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## Action planning procedures and realized action plans of municipalities and cities - results from the implementation of END

Markus Petz

ACCON GmbH, Ingenieurbüro für Schall- und Schwingungstechnik, Gewerbering 5, 86926 Greifenberg, Germany  
markus.petz@accon.de

## 1 Summary

In 2007 Strategic Noise Maps for many of the federal states of Germany were calculated and published. With examples from cities and communities it will be demonstrated how, based on a standard procedure for the preparation of a noise action plan, effective measures were defined by ACCON together with the responsible authorities from the municipality.

The chosen procedure also took into consideration the deadline for the finalisation and the commencement of an action plan at July 2008.

Based on the Strategic Noise Maps, additional hot spot analyses and a catalogue of potential measures for noise reduction were investigated and evaluated. Together with representatives of the traffic, town and environmental planning departments of the municipalities efficient measures were discussed and selected. Other local planning interests, financial outcomes and the degree of public acceptance were also considered. A typical draft action plan of a smaller city is identified and this has to be published and the public views taken into account..

All of the results described herein are subject to the approval of the City Councils in July 2008, which then allows the action plans to come into force.

## 2 Basics

With the implementation of the European Directive 2002/49/EG in national (German) law (Bundes-Immissionsschutzgesetz) in 2006, many federal states of Germany, which were responsible for putting Strategic Noise Mapping and Action Planning into practice, decided to centrally carry out country wide noise mapping of the main roads with a traffic flow of more than 6 million vehicles per year.

The results of the Strategic Noise Mapping were mostly (only) noise maps (see figure 1) and community specific statistical data, showing the estimated number of people within 5 dB classes (see figure 2). Also available, –but not very helpful for the required action planning, was information of the number of dwellings, hospitals and schools and areas affected by noise levels summarized in 10 dB classes (see figure 3).



Fig. 1:  $L_{den}$  noise map detail City of Heilbronn

dB(A)		number of people affected	
from	to	$L_{den}$	$L_{night}$
50	55	-	3350
55	60	4840	2310
60	65	2690	1460
65	70	2030	570
70	75	1240	0
75		160	0
<b>sum</b>		<b>10960</b>	<b>7690</b>

Fig. 2: Affected people by road noise City of Heilbronn

dB(A) $L_{den}$		road noise			
from	to	area	dwellings	schools	hospitals
55	65	13,2	3720	10	0
65	75	5,2	1621	0	0
75		1,5	81	0	0
<b>sum</b>		<b>20,0</b>	<b>5422</b>	<b>10</b>	<b>0</b>

Fig. 3: Number of dwellings, hospitals and schools and areas affected by road noise City of Heilbronn

In some federal states of Germany, as well in Baden-Württemberg, the communities have taken responsibility for drawing up a noise action plan. The deadline for the noise action plan in line with the European Directive is July 2008. Under pressure of the time limit of July 2008 many responsible authorities decided to work out an action plan based on a suggested standard procedure [1] by ACCON. The following procedure was suitable ideally to smaller cities and communities, where noise conflicts were caused mainly by main roads.

## 3 Procedure for preparation of an action plan

The procedure used for preparing an action plan takes into account the obligatory information and participation of the public.



Fig. 4: Noise action planning procedure for smaller cities

The city departments<sup>1</sup> in charge together with ACCON defined a work program that supports the communities with specialized knowledge on environmental noise and action planning.

The work program determined for the next 9 to 12 month can be summarized as follows:

- analysis and assessment of the noise situation (Identification and evaluation of hot spots and conflict areas; selection of useful measures for noise reduction)
- workshop within the council administration (discussion of results from noise analysis and assessments; discussion of possible measures, selection of measures for further detailed analysis of costs and effectiveness)
- drawing up a preliminary draft of an action plan and presentation at the district council
- publication of the draft of the action plan and public information and consultation within a public event
- finalization of the draft by implementing accepted changes and supplements
- approval of the final version of the action plan by the district council.

## 4 Noise analysis and Hot Spot detection

As described above, additional analysis and assessments of the noise situation are necessary to find out the most affected areas and those road sections which are responsible for the existing noise annoyance along the road network.

The following methods and graphical presentations of additional analysis, which are all based on available model data from the Strategic Noise Maps allows a focus on the actual identified hot spots and allows the quantification of the noise reduction effects of possible measures. The method also allows the study of the cost-effectiveness of (combined) measures.

### 4.1 Residential Buildings with facade levels exceeding limiting values

A simple graphical presentation of the residential buildings, which have facade levels exceeding defined limiting values (figure 5) gives an overview of conflict areas within the investigated community or area.

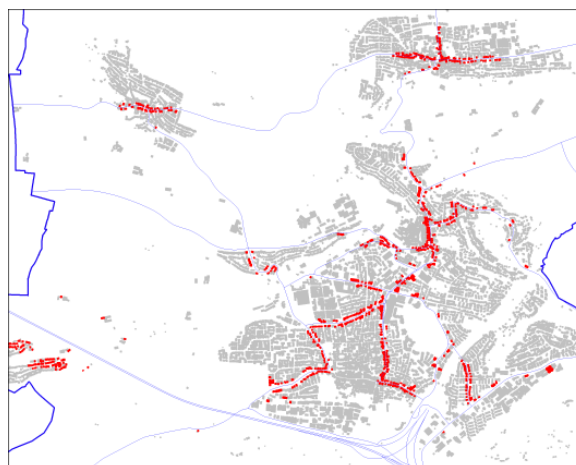


Fig. 5: Residential buildings along main roads with facade levels  $> 70 \text{ dB(A)} L_{\text{den}}$  or  $60 \text{ dB(A)} L_{\text{night}}$  (City of Leonberg)

### 4.2 Number of people exceeding limiting values

It is possible to utilise the population statistics required by the Commission and this data can be applied for detailed diagnostics and comparisons of various urban areas. The number of people living in highly exposed houses (exceeding the defined limiting values) allows a first ranking of the most exposed road sections or a first ranking of the most exposed urban area. Therefore the total number of exposed people were identified up within a defined corridor along the road sections or a defined area (gliding window along a defined grid). It has proved practicable to use corridors of 20-50 m along urban road sections and areas of 100 m x 100 m to rank the different noise situations based on the recommended limiting values of  $70 \text{ dB(A)}$  for  $L_{\text{den}}$  and  $60 \text{ dB(A)} L_{\text{night}}$ .

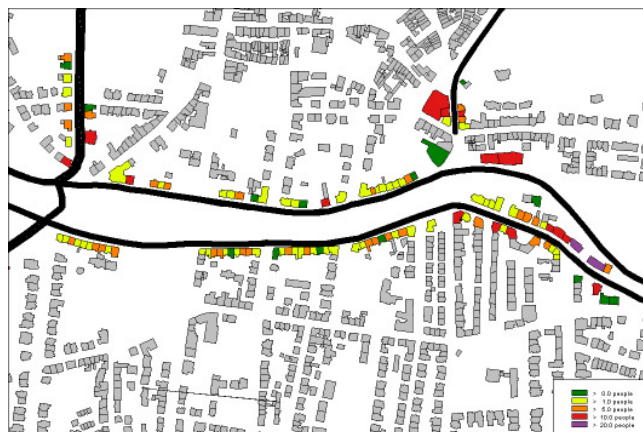


Fig. 6: Number of exposed people per building (City of Freiburg)

<sup>1</sup> Involved cities: Heilbronn, Leonberg, Ludwigsburg, Ditzingen, Gerlingen, Ravensburg, Weingarten, Freiburg, Ulm, Pforzheim

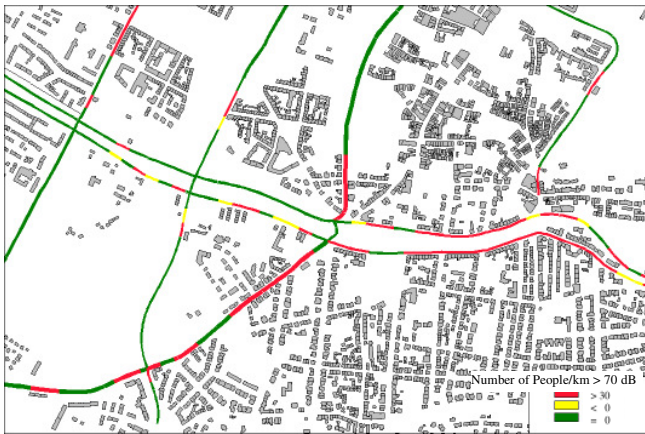


Fig. 7: Number of exposed people per road section (City of Freiburg)

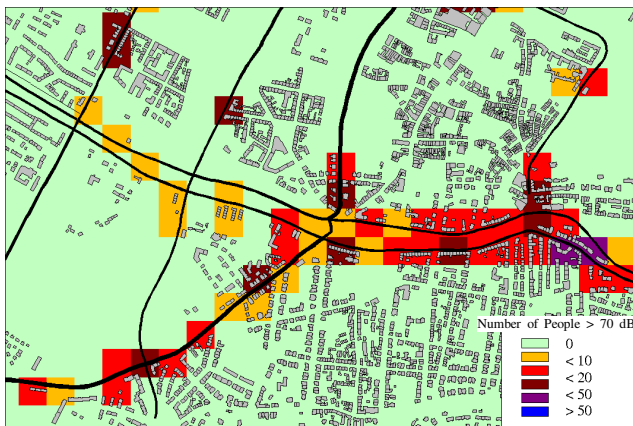


Fig. 8: Number of exposed people per area (City of Freiburg)

### 4.3 Hot Spot Detection and evaluation of measures using a Noise Rating System

It is not possible to carry out a detailed analysis and ranking of identified hot spots based on the additional analyses shown above. Accordingly, the number of people affected by noise levels below the limiting values will not be considered, but nevertheless could be appropriate. It becomes obvious that only a single number value, which takes into account both the number of people and the noise level is suitable to rank existing hot spots and to quantify the effects of intervention measures.

The theory of the “Noise Score Rating” applied here is described in detail in [2] and [3]. In practice, the Noise Score based on  $L_{den}$  and the number of people affected were calculated with the following function:

$$Y = \begin{cases} \sum_i n_i \cdot 10^{0.15 \cdot (L_{den,i} - 50)} & \text{if } L_{den,i} \leq 65 \text{ dB(A)} \\ \sum_i n_i \cdot 10^{0.30 \cdot (L_{den,i} - 57.5)} & \text{if } L_{den,i} > 65 \text{ dB(A)} \end{cases}$$

with

- Y Noise Score
- $n_i$  Number of persons with noise indicator  $L_{den,i}$  at most exposed facade
- $L_{den,i}$  Noise indicator at the most exposed facade of dwelling  $i$

This function realizes a high weighting towards unacceptably high noise levels, which is a political focus on these areas, where health damage from environmental noise cannot be excluded. Figure 9 below shows the correlation between Noise Score  $Y$  and Noise Indicator  $L_{den}$  per person:

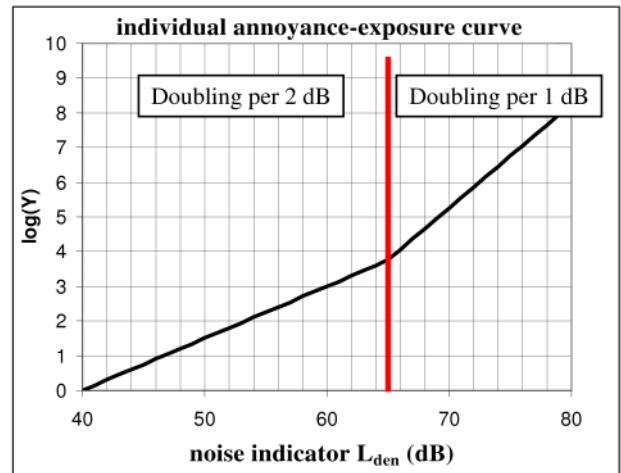


Fig. 9: Correlation between Noise Score  $Y$  and Noise Indicator  $L_{den}$  per person

The Noise Score model can be used for hot spot identification within size of investigation area.

Considering the City of Freiburg, the following map shows the 10 % of the highest Noise Scores per standardized road section (marked red).

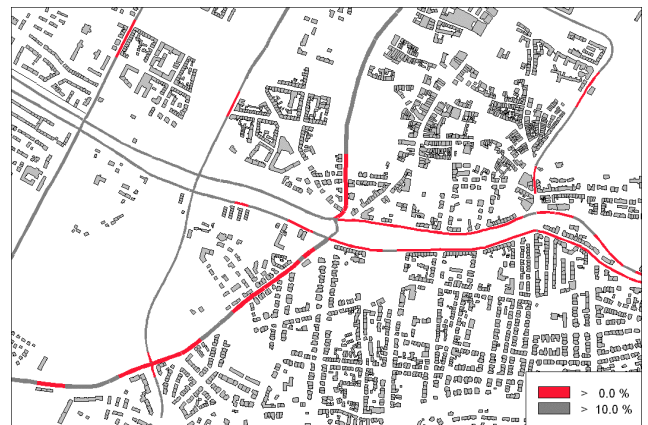


Fig. 10: Detected hot spots on the main roads (City of Freiburg)

To obtain an overview for a country wide redevelopment plan or for the fair distribution of development funds from the federal state, the hot spot detection using the Noise Score is also suitable, as figure 11 shows for the mapped main road network of Baden-Württemberg.

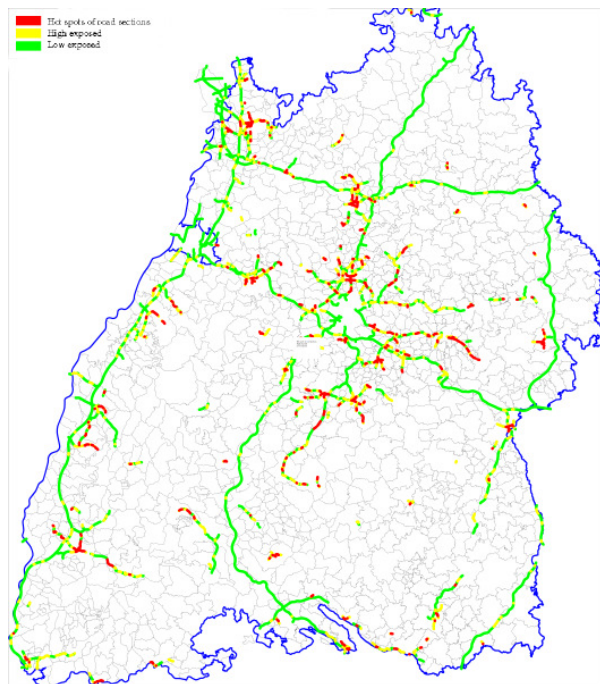


Fig. 11: Detected hot spots on the main roads in Baden-Württemberg

With the information of the countrywide weighting, the hot spots in different cities and communities can be compared and well-founded demands for implementing noise reduction measures could be addressed on the operator of the federal motorways and A roads (Bundesstrasse).

## 5 Information and Participation of the Public

All over Germany the completed Strategic Noise maps can be accessed on the internet and this provides a minimum level of information to the public. The additional local noise analyses and local evaluation of existing noise problems were separately presented and discussed with interested inhabitants of each community at a public consultation event.

## 6 Defining and evaluating of measures

For defining and evaluating local specific noise reduction measures city specific work shops with responsible members of the town planning, traffic planning and environmental planning departments were held. Other planning activities e.g. drawing up an air quality plan or planned improvements within redevelopment areas were proved on the noise reduction potentials. With the assistance of various guidelines [4, 5] and catalogues of measures [6] possible measures were discussed and different scenarios for detailed investigations regarding noise (annoyance) reduction potentials and costs were selected within the workshop.

Later on a plan of measures were developed by ACCON, which is suitable to reduce the environmental noise significantly at the considered sites or guarantees, on a long-term basis, at least healthy conditions inside the living and sleeping rooms of the most exposed dwellings.

## 7 Draft Action Plan

Formal action plans with required information according to Annex 5 of EU-Directive were prepared by the community itself. From ACCON such technical input included:

- describing the procedure of analyzing hot spots
- evaluation of measures or combinations of measures
- cost estimation and cost-effectiveness analyses were provided.

Most of the future action plans of the mentioned cities include 3 types of measures:

1. Implementation of a noise monitoring system on one or more selected hot spots to record and to publish continuously the noise situation and any changes. The aim is, to remind people of the noise effects by "self made" traffic.
2. A list of active measures, co-coordinated with local facts and financial possibilities. These measures comprise short-term or temporary actions (e.g. speed limit of 30 km/h by night time on an A road within urban areas), long-term measures (e.g. new bypass road) and additional investigations (e.g. concept for truck routing) and planning (e.g. modified land use plan)
3. A communal program to promote the exchange of old windows and the implementation of ventilation in sleeping rooms with funds. The aim is, to give incentives, that the sound insulation of the most exposed buildings will be improved within the next five years.

Fig. 12 shows the proposed measures of the draft action plan of City of Heilbronn.

Measures	Description	Time of implementation / duration
1	Installation of a Noise Monitoring System	January 2009 / permanently
2	Speed limit of 30 km/ h on selected main roads by night	January 2009 / temporarily
3	Speed limit of 30 km/ h on selected main roads by day	January 2009 / temporarily
4	Investigation of the potential of noise reduction by truck restrictions within the city by night time	immediately
5	Funding program to improve the sound insulation at most exposed facades	2009 - 2013

Fig. 12: Proposed measures of the draft action plan of City of Heilbronn

Putting all measures into practice the following future statistic of people affected by road noise is expected:

dB(A)		number of people affected	
from	to	L <sub>den</sub>	L <sub>night</sub>
50	55	-	2890
55	60	4840	2110
60	65	3190	0
65	70	2930	0
70	75	0	0
75		0	0
<b>sum</b>		<b>10960</b>	<b>5000</b>

Fig. 13: Affected people by road noise City of Heilbronn after implementation of the decided measures

The total effectiveness of all the decided measures were determined by re-calculating the facade levels with relevant changed noise parameters, related to the prognostic influence of each measure. The influence of improved sound insulation by new windows and ventilation were taken into consideration by a 15 dB reduction of the L<sub>night</sub> facade level and by a 5 dB reduction of L<sub>day</sub> and L<sub>evening</sub>, which reduces the L<sub>den</sub> by approximately 7 dB.

## 8 Public presentation of the draft action plan

In a second public event organized by ACCON and supported by the city the interested people and organizations were informed about the planned activities. Both for the decided measures and for those measures no longer under consideration, or those ideas from the public, reasons were given based on objective rating and evaluation system used, the financial situation and the competence of the city council. The public has the possibility to make statements or to object to the draft action plan.

## 9 Action plan coming into force

After considering and weighting the public statements the (modified) action plan will come into force by a decision of the representatives of the municipality.

## 10 Conclusion

The study has identified ways in which action planning can be implemented using a robust and consistent approach to noise modelling and noise scoring techniques. At the same time it has been possible to provide the municipalities and the general public with information relating to costs and benefits of various intervention schemes, both short and long term, thus ensuring that all parties get buy in to the proposals and become effective stakeholders.

## References

- [1] M. Petz, "Lärmaktionsplanung in 9 Monaten", Presentation on *Noise Congress Baden-Württemberg 2007*, (2007)
- [2] W. Probst, "Zur Bewertung von Umgebungslärm", *Zeitschrift für Lärmbekämpfung* 04/2006, 105-115 (2006)
- [3] M. Petz / A. Stenman / G. Desanghere: "Detailed diagnostic of specific hot spots related to the particular attention areas of each site and related to people complaints", *Report D1.2 within EU founded project Quiet City Transport*, [www.qcity.eu](http://www.qcity.eu), (2007)
- [4] LAI – Hinweise zur Lärmkartierung „Hinweise zur Lärmkartierung einschließlich Beratungsunterlage und Niederschrift zu TOP 9.3.1 der 112. Sitzung der Bund / Länderarbeitsgemeinschaft für Immissionschutz am 07. und 08. September 2006 in Dessau, (2006)
- [5] Lärmaktionsplanung, Informationen für Kommunen in Baden-Württemberg, LUBW Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg, [www.lubw.de/servlet/is/21643](http://www.lubw.de/servlet/is/21643) (2008)
- [6] G. Desanghere: "Consolidation - Action Plans – Dissemination, Part 1 - General measures for noise mitigation", *ReportD6.2-Part 1 within EU founded project Quiet City Transport*, [www.qcity.eu](http://www.qcity.eu), (2007)