Low Emission Zones in Europe: Access restriction criteria, vehicle identification essentials for implementation

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Low Emission Zones (LEZ)

Definition

■ Broad:
Urban area where stricter requirements apply for polluting sources, like

- Ban of certain fuels e.g. for domestic heating
- stricter emission standards for certain plants
- Stricter standards for construction machines and/or vehicles

■ Narrow:
Access restriction to urban area for certain vehicles depending on their pollutant emission (particles, NOx, hydrocarbons)

- Legal ban
- Road charging with emission dependant fees
- Combination of ban and charges

used in Europe, driven by pressure to meet AQ standards:

- common objective: Accelerated improvement of vehicle fleet
- Calming traffic is not the prime goal
- Ecozona
- urban mobility planning
LEZs in Europe

- ~250 in Europe
- ~70 in Germany
- Emission criteria based on Euro emission standards
- Most allow Diesel Particle Filter retrofits
- Most have 2+ stages
- National frameworks  Except IT & UK
- Areas range from big LEZ in London & Rhine-Ruhr area to small towns in the Po valley
LEZ in Europe

Variants

■ Restricted vehicle types
  ✐ Only heavy good vehicles, some LEZ incl. light goods vehicles
  ✐ Most LEZ incl. buses, coaches
  ✐ Some LEZ (Italy) include motor-cycles
  ✐ All vehicles (Germany)

■ Enforcement
  ✐ Manually, e.g. based on sticker system
  ✐ Automatically with vehicle recognition technology

■ Operating hours
  ✐ Permanent
  ✐ Seasonal (Italy, during winter half year)
  ✐ Selected daytime, weekdays
  ✐ Episodic, only when pollution levels exceed certain thresholds

■ Exemptions
  ✐ Emergency & other special vehicles
  ✐ Some LEZ exempt residents and/or businesses in the zone
  ✐ Many LEZ grant individual exemptions in case of hardship
LEZ  German sticker system

- (national) vehicle **labelling scheme:**

<table>
<thead>
<tr>
<th>sticker:</th>
<th>2 (S-UM43)</th>
<th>3 (S-UM43)</th>
<th>4 (S-UM43)</th>
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</thead>
<tbody>
<tr>
<td>minimum criteria for Diesel vehicles</td>
<td>Euro 2, or Euro1 plus particle filter</td>
<td>Euro 3, or Euro 2 plus particle filter</td>
<td>Euro 4, Euro 3 plus particle filter</td>
</tr>
<tr>
<td>ban for Diesel veh. older than ...</td>
<td>1992</td>
<td>1996</td>
<td>2000</td>
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<tr>
<td>minimum criteria for petrol cars</td>
<td></td>
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<td>Euro 1 with catalytic converter</td>
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</tbody>
</table>

- general exemptions for
  - police, fire brigade, military, ambulance, etc
  - two wheelers, mobile machinery, vintage cars

- technical **criteria** for DPF retrofit kits

  - no EU-wide harmonisation until now
LEZ Berlin

Vehicle emission criteria & timing

Emission criteria based on EU vehicle emission standards...

- **Stage 1:** since 1.1.2008
  - Diesel vehicles: at least Euro 2 or Euro 1 & retrofit
  - Gasoline vehicles: at least Euro 1
  - Affected 7% of the vehicle fleet

- **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}
  - Affected 10% of the vehicle fleet

**By now...**

- Up to 3 times more “green” vehicles
- More than 60,000 filter retrofits
  (up to 25% of the Diesel vehicle fleet)
- LEZ in force in more than 70 German towns

**Area:**
- About 88 km²
  (Berlin total area: 892 km²)

**Inhabitants:**
- About 1 Million
  (Berlin total: 3.4 Mio)
Diezel Passenger cars:
■ 14,000 PC (7%) with red sticker → can barely be retrofitted to
■ 60,000 PC (30%) with yellow sticker → can be retrofitted to

Commercial Diesel vehicles:
■ 10,000 LDV/HDV (12%) with red sticker → can be partly retrofitted to
■ 25,000 LDV/HDV (30%) with yellow sticker → can be retrofitted to

Affected vehicles in total: ca. 124,000

By 2011: more 60,000 Diesel vehicles retrofitted with DPF
25% Diesel PC & 20% LGV/HGV!
Netherlands LEZs

- **National framework** developed *together with* transport operators, clearly communicated, national website
- **Local schemes** under national agreement until national law in place, together with **extensive grants for retrofit**
- **Clearly laid out LEZ plan**, together with comprehensive national & local AQ Action Plans
- **Framework** requires complimentary measures, improving logistics
- **Enforced with cameras**, manual until cameras in place
- **Heavy duty lorries only**, not buses, LDV only in 3 largest cities
- **Annually assessed**

- **Until 2010**
  - Euro 1 & less banned; Euros 2 & 3 require filter
  - Euro 4, 5, 6, EEV, gas, hydrogen, E85 allowed in
- **After 2010 are:**
  - Euro 2 & less banned; Euro 3 require filter & must be <8 years old
  - Euro 4, 5, 6, EEV, gas, hydrogen, E85 allowed in
- **After 2013**
  - Only Euro 4, 5, 6, EEV, gas, hydrogen, E85 allowed in

Details see [http://urbanaccessregulations.eu/](http://urbanaccessregulations.eu/)
Source: Lucy Sadler
LEZ in Italy

- Many regional frameworks & individual LEZs
  - under an agreement of North Italian regions
- Cover all vehicles, including motorcycles
- Some LEZ time limited and/or only in winter
- Example Lombardy
  - Whole region: 2-stroke m/cycles & mopeds Euro 1, Buses Euro 3, permanent
  - In urban areas: Petrol Euro 1, Diesel Euro 3, Winter Mon-Fri 7:30-19:30

- Time dependence allows those on lower incomes to still access the city, but adds complexity and limits environment impact
- Funding to assist retrofit & those on low incomes
LEZ in Italy

**specialty: Milan Ecopass/Area C**

- Emission dependent road **charging** scheme & LEZ ban
- In force since 2008, covers the city centre
- **polluting** vehicles charged for entry 7:30-19:30
  - Free: Class 1
    - AFV; gas, electric, hybrid
  - Free: Class 2
    - Petrol: cars Euro 3+
    - Diesel: cars & GV Euro 4+ or with filter
  - 2€/day: Class 3
    - Petrol Euro 1, 2
  - 5€/day: Class 4
    - Petrol: cars Euro 0; GV Euro 1, 2;
    - Diesel: cars Euro 3; GV Euro 3; buses Euro 4 & 5
  - 10€/day: Class 4
    - Diesel: cars Euro 0; GV Euro 0-2; bus Euro 0-3
- **Resident** & multiple entry discounts (non-comm)
- In addition to Lombardy winter LEZ controls
- Was fairly effective in reducing traffic & pollution
- Now replaced by
  - LEZ Euro 4 Diesel/Euro 1 petrol, from 2017 DPF required
  - ‘flat’ congestion charge (“Area C”): 5€ standard/2€ residents per day, E-vehicles, hybrids, bi-fuel, CNG and LPG free
LEZ in Sweden

- Example: Gothenburg
  - In force already since 1996
    - Focus on PM10/PM2.5
    - Zone size 15 km²
  - Phase 2 since 2007
    - Zone enlarged to 25 km²
      - Requested by transport companies in phase 1 zone
  - Access restriction limited to heavy vehicles and buses
  - Criteria combine Euro standard with vehicle age
  - Similar LEZ in Stockholm & Malmö
  - Initially city schemes, later underpinned by national regulation

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**Definition table of the year restriction of the Swedish LEZs**

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<td>2002</td>
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<td>2010</td>
<td>2012</td>
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London’s LEZ

- Extensive assessment & consultation
- Clearly & extensively communicated in different languages
- Heavy duty lorries & coaches only, LGVs & vans stage 2 in Feb 2012
- Enforced with cameras, building on congestion charge
- No ban, but heavy charges £100-200 per single entry for non-compliant vehicles
- Penalties apply if charge isn’t paid in advance
- Part of (comprehensive) AQ Actionplan
- Retrofit possible with Diesel particle filter (DPF)
- Efficient “closed” DPFs required, with limit to primary NO₂ increase
- Foreign vehicle registration scheme
- ~98% compliance rate
- Extensive monitoring of air quality
London LEZ for goods vehicles & buses

emission criteria

Key implementation dates

<table>
<thead>
<tr>
<th>Date</th>
<th>Emission Standard for PM</th>
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</thead>
<tbody>
<tr>
<td>4 February 2008</td>
<td>Euro III for PM</td>
</tr>
<tr>
<td>3 January 2012</td>
<td>Euro IV for PM</td>
</tr>
<tr>
<td>7 July 2008</td>
<td>Euro III for PM</td>
</tr>
<tr>
<td>3 January 2012</td>
<td>Euro IV for PM</td>
</tr>
<tr>
<td>4 October 2010</td>
<td>Euro III for PM</td>
</tr>
</tbody>
</table>

From February 2008, a standard of **Euro III** for particulate matter (PM) for **Heavy Goods Vehicles** (HGVs) over 12 tonnes in weight;

From July 2008, a standard of **Euro III** for PM for **goods vehicles between 3.5 and 12 tonnes in weight**, and for **buses and coaches**;

From October 2010, a standard of **Euro III** for PM for **heavier Light Goods Vehicles** (LGVs) and minibuses; and

From January 2012, the standard will be tightened to **Euro IV** for PM for **goods vehicles over 3.5 tonnes, buses and coaches**

**Charge/Penalty:**

- **HGV’s/Buses:** £200, **Penalty:** £500 (paid within 14 days) up to £1000
- **LGV’s:** £100, **Penalty:** £250 (paid within 14 days) up to £500
Future Ultra-Low Emission Zone in London

ULEZ timeline…

- Legislation finalised: 2015
- Public consultation: 2014
- TfL bus procurement:
  - Double-deck hybrid roll out in central London to 2020
  - Single-deck zero emission roll out in central London to 2020
- ULEZ charge:
  - Euro VI: £100
  - Euro 4 (petrol): £12.50
  - Euro 6 (diesel): £12.50
- Potential future strengthening of ULEZ standards
- Taxi & PHV licensing:
  - All newly licensed taxis / PHVs zero emission capable from 2018
  - Reduce age limit for conventional diesel taxis to 10 years from 2020

ULEZ

LEZ
LEZ in France

Paris

- Area: whole Paris
- From 1 July 2015: HGV at least Euro 1
- From 1 July 2016: All vehicles at least Euro 1
- Operation time: daily from 08:00 - 20:00
- National sticker scheme
- Future restrictions not yet adopted
- Diesel will not get a green sticker, because of high NOx emissions, even of new Euro 5/6 Diesel cars

Source: Olivier Chrétien, Paris 2015
Summary: Result of impact studies of LEZ in Berlin, Germany and London
LEZ impact analysis

*approach & needed tools*

1. **Impact on traffic flows?**
   - has road traffic decreased within the LEZ?
   - has road traffic been re-routed to areas outside the LEZ?
   - has road traffic been avoided?
     - monitoring of traffic flows

2. **Effect on the vehicle fleet composition?**
   - change in the characteristic of the registered vehicle fleet?
   - change in the real fleet on the roads in & outside the LEZ?
     - evaluation of vehicle registration data base
     - monitoring of real vehicle fleet

3. **Impact on the pollution emissions from road traffic?**
   - calculation of the exhaust emissions
   - comparison with default fleet and situation before/after LEZ

4. **Impact on the air quality?**
   - evaluation of routine air quality monitoring data: PM10, PM2.5, NO, NO2, NOx
   - evaluation of extra AQ measurements: PM-species (EC, OC, sec. PM, passive samplers)
   - dispersion modelling with LEZ-related emission reduction
LEZ Berlin  ➔ real impact

Emission categories of the real-world vehicle fleet

- emission standards of vehicles on the road in and outside of the LEZ
- identification through recording of the vehicle number plates at 5 spots,
  ➔ 2 within,
  ➔ 3 outside of the LEZ
- evaluation through vehicle registration office
- Analysis of fleet characteristic
- extrapolation on the whole mayor road network
**Berlin LEZ – impact analysis**

- **vehicle fleet composition**

change of the vehicle fleet composition on the road
(from number plate recognition Frankfurter Allee)

<table>
<thead>
<tr>
<th></th>
<th>Feb 07 vor UWZ</th>
<th>Sep 09 UWZ I</th>
<th>Sep 09 UWZ II</th>
<th>Sep 10 ohne UWZ</th>
<th>Trend 10 ohne UWZ</th>
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<tr>
<td><strong>Pkw Diesel</strong></td>
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<tr>
<td>Diesel cars</td>
<td>-6%</td>
<td>-6%</td>
<td>-6%</td>
<td>-1%</td>
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<tr>
<td></td>
<td>-24%</td>
<td>-20%</td>
<td>-20%</td>
<td>-7%</td>
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<tr>
<td><strong>LNFz Diesel</strong></td>
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<tr>
<td>Diesel LGVs</td>
<td>-6%</td>
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<td>-6%</td>
<td>-1%</td>
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<td>-24%</td>
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<td><strong>Lkw &gt; 3,5 t</strong></td>
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<tr>
<td>HGV</td>
<td>-6%</td>
<td>-6%</td>
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<td>-1%</td>
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<td>-24%</td>
<td>-20%</td>
<td>-20%</td>
<td>-7%</td>
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- **decrease:** cat.1 (no sticker) by 70-90 %; Cat 2 (red) by 50-80 %
- **increase:** category 4 (green) by factor 1,5 to 3
LEZ Berlin  💲 real impact

Emission of vehicle fleet in & outside of the LEZ

**items for evaluation**
- year of entry into service
- vehicle type
- Emission category
- fuel
- cylinder capacity
- deadweight
- gross vehicle weight
- number of axles

* Database of emission factors for different vehicle types, technologies and driving modes

**identification of the vehicle category in the handbook**

* calculation of the emissions of the vehicle fleet in and outside or before/after launch of the LEZ

**LEZ Berlin ≠ real impact**

Senatsverwaltung für Stadtentwicklung und Umwelt | Abteilung IX Umweltpolitik

Martin Lutz | GIZ mission on LEZ, Mexico, November 2015
Berlin LEZ – impact analysis

**Emissions of PM**

LEZ impact: change in particle exhaust emissions

based on fleet composition at a busy main road (new emission factor data base HBEFa 3.1)

Not representative for Mexico due to significant Diesel share (30%)
Berlin LEZ – impact analysis

The trend of total black carbon concentrations from traffic

Traffic related* total carbon concentration in Berlin
adjusted with traffic volume changes

- 98% 100% 100%
- 112% 104% 100%
- 82% 75%
- 86% 81%
- 50% -56%
- 54% 44%
- 55% -53%
- 42% 47%

*traffic increment based on the difference between kerbside and urban background sites

data recalibrated Oct 2014

Average TC over 12 mini sampler outside the LEZ
Average TC over 10 mini sampler inside the LEZ

Average total carbon concentration
TC = EC + 1.2 * OC in µg/m³

Share of situations with low wind speed <2.4 m/s (2007=100%)
Senatsverwaltung für Stadtentwicklung und Umwelt | Abteilung IX Umweltpolitik

Berlin LEZ – impact analysis

on total PM concentrations....

decrease* resulting from the reduction of traffic emissions caused by the LEZ → 7% or ca. 2 µg/m³ less PM10

before LEZ 2007

LEZ 2010

black carbon from traffic in Berlin

secondary particles from traffic

NOx-emissions in Berlin

re-suspension, abrasion

from road traffic

other sources in Berlin

traffic outside Berlin

other sources outside Berlin

* related to PM2,5-levels in a busy main road in Berlin’s city centre in 2007 before the LEZ
Berlin LEZ – impact analysis

benefit for climate change

radiative climate forcing per sector

On-road (199)
Household biofuel (132)
Animal Husbandry (98)
Household fossil fuel (84)
Waste/landfill (84)
Power (79)
Agriculture (29)
Off-road land (20)
Aviation (-6)
Agr. waste burning (-14)
Shipping (-43)
Biomass burning (-106)
Industry (-158)

source: Unger et al., 2010
Berlin LEZ – impact analysis

NOx 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 (with DPF-retrofit, only warm emissions, no cold start impact)
LEZ in Germany

**Summary of impact analysis**

- **no visible shift of traffic** into surrounding areas
  - provided that LEZ covers sufficiently large parts of a city

- **significant modernisation of the vehicle fleet:**
  - Increase of category 4 (green) vehicles by factor 1.5 to 3
  - more than 60,000 vehicles retrofitted with DPF

- **decrease of traffic emissions** on top of trend:
  - 60% toxic Diesel exhaust particles, -20% NOx
  - 175 t/a in total Diesel PM emissions from road traffic
  - 30 t/a Diesel emissions of heavy goods vehicles > 3.5t

- **LEZ is effective, if**
  - based on ambitious emission criteria
  - covering a larger area
  - introduced not too late
  - exemptions are limited

- **potential benefit for the air quality**
  - 5-10% reduction of total PM10/2.5
  - traffic related decrease of black carbon ~50%
  - ~10 less excess days > 50 µg/m³ PM10
  - smaller progress for NO2: <5%

- Reduces the most toxic PM component & mitigates CC impact
Impact of implemented measures on estimated emission reduction

- **Fight congestion**: only small scale effect: up 30% reduction of local traffic contribution
- **More gas vehicles**: 3
- **Speed limit 30 km/h**: only small scale effect: up 30% reduction of local traffic contribution
- **Filter retrofit buses**: 37
- **Improving public transport & cycling**: 54
- **Low emission zone**: 173

**Reduction of PM10 emission in t/a**:
- **Total PM10-Emission in 2005**: 3854 t/a
- **Low emission zone**: 173

**Reduction of NOx emission in t/a**: only small scale effect: up 30% reduction of local traffic contribution
- **Total NOx-Emission in 2005**: 20292 t/a
- **Low emission zone**: 1517

**Total PM10-Emission in 2005**: 3854 t/a
**Total NOx-Emission in 2005**: 20292 t/a
LEZ in Berlin & Germany

**Summary of Environment Impacts**

- AQ emissions:
  - Smaller, more harmful PM metrics: -60%
  - PM10: -20%
  - NOx: <20%

- AQ concentrations:
  - Smaller, more harmful PM metrics: -50%
  - PM2.5: -10 to -15%
  - PM10: -7 to -10%
  - NO2: <5%

- Climate Change:
  - Black Carbon: -60%

- CO2:

**Source:** L. Sadler, modified
LEZ air quality impacts

- Vary with scheme details
- emissions standard, vehicles affected
- existing vehicle fleet: age & type
- compliance / enforcement
- topography / meteorology
- % contribution from traffic / imported background

For recent LEZs, from published studies

** 2 assessments

For details see http://urbanaccessregulations.eu/

Source: Lucy Sadler
London LEZ

modelled PM decrease 2012

source: Sean Beavers, Kings College, London
London LEZ

estimated health impacts (NO2 and PM10)

Two approaches were used for quantifying health effects:

- New Defra methodology, as developed for the Defra UK Air Quality Strategy Review (AQSR), and published by the IGCB (the Inter-Department Group on Costs and Benefits) in April (IGCB 2006, COMEAP).
- The European Commission part of the Clean Air for Europe (CAFE) programme, a much wider range of health impacts (morbidity).

DEFRA: 5200 years of life gained, 43 respiratory and cardiovascular hospital admissions avoided.

EU – additionally: 310,000 cases of lower respiratory symptoms, 30,000 cases of respiratory medication and 231,000 restricted activity days avoided.

DEFRA discounted benefits: £200 million.

EC Café CBA analysis: £420 million.

Not just in London (central London saw greatest benefits).

SocioEconomic, Environmental perception, Noise and road safety.

Summary:
What needs to be considered when implementing a LEZ
LEZ  ★ pros & cons

**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
- High share of Diesel vehicles

**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

**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
- considerable administrative effort, e.g. for granting single exemptions
LEZ implementation

What's needed?

Define simple traffic sign for LEZ

German LEZ traffic sign
„Zeichen 270.1
LEZ in Berlin/Germany/Europe

❖ lessons learnt with potential relevance for Cuernavaca

❖ Define the zone sufficiently large
  ❁ to avoid pushing traffic in neighbouring areas
  ❁ to create an impact on the vehicle fleet in the whole city

❖ Undertake a thorough ex-ante impact assessment study
  ❁ To be convincing enough to get sufficient support by the public & important stakeholders

❖ Set ambitious environment criteria
  ❁ To avoid introducing merely a bureaucratic scheme without convincing benefits for health and urban quality of life

✔ Few general exemptions from traffic ban, but allow for (limited) individual exceptions in cases of economic hardship
  ✔ But no exemptions for the public fleet to maintain role model

✔ Allow sufficiently long transition periods in combination with ..,

✔ economic incentives
  ❁ Tax discounts, funding for cleaner/retrofitted vehicles (with particle filters, gas)
  ❁ to mitigate the burden for vehicle owners, to help especially businesses to do the necessary investments
  ❁ Serves also a stimulus to the (local) economy
LEZ in Berlin/Germany/Europe

lessons learnt with potential relevance for Cuernavaca

❌ Focusing on heavy Diesel vehicles could be a useful option
  ❯ Examples in London, Copenhagen & Scandinavia

❌ (national) vehicle classification scheme (& stickers)
  ❯ The simpler to convey the better
  ❯ Extent current hologramme scheme by particle emission component
  ❯ Promote retrofit options as a cheap means to clean up vehicles

☑ Install effective enforcement & sanctions
  ❯ To avoid loosing acceptance by those who abide by the rules

☑ Extensive public information campaign
  ☑ Including early stakeholder involvement in the preparatory phase
  ☑ Focusing on presenting the benefits for the urban population

☑ Prepare for appropriate ex-post impact assessment
  ☑ To encounter resistance with convincing data

☑ Undertake complimentary measures,
  ☑ Especially foresee a modernisation programme for public vehicle fleet, like buses, garbage collection, road cleaning vehicles, etc
  ☑ Serves as role model for the private sector
Example Berlin:

- Definition of quality of PT in “Public Transport Management Plan”
  - Includes environment criteria for bus fleet
  - Provides basis for issuing concessions/service contracts with public and private bus companies

- since 1999: filter retrofit & fleet modernisation programme of Berlin’s 1400 Diesel buses, resulted in
  - > 90% reduction of Diesel soot emissions
  - -37 t/a Diesel soot emissions
    - ¼ of the mitigation effect of the LEZ
  - -732 t/a NOx emissions
    - ½ of the mitigation effect of the LEZ

- Now: setting criteria for public bus services
  - attainment of Euro 5/EEV-standard for NOx in the whole fleet by 2014
    - 300 t/a less NOx emissions
  - SCR – retrofit of 200 Euro IV busses by 2015
    - 50% funding through EU regional funds
  - Upgrade of OEM Euro V/EEV buses to enhance SCR performance
    - Better insulation of tailpipe & extra heating to ensure operation of SCR during urban driving mode
  - Accelerated replacement by Euro-VI/CNG/biogas-vehicles
    - Procurement condition: E VI performance required in urban driving conditions
implementing an LEZ: lots of tasks - many stakeholders

**tasks**
- basic planning process
- delimitation, monitoring – deployment of traffic signs
- vehicle identification/labelling – stickers or camera systems
- granting some exemptions
- funding
- surveillance
- communication
- legal action
- evaluation, impact assessment

**actors**
- pollution control authority
- traffic authority
- local district authorities for traffic
- vehicle registration office
- police
- public order office
- department for the economy
- press/public relations bureau
- public banks, gas supplier (funding of clean vehicles/fuels)
- vehicle inspection agencies
- chamber for industry and commerce, haulier organisation, other lobby groups, NGOs
Measures supplementing Berlin’s LEZ

Sustainable City & Transport Planning

traffic management measures

- Re-routine lorry traffic
  - Reduces PM pollution by 7-9%
  - Needs alternative lorry routes
  - Application limited in large cities

- Traffic flow optimisation
  - Conflicts with traffic light priority for bus & tram
  - Application limited in large cities
  - Can reduce pollution by up to 8% (PM) or 15% (NO2)

- City-compatible speed limits
  - Reduces vehicle emissions, if traffic flow remains good
  - Decrease of local traffic contribution to PM & NO2 by up to 30% or 15%, respectively
  - Reduces traffic noise by up to 2 dB(A)
Measures **supplementing** Berlin’s LEZ

**Sustainable City & Transport Planning**

**Improving public transport**

- Extra bus lanes
- Traffic light priority for tram

- Expanding the tram network into West Berlin

- Makes public transport more attractive

- Makes transport more energy efficient

- Avoids car trips in urban areas

- Reduces air & noise emissions

- Hence: strongly linked noise action planning, CC and AQ strategies

- Building the new Main Station
- Enhancing Berlin’s connectivity
- Making railway more attractive

- Closing gaps in the metro network

- Closing gaps in the light-train network
Measures **supplementing** Berlin’s LEZ

- Sustainable City & Transport Planning
- Enhancing inter-modality

**For freight transport…**

- Bike & Ride
  - makes PT & cycling more attractive
  - shifts car traffic to cleaner modes

- Park (& Charge) & Ride
  - makes PT more attractive
  - reduces car trips in the city
  - incentives electric vehicles

- makes rail-road more attractive
- keeps lorries out of sensitive urban areas
- Reduces noise and air pollution
- makes freight transport more energy efficient
Measures supplementing Berlin’s LEZ

- Sustainable City & Transport Planning
- promoting bicycle use

• makes bicycle us more attractive
- avoids car trips in urban areas
• reduces air & noise emissions
• makes transport more energy efficient
- good for public health
- Hence: strongly linked noise action planning,

CC and AQ strategies

Re-allocation of road space in favour of cyclists & pedestrians:
- Safe riding on extra bicycle lanes on the road
- Reduces noise levels at the building line

Free ride on bus lanes

Setting up a dense cycle – route network
- Safe riding through smaller roads and parks
- Attractive new routes through the centre along the former wall

Free ride on bus lanes before and after.
Measures supplementing Berlin’s LEZ

Sustainable City & Transport Planning

promoting walking

- Berlin’s pedestrian traffic strategy

Some examples…

- New green walks along the former wall

- Safer pedestrian crossing at frequented junctures

- Redisigning road space along Boulevards
Measures **supplementing** Berlin’s LEZ

**Sustainable City & Transport Planning**

**Focus on** urban climate adaptation

**Micro-scale:** measures for single streets & buildings

- increase albedo of building surfaces
- roof and facade greening
- courtyard greening
- tree planting
- de-sealing of surfaces

Good also for AQ (dust concentrations)

**Macro-scale:** Largely maintaining open space & green areas so as to keep free flow of fresh and cool air into the city centre
Measures supplementing Berlin’s LEZ

- Sustainable City & Transport Planning
- Impact on traffic volumes & congestion

**Less Traffic:** trend in traffic volumes 2002-2014 in Berlin (2002 = 100%)

![Trend in traffic volumes](chart.png)

**Less congestion:** Morning traffic peak during an „normal“ Thursday

![Traffic congestion map](map.png)

(Forecast from 24/02/10 for the 25/02/10)

Quelle: Verkehrsmanagementzentrale Berlin i.A. der Senatsverwaltung für Stadtentwicklung. www.vmzberlin.de/vmz
Measures **supplementing** Berlin’s LEZ

**Sustainable City & Transport Planning**

**Impact** on CO2 – emissions

Shift towards cleaner means of transport

expected decrease of CO2-Emissions from road transport on Berlin’s main road network

2.6 Mio t CO2 in 2006

\[ \downarrow \ -38\% \]

1.6 Mio t CO2 in 2025

incl. renewal of vehicle fleet

source: master plan transport 2011
¡Muchas gracias!

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For more information on

Berlin‘s LEZ see
www.berlin.de/umweltzone (also in EN and ES)

LEZ in Germany see
http://www.umweltbundesamt.de/umweltzonen/index.htm

LEZ-cities in Europe visit
http://urbanaccessregulations.eu,
run by Lucy Sadler of SadlerConsultants funded by the EU

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