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Summary Form

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Title: Estimation of Temporary Emission Reductions by a Low Emission Zone in Zürich

Due to episodes of extremely high air pollution by PM10 in the winter of 2006 different temporary measures for smog abatement have been studied for the city of Zürich. Besides reduced speed limits on motorways and prohibited heavy duty transport through the city center different scenarios of limited access for high emission vehicles to central zones have been considered from the environmental point of view. The zones have been defined as downtown area (zone 1) and Oerlikon area (northern part of Zürich, zone 2) as well as a combination of the two (zone 3). While the smaller restriction zones represented 10% of the city area each, the latter corresponds to more than 30%. Analysis showed that transport splits evenly into modes entering the zone, leaving the zone, transiting the zone and zone internal. In the smaller downtown zone internal traffic is lower, transit mode higher. Access criteria were varied from Euro 1 to Euro 3, light and heavy duty vehicles respectively. As a comparison full driving bans in zone 3 and all over the canton of Zürich were considered. Effects were estimated for emissions of nitrogen oxides (NOx) and particulate matter (PM10) exhaust only. Eliminating Euro 1 and 2 vehicles from circulation the potential for emission reductions ranged from 1 to 5% (NOx) and from 1 to 2% (PM10), depending on the size of the zone. At the time of the study 63% of the Zürich vehicle fleet were affected by this scenario, only 2% of these being Diesel LDV's. These effects could be doubled including Euro 3 vehicles, thus affecting 85% of the fleet (8% Diesel). The Euro 3 scenario however was shown to produce unacceptable side effects such as longer bypass travel distances outside the low emission zones. Emission reductions of up to 15% were calculated for the complete driving ban. In these calculations 100% corresponds to overall emissions in the City of Zürich including stationary sources and transport sources outside the restriction zones. This comparison of different perimeters seemed justified as pollution levels proved to be practically equal all over the city during these smog episodes.

Additionally the legal framework for installation of temporary LEZ in Switzerland was studied and questions concerning implementation and control were raised. Swiss legislation does not contain any regulations for LEZ road signals nor labels for clean vehicles comparable to the ones in Germany. Such regulations have to be established on national level before a possible introduction of LEZ. Complete driving ban is possible by applying Art. 3 Abs. 6 SVG ("polizeiliche Generalklausel") if smog is considered to be a case of emergency and the measure is restricted to a limited area during a maximum of 8 days. Problems of implementation, exemptions, city supply, bypass transport management etc. were not studied.

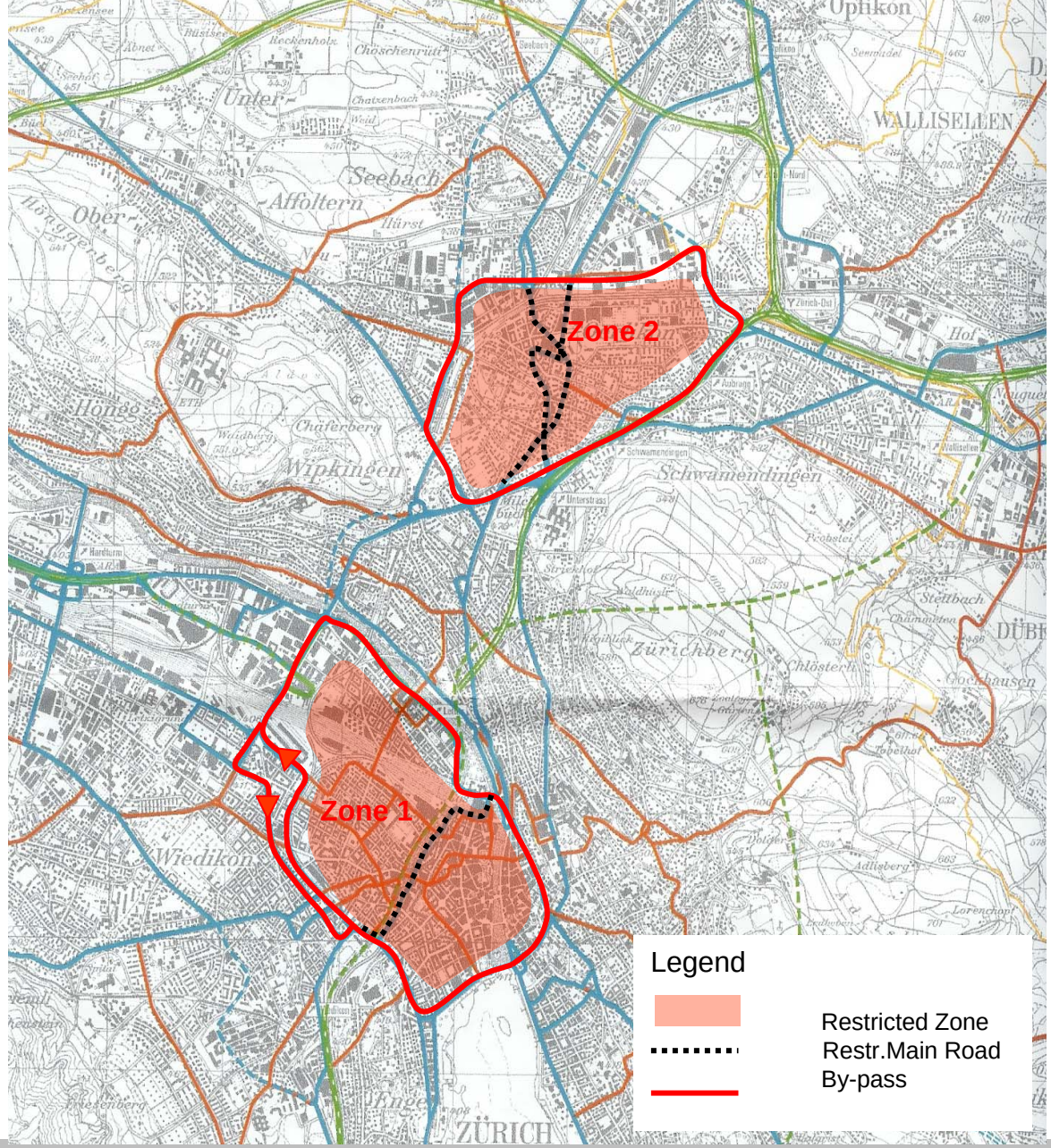
As a conclusion low emission zones as a temporary measure for smog abatement are not recommended. To estimate the effects of a permanent LEZ on air quality in Zürich further investigations may be necessary.

Estimation of Temporary Emission Reductions by a Low Emission Zone in Zürich

Project Study October 2006

Hansjörg Sommer
Zürich, 25. June 2008

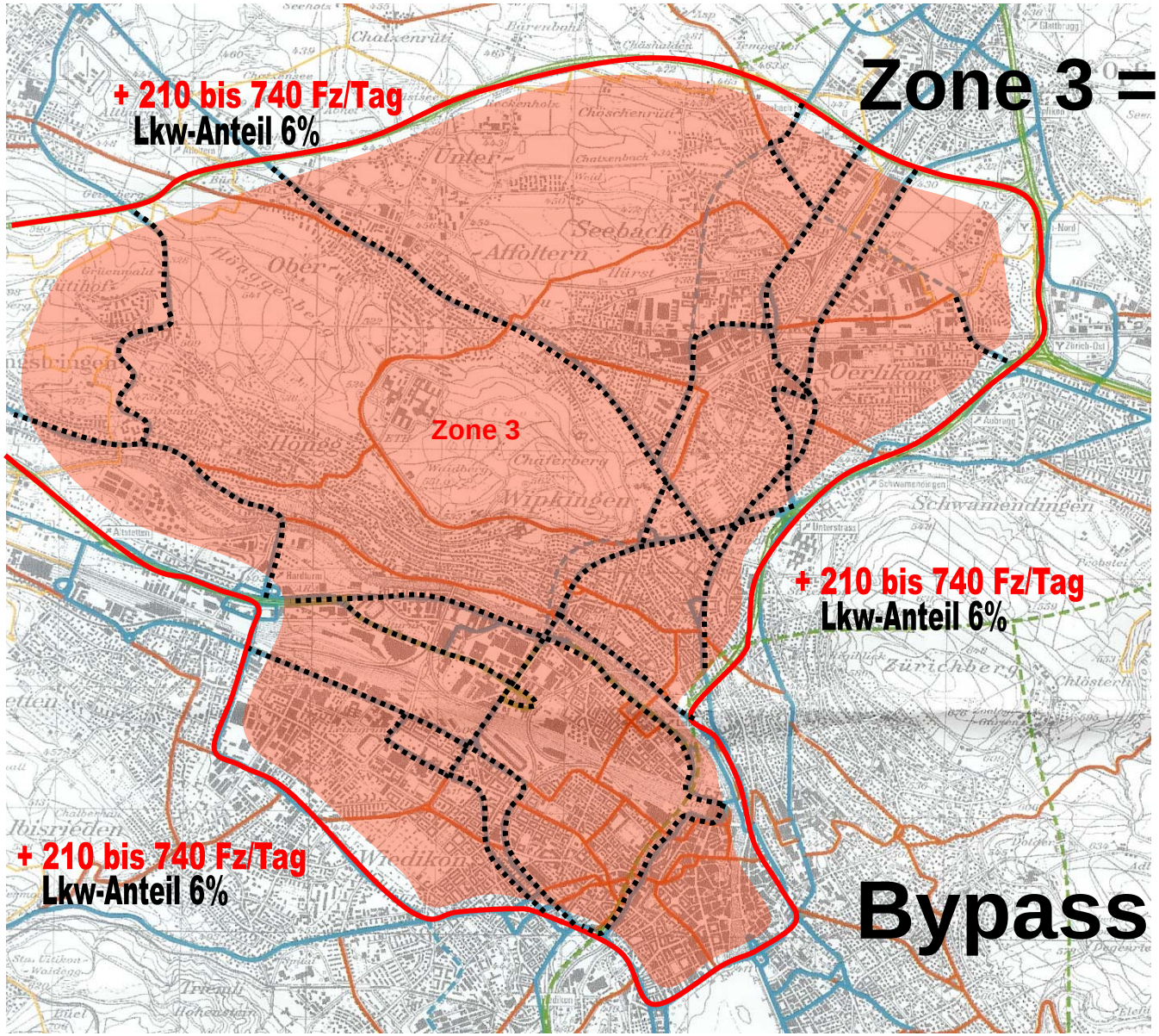
Baudirektion
Kanton Zürich
AWEL Amt für
Abfall, Wasser, Energie und Luft



LEZ Definition:

Zone 1 = Downtown

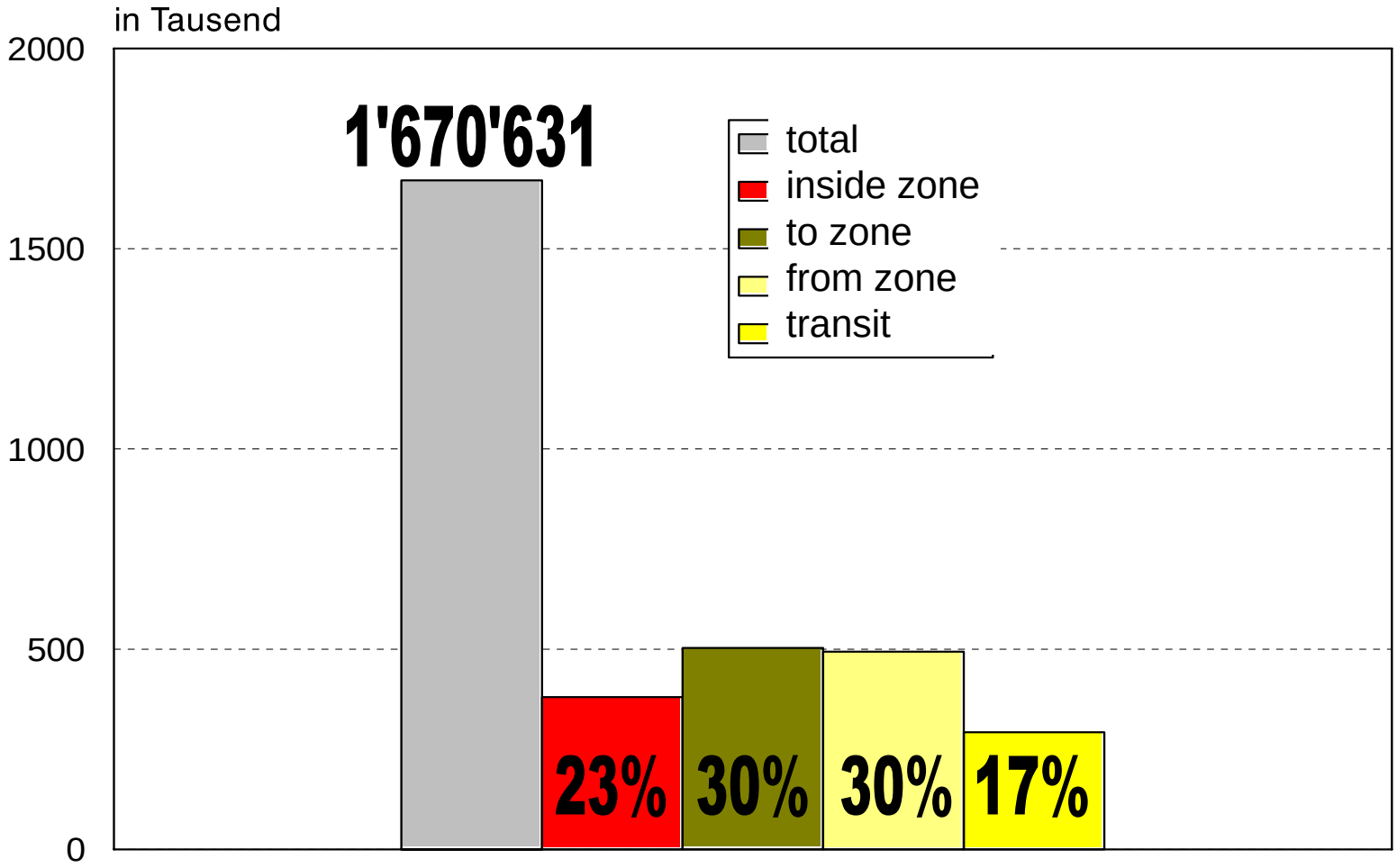
Zone 2 = Oerlikon (subcenter)



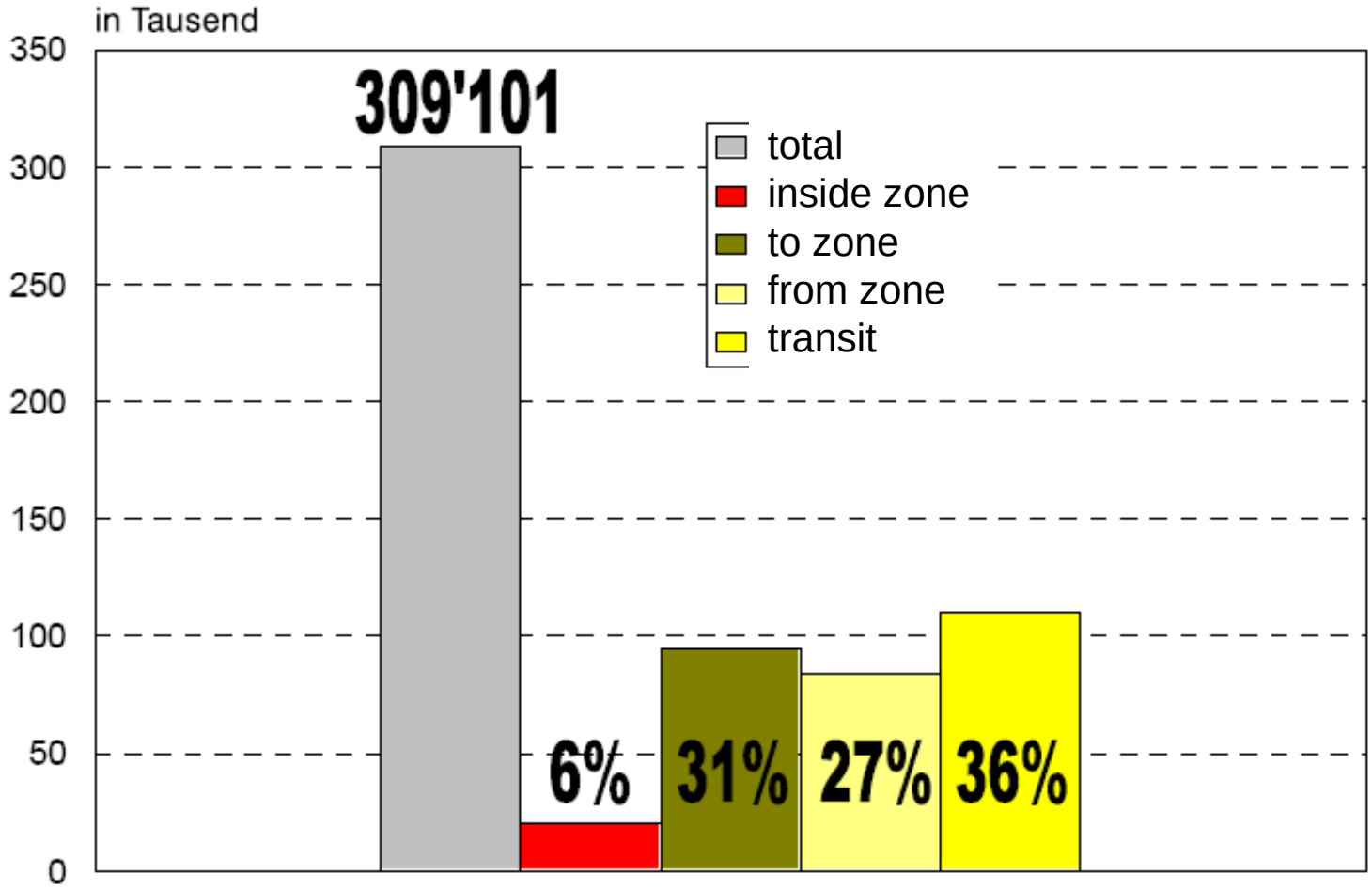
Zone 3 = areawide

Bypass trips

Vehicle Kilometers in Zone 3 (km/day)



Vehicle Kilometers in Zone 1 (km/day)



LEZ Scenarios

Scenario A - EURO 2 and older
- Diesel Passenger Cars
- PM10 (Exhaust only) and NOx Emissions

Scenario B = Scenario A + Heavy Duty Vehicles

Scenario C = Scenario B + EURO 3

Scenario X - All Passenger Cars and Heavy Duty Vehicles
- PM10 (Exhaust + Resuspension) und NOx Emissions
- Driving Ban Zone 3 (Assumption: 15% Excepted)

Scenario Y - All Passenger Cars and HDV EURO 1
- PM10 (Exhaust + Resuspension) and NOx Emissions
- Driving Ban all over Kanton Zürich

Percentage of Fleet Affected by LEZ

(Fleet October 2005: 610‘000)

	Emission Standard	Diesel	Gasoline	Total	%
	B00	1’033	22’600	23’633	
	EURO 1	5’351	213’903	219’254	
Total		6’384	236’503	**242’887**	**40**
	EURO 2	7’941	131’937	139’878	
Total		14’325	368’440	**382’765**	**63**
	EURO 3	34’242	102’236	136’478	
Total		48’567	470’676	**519’243**	**85**

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Emission Inventory of Zürich City

	NOx (t/y)	PM (t/y)
Transport	1295	155
Energy Production	695	45
Industry	325	75
Agriculture/Forestry	10	5
Airport	0	0
Total (2005)	2325	280

Specific PM10 – Emission Reductions of Scenarios A to Y (%)

Area	Reference Emission (t/a)	A	B	C	X	Y
Zone 1+2	11.3	**- 1.7%**	**-7.2%**	**- 14.5%**		**- 8.4%**
Zone 3	49.5	**- 1.6%**	**-7.8%**	**- 15.6%**	**- 85%**	**- 8.4%**

Overall Emission Reduction PM10

	Kanton Zürich (100% = 1'862 t/a)			City of Zürich (100% = 258 t/a)	
	Zone 1+2	Zone 3		Zone 1+2	Zone 3
Scenario A	- 0.01%	- 0.04%		- 0.07%	- 0.30%
Scenario B	- 0.04%	- 0.21%		- 0.32%	- 1.49%
Scenario C	- 0.09%	- 0.42%		- 0.64%	- 3.00%
Scenario X	- 2.3%			- 16.3%	
Scenario Y	- 8.4%			- 8.4%	

Legal Aspects

- **Scenarios A, B, C:**
  Legal Base for Road Sign missing (SSV)
  Clean Vehicle Labels missing (VTS)
  Competence Federation
- **Scenario X:**
  Art. 3 Abs. 6 SVG („poliz. Generalklausel“) applicable
  Signaling of Temporary Driving Ban possible
- **Scenario Y:**
  Area-wide Driving Ban not possible
  Competence Federation

Conclusion, Recommendation

- **Scenarios A, B: Intervention justifiable, implementation and control complex, limited impact**
- **Scenario C: Higher impact on air quality, but problem partially displaced outside LEZ**
- **Scenarios X, Y: Highly effective on air quality, but serious degree of intervention (X) and control checks highly difficult (Y)**
- **No scenario adequate for temporary emission reduction**

Follow up activities

- Geneva, Lausanne and Basel are studying LEZ
- Effects of permanently installed LEZ may be different and are to be studied
- Legal framework for permanent LEZ will be studied. Focus on tagging/labelling like Germany
- No retrofitting options considered (too complicated to control)
- HDV to be included, possibly as 1st step