

Air Pollution & Noise Control in Berlin: Concepts and synergies

Ab 1.1.2010
wird die Umweltzone
grün

Informationen und Ausnahmeregelungen
in unserem Flyer oder im Internet unter:
www.berlin.de/umweltzone



Berlin 

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- ⊗ need for action
- ⊗ the low emission zone (LEZ) and its impact
- ⊗ other transport planning measures
- ⊗ synergies between actions on noise and air
- ⊗ examples for measures and their impact
- ⊗ résumé,

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1

Introduction need for action

■ drivers:

- ↪ **air quality** standards for fine particles (PM10) and nitrogen dioxide (NO2) still exceeded
 - ☞ need for city strategy to reduce air pollution
- ↪ obligation for **noise** actions planning
 - ☞ own target levels: 70 dB(A) day/60 dB(A) night
- ↪ ambitious goals to curb **greenhouse gas** emissions
 - ☞ -40% CO2 emissions by 2020 compared to 1990
 - ☞ control soot particle emissions as a driver for climate change

■ relevance of road transport:

- ↪ road traffic is **main contributor** to PM10 and NO2
- ↪ transport is the only sector with **rising** CO2 emissions
 - ☞ +7% from transport since 1990, -10 to 40% other sectors
- ↪ urban noise pollution is **mainly** generated by road traffic
- ☞ **need for action to make road transport more sustainable**

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2

Map of daytime noise levels in Berlin



Senatsverwaltung für Gesundheit, Umwelt und Verbraucherschutz Berlin

Lärminderungsplanung für Berlin - Aktionsplan
Karte 5
Mittelungspegel Tag (6.00 - 22.00) nach Schwellenwerten an der Straßenanbahnung, lauteste Straßenseite - Kfz- und Straßenbahnverkehrslärm Analyse 2005

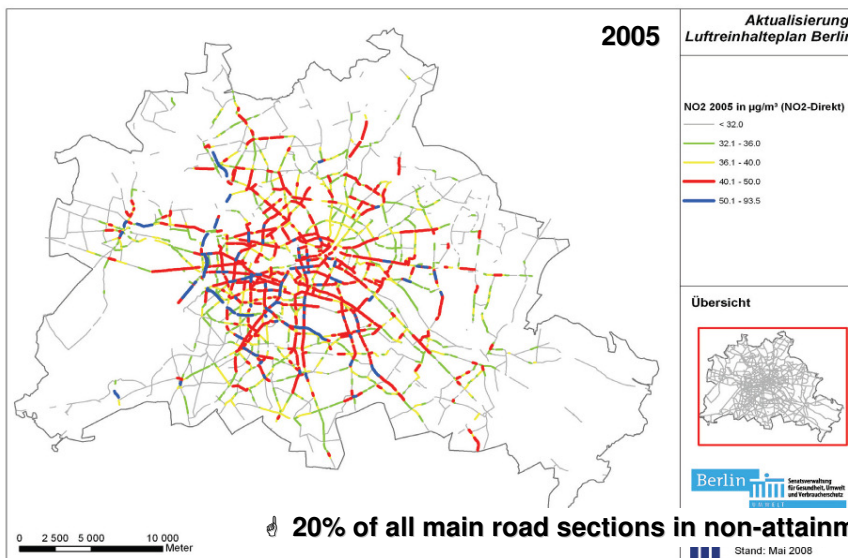
- < 65 dB(A)
- 65 - 70 dB(A)
- > 70 dB(A)

Affected residents along main roads:

- **LDEN >70 dB(A)**
133,400 Residents
- **LNIGHT >60 dB(A)**
193,000 Residents
- **LDEN >65 dB(A)**
273,600 Residents
- **LNIGHT >55 dB(A)**
339,400 Residents

AQ assessment in Berlin

 **modelled NO2 in main roads**



2005

Aktualisierung Luftreinhalteplan Berlin

- NO2 2005 in $\mu\text{g}/\text{m}^3$ (NO2-Direkt)
- < 32.0
 - 32.1 - 36.0
 - 36.1 - 40.0
 - 40.1 - 50.0
 - 50.1 - 93.5

Übersicht

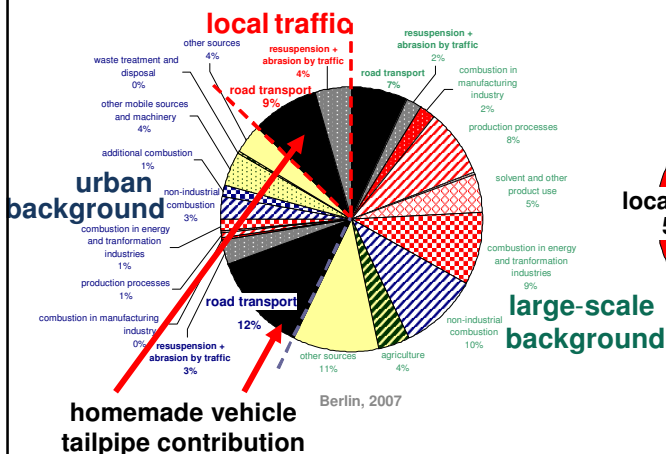


 **20% of all main road sections in non-attainment**

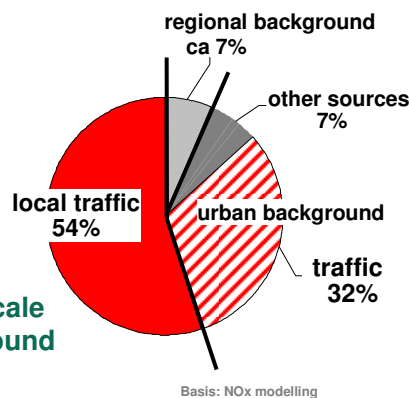
Stand: Mai 2005

origin of kerbside PM2.5 and NO2 in Berlin

sources of roadside PM2.5 pollution



sources of roadside NO2 pollution



- **Large Stationary sources:**
 - ↪ Best Available Technology; already largely exhausted
- **Domestic heating:**
 - ↪ cleaner fuels (nat. gas), heat&power cogeneration
 - ↪ promotion of energy saving measures
 - ↪ renewables (but strict emission limit values for wood fired burners)
 - ↪ option: stricter emissions standards for wood heating systems (< 10 mg/m³)
 - ↪ synergies with new Berlin energy program
 - ↪ aim: 25% less CO₂-emission by 2010 (relative to 1990)
 - ☉ only few single coal fired stoves left (<2% of all flats);
- **Construction:**
 - ↪ Guidelines & information about dust abatement measures
 - ↪ Regulations based on Berlin's regional Pollution Control Act
- **Transport:**
 - ↪ **Cleaner vehicles and fuels (CRT retrofit & CNG)**
 - ↪ municipal vehicle fleet (CRT retrofit & CNG)
 - ↪ filter retrofit of passenger cruising ships
 - ↪ **LEZ (low emission zone)**
 - ↪ **Less traffic through sustainable transport- and city planning**
 - ↪ master plan transport, "StEP"
 - ↪ **Optimized traffic management**
 - ↪ **Speed limits (30 km/h)**
 - ↪ **Ban of heavy duty vehicles in single streets**
 - ↪ ...

Cleaner vehicles and fuels.....

■ cleaning up the municipal vehicle fleet

- ↪ particle filter: police, buses
 - ☞ 1000 old buses retrofitted with CRT since 1999
 - ☞ full CRT coverage by 2008
- ↪ compressed natural gas & biogas:
 - ☞ 25% of garbage collection vehicles, 50% by 2008
 - ☞ 15 buses running on CNG and 5 on hydrogen
- ↪ SCRT retrofit for public buses
 - ☞ retrofit programme of about 100 buses planned



■ CNG (compressed natural gas) for private & commercial Diesel vehicles

- ↪ 1000 private cars: Gas-vouchers & tax refunds
- ↪ 1000 taxis and driving schools: funding of new CNG-vehicles
- ↪ 100 HGVs&LGVs: funding of new vehicles running on CNG



■ network of natural gas refilling stations (14 stations by now)

- ↪ increasing share of biogas



☞ particle filter in passenger cruise ships



pilot project 2008-2010:

- retrofit of 3 vessels with different filter systems
- monitoring of filter efficiency, performance and handling during routine operation



Problems in Berlin...

- again (after 2 years compliance) **excess** of PM10
- **widespread excess of NO2 (up to 50%) in central main roads**
- local scale traffic restrictions merely shift problem in other roads
- short-term temporary traffic restrictions **not effective** during pollution episodes
- **previous measures insufficient**
 - ☞ modernisation of municipal fleet,
 - ☞ funding scheme for CNG-vehicles
 - ☞ shift to clean transport modes by traffic planning

Solution for wide-spread traffic-related pollution...

☞ **LEZ: selective traffic ban for high polluting vehicles**

- ☞ **large-scale:** not only in single roads but covering the whole (potential) non-attainment area
- ☞ **durable:** not only on days in excess of 24h-limit value
- ☞ **transition period** (Berlin > 2 ½ years) prior to the start
 - ☞ ensures **proportionality**
 - ☞ **Berlin: no general exemptions** for residents and commercial traffic
 - ☞ **some individual** temporal exemptions possible



Low Emission Zones in Europe

LEZ found in:

- Sweden: 5
- Denmark: 5
- UK: 2
- Germany: 40
- Czech: 1
- Austria: 3 (motorways)
- Italy: 7 regions
- Netherlands: 17
- Hungary: 1 planned

More information:

Low Emission Zone in Europe Network (LEEZEN):

www.lowemissionzones.eu





Area:

about 88 km²
(Berlin total area: 892 km²)

Inhabitants:

about **1 Million**
(Berlin total: 3,4 Mio)

Stage 1: since 1.1.2008

- Diesel vehicles: at least **Euro 2** or Euro 1 & retrofit
- Gasoline vehicles: at least **Euro 1**
- 7%** of vehicle fleet affected



Stage 2: since 1.1.2010

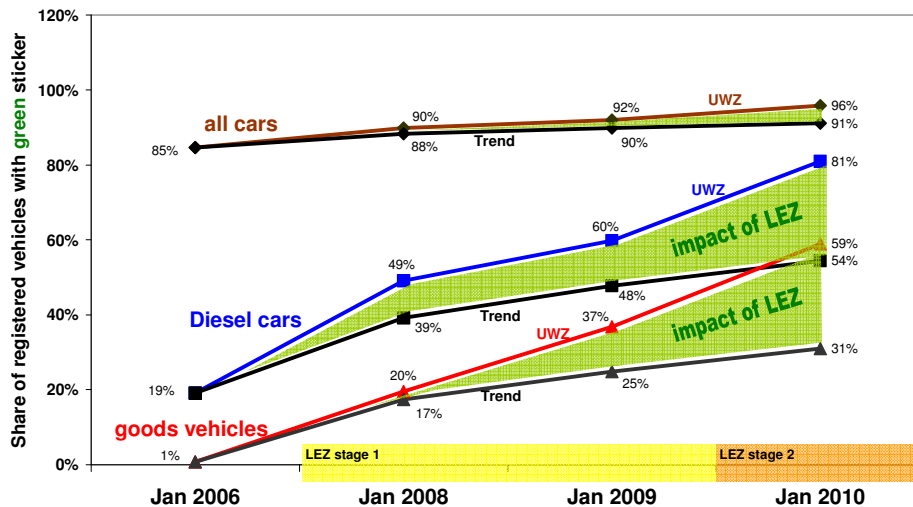
- Diesel: Particle emission **Euro 4**: cars: **Euro 3 + particle filter** or better
- goods vehicles: also **retrofit** of Euro 1-3 towards Euro 4_{Particle}
- 10%** of the vehicle fleet affected

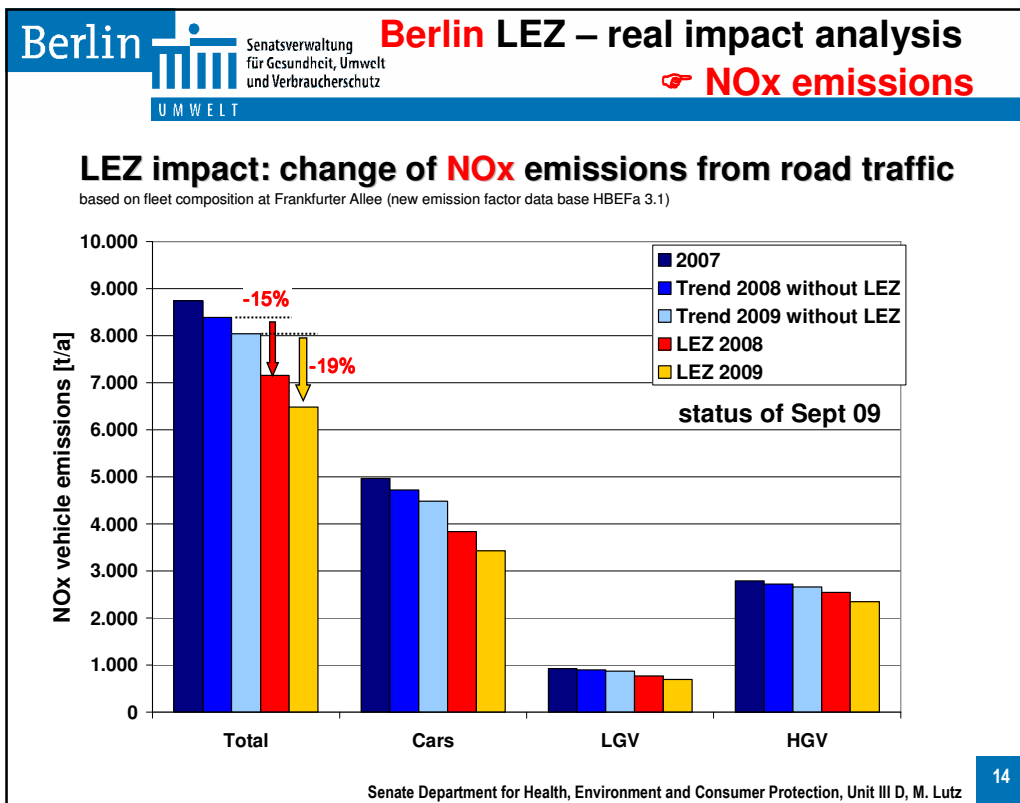
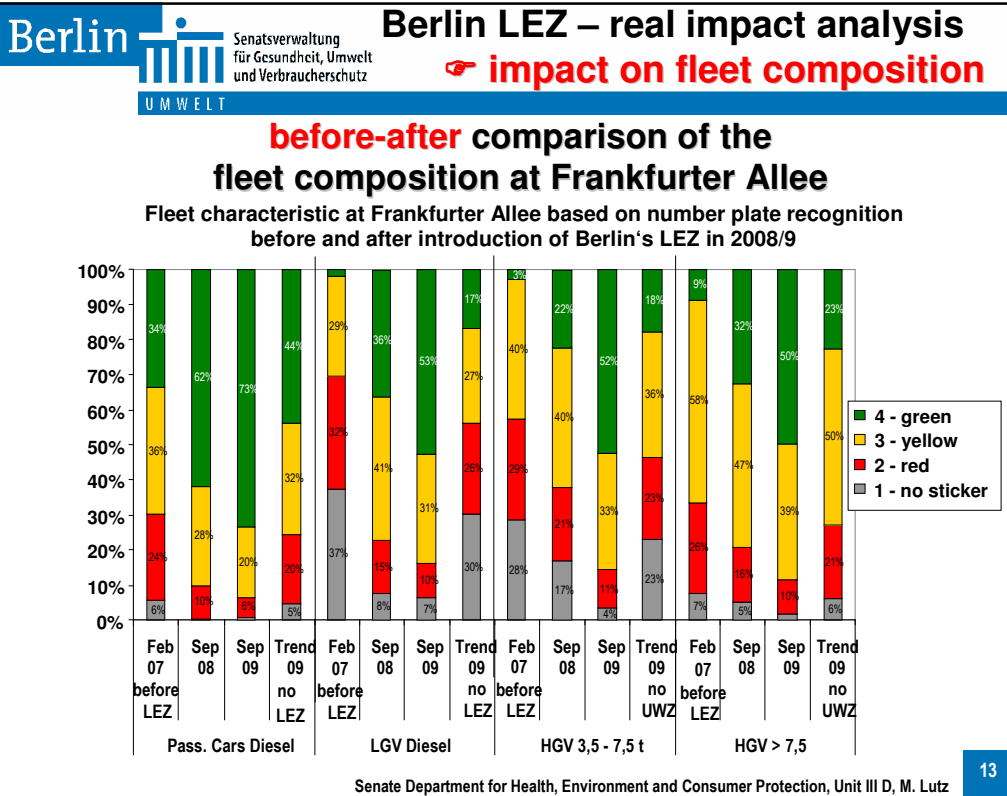


more than 40 LEZ planned/in force in Germany, but with different emission criteria

Share of **registered vehicles with green sticker**

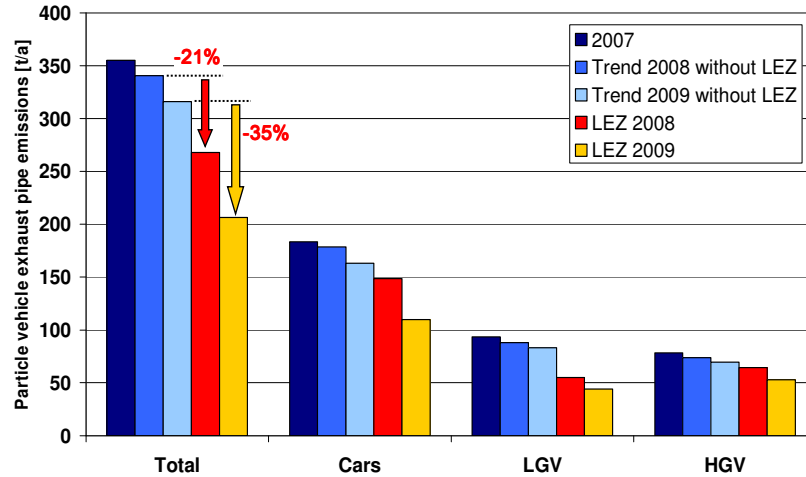
Positive impact of Berlin's LEZ on the registered vehicle fleet





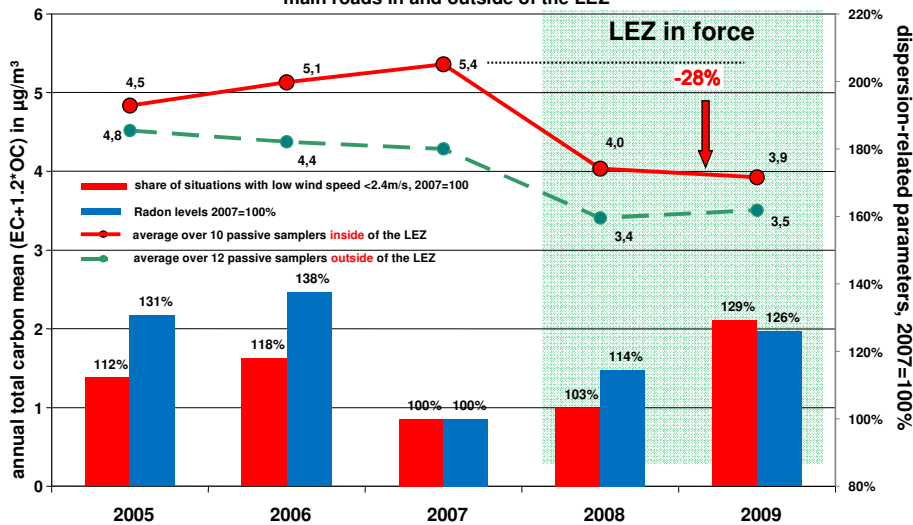
LEZ impact: change of particle exhaust emissions

based on fleet composition at Frankfurter Allee (new emission factor data base HBEFa 3.1)



emissions extrapolated to the entire main road network based on the fleet composition at Frankfurter Allee (without DPF retrofit, only warm emissions, no cold start impact)

traffic-adjusted trend of the local traffic increment of total carbon concentrations in main roads in and outside of the LEZ



- **no visible shift of traffic** into surrounding areas
 - **significant change in the vehicle fleet composition:**
 - ↳ fewer „dirty“ vehicle (<E1):
 - ↳ LGV/HGV: only 4-7% instead of 30 %
 - ↳ more clean vehicles (E4):
 - ↳ cars 73% instead of 44%,
 - ↳ lorries 50% instead of 17-23%
 - decrease of **traffic emissions** on top of trend :
 - ↳ exhaust particles: - 35 %; NOx: - 19 %
 - **LEZ is most effective single measure, if**
 - ↳ based on **ambitious** emission criteria
 - ↳ covering a **larger area**
 - ↳ introduced **not too late**
 - ↳ **exemptions are limited**
- possible benefit for the air quality**
- ↳ **10% reduction of PM10/2.5 & NO2**, black carbon decrease **~20%**
 - ↳ **10-15 less excess days** > 50 µg/m³ PM10

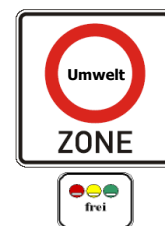


↳ ~2010-12

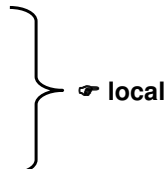


- **Objective:**
 - ↳ faster modernisation of vehicle fleet
- **Criteria: When should a LEZ be considered?**
 - ☑ **high** contribution of urban **traffic-related** air pollutants
 - ☑ air quality limit values **exceeded** in **many urban streets**
 - ☑ **low** proportion of **through traffic** or no alternative routes
- **Advantages:**
 - ☺ aims specifically at the highest emitting vehicles
 - ☺ **rewards** vehicle owners who invested in clean vehicles
 - ☺ reduces the emission of the overall vehicle fleet all over the LEZ → decrease in all streets → decrease of urban background concentrations → decreasing urban population exposure
 - ☺ proven benefit for air quality
 - ☺ **controls** the most **hazardous component** of PM (↳ black carbon)
- **Disadvantages:**
 - ☹ financial burden for owners of high emitting vehicles
 - ↳ in particular for small business
 - ☹ in Germany: every car owner has to buy a sticker to facilitate control
 - ☹ administrative effort for granting individual exemptions

„Zeichen 270.1



- ✓ (national) **vehicle classification** scheme in force in time
 - ↳ EU-wide regulation !?
 - ↳ national/EU
- ✓ **technical criteria for retrofit** systems to be set early
 - ↳ EU-wide regulation, at least cross-border compatibility!!
 - ↳ prohibit increase of NO2-emissions !!
 - ↳ EU/national
- ✓ **sufficient market coverage** for retrofit kits, in particular for commercial vehicles
- ✓ **economic incentives**
 - ↳ tax discounts, funding for cleaner/retrofitted vehicles (with particle trap, CNG, hybrid, etc.)
 - ↳ national/local
- ✓ **stricter vehicle emission standards**
 - ↳ EU-wide regulation !!
 - ↳ EU
- ✓ **sufficiently long transition period**
- ✓ **few exemptions** from traffic ban
- ✓ **intensive public information**
- ✓ **effective enforcement & sanctions**



But, LEZ alone not **sufficient**, needs to be supplemented by...

re-routing through traffic

Promotion of sustainable transport modes & car sharing

allocation of road space in favour of cyclists & pedestrians












Parking management








Traffic bans

Speed limits

traffic light synchronisation optimising vehicle flow

strongly linked to noise action planning

Concept	good for air quality
Urban Planning and Development  setting objectives for low-noise city planning	(✓)
Traffic Development and Planning  promotion of eco-mobility & clean transport modes  mitigation of source & target traffic, area parking management  mobility management by business  enhancing intermodality, park & ride	✓ ✓ ✓ ✓
Traffic network design and traffic control  re-routing traffic to new or existing roads with less pollution or residents  control or re-routing of commercial traffic	✓ ✓
Traffic management and road space re-allocation  Renewal of road surface  speed limits  improving traffic flows without traffic growth  altering road space design in favour of green transport modes	✓ for PM ✓ ✓ ✓

- **shift modal split from motor traffic to clean transport modes**
 Berlin's planning objective:
 -10% less motor traffic in 10-15 years
 results in up to -10% NO₂, 3-4% less total PM₁₀
- **optimizing traffic flows** (progressive signal systems):
 impact difficult to quantify
 → **local effect**, traffic signal coordination works only in one direction, potentially negative effects on cross-roads
 -  conflict with acceleration of bus/tram
 -  risk that gained road capacities will attract more traffic
 -  **small** net gain in pollution control
- **truck ban:**
 example HEAVEN project: up to 20% less NO₂, -7% PM
 → only **local** effect in single roads, merely shift to other roads, no net reduction
- **speed limit 30km/h:**
 example Schildhornstraße Berlin: 10 % less NO₂, -6% PM
if traffic light coordination with 30 km/h works well
 speed limit is **enforced**
 → also less noise and traffic accidents



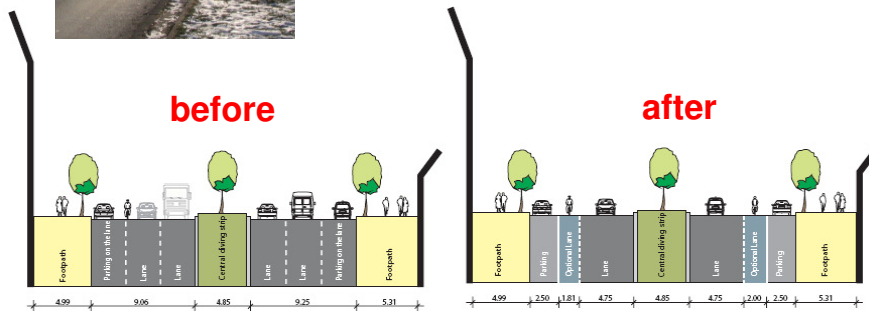
Example for noise measures

👉 redesigning road space



Example Prinzenallee

- removing one traffic lane
- set up separate lane for cyclists
- improve crossing for pedestrians
- planting of additional trees



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Example for noise measures

👉 redesigning road space

before

after

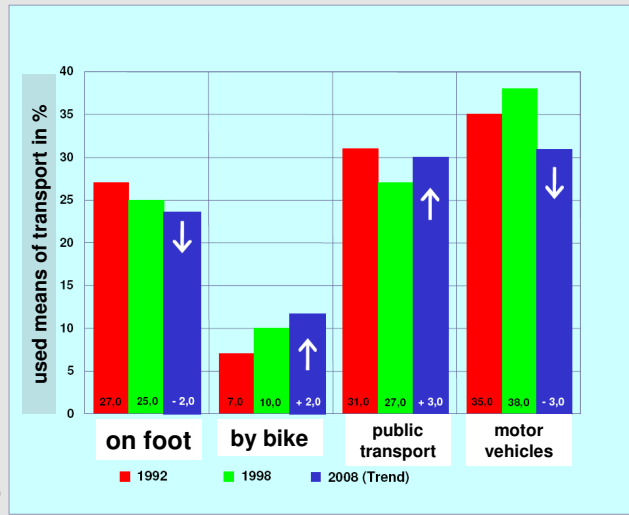
Sanierung Prenzlauer Promenade



- separating trams tracks from motor traffic
 - ↳ shorten travel time of public transport & make it more attractive
- set up noise absorbing lawn tracks
 - ↳ also reduces re-suspension of road dust

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Modal Split Development 1992 / 1998 / 2008

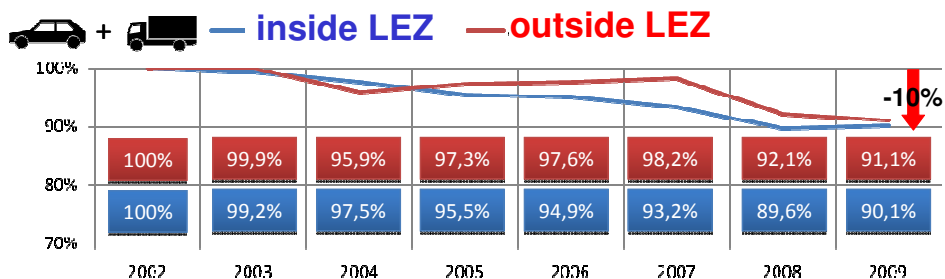


Quelle Diagramme: Senatsverwaltung für Stadtentwicklung*

* Stand 1998 (Letzte Haushaltsbefragung; neue Erhebung 2008)

trend of traffic volumes 2002-2008 inside and outside of the low emission zone (LEZ)

2002 = 100%



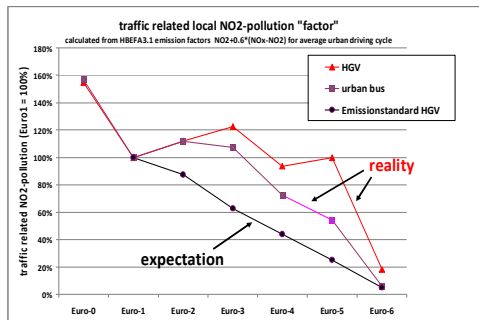
- Road **transport** is a major source of air **pollution**, noise & greenhouse gas emissions in Berlin
- Berlin **needs to act** because of
 - ☞ legally binding obligations to meet air quality standards
 - ☞ mandatory noise action planning
 - ☞ own stricter objectives to curb greenhouse gas emissions
- Berlin has come up with an
 - ☞ **air quality strategy** ☞ low emission zone, traffic management
 - ☞ **noise action plan** ☞ traffic management, speed limits, road surface improvement
 - ☞ **master plan transport** ☞ public transport & cycling infrastructure investment
- Achieved/expected **benefits**
 - ☞ ~10% less motor **traffic** in downtown city areas in a decade
 - ☞ less **PM10** (~10%), **diesel soot** (>20%) and **NO2** pollution (~10%)
 - ☞ about **15% less** roads with **noise** threshold excess by 2012
 - 👉 **results in better health and quality of urban life**

- requires **concerted action** between many stakeholders
 - ☞ **government**: urban planning, transport and environment departments
 - ☞ **economy**: business, industry, hauliers
 - ☞ **society**: NGOs, local neighbourhood initiatives, interested citizens
- needs **supportive policy framework** on
 - ☞ **national level**
 - ☞ funding of urban public transport & cycling infrastructure
 - ☞ sustainable (freight) transport planning
 - ☞ **European level**
 - ☞ sustainable (freight) transport planning
 - ☞ setting and early introduction of ambitious technical standards for vehicle emissions and technology retrofit
 - 👉 Euro VI, vehicle noise emissions, particle filter and SCR retrofit
 - ☞ ensure consistency with ambition level of air quality standards

- **NO2 direct emissions** of cars & LGV increased up to Euro 4 due to lack of regulation
- **HGV up to Euro V show no decrease** of NOx emissions under real urban conditions
- **only Euro 6/VI will (hopefully) bring about a tangible reduction** of NOx & NO2 in cities
- **but Euro 6/VI mandatory only 2014/15**, won't help to attain NO2 AQ standards by 2010/2015

- ⊗ **EU vehicle emission control policy has largely flopped !**
- ⊗ **full compliance with NO2 air quality standards even by 2015 will be terribly difficult**
- ☠ **air pollution problems, in particular from traffic, cannot be solved only by municipalities**

real NOx emissions of heavy duty vehicles in urban driving conditions:

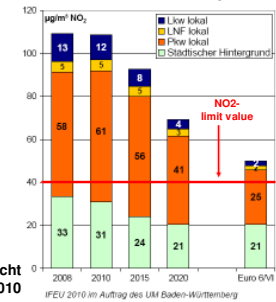


scenario calculation for a traffic site in Stuttgart (Germany):

⊗ **LV excess even in 2020 and even if all vehicles were Euro 6/VI**

source: Udo Lambrecht
IFEU Institute 2010

modelled NO2-levels at traffic site Stuttgart Neckartor



For more information on

- ☞ Berlin's LEZ see www.berlin.de/umweltzone (also in EN & FR)
- ☞ LEZ in Germany see <http://www.umweltbundesamt.de/umweltzonen/index.htm>
- ☞ LEZ-cities in Europe visit www.lowemissionzones.eu, the website of the European Network of LEZ-cities (LEEZEN)
- ☞ Berlin's Noise Action Plan see http://www.berlin.de/sen/umwelt/laerm/laermminderungsplanung/download/laermaktionsplan/noise-reductionplan_berlin.pdf
- ☞ transport related measures in EU cities visit www.civitas.eu