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NOISE INVESTIGATIONS IN THE ROTTERDAM AREA

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ABSTRACT

Last year the DCMR (Environmental Protection Agency) has started an large investigation called "Deltaplan noise". Deltaplan is a typical Dutch word and means planning and designing dikes, dams and storm sludge barriers to attack the dangers of the sea. The Deltaplan noise however doesn't protect the dwellings against the storm and the sea but tries to find solutions and measures for reducing noise and annoyance in the Rotterdam region. In an area of about 600 km² the noise from aircrafts, industry, traffic and railways has been calculated. After all these noise levels were summed according to the Miedema method to account the total number of annoyed people and a study has done to an earlier inquiry that was hold in the Rotterdam area. The investigation has been split up into five parts: Part 1: inventory of developments, bottlenecks and planned measures. Part 2/3: investigation to outdoor noise (present situation and future situation in 2010), calculated noise levels, the findings presented by GIS technology and additional measures to take. Part 4: relation between calculated noise levels, annoyance at local positions and the quality of the liveability of the surroundings Part 5: summary, recommendations and conclusions The paper, presented by Rob Witte of dgmr, will present the methods of modelling and computation. This paper however presents the outcome of this project in terms of noise-reductions costs, benefits and the reduction of the number of annoyed people in this area.

1 - INTRODUCTION

From January 1999 until February 2000 DCMR Environmental Protection Agency conducted a large noise survey for the Rijnmond-area (The Netherlands) called "Deltaplan Geluid", DPG ("geluid" is Dutch for noise). The Rijnmond, in the Province of South-Holland, is located around the city and harbour area of Rotterdam (700 km², population over 1.000.000 people). DPG is a ROM-Rijnmond survey where ROM stands for Spatial Planning and Environment. In ROM-Rijnmond participate 18 regional municipalities (Rotterdam included), the Province, several Ministries and the business world. For the year 2010 ROM-Rijnmond has set targets reducing noise annoyance caused by traffic, industry and railways. The general target in the range > 65 dB(A) is "no exposed houses". In the range 56-65 dB(A) the target is a reduction of the number of exposed houses between 50% and 90% (reference year is 1993). Although measures to meet the ROM-targets were investigated, the main purpose of phase I of DPG was to find measures that reduce the experienced annoyance.

The paper called "Environmental noise around Rotterdam", presented by Rob Witte of dgmr (one of the consultants of DPG), gives more information about the survey like the calculation methods and the presentation of the calculations and annoyance on maps of the area.

2 - SETUP OF THE SURVEY

Besides traffic, industrial and railway noise, DPG also looked into shipping and aircraft noise. The sound levels of all these five sources were, according to the "Miedema-method", summed to Environmental Cumulation Measures (ECM's). Based upon the ECM levels the to be expected annoyance was calculated. Concerning the present experienced annoyance DPG primary used the environmental poll of the Province of South-Holland. The complaints the DCMR received from the inhabitants of the Rijnmond played a supportive role in the mapping of the experienced annoyance.

To determine what type of measures should be taken to reduce the experienced annoyance, the presently experienced annoyance was compared with the to be expected annoyance. Per residential area both "experienced" and "expected" annoyance were presented on maps showing the number of annoyed persons per 10.000 m². To get statistic reliable outcomes for the presentation of the experienced annoyance, sometimes information of several residential areas had to be joined together. For those joined areas the presented information of course is less detailed. Next, the for the future expected annoyance (calculated) was compared with the present situation in order to shed some light on the possible experienced annoyance in the future. Prediction of the experienced annoyance of course is very difficult while, for instance the composition of the population constantly changes. Besides the composed maps with sound levels and numbers of annoyed people, the DCMR used her specific knowledge of the area.

The DPG survey resulted in four reports (all in Dutch). [1] is an inventory of developments, bottlenecks and planned measures. [2] concerns the investigation into connections between sound levels, annoyance and quality of living for the Rijnmond. [3] concerns the calculated sound levels, the mapped annoyance (based upon the recommendations from [2]) and the possible measures. [4] is a summary with the conclusions and recommendations.

3 - LIMITED CONDITIONS AND APPLICABILITY

The investigated measures in phase I of DPG were conventional, realistic and applicable within the limits of present, and certain future-, environmental policy (limited condition). Due to specially the relative limited information about the experienced annoyance, the applicability of the survey has its limits. DPG therefore must be seen as a first step in monitoring and comparing sound levels, annoyance and measures for such a large area. DPG however shows which sources are relevant in terms of sound levels and annoyance, and what (type of) measures could be taken to reduce the annoyance.

4 - RESULTS

4.1 - Calculations

Table 1 shows, for the year 2010 with no extra measures other then already planned, the calculated numbers of exposed houses for the individual sound sources and the cumulation (ECM). Tables below (1, 2 and 3) further show the expected annoyance, based upon the ECM levels.

Until the year 2010 traffic, industrial and shipping noise will increase, aircraft and railway noise will decrease. Looking at the total noise (ECM levels) in the Rijnmond, however there will be an increase, and therefore an increase of the expected annoyance. The ROM targets for traffic noise will not be met due to the autonomous increase of traffic. In the range 56-60 dB(A) the ROM target for industrial noise will not be met due to further development of the existing industrial areas, which the government agreed upon in the "sanitation of industrial noise" (Dutch Noise Abatement Act). Traffic clearly is the most dominant sound source.

4.2 - Experienced annoyance

In the present situation traffic is the most annoying sound source, specially within the area of the city of Rotterdam. The industry often is the most annoying source near the harbours, aircraft's the most annoying source near the airport, but also at greater distances in the cities of Schiedam and Vlaardingen due to the flight path. Because of the increase of traffic and industrial noise, continuation, and most likely an increase, of the experienced annoyance is to be expected. Since aircraft noise in the year 2010 will only be slightly reduced, a significant reduction of the annoyance is not expected. Railway noise in general causes little annoyance, except in specific situations where steel built bridges are involved. There are no reliable sources that point out shipping noise as a general source of annoyance.

4.3 - Confrontation of experienced and to be expected annoyance

Confrontation of the experienced and the (to be) expected annoyance shows that, besides areas where the two match, there are areas where there is no 1:1 relation between the sound levels and the experienced annoyance. DPG distinguishes three categories of areas:

Category 1: high sound levels and much annoyance

One can expect that reducing the sound levels will lead to less annoyance. The areas in question are for instance large parts of the city of Rotterdam where traffic is the dominant sound source, and the village of Rozenburg with the nearby highway and the industrial area Botlek/Pernis as the dominant sound sources.

Sound source	Quantity	Range [dB(A)]				
		51-55	56-60	61-65	66-70	71-75
Traffic	Exposed houses in 2010	174.865	140.644	53.963	19.066	(4.129)
	ROM-target for 2010	-	21.500	26.500	0	0
	Increase related to present situation	+5%	+19%	+7%	+12%	+23%
Industry	Exposed houses in 2010	53.338	10.008	810	(79)	(12)
	ROM-target for 2010	-	3.500	800	0	0
	Increase related to present situation	+18%	+58%	+7%	-32%	+100%
Aircraft's	Exposed houses in 2010	19.026	5.632	68	10	0
	Increase related to present situation	+15%	-8%	-81%	-41%	-100%
Railways	Exposed houses in 2010	54.047	20.697	4.577	2.416	(646)
	ROM-target for 2010	-	-	4.500	0	0
	Increase related to present situation	+7%	+4%	-21%	-2%	-42%
Ships	Exposed houses in 2010	88.128	24.653	7.556	(3.286)	(214)
	Increase related to present situation	+3%	+21%	+21%	+3%	-

Table 1: Calculations for the year 2010 and comparison with the present situation.

Sound source	Quantity	ECM qualification				
		<i>Reasonable</i>	<i>Moderate</i>	<i>Rather bad</i>	<i>Bad</i>	<i>Very bad</i>
Total, ECM	Exposed houses in 2010	99.671	235.111	94.867	25.815	(6.644)
	Increase related to present situation	-7%	+13%	+16%	+11%	+24%

Table 2: Calculations for the year 2010 and comparison with the present situation.

Sound source	Quantity	Annoyed	Highly annoyed	Total
Total, ECM	% annoyed in 2010	22,4%	6,7%	29,2%
	Number of annoyed in 2010	224.389	67.184	291.573
	Increase related to present situation	+10%	+12%	+10%

(1.000) is a less reliable result, due to the chosen method of calculation

Table 3: Calculations for the year 2010 and comparison with the present situation.

Category 2: low sound levels and much annoyance

Reduction of the sound levels will not reduce the annoyance. Measures to be taken are on the one hand measures which influence the negative perception of the noise such as "uncommon", "unknown" and "unbeloved". On the other hand there are measures that intervene in other, non-acoustic, environmental factors that determine the quality of living such as "quality of the house and its surroundings" and "personable variables". In phase I of DPG these measures were not investigated because an extensive analysis of how these before subscribed factors "score" in those concrete situations would be needed first. One of the areas in question is village of Oostvoorne, located near the North-Sea in the countryside behind the dunes, but with the industrial area Maasvlakte/Europoort and it is supporting road and railway nearby.

Category 3: high sound levels and less annoyance

In the present situation apparently there is a balance in which other, non-acoustic, factors that determine the quality of living in a positive way, compensate the high sound levels. Increase of the sound levels could however disturb this balance. As goes for "category 2", the factors itself are known, how they score in those specific situations however not, and further research therefore is necessary first. The general recommendation is that the government should be very careful in allowing a further increase of the sound levels. One of the areas in question is the village of Pernis, between the two large industrial areas "Pernis" and the "Eemharbour".

5 - RECOMMENDATIONS

5.1 - Short term (< 5 years)

To reduce the experienced annoyance within a relative short period (< 5 years), DPG recommends that measures should be taken for the DPG-locations with high sound levels and much annoyance (category 1). For those locations shipping and railway noise are not relevant. Within the limits of present policy, industrial noise can not be reduced more than is agreed upon in the earlier mentioned "sanitation of industrial noise". The same applies to aircraft noise since the airport and the government already have agreed upon certain measures. Only for traffic noise concrete measures can be taken. DPG recommends "double layered open-graded asphalt" for roads which cause sound levels > 65 dB(A), in combination with the executing of agreed plans for acoustic barriers and improvement of the insulation of houses.

5.2 - Long term (> 5 years)

Phase I of DPG shows that within the limits of present policy, and with only conventional measures, reduction of the experienced annoyance is only possible for traffic noise. In search for effective reduction

of annoyance, a follow up on DPG should investigate new and more extensive measures, including changes in policy. With the conclusion that not everywhere in the Rijnmond there is a 1:1 relation between sound levels and annoyance, DPG states that "area-related policy" is a better way to control and steer developments. Here DPG links up with a new development in Dutch environmental legislation, in which the "Noise Abatement Act" will be revised, and an "area related" approach is proposed. DPG recommends to:

1. Implement the knowledge and the findings of phase I of DPG in presently to be developed policy that is focussed on "area related standards";
2. Reconsider the present ROM-targets;
3. Analyse how the factors that determine the quality of living, other than the sound level, score in concrete situations where experienced and expected annoyance do not match;
4. Intensify and extend the environmental poll of the Province of South-Holland;
5. Stimulate research of innovative measures to reduce noise nuisance, improvement of the logistic systems and subsidy regulations to lower the sound emission in general.

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