Workshop *Inquinamento Acustico*

Noise prediction method uncertainties

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▶ Overview

- Preliminary remarks

- Uncertainty 1: Source data

- Uncertainty 2: Man-made mistakes

- Uncertainty 3: Calculation

- Uncertainty 4: Result interpretation

- Conclusions

- **Preliminary remarks**

- Uncertainty 1: Source data

- Uncertainty 2: Man-made mistakes

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- Conclusions

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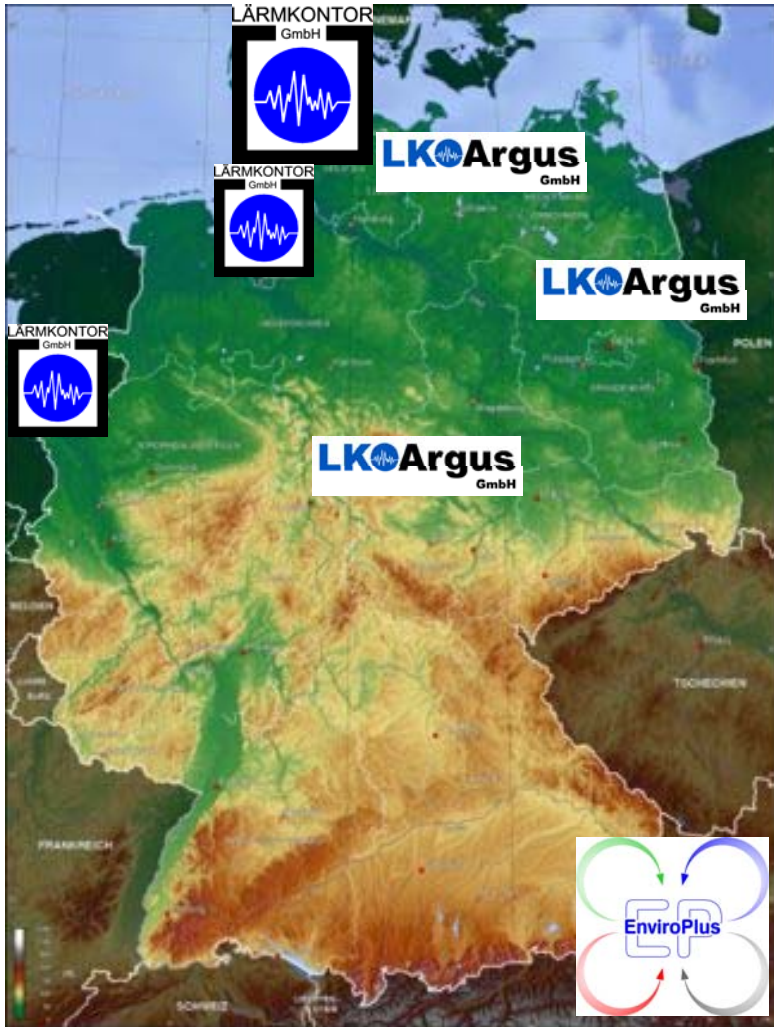
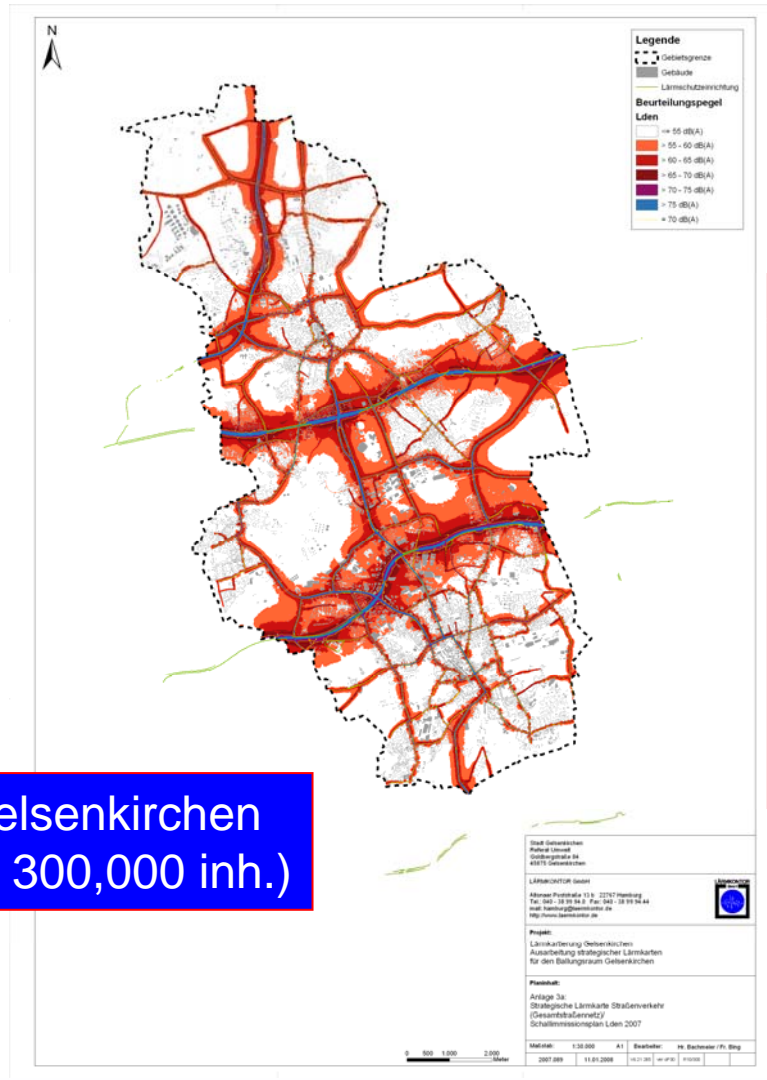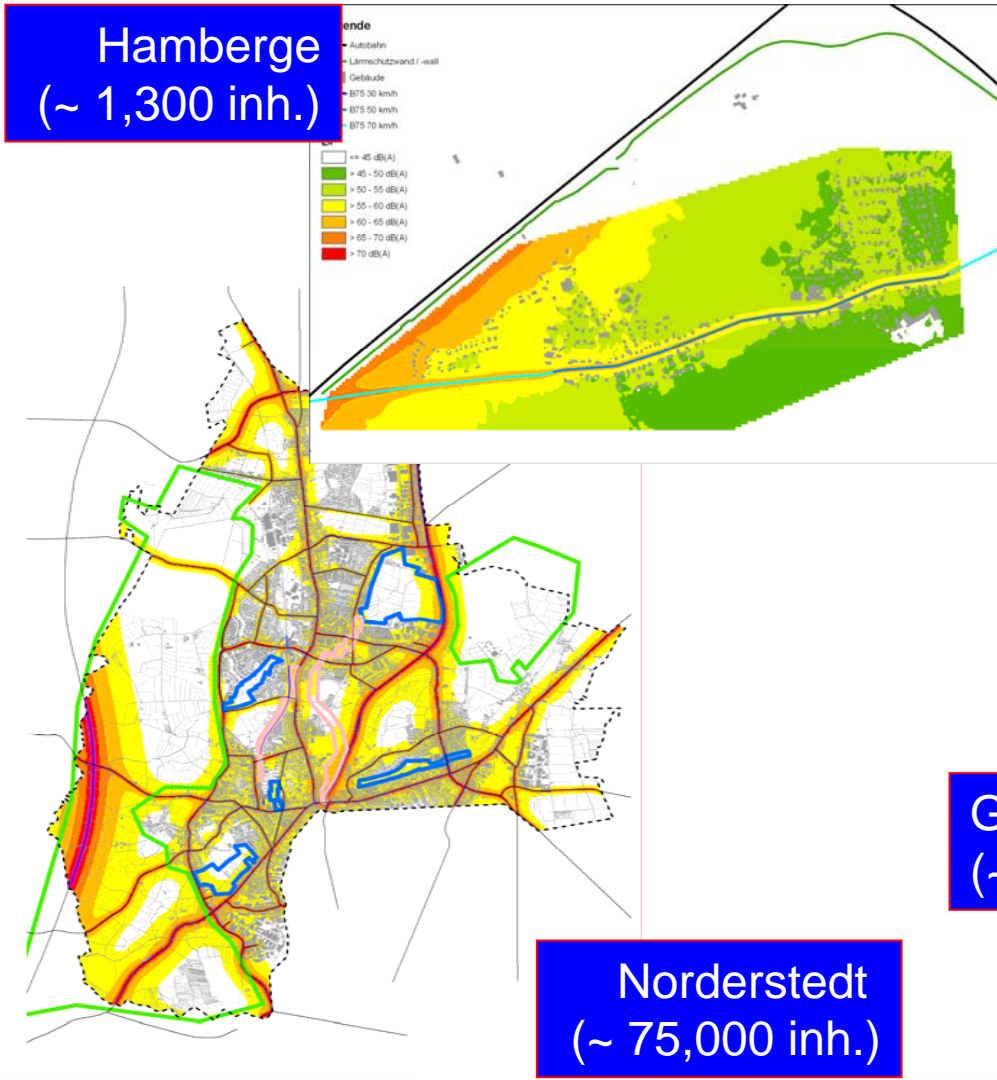

Main office:
Hamburg

- **Noise**
- Odours
- Air pollution
- Vibrations
- Dust propagation
- Light immissions

Branch offices:
North Rhine-Westphalia + Lower Saxony

Associated companies:
LK.Argus GmbH (Hamburg / Berlin / Kassel)
EnviroPlus Kft. (Budapest, Hungary)

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▶ Mapping projects

Hamberge
(~ 1,300 inh.)

Gelsenkirchen
(~ 300,000 inh.)

Norderstedt
(~ 75,000 inh.)

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► **Mapping projects**

Bremen (~ 600,000 inh.)

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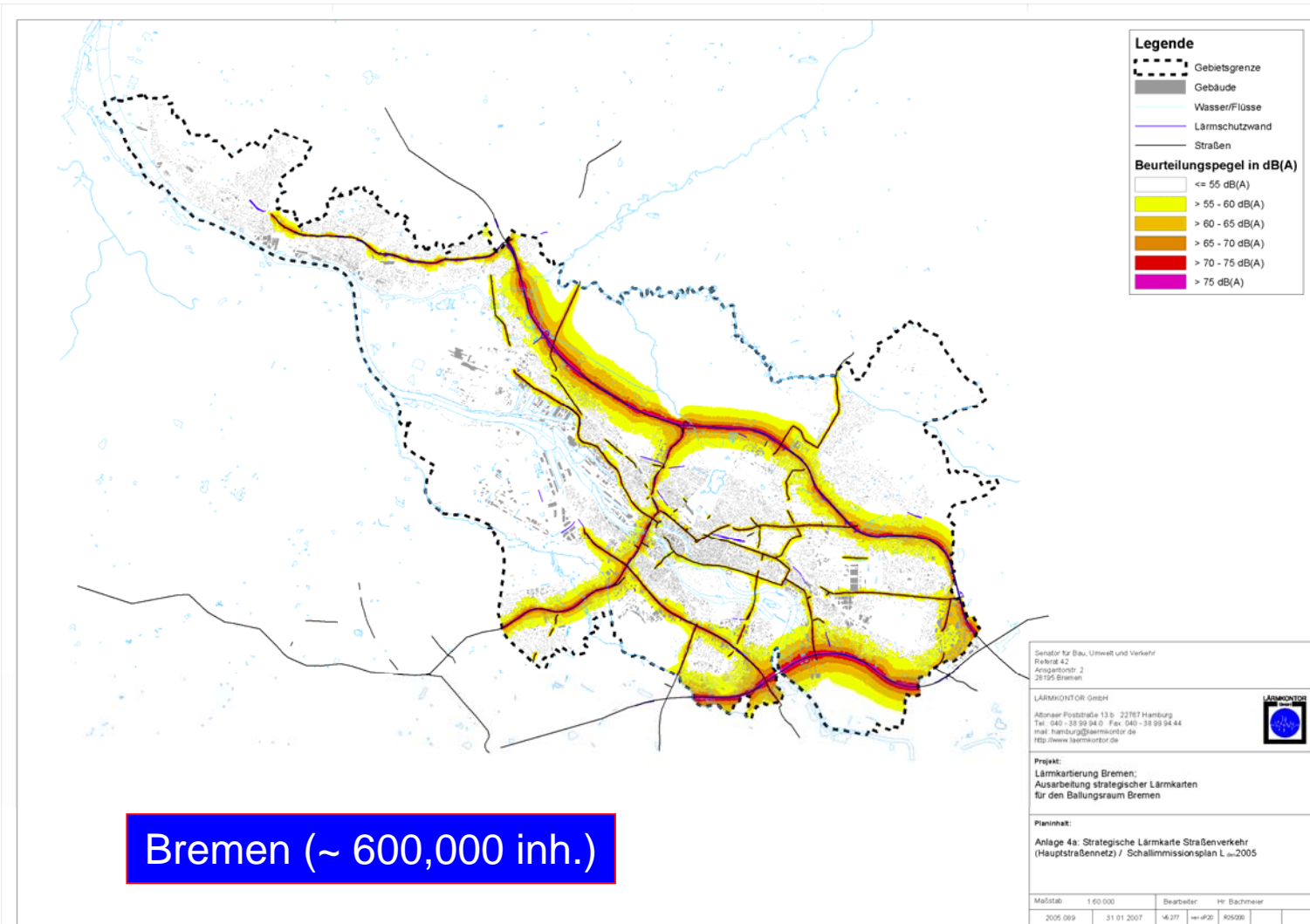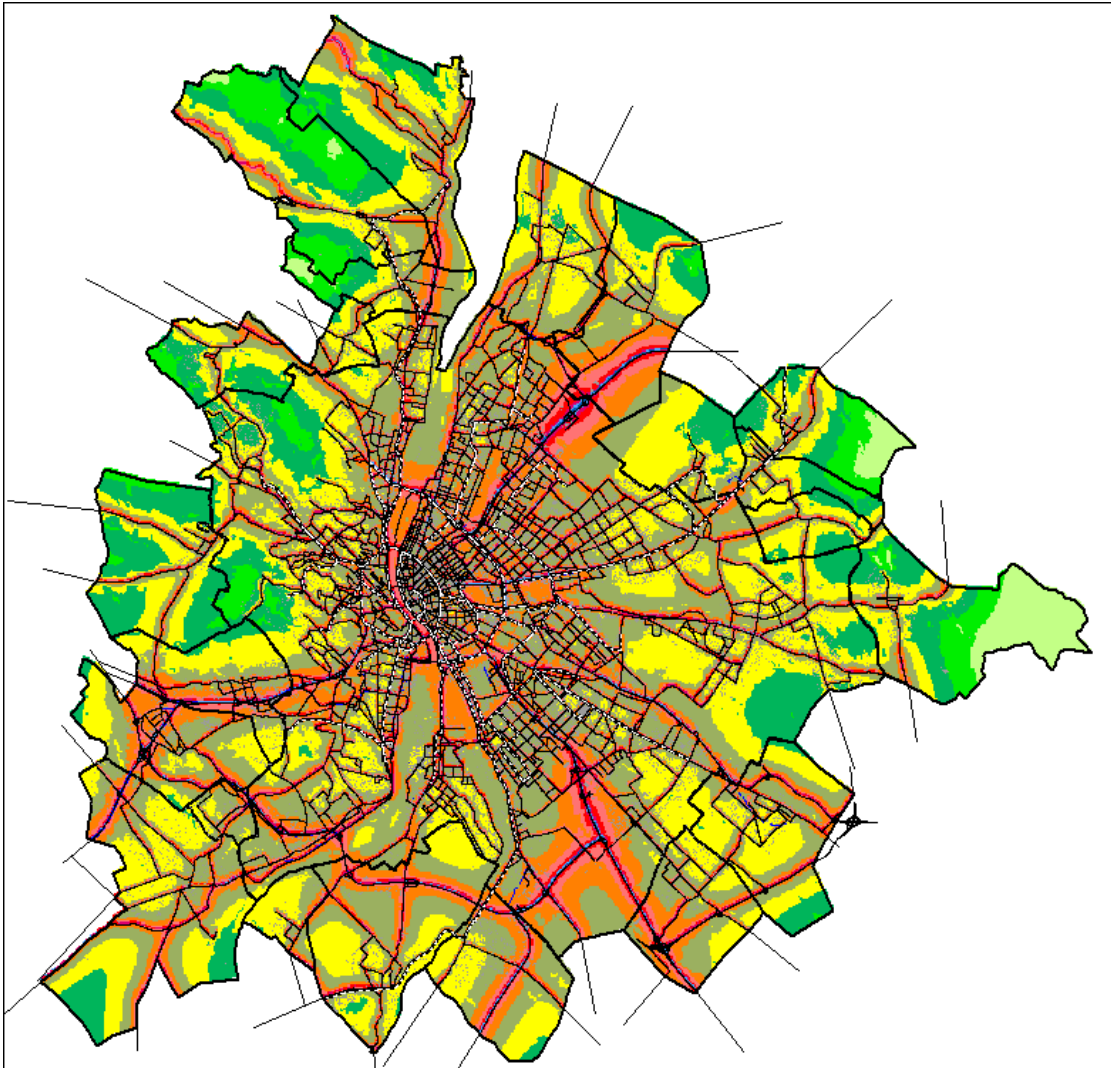
▶ Mapping projects

Budapest (~ 1,800,000 inh.)

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▶ **Mapping projects**

Berlin
(~ 3,500,000 inh.)

▶ **Mapping projects**

Legend
- LDEN 55-dB(A)
- Port Boundary
- Buildings
- Industrial Use

Port of Hamburg
(~ 80 km²)

Noise Imission
All industrial Companies, Roads and Railways
DEN

- <= 45 dB(A)
- > 45 - 50 dB(A)
- > 50 - 55 dB(A)
- > 55 - 60 dB(A)
- > 60 - 65 dB(A)
- > 65 - 70 dB(A)
- > 70 - 75 dB(A)
- >75 dB(A)

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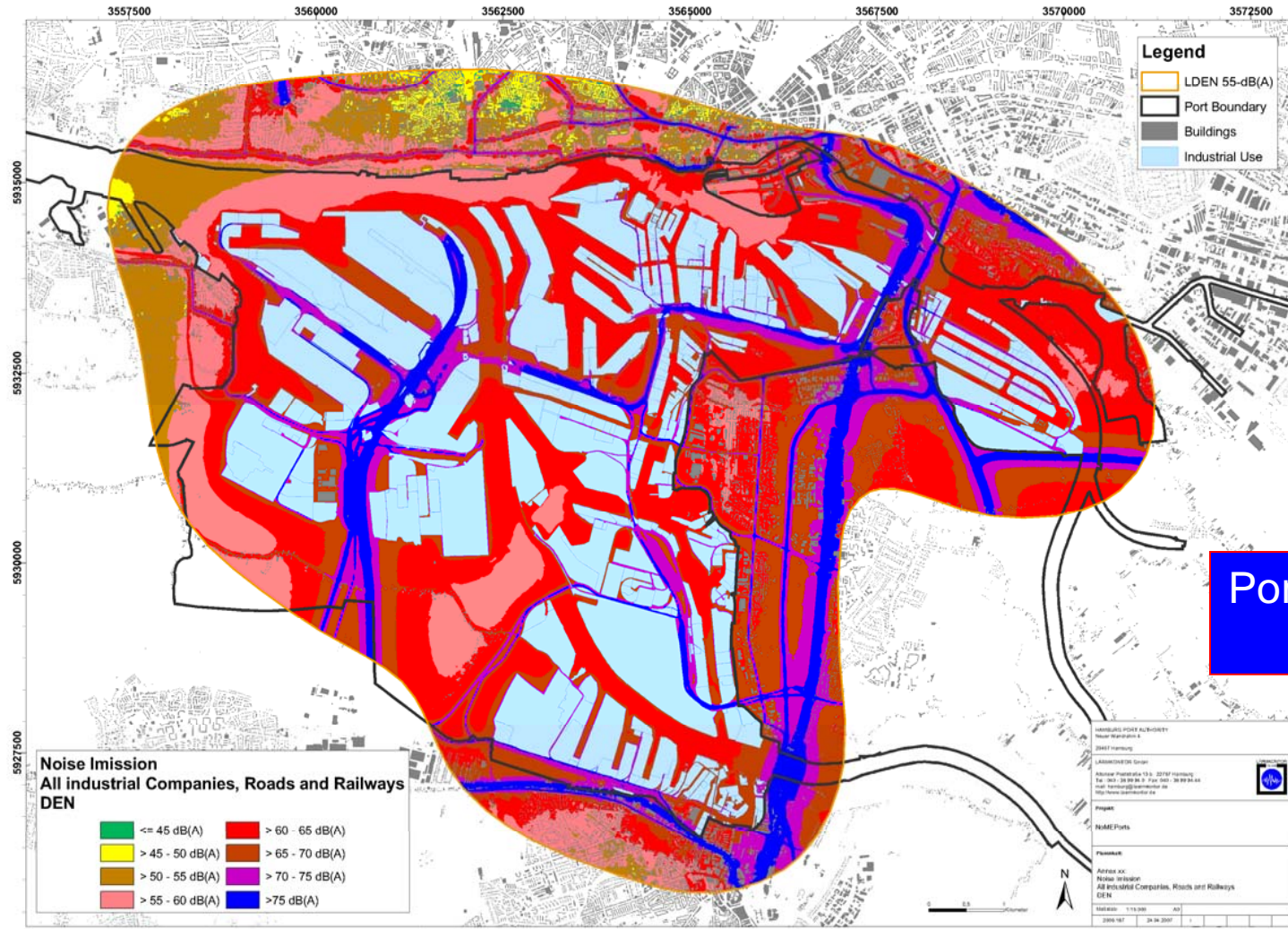
► **Uncertainty**

If we are talking about "uncertainty" in context of strategic noise mapping acc. to Directive 2002/49/EC, we are generally talking about noise prediction software caused uncertainties.

But, our noise mapping experience gained in the passed 20 years says: "Noise prediction uncertainties have at least four important aspects!"
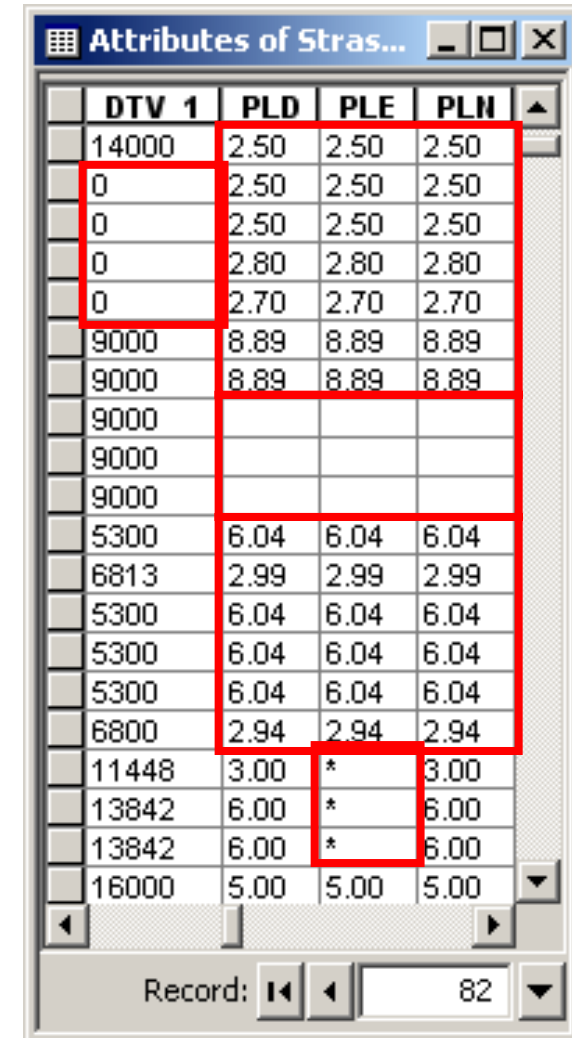
1st aspect: Source data

2nd aspect: Man-made mistakes

3rd aspect: Calculation

4th aspect: Result interpretation

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- Preliminary remarks

- **Uncertainty 1: Source data**

- Uncertainty 2: Man-made mistakes

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▶ **Source data –** Availability

For instance:

- No data at all

- Mean values deduced from too short periods

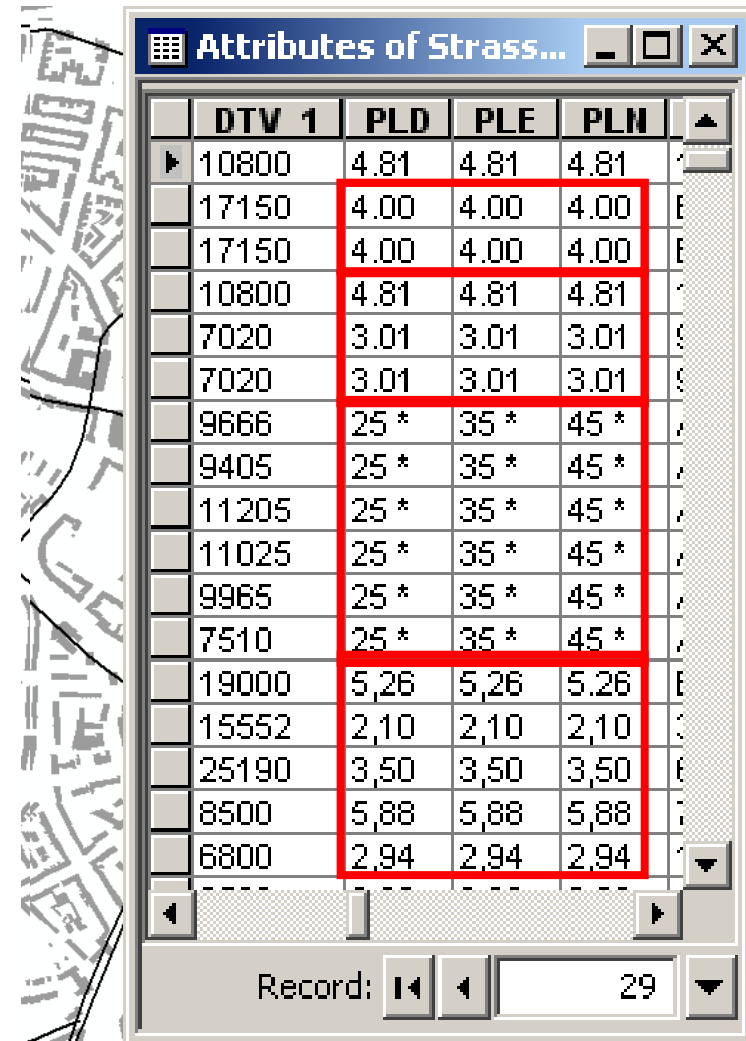- Missing attributes

- No differentiation of day / evening / night

	DTV 1	PLD	PLE	PLN	
	14000	2.50	2.50	2.50	
	0	2.50	2.50	2.50	
	0	2.50	2.50	2.50	
	0	2.80	2.80	2.80	
	0	2.70	2.70	2.70	
	9000	8.89	8.89	8.89	
	9000	8.89	8.89	8.89	
	9000				
	9000				
	9000				
	5300	6.04	6.04	6.04	
	6813	2.99	2.99	2.99	
	5300	6.04	6.04	6.04	
	5300	6.04	6.04	6.04	
	5300	6.04	6.04	6.04	
	6800	2.94	2.94	2.94	
	11448	3.00	*	3.00	
	13842	6.00	*	6.00	
	13842	6.00	*	6.00	
	16000	5.00	5.00	5.00	

Record: 82

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▶ **Source data –** Accuracy

For instance:

- Different geo-referencing

- Incorrect / (partly) missing
  attributes -> default values

- Different value coding
  (e.g. <u>comma vs. point</u>)

- Different accuracy of attributes

- Missing meta data
  (e.g. accuracy information)

DTV 1	PLD	PLE	PLN
10800	4.81	4.81	4.81
17150	4.00	4.00	4.00
17150	4.00	4.00	4.00
10800	4.81	4.81	4.81
7020	3.01	3.01	3.01
7020	3.01	3.01	3.01
9666	25 *	35 *	45 *
9405	25 *	35 *	45 *
11205	25 *	35 *	45 *
11025	25 *	35 *	45 *
9965	25 *	35 *	45 *
7510	25 *	35 *	45 *
19000	5,26	5,26	5.26
15552	2,10	2,10	2,10
25190	3,50	3,50	3,50
8500	5,88	5,88	5,88
6800	2,94	2,94	2,94

Record: 29

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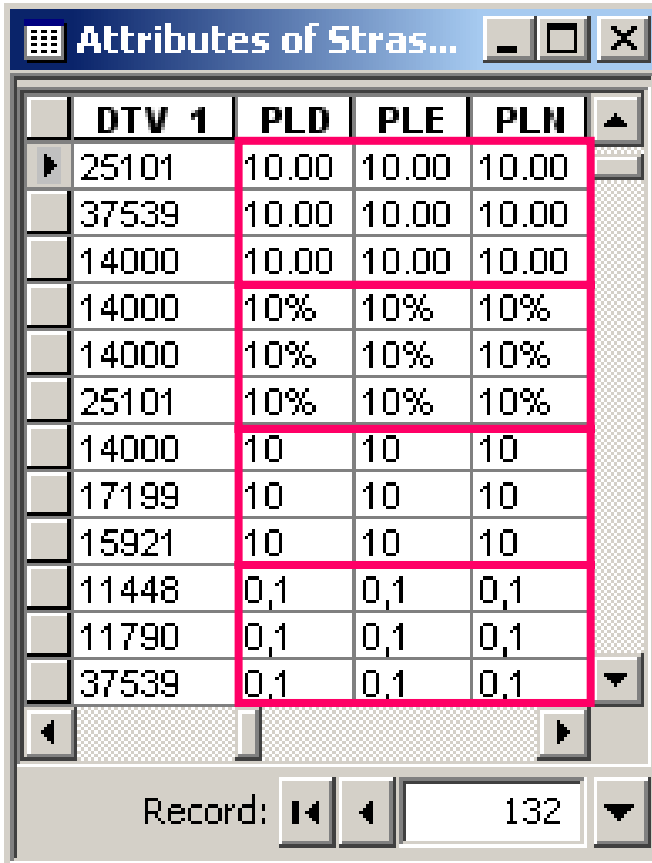
- Preliminary remarks

- Uncertainty 1: Source data

- **Uncertainty 2: Man-made mistakes**

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▶ **Man-made mistakes –** Data processing

For instance:

- Unnoticed data change or corruption

- Data conversion errors

- Geo referencing is very complex (often wrong or unknown for data sets)

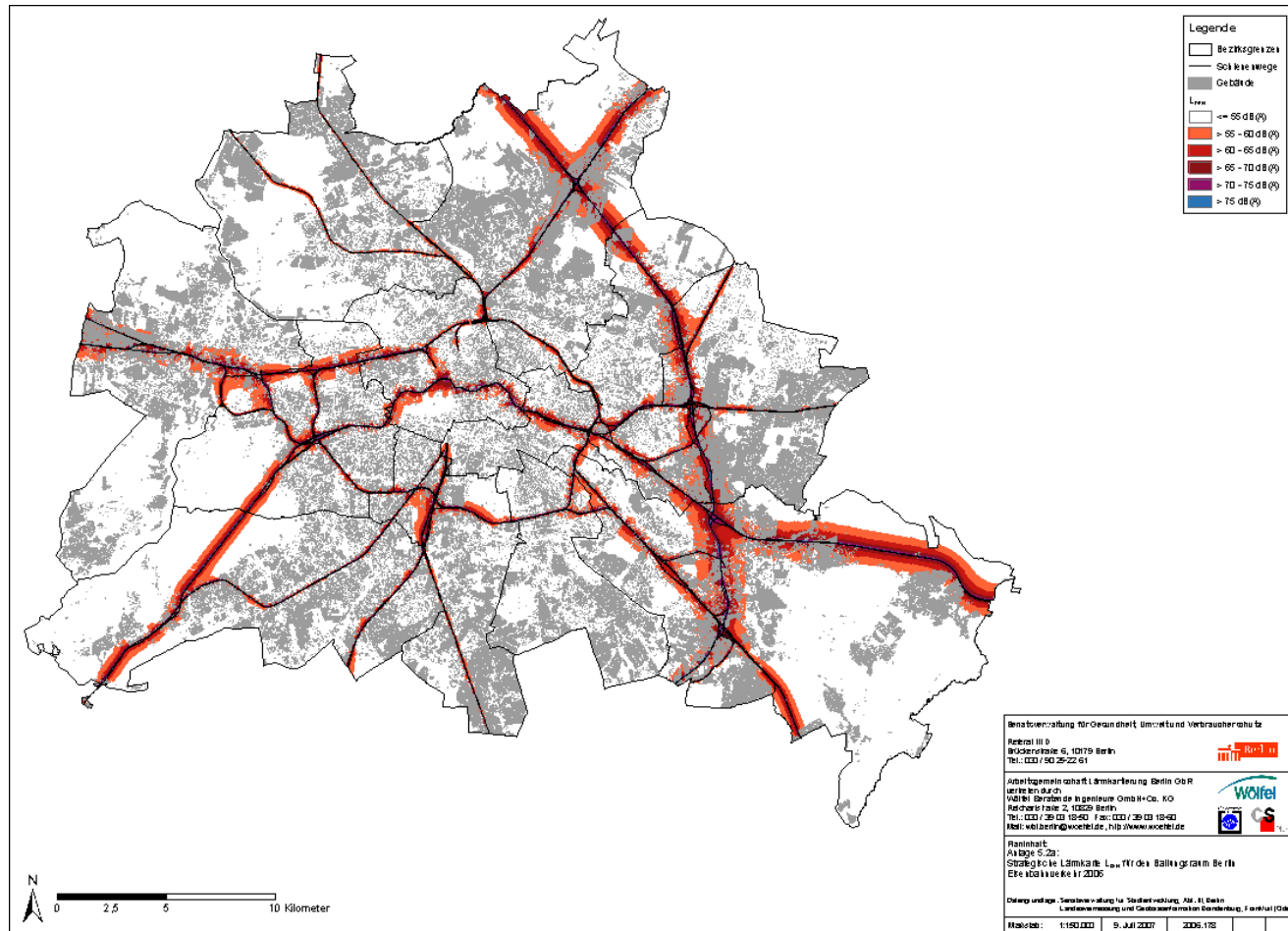- Field values type may vary (unnoticed already) in one dataset

▦ **Attributes of Stras...** _ ☐ ✕

	DTV 1	PLD	PLE	PLN	▲
▶	25101	10.00	10.00	10.00	
	37539	10.00	10.00	10.00	
	14000	10.00	10.00	10.00	
	14000	10%	10%	10%	
	14000	10%	10%	10%	
	25101	10%	10%	10%	
	14000	10	10	10	
	17199	10	10	10	
	15921	10	10	10	
	11448	0,1	0,1	0,1	
	11790	0,1	0,1	0,1	
	37539	0,1	0,1	0,1	▼

Record: ◄◄ ◄ 132 ▼

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► **Man-made mistakes –** Data check

–►**Complex models are … –►… complicated to handle and to check**

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Man-made mistakes – Calculation model

Data selection by attribute (e.g. ADT)
may lead to gaps

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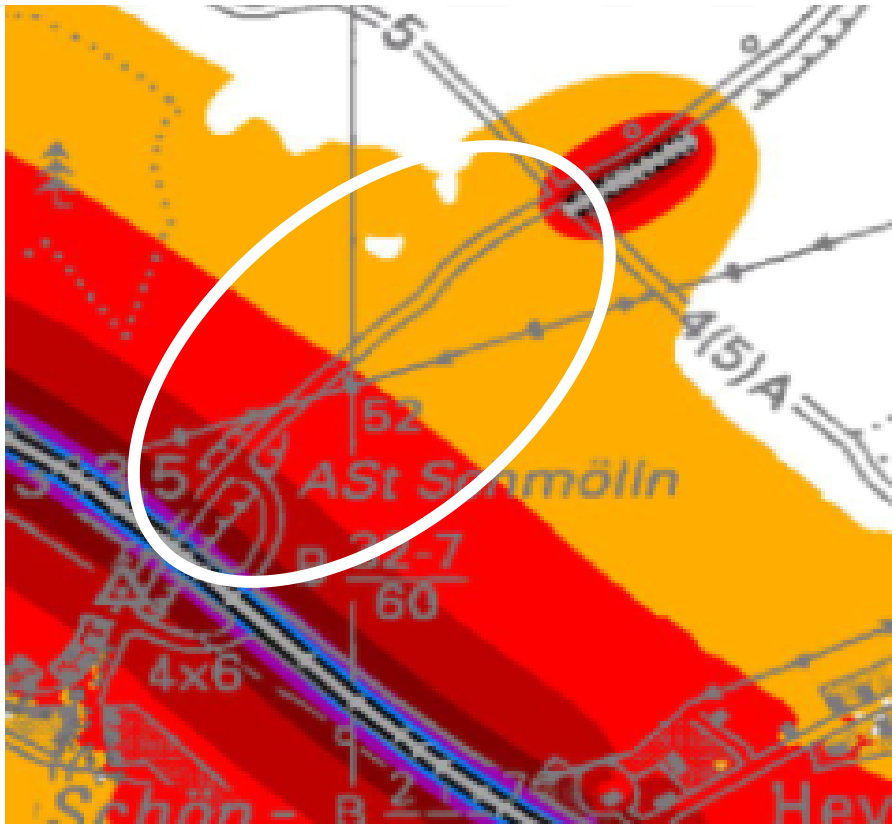
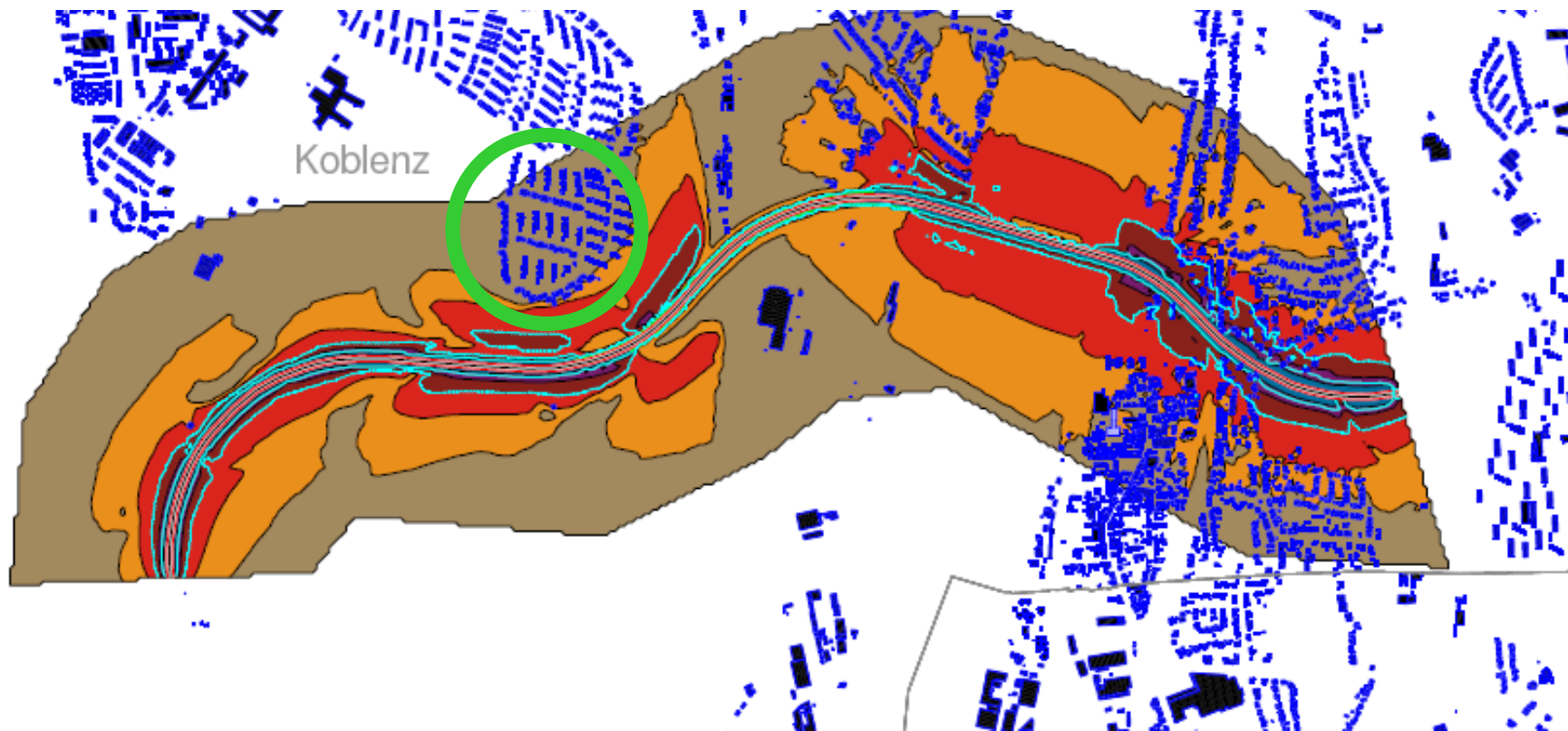► **Man-made mistakes –** Calculation model

Buildings should have a height!
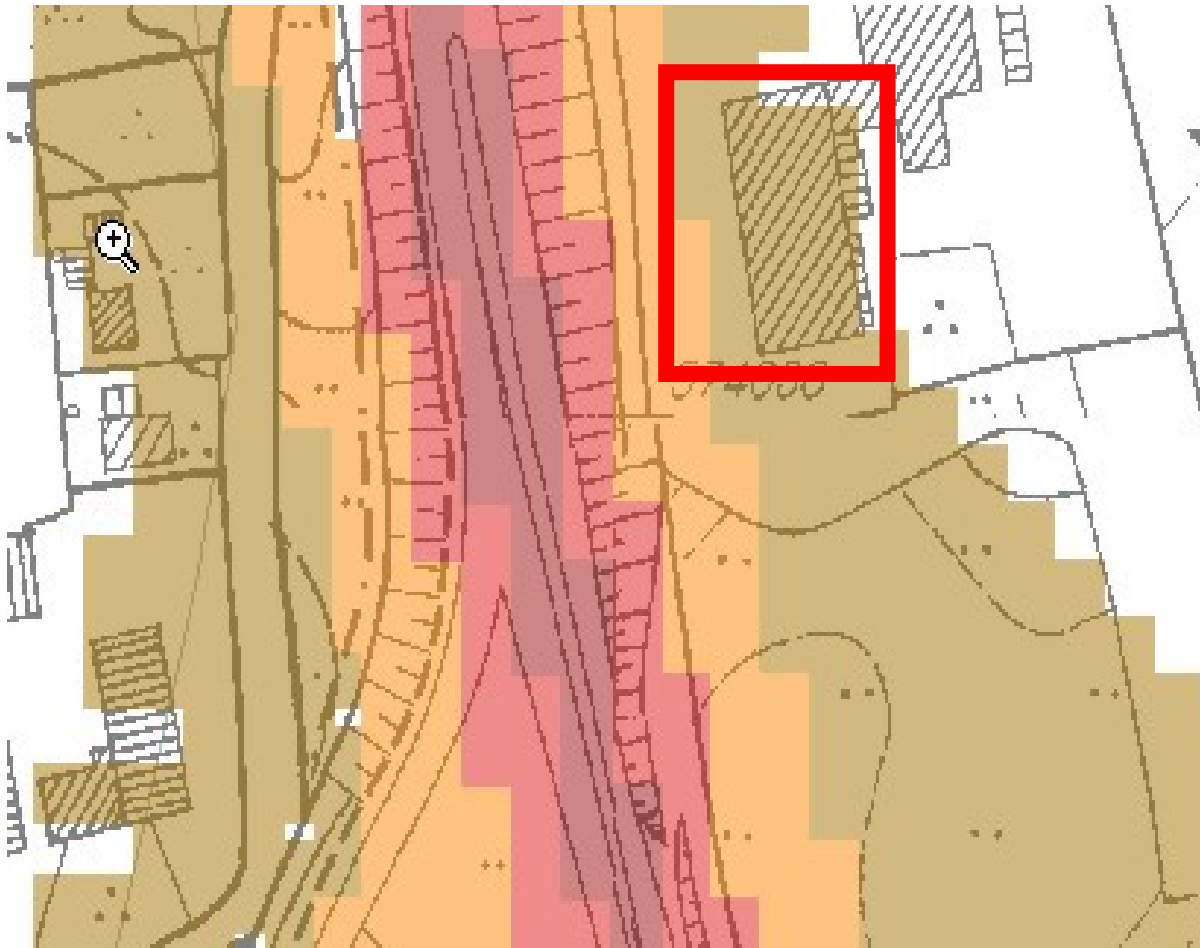
Legende

Straße Nacht

über 50 dB(A) bis 55 dB(A)

über 55 dB(A) bis 60 dB(A)

über 60 dB(A) bis 65 dB(A)

über 65 dB(A) bis 70 dB(A)

über 70 dB (A)

Gemeinden

DGK5

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► **Man-made mistakes –** Calculation model

Buildings should have a screening effect!
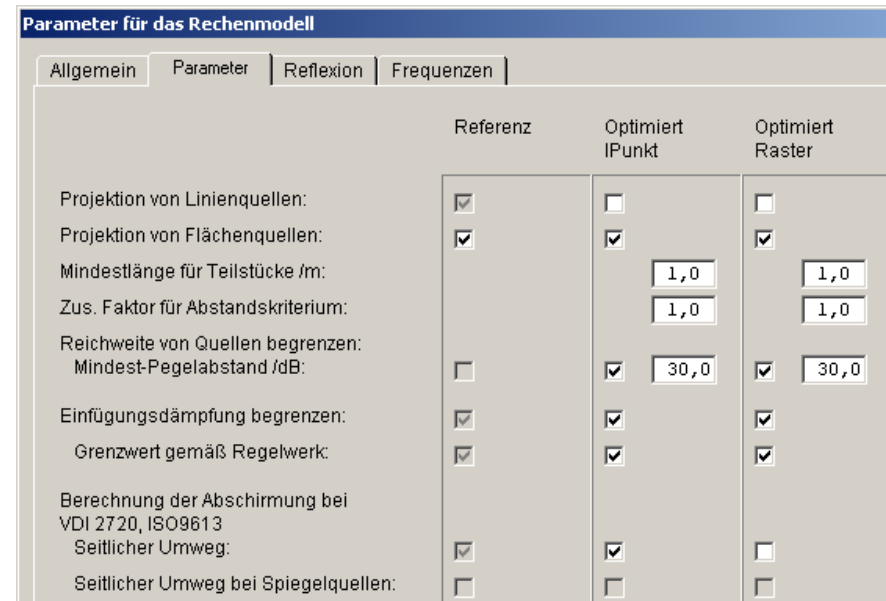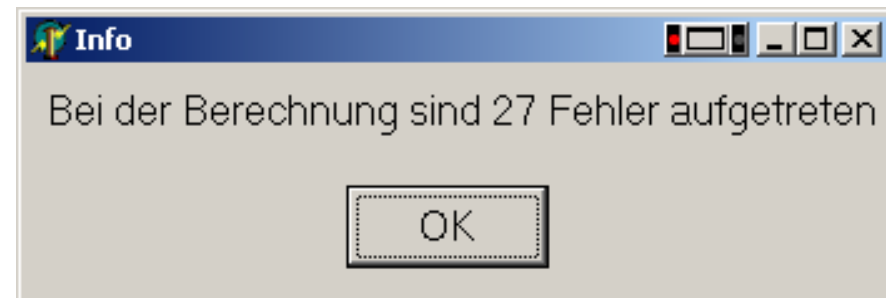

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Calculation – 3 major software and computation errors

- **Interpretation of calculation method**

NMPB, VBUS ... ???

- **Software errors**

Info

Bei der Berechnung sind 27 Fehler aufgetreten

OK

- **Optimisation („speed-up") parameters**

Parameter für das Rechenmodell

Allgemein	Parameter	Reflexion	Frequenzen		

	Referenz	Optimiert IPunkt		Optimiert Raster	
Projektion von Linienquellen:	☑	☐		☐	
Projektion von Flächenquellen:	☑	☑		☑	
Mindestlänge für Teilstücke /m:			1,0		1,0
Zus. Faktor für Abstandskriterium:			1,0		1,0
Reichweite von Quellen begrenzen: Mindest-Pegelabstand /dB:	☐	☑	30,0	☑	30,0
Einfügungsdämpfung begrenzen:	☑	☑		☑	
Grenzwert gemäß Regelwerk:	☑	☑		☑	
Berechnung der Abschirmung bei VDI 2720, ISO9613 Seitlicher Umweg:	☑	☑		☐	
Seitlicher Umweg bei Spiegelquellen:	☐	☐		☐	

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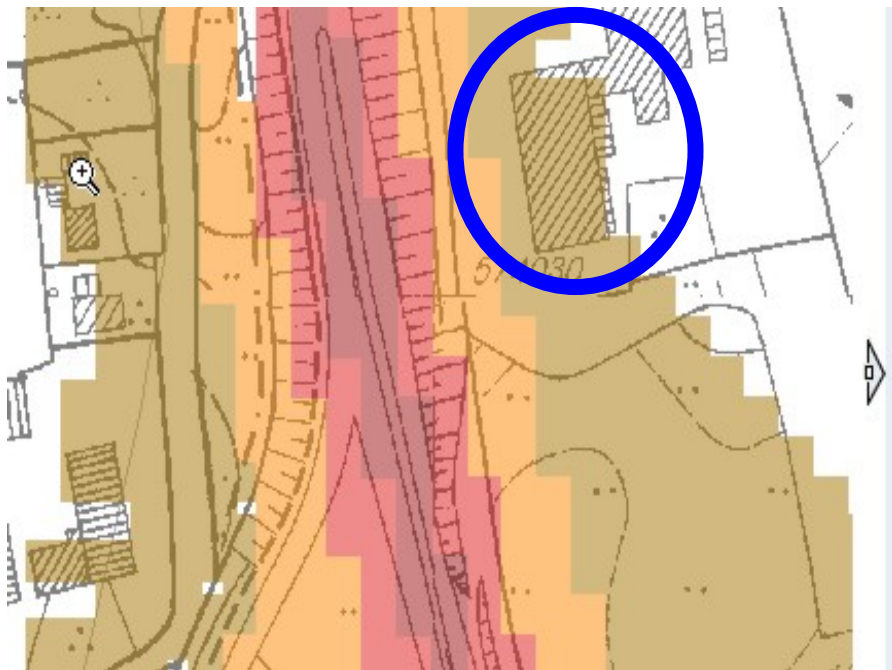
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▶ **Calculation –** Calculation method

- Designed for calculations without computer

- Tendency to overestimate

- Implicating simplifications (e.g. selection of reflecting obstacles)

- Validity (e.g. distance, ground, water, wood)

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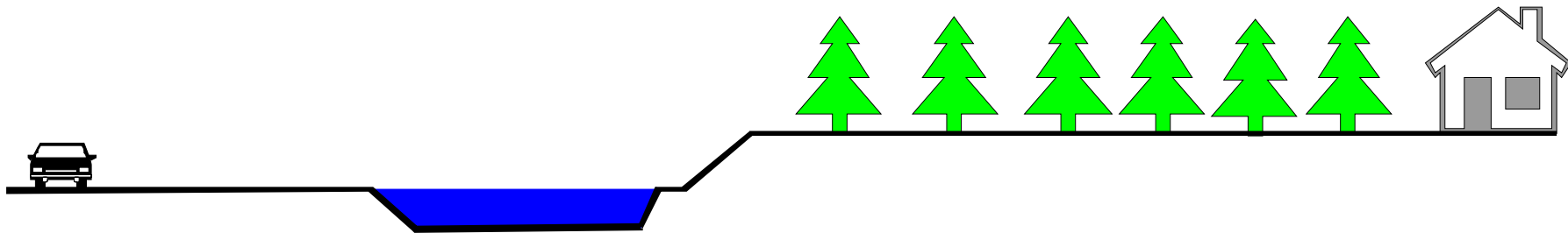
► **Calculation –** Simplifications

- Different simplification methods

obstacles **off**
reflection **off**

Legende

Straße Nacht

über 50 dB(A) bis 55 dB(A)
über 55 dB(A) bis 60 dB(A)
über 60 dB(A) bis 65 dB(A)
über 65 dB(A) bis 70 dB(A)
über 70 dB (A)
∧ Gemeinden
DGK5

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Calculation – Simplifications

- Unknown simplifications with unknown effects

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► **Result interpretation –** Which is the noisiest city in Germany?

Rank	City	$L_{den} > 55$ dB(A)	$L_{night} > 50$ dB(A)
1	Norderstedt	**46 %**	**38 %**
2	Berlin	32 %	24 %
3	Hamburg	28 %	21 %
...			

Is Norderstedt the noisiest city in Germany

?

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Result interpretation – Road network

Roads > 16,000 vehicles/day

Roads > 8,000 vehicles/day

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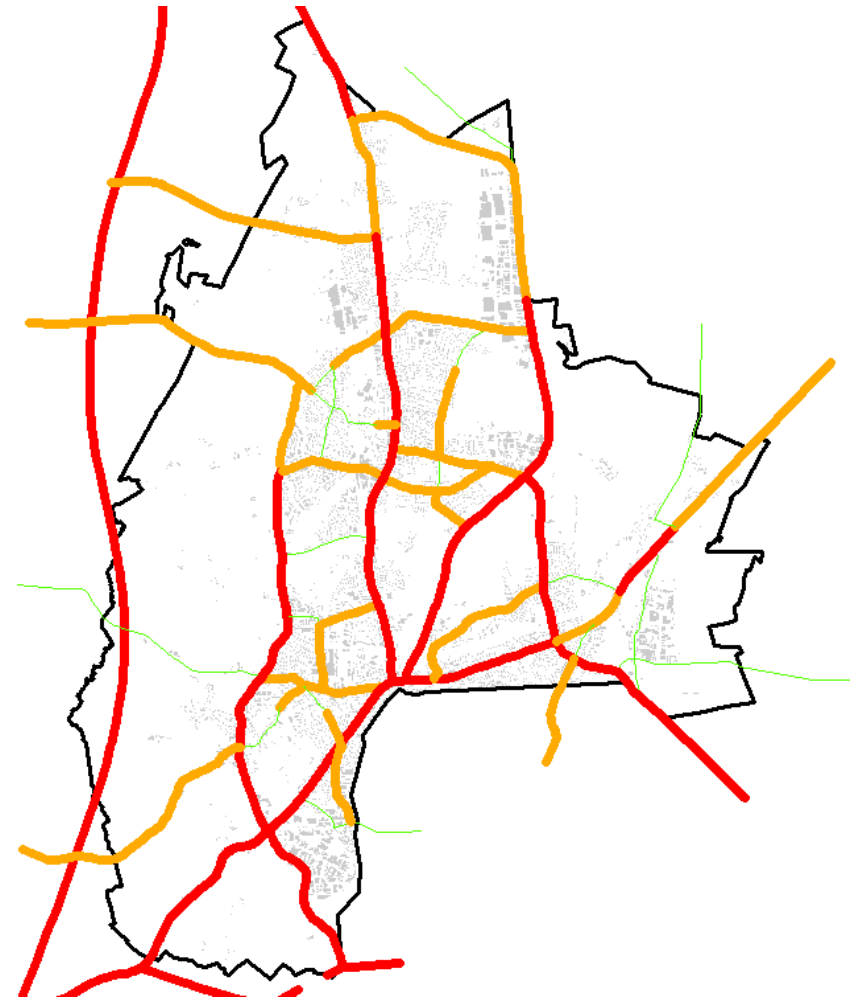
Result interpretation – Noise sources taken into account

Road > 8,000 vehicles/day
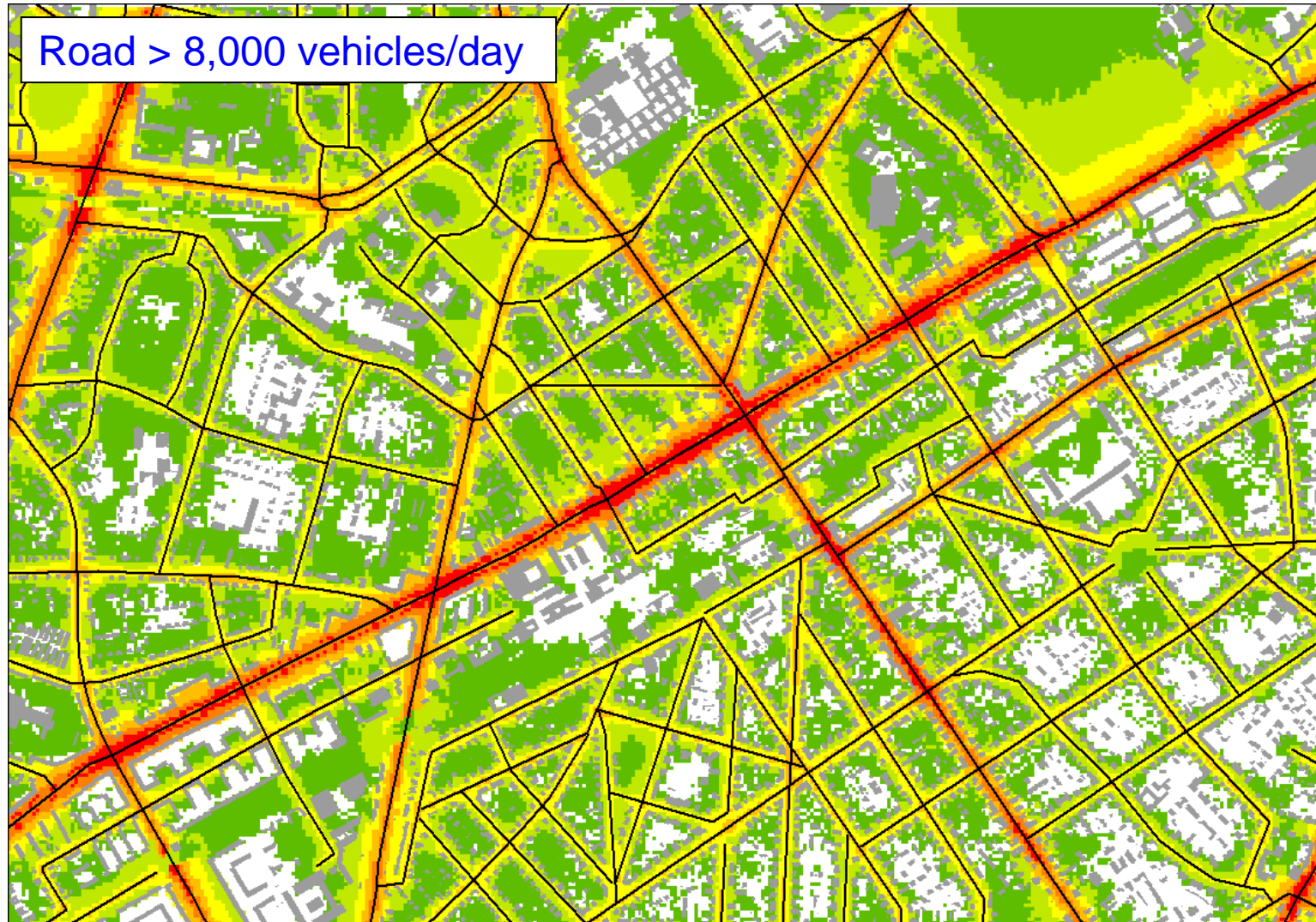
► **Result interpretation –** Last but not least: the **COLOR**

WG AEN

DIN 18005 Teil 2

> 70 dB (A)

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▶ Conclusions

- Noise prediction **method uncertainties** can **influence results** and **acceptance of results significantly**

- Noise prediction methods are **only one aspect under several**

- More important are aspects like

  - **input data availability and correctness**,

  - **qualification** (and mood) **of the personal,**

  - **data inspection** and **interpretation** as well as

  - Intention of **contracting body**

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Grazie molto per ascoltare!