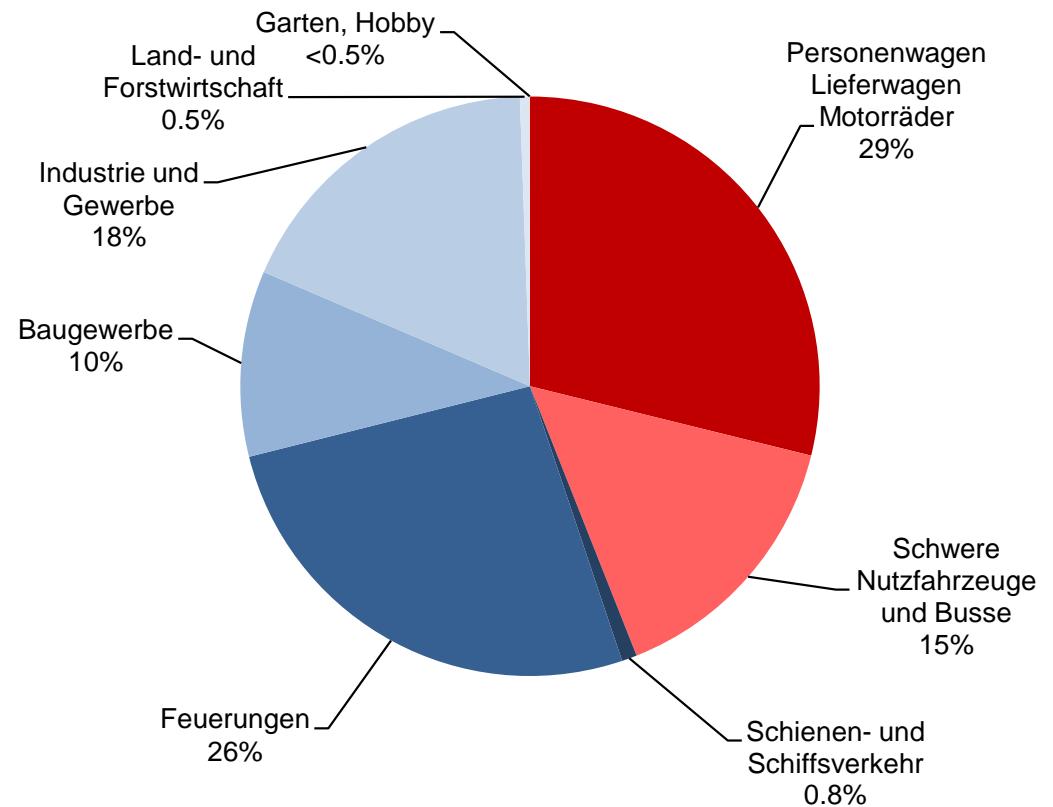
## PM10-Emissionen Stadt Zürich 2015

(Total 360 t)



## NOx-Emissionen Stadt Zürich 2015

(Total 1555 t)



Quelle: Emissionskataster Kanton Zürich



# Clean Air Action Plan 2011, City of Zurich

**Limit Value for Particulate Emissions: 5 mg/m<sup>3</sup>**

- **Stationary Internal Combustion Engines** (> 1 MW; production of electricity)
- **Emergency Generators** (< 25 hours/year) > 1 MW
- **Temporary Installations** (< 480 hours/year) > 37 kW





# Clean Air Action Plan 2011, City of Zurich

**Construction Sites** > 20'000 m<sup>3</sup> volume

→ Regulation concerning transport vehicles

Limit value for particulate emissions: EURO IV, V, VI,  
EURO III + PFS

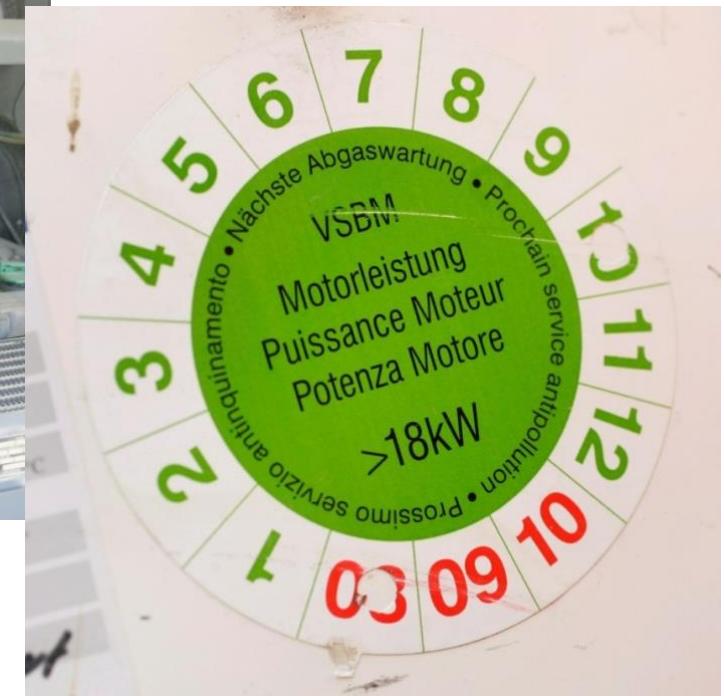
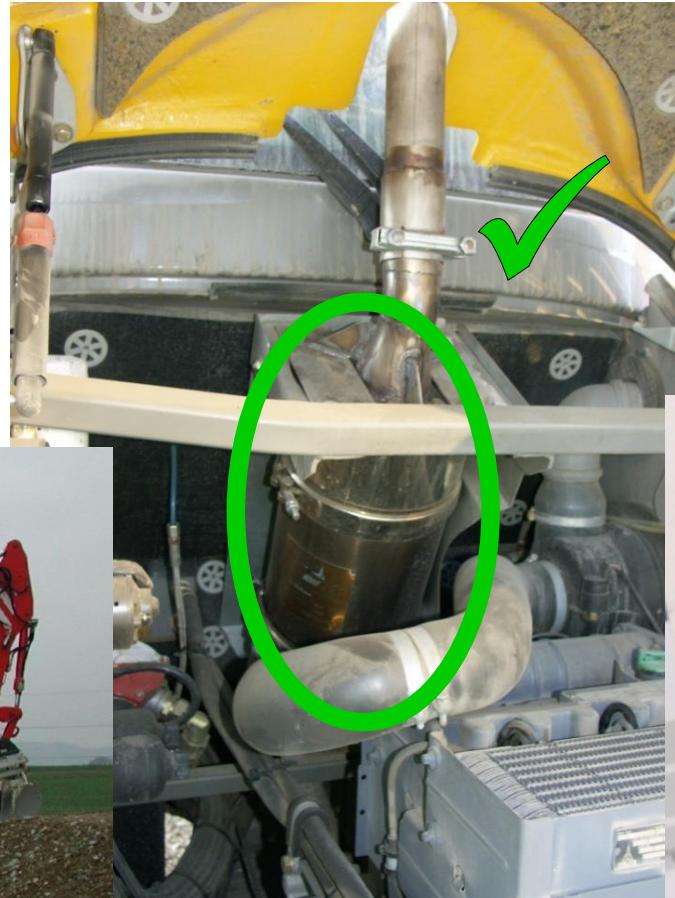
**Transport of Goods**

→ Preferably by rail



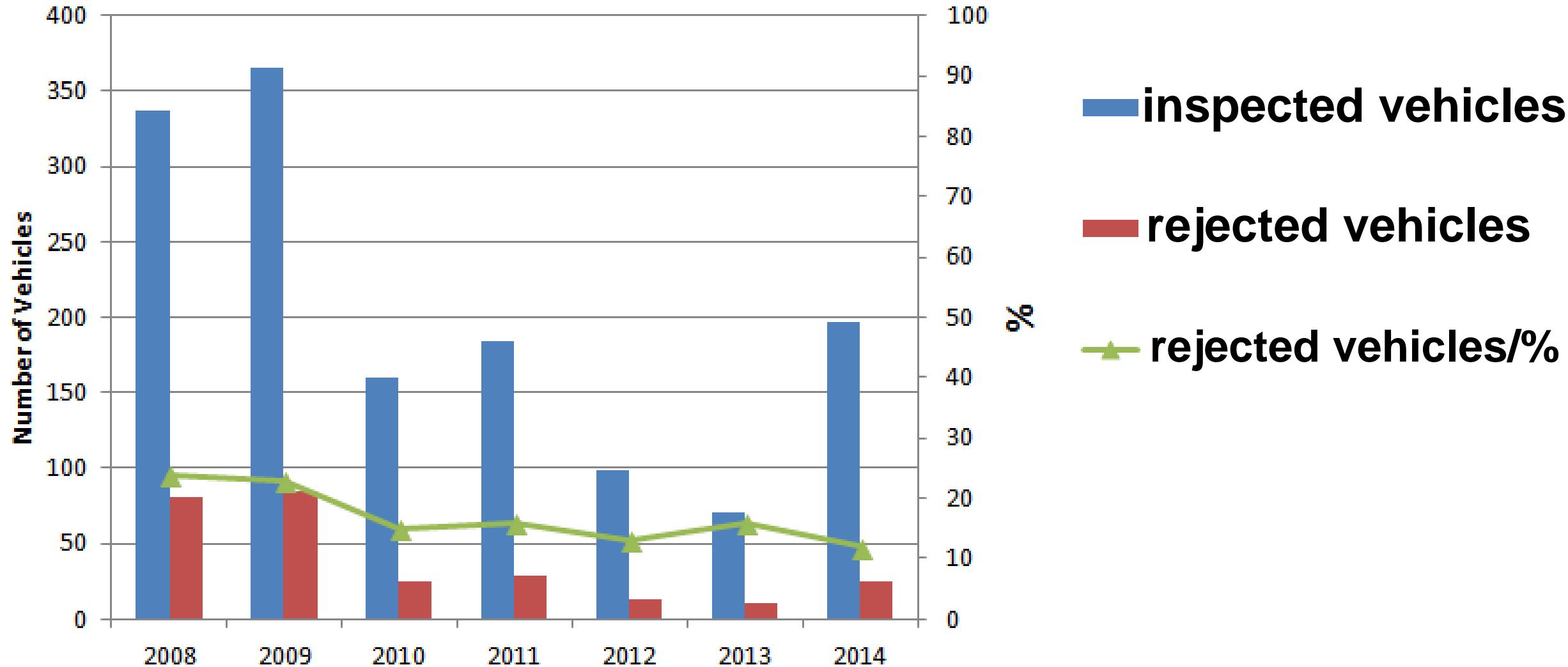


# Inspections on Construction Sites - PFS

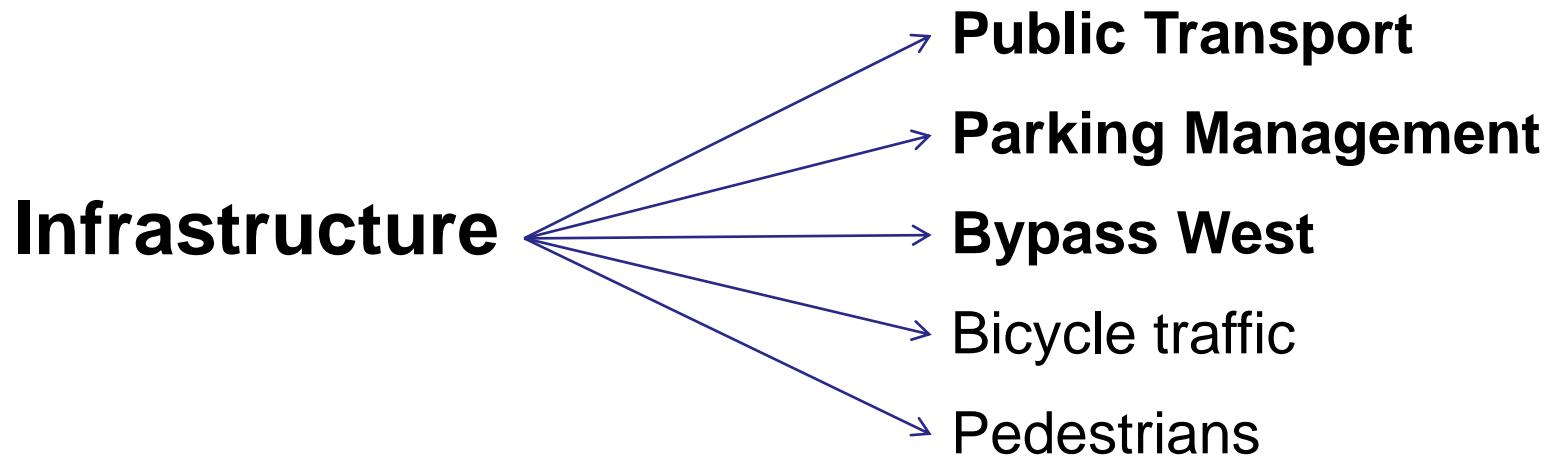




# Inspections on Construction Sites - Results



# Measures Concerning Road Traffic



**Traffic system management** → **Traffic control**

**Mobility management** → **Consulting**

**Company cars** → **Electric vehicles for municipal authorities**

# Public Transport – Canton of Zurich

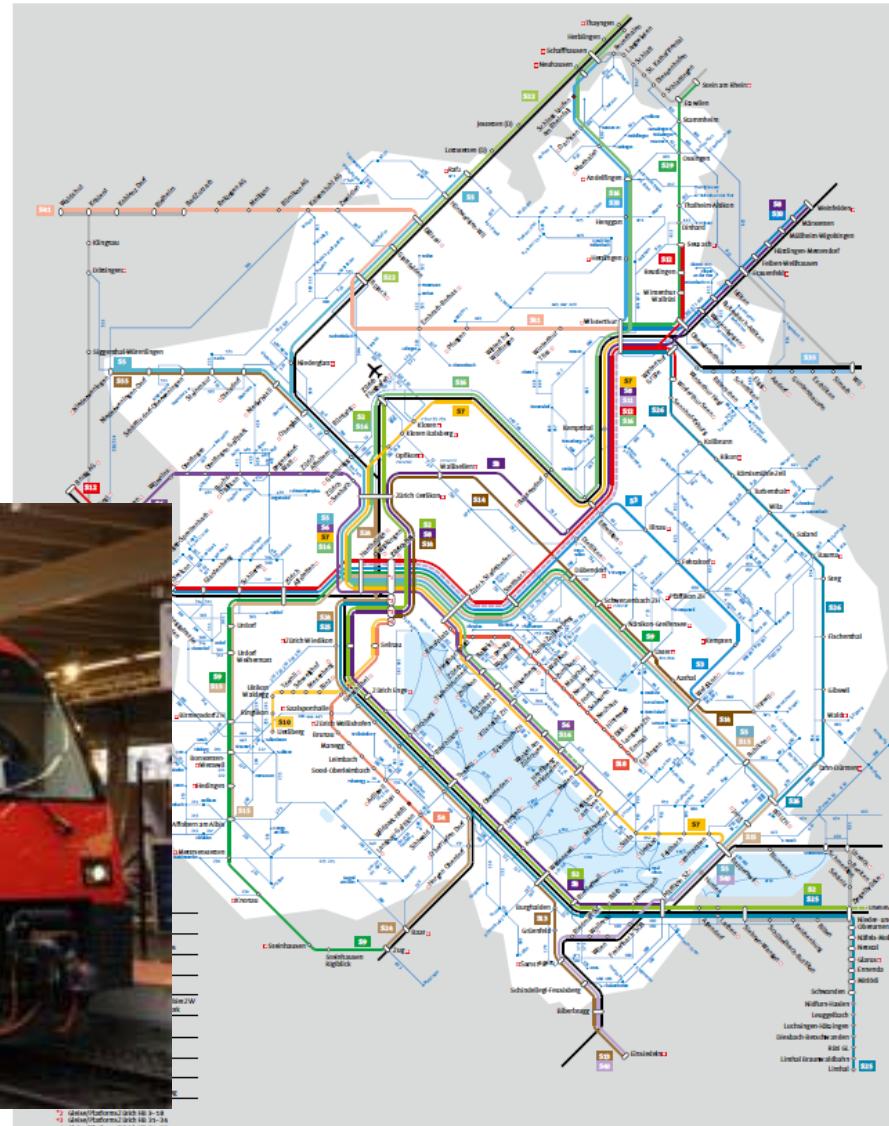
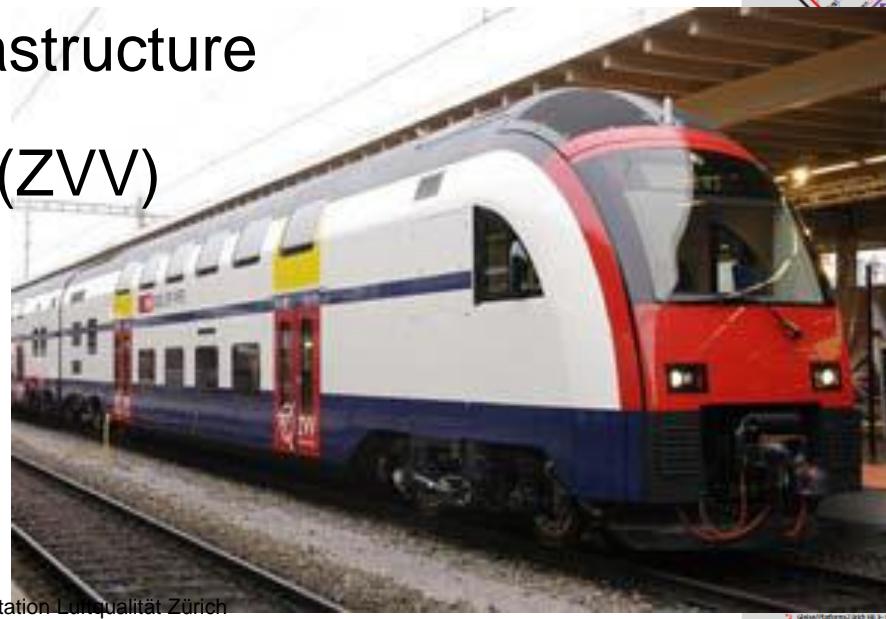


S-Bahnen, Busse und Schiffe  
S-Bahn trains, buses and boats



## S-Bahn: The Suburban Railway System

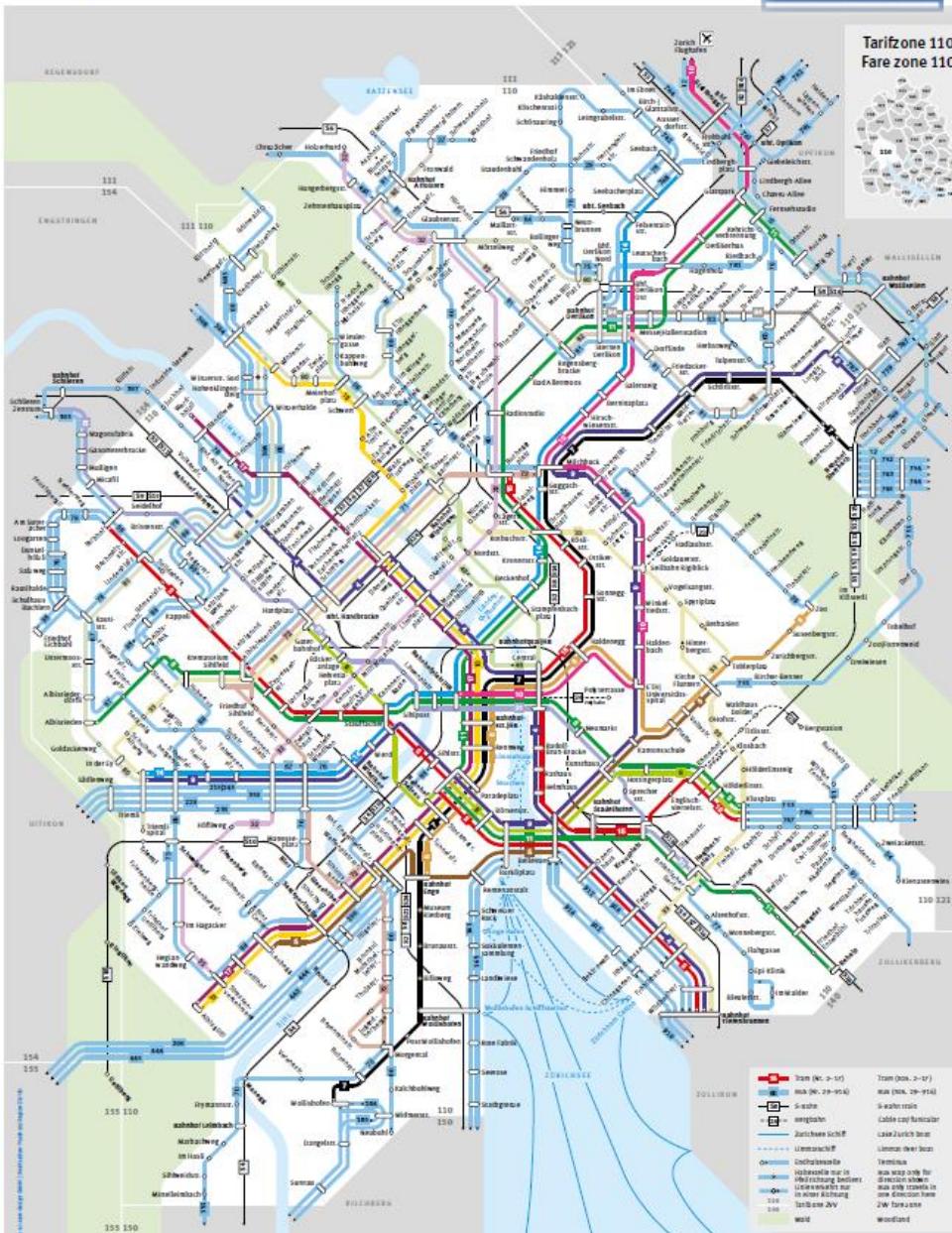
- Opening 1990
- 420 km of network
- 26 lines, 176 stops
- Number of passengers doubled within 20 years
- Further extension of infrastructure
- 1 transport association!! (ZVV)



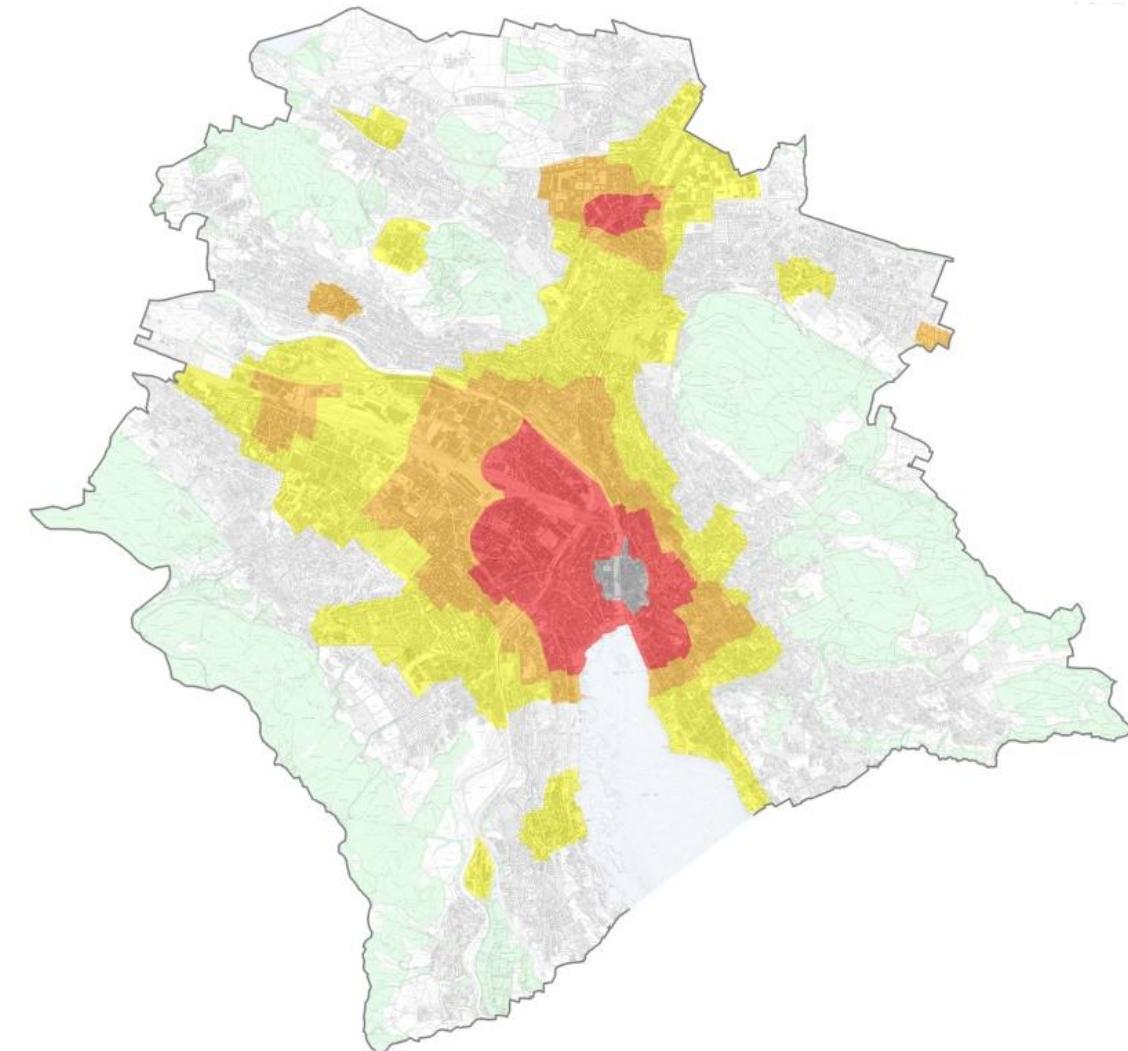
# Public Transport – City of Zurich



- Backbone of Zurich's urban mobility system
- Dense and efficient network
- Train, tram, bus, cable car and ship
- Significant increase in frequency within the last years
- Latest extension of main station doubles capacity



# Parking Management



Restriction of private parking depending on area

- at locations with good public transport
- Depending on capacity of roads nearby
- depending on air quality in the area

% of standard	
Gebiet A:	10%
Gebiet B:	45%
Gebiet C:	70%
Gebiet D:	95%
übrige Gebiete:	115%

# Parking Management



- shifted from street to underground public parking garages
- On-street spaces are now reclaimed for other uses

"Historic Parking Compromise"

- Cap on the parking supply for visitors and customers
- Public parking spaces frozen on the level of 1990



# Parking Management

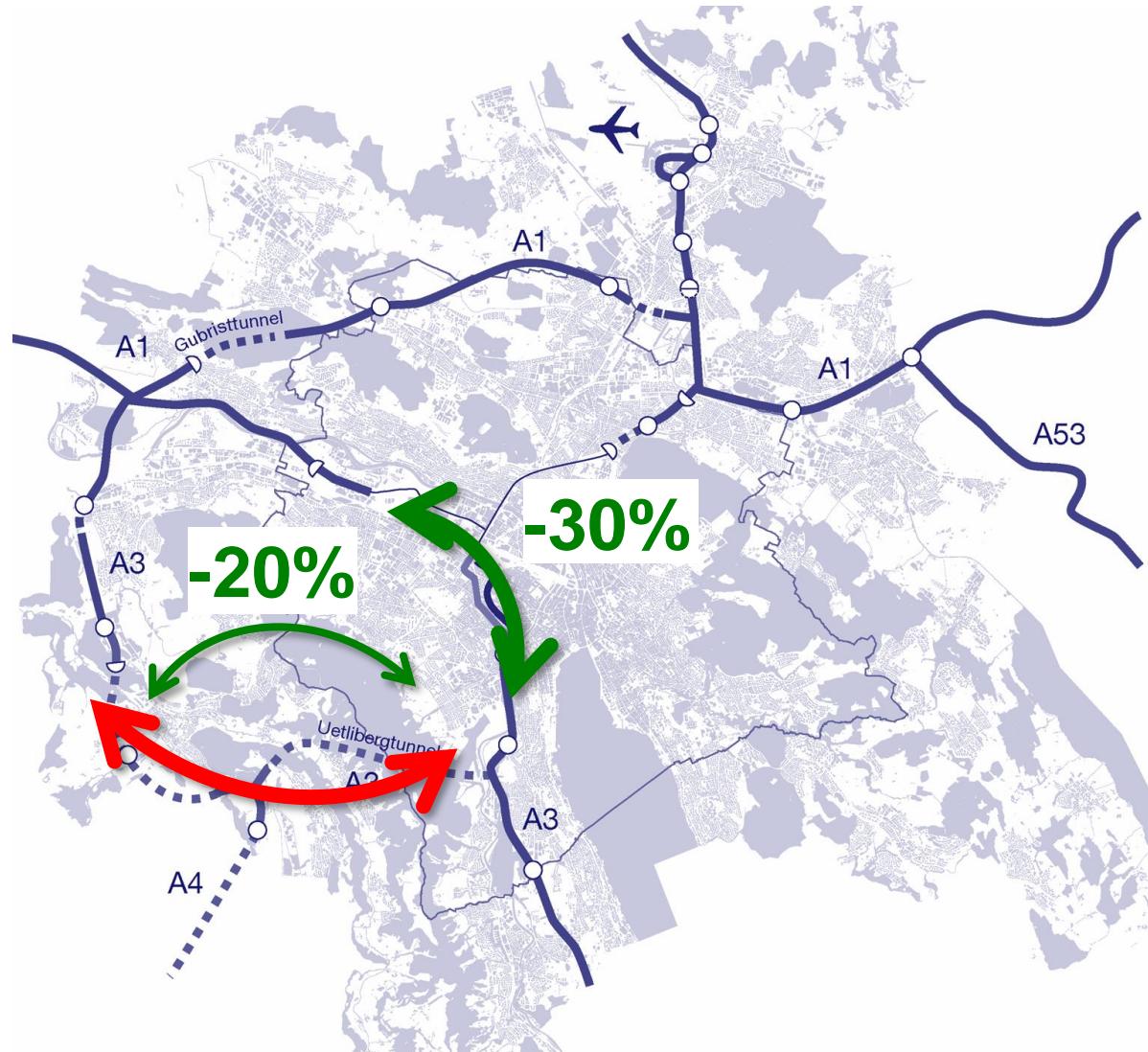
- car-free housing
- Parking spaces in new buildings can be reduced if specific mobility management measures are taken

→Example «Kalkbreite»

230 inhabitants, few parking spaces for disabled persons and visitors



# Bypass West 2009 → Less Traffic in the City Center



# Bypass West → - 25'000 vehicles/day



2008

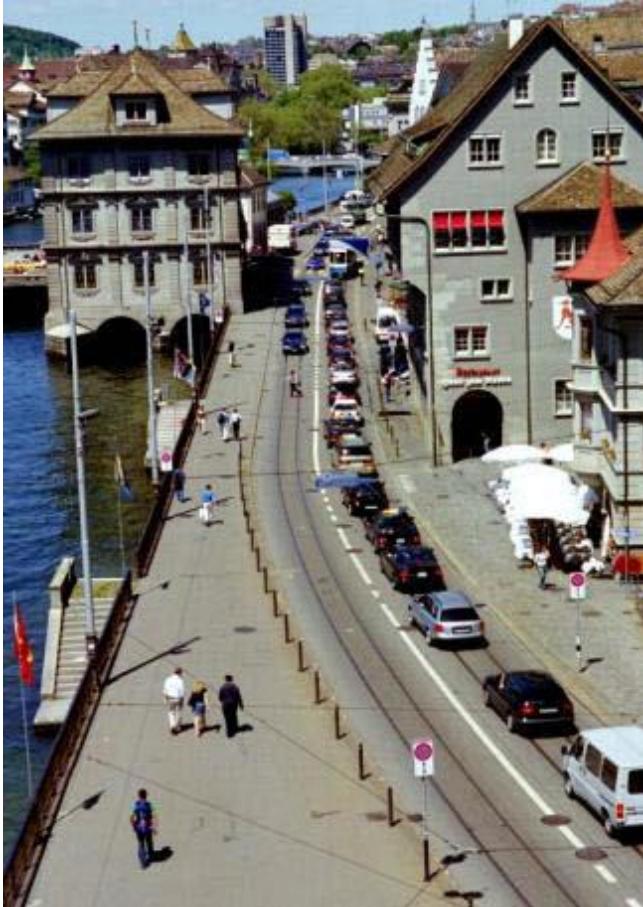


2010

# Bypass West → - 50 % NO<sub>2</sub> & PM<sub>10</sub>



# Pedestrians



2004

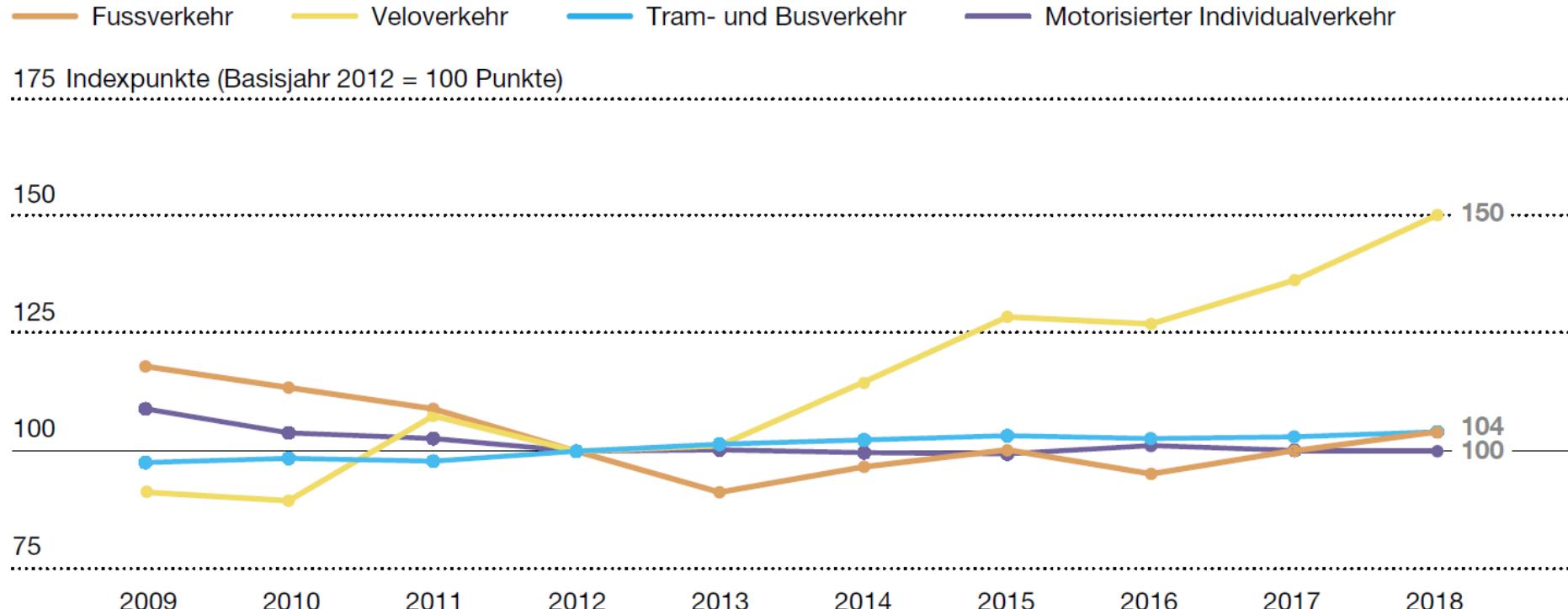


2010

# Urban Traffic Programme «Stadtverkehr 2025»



## 1 Städtische Verkehrsentwicklung

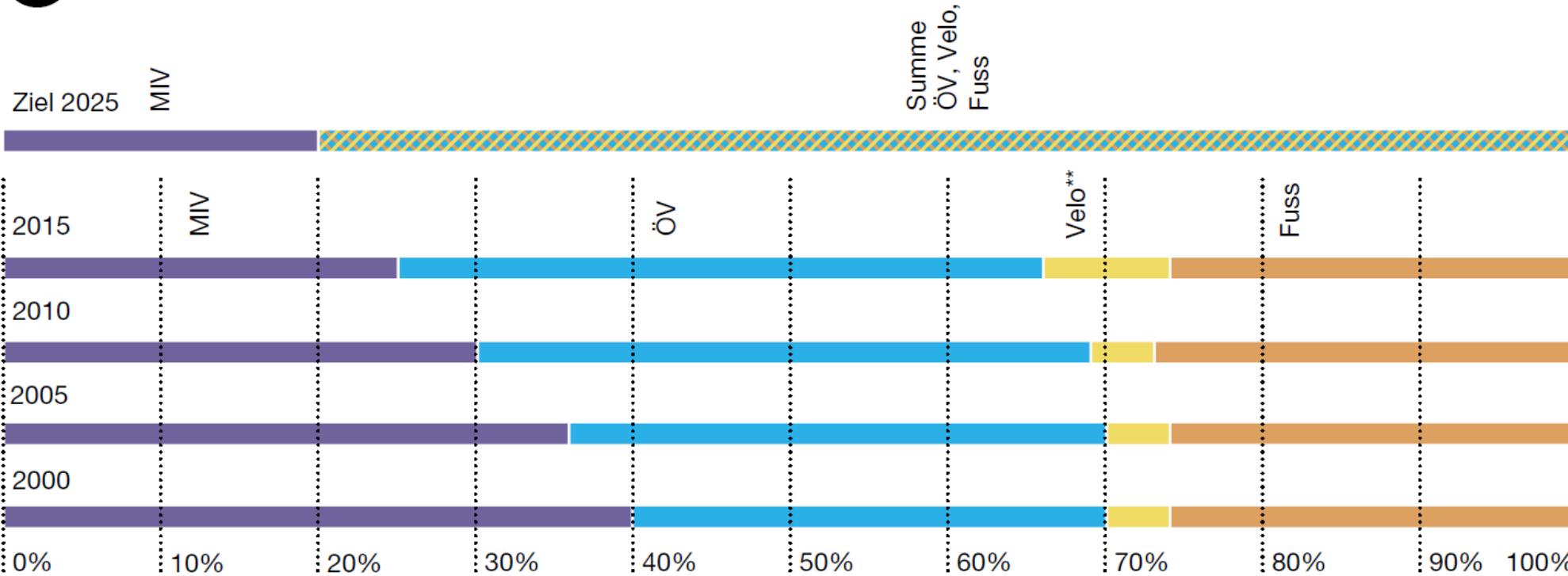


Mittlere Tagesaufkommen an den automatischen Zählstellen (Fuss-, Velo- und motorisierter Individualverkehr) sowie jährliche Verkehrsleistung mit Trams und (Trolley-)Bussen auf dem Stadtgebiet. Details siehe «Stadtverkehr 2025» online.

# Urban Traffic Programme «Stadtverkehr 2025»



## 3 Modalsplit\*

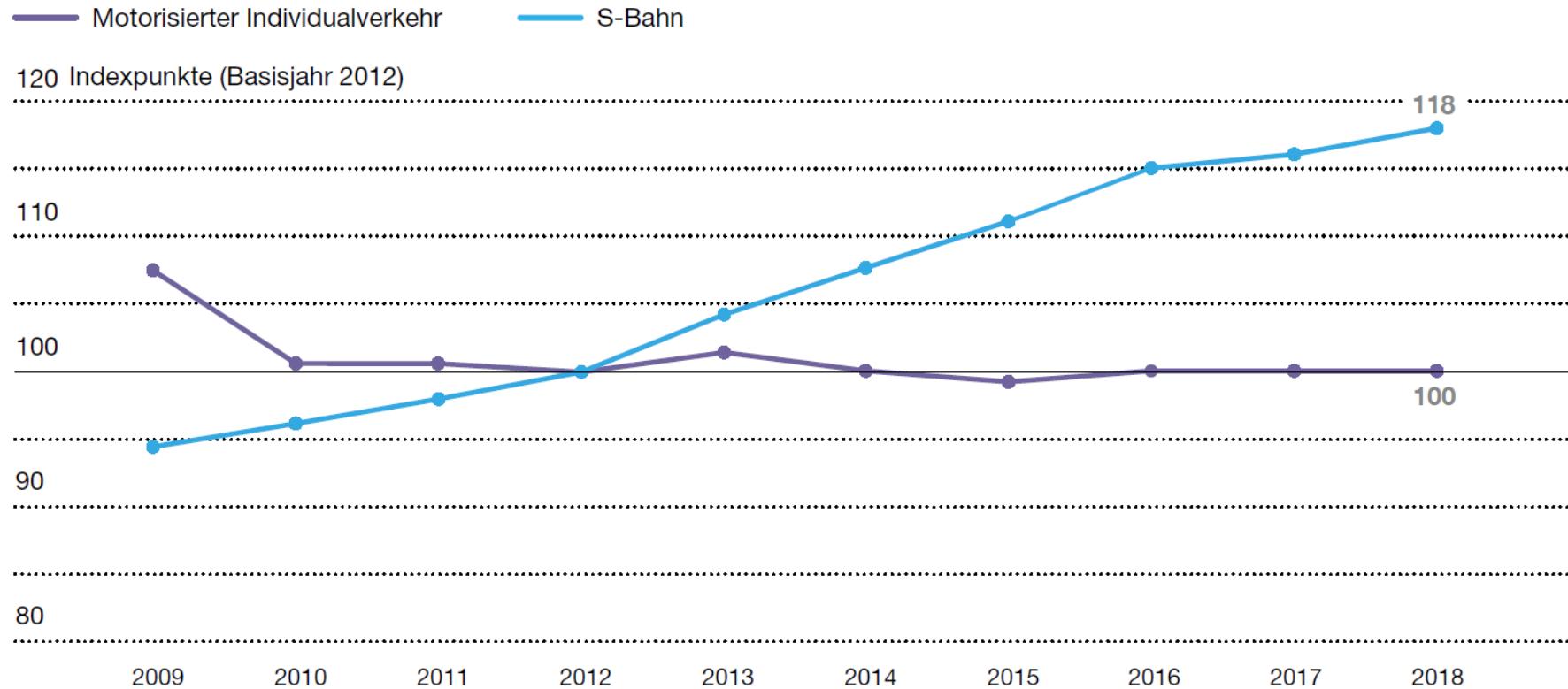


\* Keine neuen Daten verfügbar, Details siehe «Stadtverkehr 2025» online.

\*\* Ab Mikrozensus 2015 E-Bikes konsequent zu Velos gezählt.

# Urban Traffic Programme «Stadtverkehr 2025»

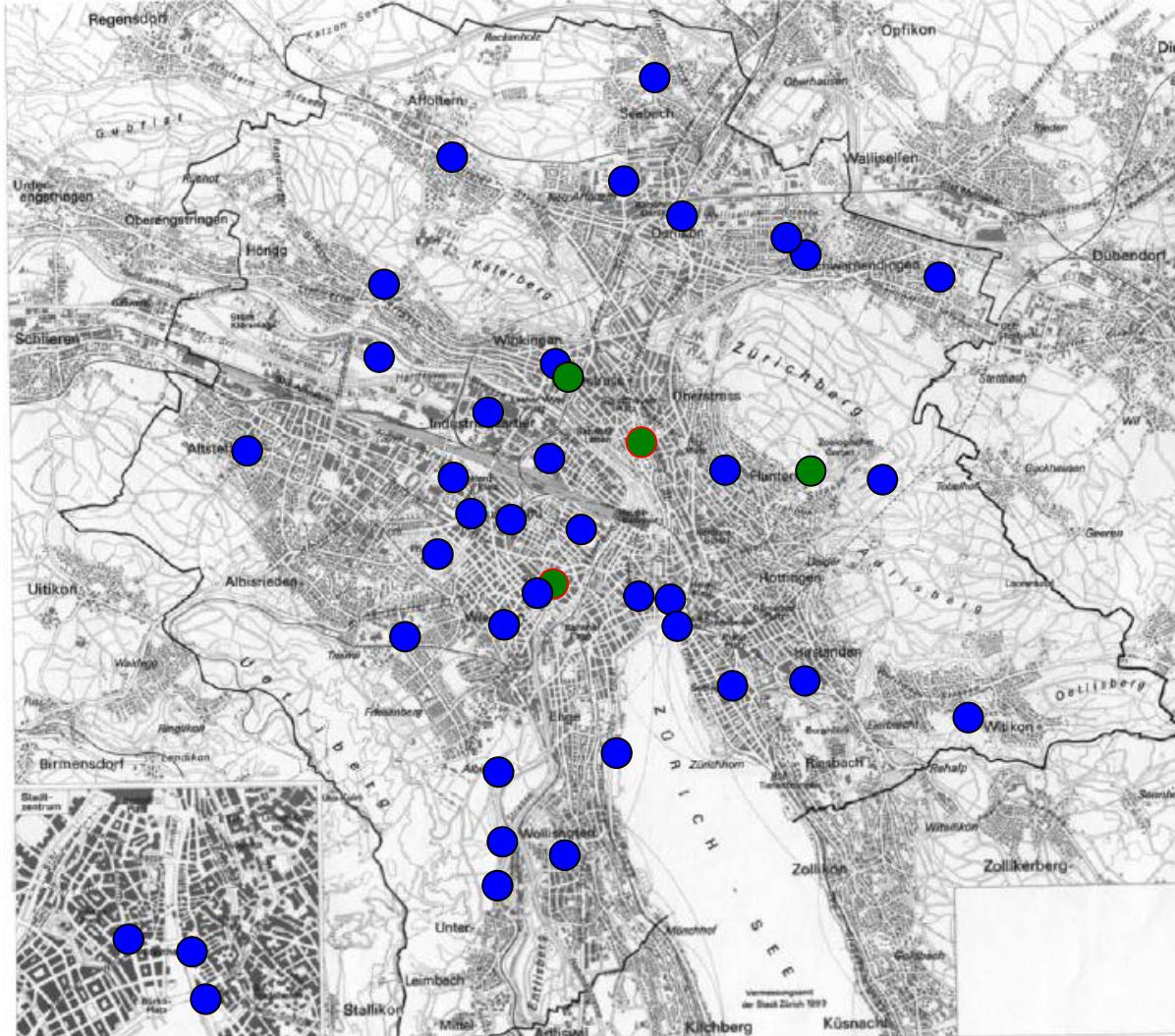
## Verkehrsentwicklung an der Stadtgrenze



Grundlagen sind automatische Zählungen, Details siehe «Stadtverkehr 2025» online.



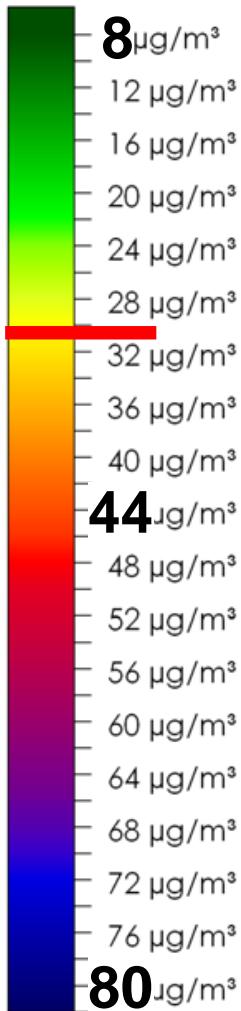
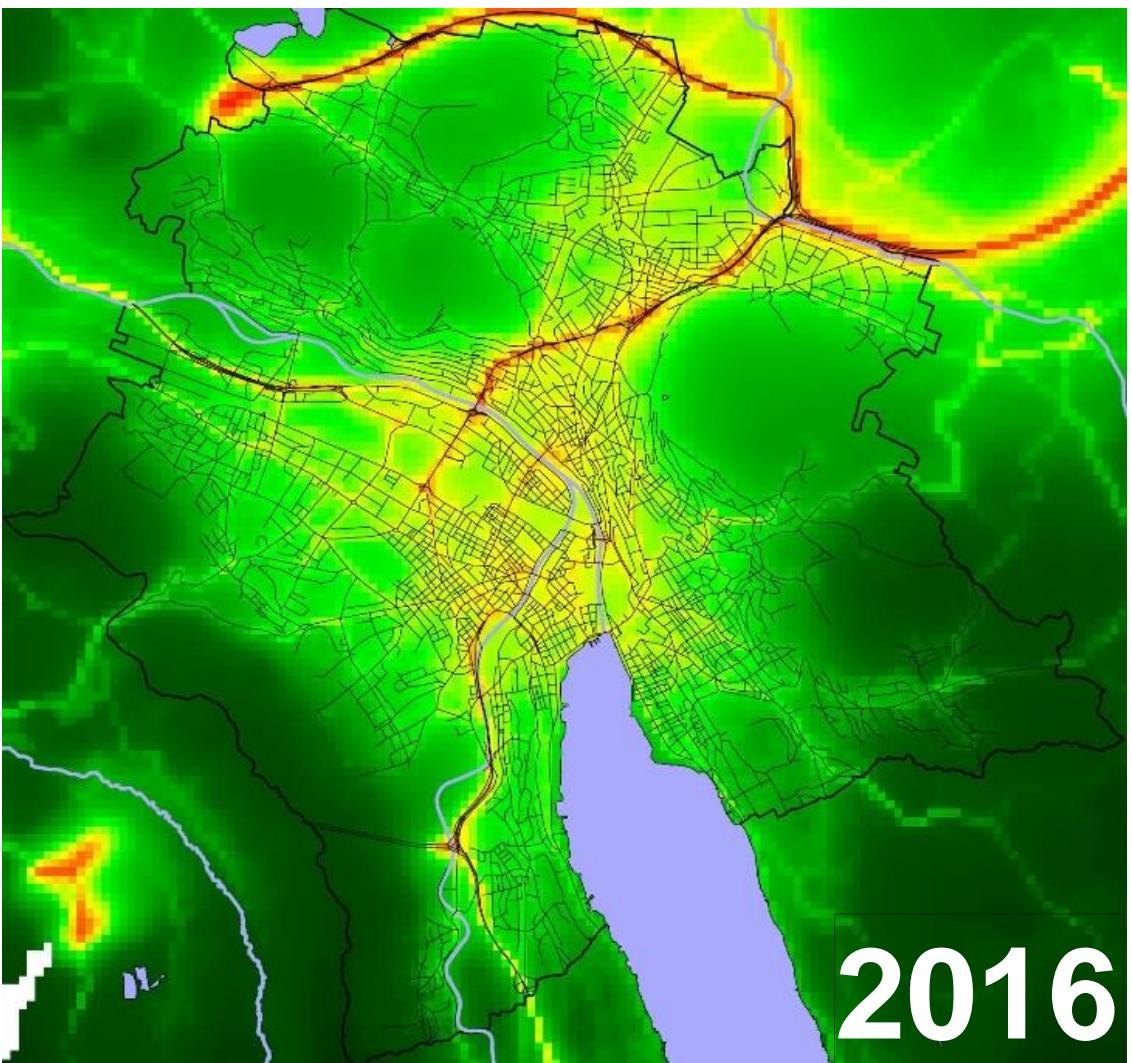
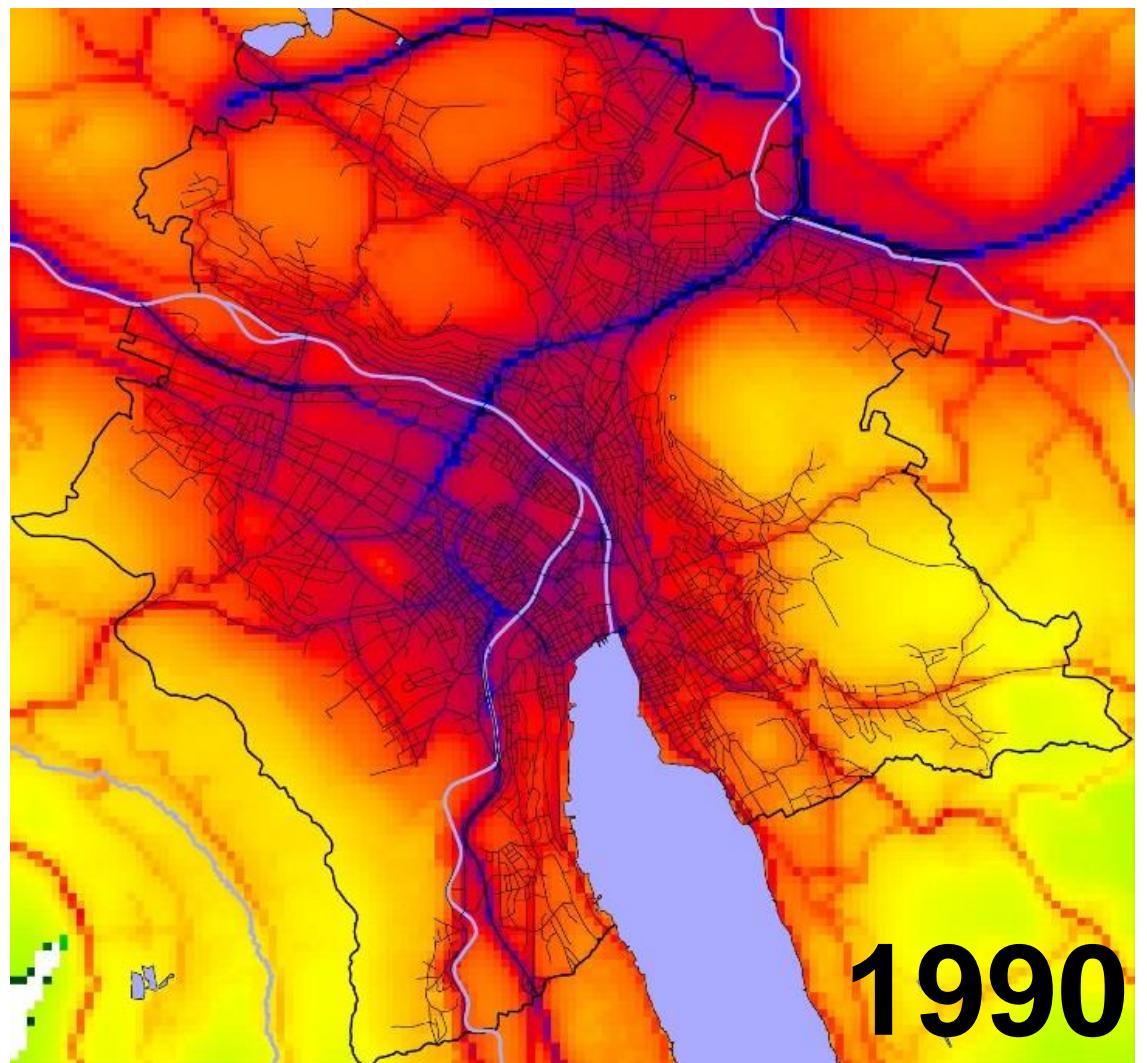
# City of Zurich - Monitoring of the Air Quality



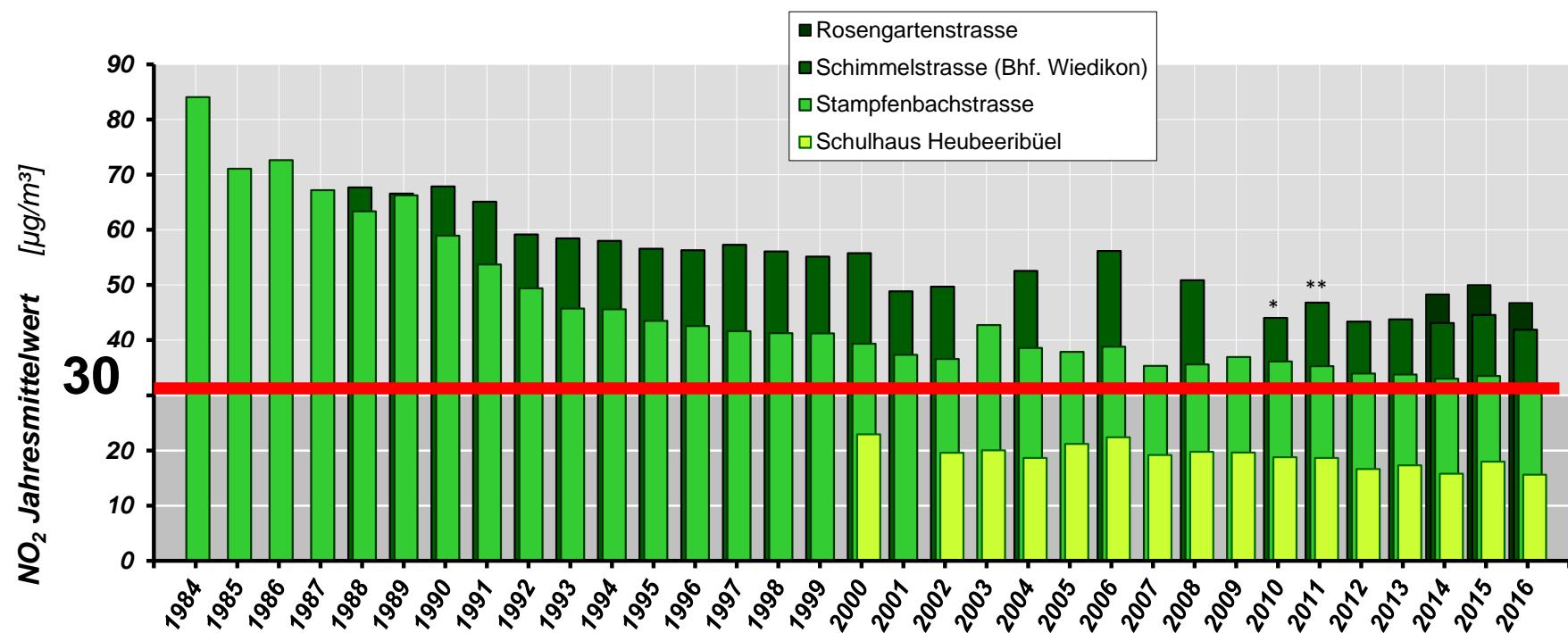
**Green:**  
continuous measurements

**Blue:**  
passive samplers für NO<sub>2</sub>

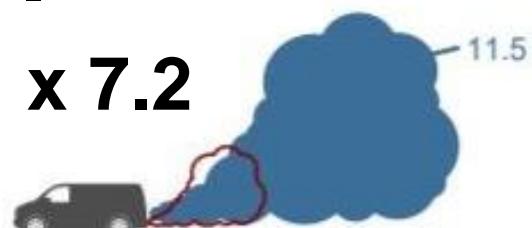
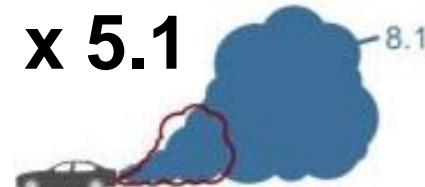
# Nitrogen Dioxide ( $\text{NO}_2$ )



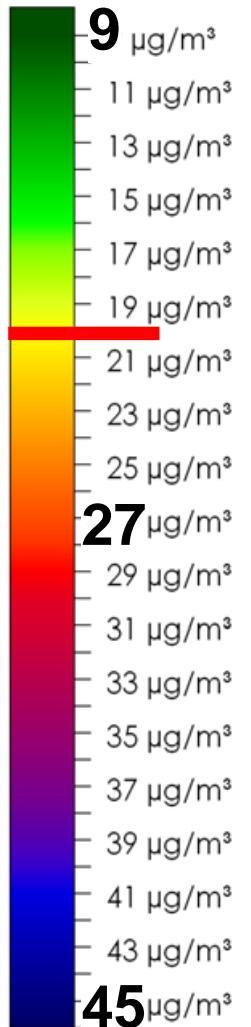
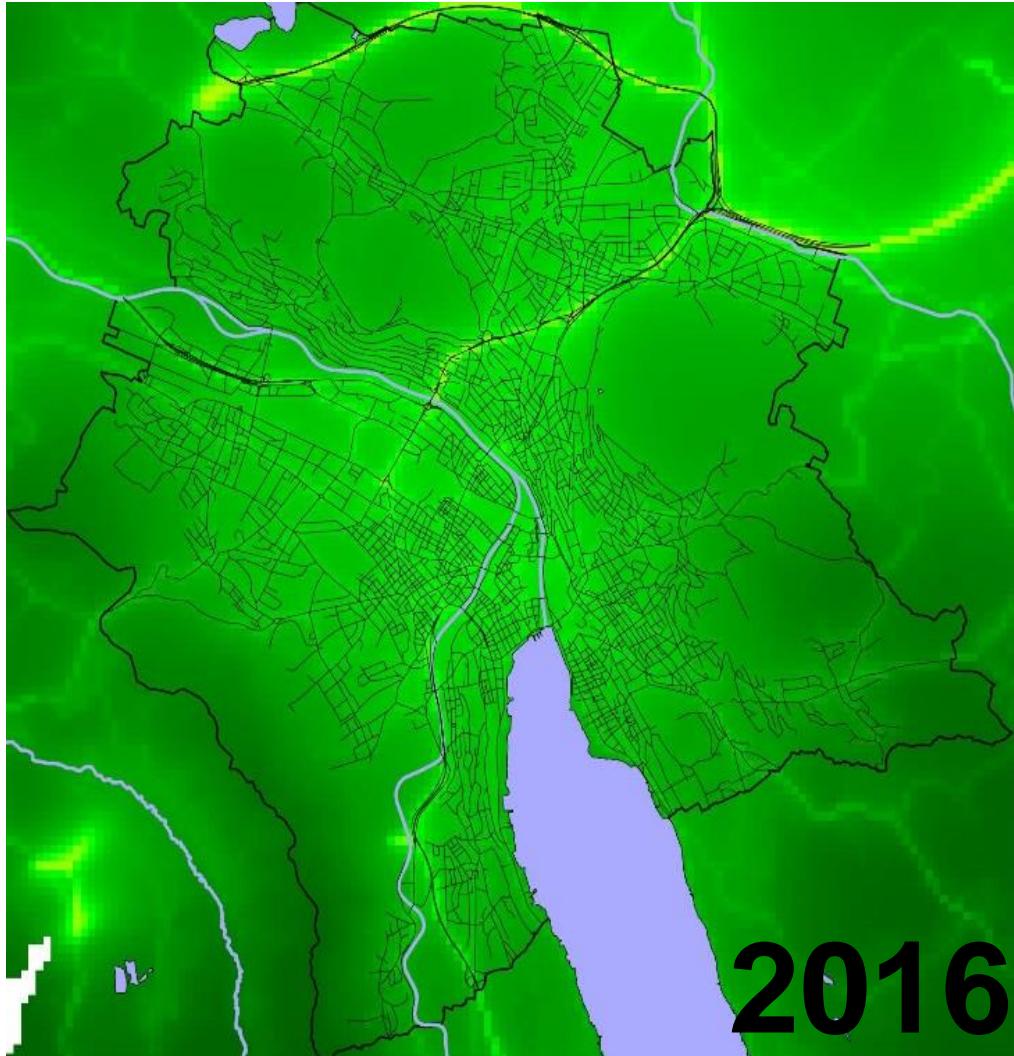
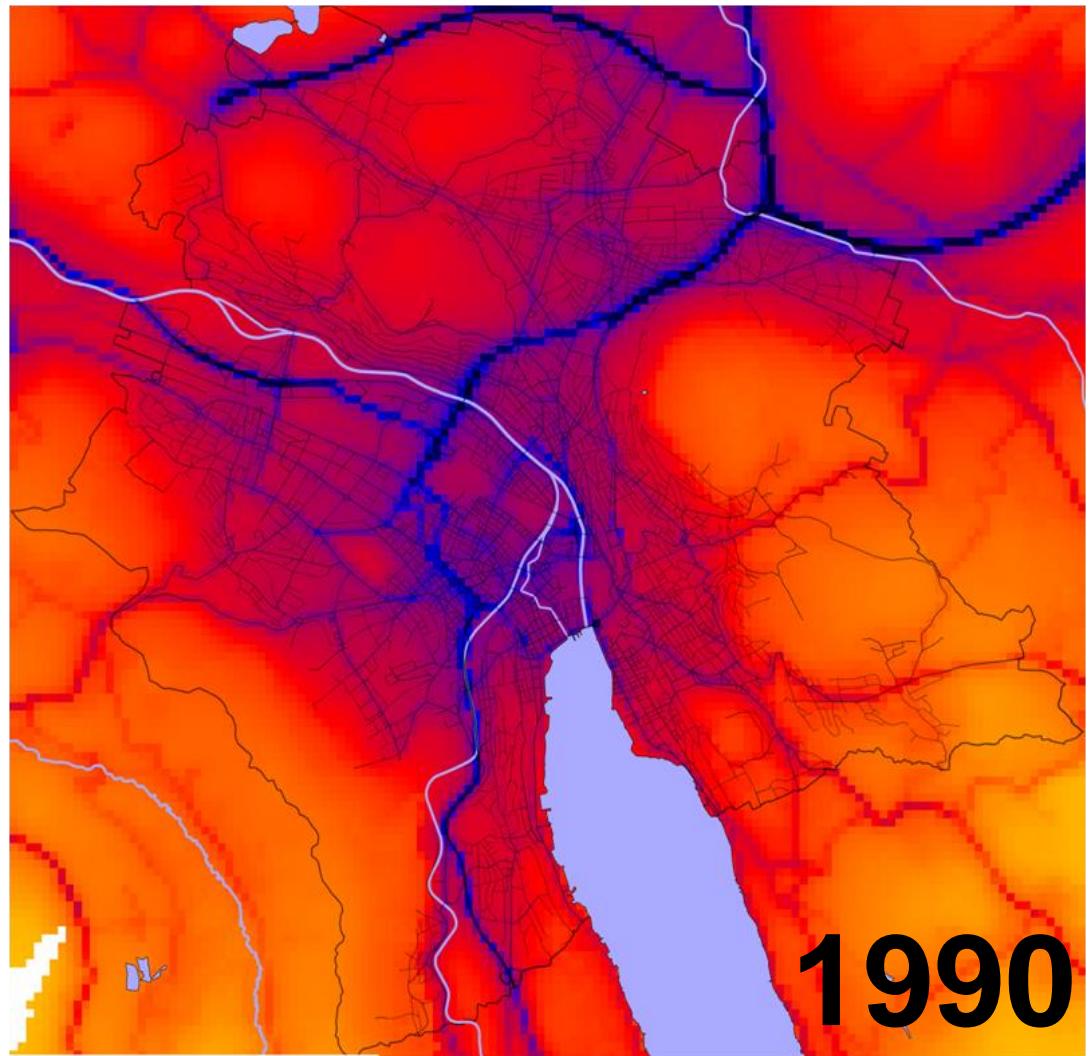
# Nitrogen Dioxide (NO<sub>2</sub>)

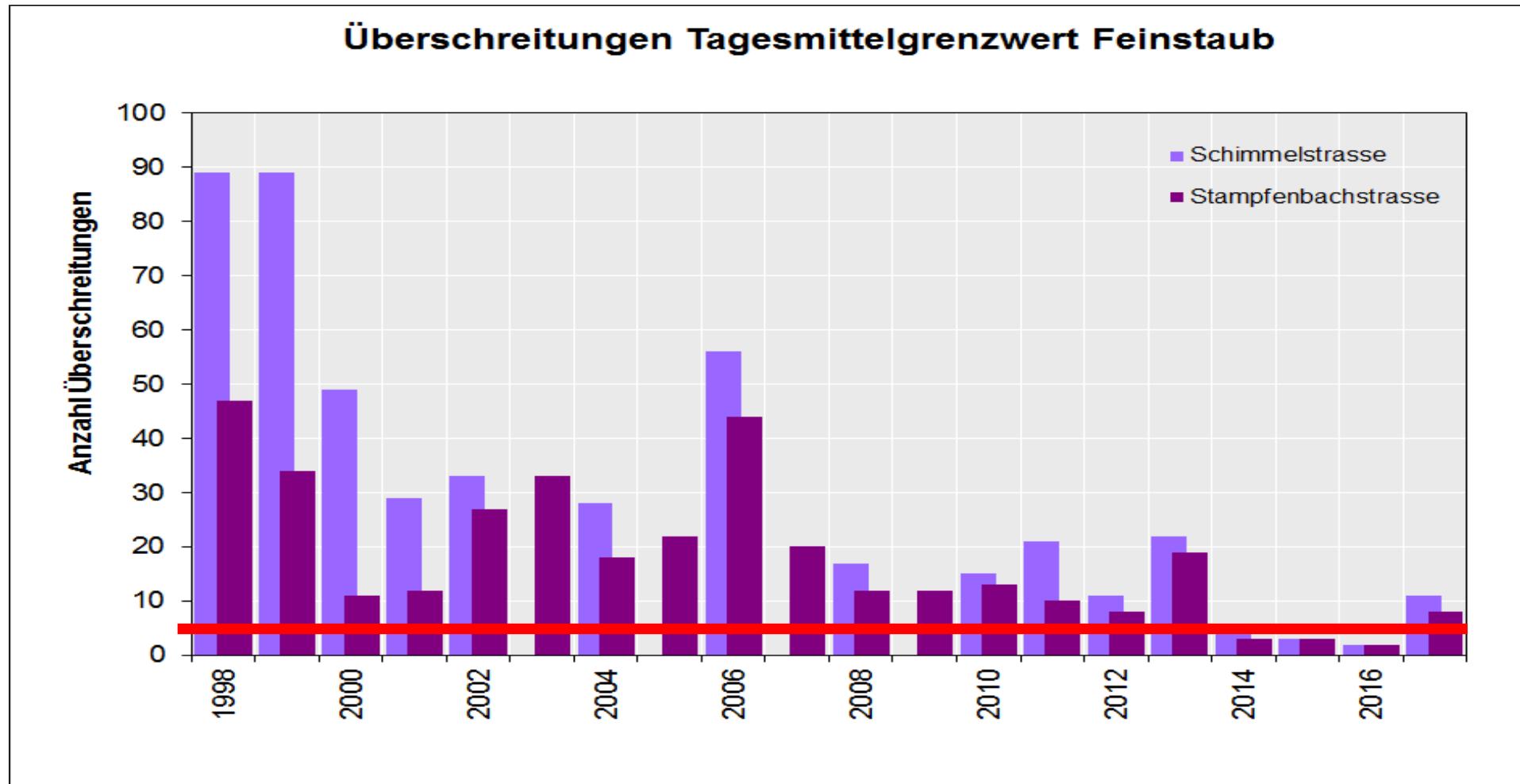
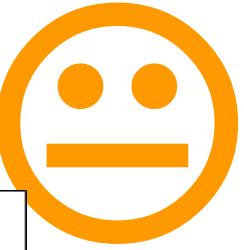


Diesel



# Particulate Matter PM<sub>10</sub>

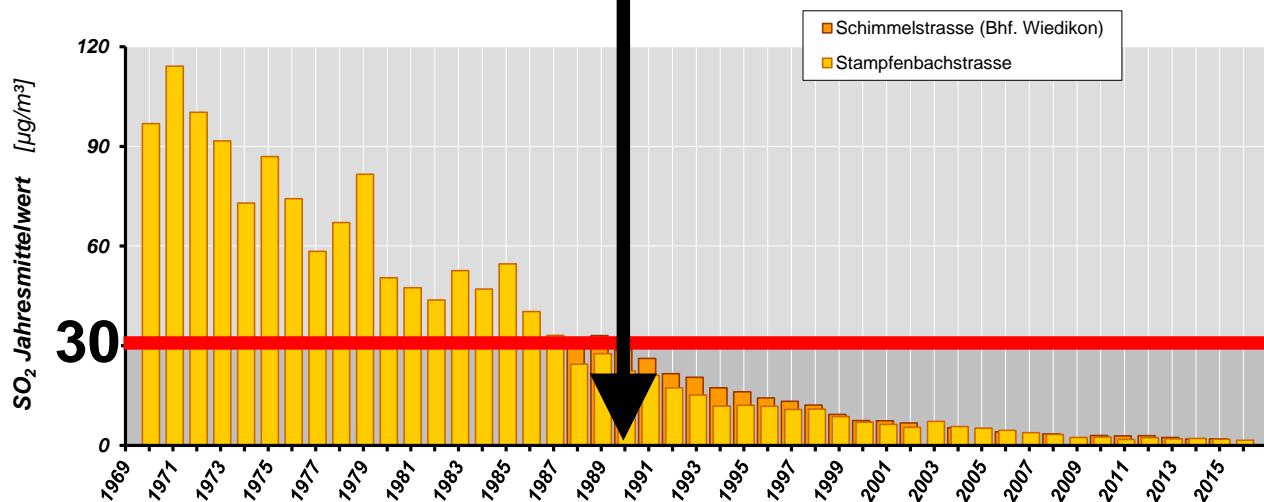




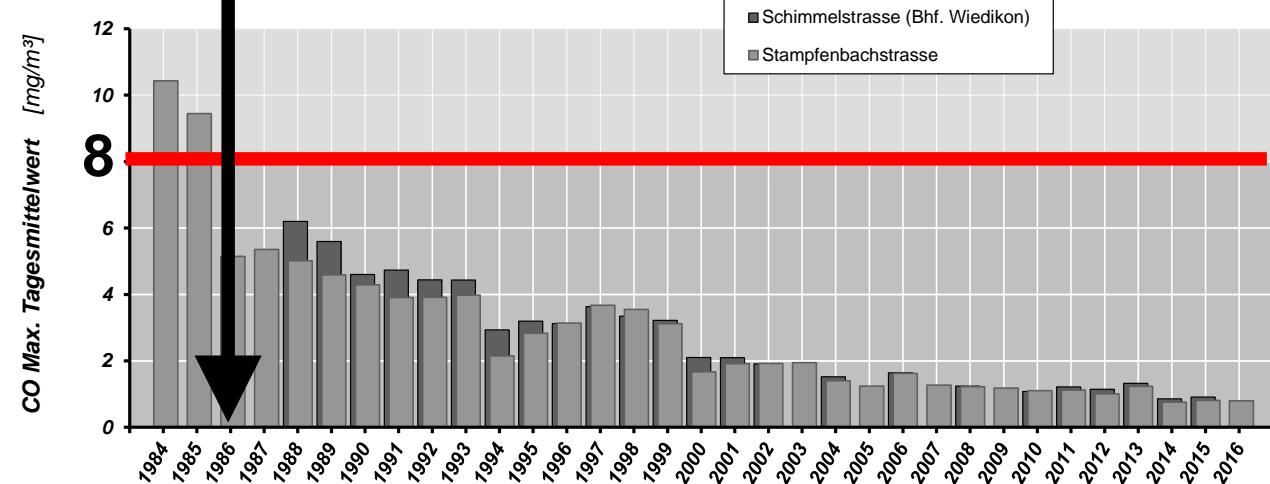
# Sulfur Dioxide ( $\text{SO}_2$ ) & Carbon Monoxide (CO)



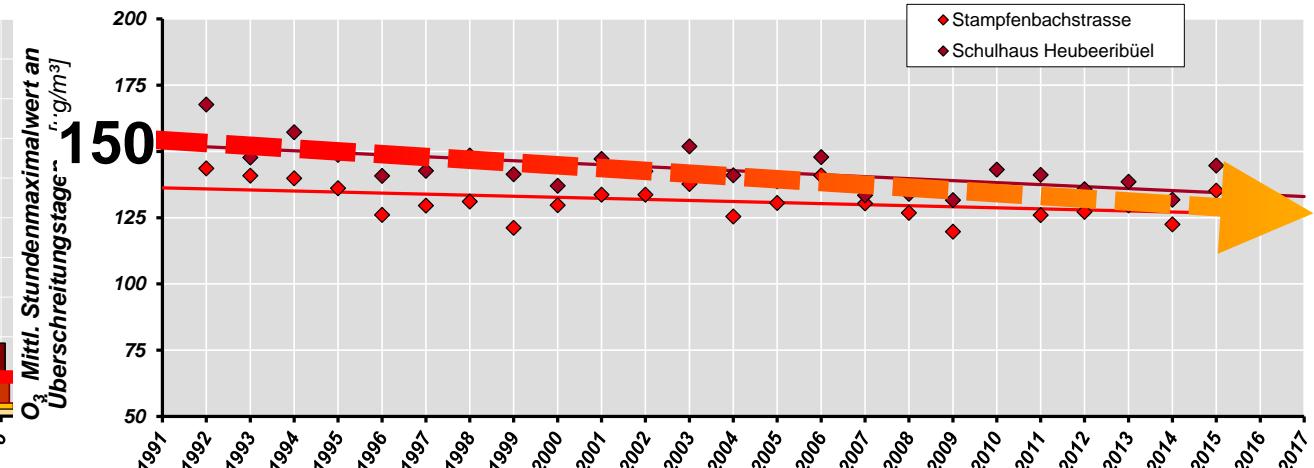
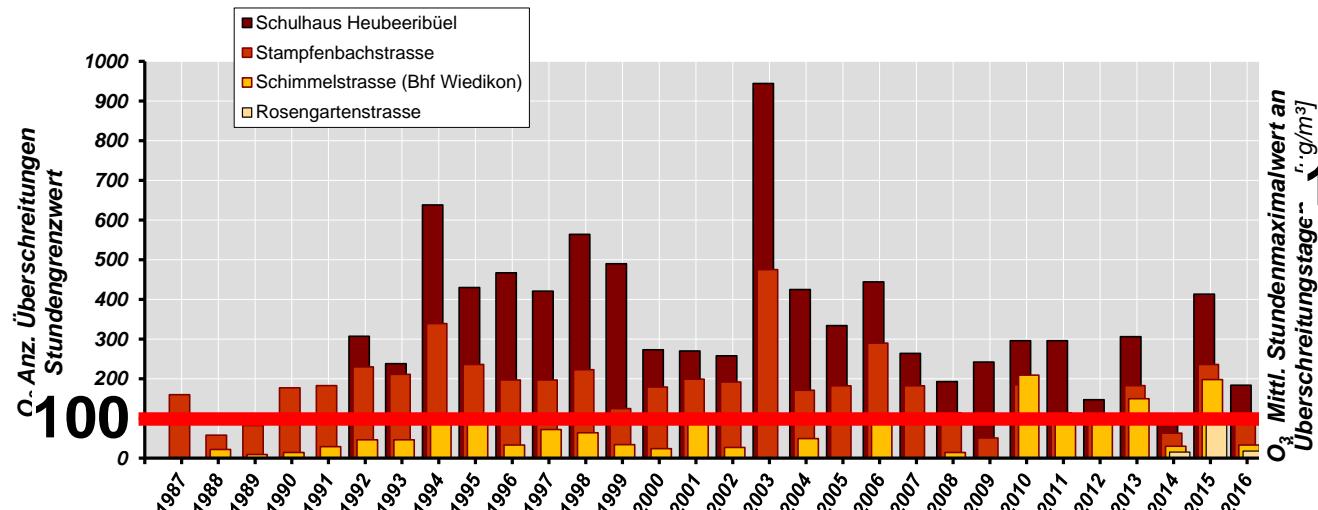
1990



1986



# Ozone ( $O_3$ )



# Compliance with Critical Values

	Parameter	Critical Value	1986	2016	2020	2025
<b>Sulfur Dioxide (SO<sub>2</sub>)</b>	Yearly Average	30 µg/m <sup>3</sup>				
<b>Carbon Monoxide (CO)</b>	Daily Average	8 mg/m <sup>3</sup>				
<b>Nitrogen Dioxide (NO<sub>2</sub>)</b>	Yearly Average	30 µg/m <sup>3</sup>				
<b>Ozone (O<sub>3</sub>)</b>	½-h-Average within a Month	100 µg/m <sup>3</sup>				
<b>Particulate Matter PM<sub>10</sub></b>	Yearly Average	20 µg/m <sup>3</sup>				
	Yearly Average	500 ng/m <sup>3</sup>				
	Yearly Average	1.5 ng/m <sup>3</sup>				

# SootFreeCities.EU



## European City Ranking 2015 Best practices for clean air in urban transport

Air pollution causes nearly half a million premature deaths each year in the European Union. In busy cities, air quality is usually at its worst, with high concentrations of particulate matter (PM), nitrogen dioxide (NO<sub>2</sub>) and ozone. The average life expectancy of people living in the EU's most polluted areas is reduced by over two years as a consequence of this. A lot can be done at a local level to avoid these emissions.

Air pollution not only damages human health but also affects our natural environment, by causing acidification and eutrophication. Furthermore, soot, or black carbon (a part of PM10), emitted largely by diesel cars, contributes to global warming by reducing the

reflection of sunlight when deposited on snow and ice. The ambient air quality directive (2008/50/EC) demands that local authorities comply with short term and annual limit values of PM10 and NO<sub>2</sub>. Municipalities have adopted measures to reduce air pollution and to comply with the above mentioned air quality limit values.

What measures have been designed and implemented in some of Europe's most polluted cities? With this ranking we aim to answer this question and demonstrate that local solutions to reduce air pollution exist. We identify which cities are best at it, and what others can learn from them.



## Ranking overview

In this ranking, 23 European cities are evaluated in nine categories. These measures include technical and economic measures, as well as sustainable transport measures. Also emission reduction, modal split and transparency are being looked at.

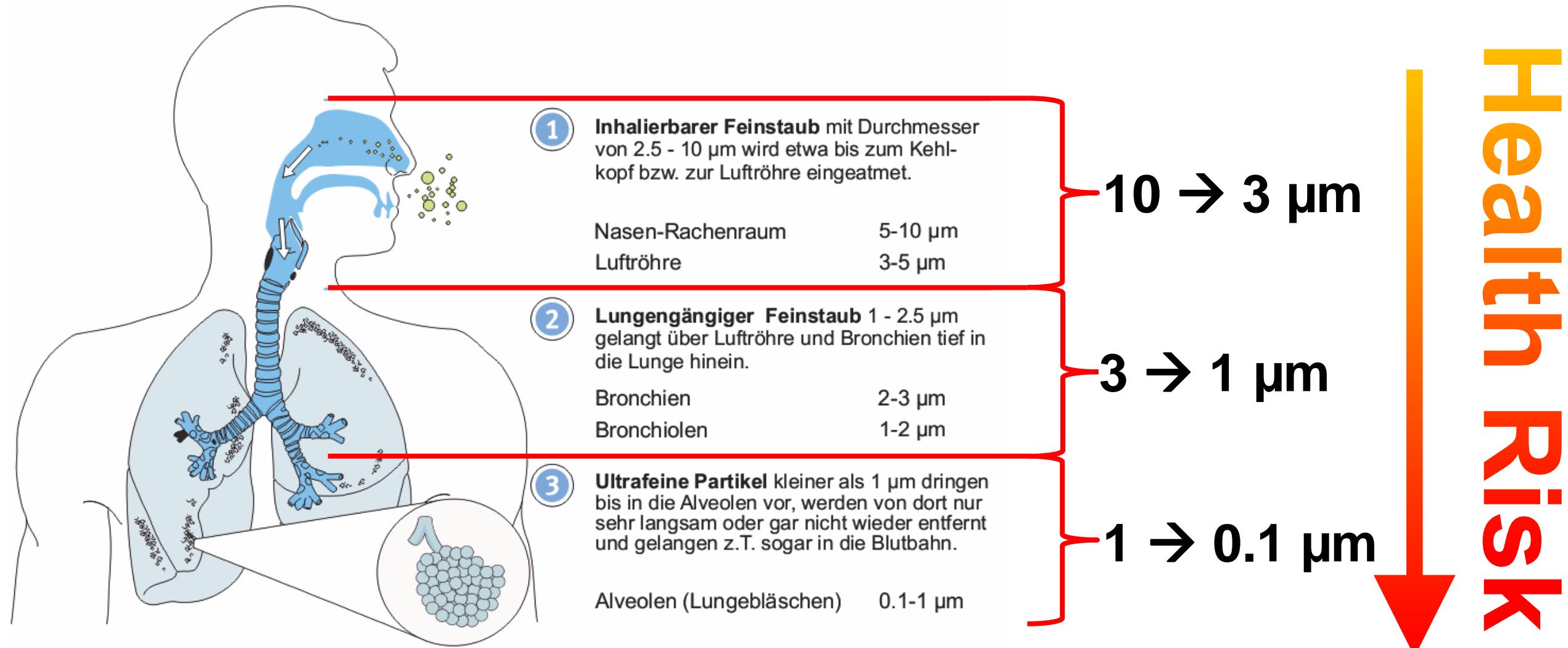
The winner of this round of the city ranking is the Swiss city of Zurich. It is followed closely by Copenhagen, Vienna and Stockholm. Berlin, the winner of the last ranking in 2011 finished fifth. None of

the 23 cities reached grade A, which is awarded for cities that score at least 90% of the maximum number of points. The last two places in the ranking are Lisbon and ultimately Luxembourg. A total of six cities failed with an F grade.

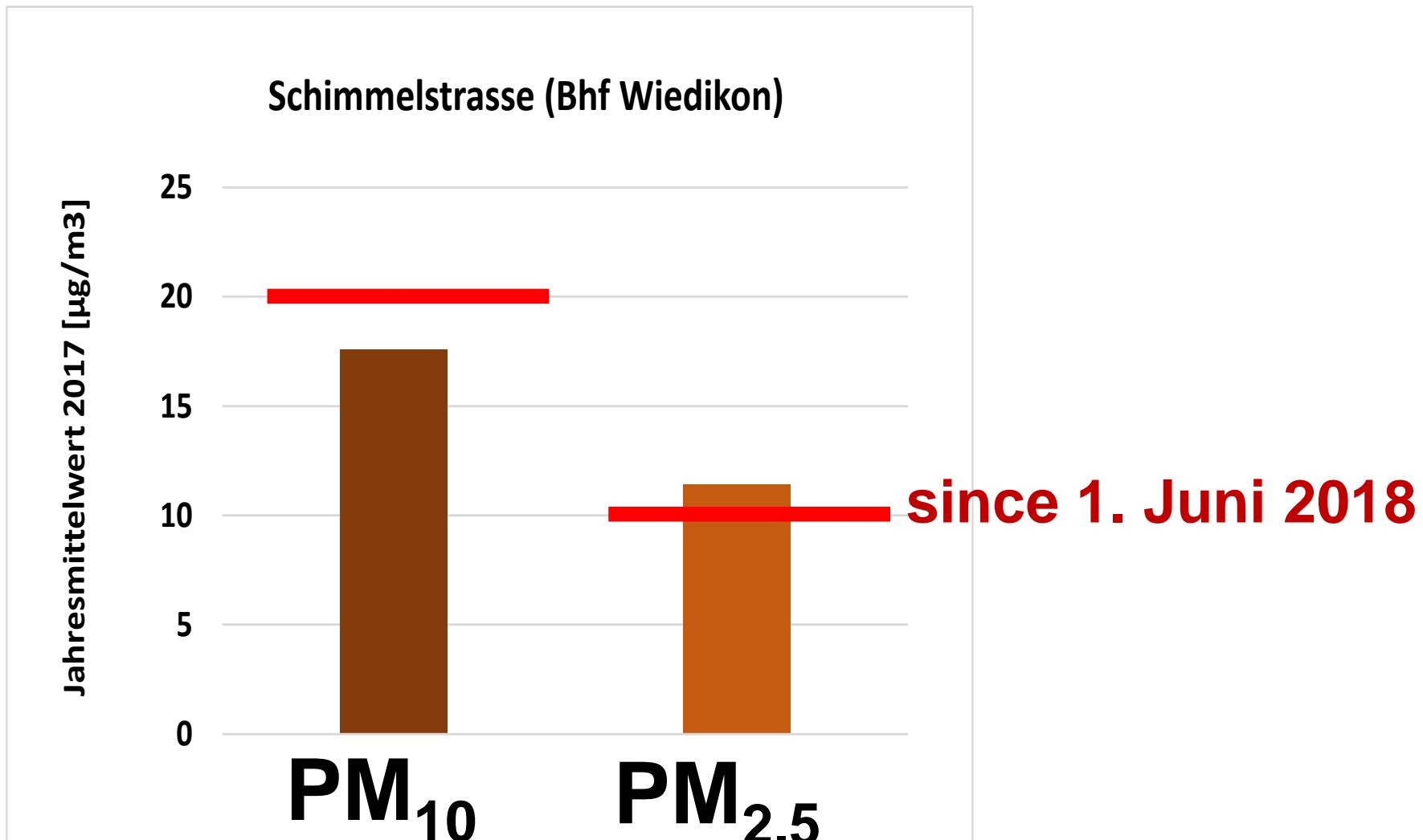
For each of the 9 category of measures, cities could be attributed ++ (very good), + (good), 0 (satisfactory), - (fair), or - (fail).



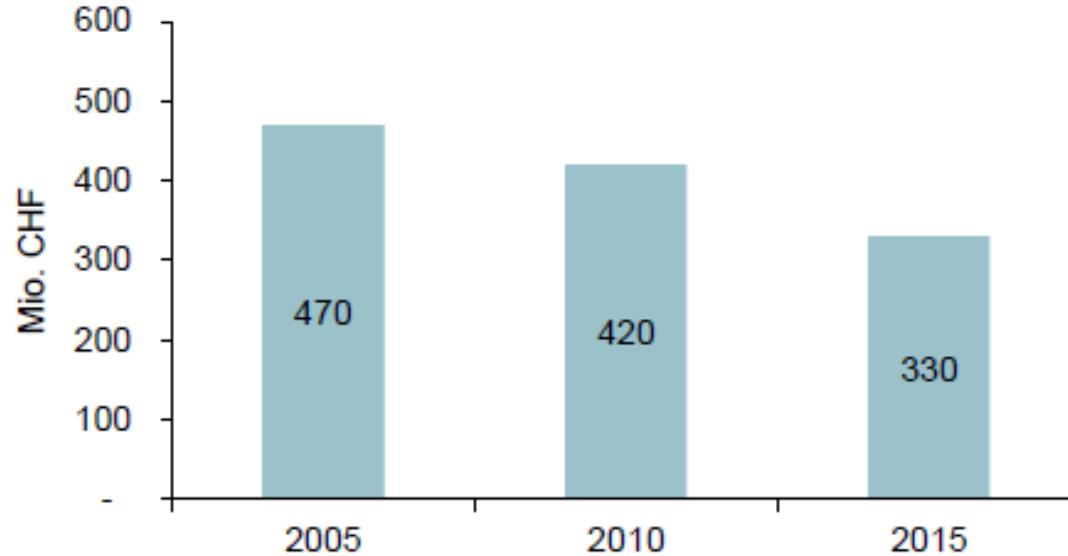
# Particulate Matter PM<sub>x</sub>



# New Critical Value for PM<sub>2.5</sub>

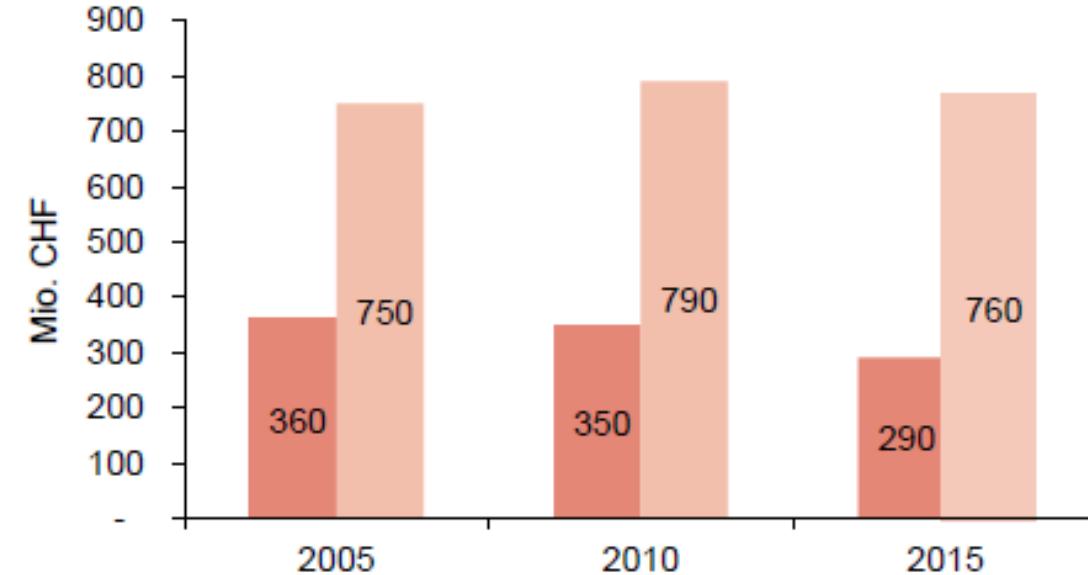


# Health Costs due to Air Pollution



## PM<sub>10</sub>

→ Gesundheitskosten durch PM10  
rückläufig wegen geringerer PM10-  
Belastung



## NO<sub>2</sub>

→ Gesundheitskosten durch NO<sub>2</sub>  
stagnieren auf hohem Niveau