

The wall has come down: **Proving the success of abatement strategies** in the example of Berlin



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- ➢ Already history: the tragic fate of SO2
- ➢ Changing challenges: re-shaping the AQ network
- Stronger focus: source & impact assessment
- ➢ Contested measure: LEZ top or flop?
- ➢ Convincing the motorists: the merit of speed limits
- ☑ lesson learnt: a few hints for network design



Berlin (West) bevor 1989

air quality monitoring in a **prison** surrounded by The Wall



Berlin (West): SO2 monitoring in grid-like network structure easy recording of SO₂ plumes of big power plants



Berlin (West): SO2 monitoring in grid-like network structure easy recording of SO₂ plumes of big power plants







demonstrating the success story of SO2 control



SO77_97.cdr, 9.10.98,ps



year

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AQ monitoring in Berlin (West&East) in the 90-ties re-designing Berlin's AQ network compliant with new EU criteria

Martin Lutz | AirMonTech Workshop March 2013

AQ monitoring in Berlin

rew focus: hot spots & urban exposure & source analysis

Source analysis Berlin (2007)

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origin of kerbside PM2.5

speciation

source contribution

impact analysis of measures Berlin's Low Emission Zone

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 Euro1

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}
- precondition: retrofit kits available for Euro 3
- LEZ in force or planned in 56 German towns with differing ambition levels

Berlin LEZ – impact analysis NOx emissions

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LEZ impact: change of 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)

Berlin LEZ – real impact analysis particle tailpipe emissions

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 (with DPF-retrofit, only warm emissions, no

cold start impact)

(preliminary results, vers. 22/3/2011)

LEZ impact analysis in Berlin annual mean PM10

Berlin LEZ – impact analysis reference total carbon concentration

traffic related^{*} black^{*} carbon particle concentration in Berlin

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

* local BC increment at traffic sites, adjusted to traffic volumes trend relative to 2007 before LEZ came into force

Berlin LEZ – impact analysis **NO**₂ concentration

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trend of traffic related NO₂ concentration in Berlin

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impact assessment with AQ monitoring data
 benefit of a speed limit 30 km/h on PM10 and EC

based on 1 year data before/after the speed limit was enforced

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impact assessment with AQ monitoring data

Senefit of a speed limit 30 km/h on NOx and NO2

based on 1 year data before/after the speed limit was enforced

impact assessment with AQ monitoring data benefit of a speed limit 30 km/h on NOx and NO₂

based on 3 years data before/after the speed limit was enforced

Impact analysis with monitoring data *** résumé**

- with regard to impact of measures...
 - § fuel switch and exhaust control technology have brought down SO2 levels by more than 95%
 - ♦ LEZ resulted in ...

5-10% decrease of total PM10 and NO2

Image: more than 50% traffic-related total carbon reduction

- Speed limit 30 km/h (instead of 50 km/h) can deliver ...
 - ☞ about 5% less (total) PM (derived from a 25-30% drop of local PM increment)
 - 6-10% decrease fo total EC (derived from a 14-21% drop of local PM increment)
 - 7-12% fall of NO2 (derived from a 15-25% drop of local NO2 increment)
- d results are
 - not in line with speed-dependent emission measurements
 - depend on optimised traffic flow
 - site specific, difficult to extrapolate

Impact analysis with monitoring data *** résumé**

- with regard to AQ network structure & design...
 - Sources
 Sources
 Sources
 - barely relevant by now
 - representative hot spot & urban background station pair essential for source & impact analysis

add traffic detectors at each AQ traffic site

- should be complemented by representative regional background site(s) for assessment of local vs external source contribution
- PM speciation at these sites helpful for quantitative source & impact analysis
 - EC/OC for Diesel exhaust (levoglucosan for wood burning,, etc)
 - **secondary inorganic for long-range transport and share of NOx sources**
- impact analysis of traffic management measures needs more extensive site-specific monitoring
 - Cheap passive sampling (& other mini samplers/sensors) allows better coverage

Senatsverwaltung I _

ON AIR QUALITY MONITORING"

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