NEW DUTCH LEGISLATION AND A EFFICIENCY CRITERION FOR MEASURES AROUND MOTOR WAYS

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1 INTRODUCTION

It is expected that next year the Dutch legislation will change for situations around motorways[1]. Only two standards for all situations[1]; 50 dB preferable, maximum 65 dB. Simplifying procedures and guarantee these noise levels at the dwellings. Maximum noise production levels will be introduced and monitored. On the other hand the road authority may widen de road as long as this maximum production level will not be exceeded. Further a legal efficiency criterion[2] has been formulated.
The proposal should be approved by the Dutch Parliament, but the Dutch Government has been offered their resignation by the Queen. We have to wait longer for this new legislation. The decision for a new legal efficiency criterion is already taken and the criterion is in force since January 2010. This paper will give a brief overview of the new Dutch legislation as proposed and deals more in detail with the new efficiency criterion.

For this paper the following documents have been used: De Wet geluidhinder (Noise Nuisance Act), The new proposal to the parliament to change this act on some points (Not yet accepted), The regulation for the Efficiency Criterion, (in force since 1st January 2010) and the information folder[3] for appliers “Doelmatigheidscriterium” from 7 December 2009 edited by Rijkswaterstaat.

2 SITUATION UNTIL NOW

2.1 Legislation

The existing legislation[7] showed different preferable and maximum noise levels. For existing situations and new situations the preferable noise level is 48 dB(A) but for the new situations the maximum noise level is 58 dB(A) and for existing situations the maximum noise level is 68 dB(A).
The new legislation foresee equal assessment for new and existing situations. That means that the preferable noise level is 50 dB and the maximum noise level is 65 dB. The difference between dB and dB(A) shows if the level is a L_{den}(dB) or the former Dutch L_{etm}(dB(A)). All the existing situations should be improved to a level of 60 dB and where the existing noise level exceeds 65 dB should be improved and the noise level should be reduced to at least 65 dB. In this congress Wiebe Alberts will tell you more about the old and new legislation.

2.2 Old efficiency criterion

2.2.1 Efficiency criterion for existing situations

Until January 2010 two different efficiency criteria exist, one for improvement of existing situations. In existing situations places where the noise level on March 1986 was higher than 60 dB(A). Dwellings that fulfils that criterion will be called **improvement dwellings**[4].
The Ministry of Environment has a special budget for improving the worst situations. This budget was mainly for the construction of noise barriers and if it was not possible to built a noise barrier in that situation or it gave not enough reduction then was insulation of the dwelling the last possibility. The available budget for a barrier in a special situation could be calculated in a given way. The calculation is given in the table 1 below.
Category 1 dwellings are apartments without a balcony or with a balcony smaller than 4 m^2. Category 2 are all the other dwellings which are not category 1.

The first column under dwelling shows the number of dwellings in the noise level class mentioned in the first column. The total of all noise level classes is A and this figure shall be reduced with the costs necessary for insulation in column B.
The total of category 1 and 2 multiplied by 4150 is the available budget for a noise barrier in euro's.
In special situations an extra budget is available when the baring of the soil is bad or if barriers on bridges should be built and so on.

Tabel 1: Determination of the available budget for improving situations

Noise level class Lden dB	dwellings			
	Category 1		Category 2	
	total number per class	number additional insulation (B)	total number per class	number additional insulation (B)
49-58	….x 1	….x1	….x 2	….x 2
59-63	….x 3	….x1	….x 10	….x 3
64-68	….x 5	….x2	….x 12	….x 4
>68	….x13	….x2	….x 18	….x 4
Sub total	A:	B:	C:	D:
Total		A-B+C-D=E		
Maximal barrier costs in €		E x 4150		

This budget was strictly for building noise barriers and could not be used for the application of low noise road surfaces. In case of a combination of improvement of widening a road and improvement of bad situations it was not possible to combine the budget for noise measures for improvement and for the increase of the noise levels caused by the increase of traffic due to the widening. It was nearly impossible to explain this to the people living nearby those foreseen measures. If you combine those two budgets it was possible to built a noise barrier and due to the regulations it was not possible.

2.2.2 Efficiency criterion for new situations and road widening

Since a couple of years a efficiency criterion has been developed by the Road Authority[5]. This criterion has not a legal basis, but it has been accepted by the Dutch Council of State so it can be used for both new situations and widening. In case of a new situation the preferable basis, 50 dB, is the starting point. More difficult is the procedure for widening the road. Only in case the increase of the noise level is $\geq$ 1,5 dB measures are necessary because of the threshold for reconstruction according to the Law then dwellings are called reconstruction dwellings. If there is no dwelling in that area the application of that criterion is simple too. For each dwelling that has an increase of the noise level with 1,5 dB or more the budget is the number of dB's reduction time 3000 €. So in a specific residential area the total budget is:

$$Budget = \sum_{1}^{n} n * \Delta dB * 3000 \quad \text{in Euro}$$

n is number of dwellings
Δ dB is the reduction for each separate dwelling [dB]

This budget is called the credits, the measures costs for low noise road pavements and noise barriers has been determined from all. And based on the cost level of 2001.

More difficult is the situation if there are improvement dwelling involved. In that case first the budget for improvement should be determined and investigate if it is possible to built a noise barrier for that budget. The use of this budget for the application of low noise pavement is only allowed if the costs for a barrier and low noise pavement combination is equal to or lower than a noise barrier only and the reduction of the noise level should be al least the same. If measures are not possible than this procedure is finished. The procedure will be continued to determine if there is enough budget to apply low noise road surface or to built a barrier for all the dwellings under the regime of widening. If

there is enough budget than the first step is to apply low noise road surface and if there is enough money left the noise barrier will be designed.

This method has two disadvantages:

- During the public enquiry it is hard to explain that if there is not enough budget for a barrier for improvement dwellings that this budget cannot be added to the budget for reconstruction dwellings. Both budgets are coming from the Government, but from different Ministries. People cannot believe that the Authorities doesn't take in account the whole situation.
- The costs for measures are based on cost level 2001, and were average costs at that moment. The ones involved because they are living nearby the road as the ones working on the project always say: "there is a contractor who can built this barrier cheaper". They do not realize that the costs are a bit fancy costs and only to determine if there is enough budget for taking measures.

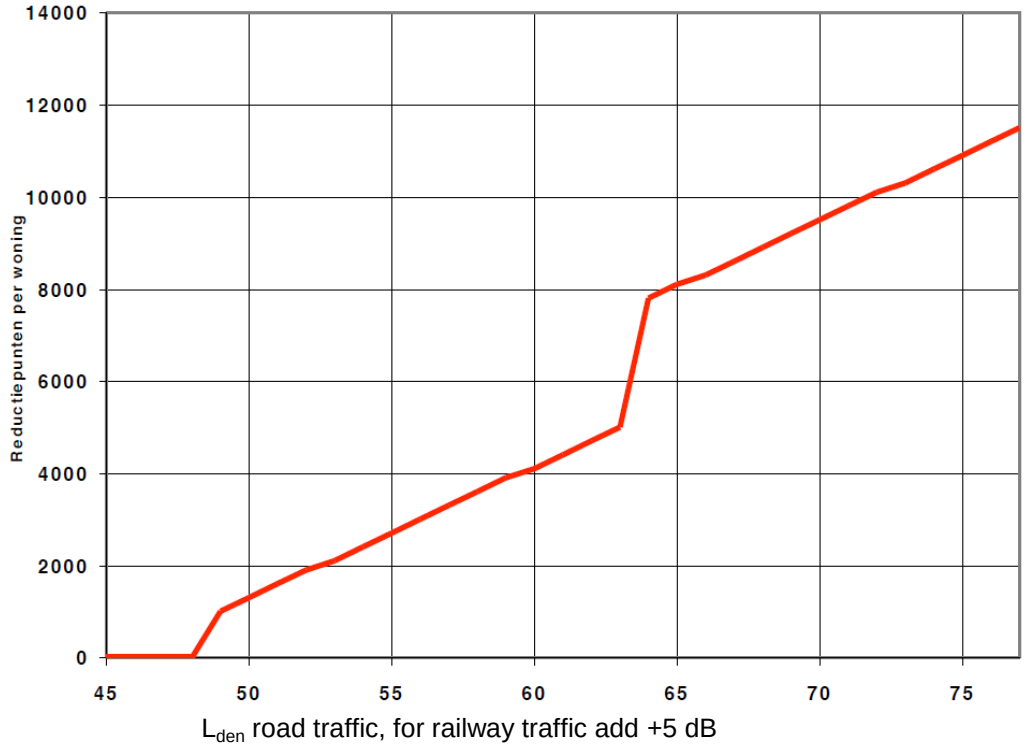
Both problems caused that a new efficiency criterion has been designed and both problems mentioned above have been solved. This new criterion became in force on January 1th 2010.
The working from this criterion will be explained in the next chapters.

3 SITUATION FROM NOW ON

3.1 Introduction

In fact there were three different efficiency criteria; two for road or railway new construction and reconstruction and one for improving existing situations. The new criterion has the same approach for new constructions, reconstructions and improvement of existing situations. Because the new Noise Legislation is not yet in force the old noise limits will be used. So the preferable limit is 48 dB and the maximum level is 63 dB, but in some cases 68 dB is acceptable. This is in the period before the law will be changed.

Figure 1: determination of reduction points. Only for rounded figures, interpolation is not sustained



The line has been based on dose-effect-relations between noise levels and annoyance. To make it not too difficult the original curve has been replaced by a straight line. The discontinuity at 63 dB is caused by the wish of the government to reduce extreme high noise levels and therefore an extra budget will be generated if the noise level in an unprotected situation is over 63 dB.

The efficiency criterion works with points, points for reduction and point for measures. The total reduction points will be determined in the following way. For all the dwellings in a residential area the noise level will be determined in a situation without noise measures, even without the existing measures(see figure 1). The situation with 10 dwellings at 65 dB and 5 at 58 dB will give 10x81000 + 5x3600 = 99000 points.

As mentioned before, for measures measure points have been fixed too. To give an impression of this points see table 2. This table has been divided in two parts; one for measures at the source and one for measures in the transmission.

Table 2: measure point

description measure	conditions	measure points	
road			
porous asphalt (PA)	Traffic density high enough No wrangling or braking traffic Max vehicle speed more than 70 km/h	4 points per 10 m2 related to Dense Asphalt Concrete (DAC)	
Two layer porous asphalt (2PA)	Traffic density high enough No wrangling or braking traffic Max vehicle speed more than 70 km/h	26 points per 10 m2 rel. to DAC 22 points per 10 m2 rel. to PA	
Thin surface layer (TSL)	Max speed 80 km/h or lower Not on crossings or roundabouts	13 points per 10 m2 rel. DAC 9 points per 10 m2 rel. to PA	
Railway			
Rail dampener	Not on points or dilatations	46 per m single track	
Concrete rail supports	If foundation on stones	45 per m single track	
Barriers			
Noise barrier	No special conditions	Per m barrier height	
		1 m	53
		2 m	93
		3 m	133
		4 m	173
		5 m	212
		6 m	251
		7 m	289
		8 m	327
		>8 m	44 for each m higher
Noise barrier in central reservation	No special conditions	1 m	64
		2 m	112
		3 m	160
		4 m	207
		5 m	254
		6 m	301
		7 m	347
		8 m	392

For noise barriers along railroads the figures are a bit higher than for road side barriers.
The measure points and the reduction points have been fixed in legislation[6].
For earthberms instead of noise barriers the same points are valid but the conditions are:
The needed area must be available and the bearing capacity of the soil should be sufficient.
For special situations there are no extra points but it should be considered as normal barrier. In the project self an estimate of the real costs should be made, but this has no influence on the determination of the barrier height in a give situation.

With this approach it is not longer possible that some contractors may fix the project for a lower price. The credit points and the measure points have been fixed in legislation.

3.2 General conditions

For the use of this method four general restrictions has been formulated in the legislation. This restrictions should be taken into account in the design phase of a project.

1. The first restriction is that enough reduction is enough. Further explanation: the road authority is not obliged to take further measures if the preferable limit will not be exceeded in that residential area. Even when a lot of reduction points are left.
2. If it is not possible to reduce the noise level to the preferable level, than use the reduction points to achieve the best reduction for the dwellings in that area. Dwellings for which it is not possible to reduce the noise level to the preferable level the road authority has the possibility to ask for an exemption. There are legal procedures for exemptions if the road authority has this request sufficiently founded. In the new legislation there is no longer exemptions needed. Because this is a legal regulation financial objections is one of the arguments for asking an exemption.
3. Sometimes, for instance in dense build-over areas with some high buildings, there can be enough reduction points for a extremely high barrier. The extreme height is may be caused by a few dwellings. To be efficient it is necessary to check if a barrier with a less extreme height will give almost the same reduction. In that case a rule of the thumb can be used: if a less high barrier gives still almost the maximum reduction (not less then 95% of the maximum) and saves a substantial amount of measures points, you can call the higher barrier not efficient.
4. How to handle relative young noise barriers. In general young barriers are relative high and it is not possible to punt an extra meter barrier on this existing barrier. To demolish that barrier cost extra money. In these cases the road authority is not obliged to demolish the existing barrier and to built a new one. The condition is that with the existing barrier a noise reduction will be achieved is that at least 90% of the reduction that will be realized with a new, higher barrier.

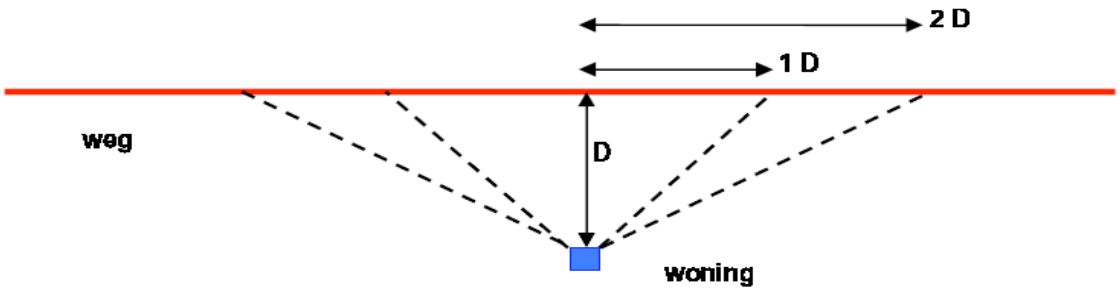
The first two restrictions should be applied in the way they have been formulated, the last two conditions should be handled carefully and see how it works in specific situations.

4 RULES FOR DETERMINATION OF MEASURES

The rules to determine measures is specifically Dutch and related to Dutch legislation. If someone is interested in this procedure than sent me an e-mail. It is different for “improvement dwellings”, for new constructions and for widening of the road. The application of this method will be showed by an example. First of all a cluster of dwellings will be determined, and for this cluster a calculation is made of the available reduction points and which measures are possible within the total of measure points. These measures could be only low noise road surface or only noise barriers or a combination of both measures, If more combinations are possible within the budget the results have to be checked for the general conditions as mentioned above. The most cost effective one should be chosen. The application of the efficiency criterion will be explained in an example in chapter 5. The real costs of the measures are not important in this phase of the project and this system is for designing measures only!
In the example Dutch data have been used and the Dutch calculation method for acoustical reports. These data and the result could be different if other calculation schemes will be applied.

Before going on in further detail for the example it is good to specify the cluster, which houses belong to a cluster and which do not belong to the cluster. For this purpose the 1D and 2D approach is an aim see figure 2. Draw a line from the dwelling perpendicular on the on the road, each dwelling within the 1D distance belongs to the cluster. The best way is to start with houses at the edge of a cluster. In some cases there are some houses that do not fulfil this criterion but they are within the 2D distance, than they could be included in the cluster if the density of dwellings justify to add them to the original cluster. Arguments to add them to the cluster will be needed.

Figure 2: Determination which house belong to a cluster.



5 EXAMPLE

For the example a rather simple situation has been chosen. For more difficult situations you may ask for the folder by the Dutch Ministry of Traffic, Public Work and Watermanagement.
Figure 3: Situation for this example

Along a Highway there is a residential area and the situation is shown in figure 3. Widening of the road causes an increase of the noise levels at the facade of the dwelling of 2 dB in this cluster.

The following facts are known:

1 In the present situation the road is covered with a top layer of porous asphalt and after the widening the top layer will remain the same. The road is 22 m broad.

2 In table 3 the noise levels at the facade of the dwellings have been mentioned.

3 After calculations there are three possible solutions:

- A A new top layer on the road, with a length of 1200 m, two layered porous asphalt. With this measure none of the dwellings will have an increase of the noise level.
- B Two layered porous asphalt with a length of 1000 m. In this case six dwellings will have an small increase of the noise level.
- C. A noise barrier of 1200 m with a height of 2 m, in which case none of the dwellings has an increase of the noise level.

Future situation(dB) with Porous Asphalt and no noise barrier	Number of dwellings	Reduction points per dwelling	Reduction points
48	-	0	0
49	-	1000	0
50	20	1300	26000
51	9	1600	14400
52	5	1900	9500
53	2	2100	4200
54		2400	0
55		2700	0
Total	36		54100

A further analysis of the possible solutions:

For measure A
To apply two layer porous asphalt a length is needed of the length of the cluster plus to times the closest distance between the nearest dwelling and the road, on both sides. This is in this case 800+200+200= 1200 m. The costs for two layer porous asphalt is 2,2 point per m^2. So the total costs are 1200x22x2,2= 58080 measure points.
With this measure there is no increase at all for all dwellings. But there is only 54100 points available and the conclusion is not appropriate.

For measure B
In this case a length of 1000 m, 800 m sector + 2 x 100 m (=1D). This cost 48400 measure points and this is within the available budget. The main condition mentioned in 3.2 says that no further measures are needed. Not for all dwellings the increase has been taken away, but this measure is appropriate.

For measure C
A noise barrier for 800 m plus two times 2D meter is 1200 m noise barrier. This will cost 111600 measure points. If this measure will be applied for all the dwellings the increase of the noise level caused by the widening or the road is zero. So problem is solved, but cost too much compared with the reduction points. Conclusion is this measure is not appropriate.

In a real project the project leader will decide that measure B will be applied and that the length of the track with 2 layer porous asphalt will be enlarged with 50 m on both sides. This because there are some reduction points left and the measure does not fulfil the requirement to reduce the increase of the noise levels for all dwellings to zero. To enlarge the length of the track with to 1100 m cost 53240 measure points and is within the budget.

This was a rather simple example, but in combination with improvement dwellings and dwellings with a higher level than 65 dB the whole calculation becomes more complex. Improvement dwellings will generate much more reduction points because the noise levels are mostly higher than 60 dB. The same is true for situations which are not improvement dwellings but with a higher level than 65 dB. This are mostly dwellings that are situated solitaire and for which in the past an exemption has been given because to take measures was too expensive. These exemptions did not exceed 60 dB in the time that they has been granted, but due to the enormous increase of the traffic flow the levels raised. In some cases this exemption has been exceeded with more than 5 dB. In the Mobility Policy Document[2] has been stated that in the next period of about ten years the authorities will reduce the number of dwellings with that high noise levels.

6 REFERENCES

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