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Evaluation of low and high noise barriers along roads

With respect to cost-benefit analysis

Master's thesis in Master Program Sound and Vibration

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CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2018

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Cover: Picture of the sound barrier in Partille along E20.

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Abstract

In inner city environments traffic noise is a problem with regards to both annoyance and to measurable health effects. Noise barriers can reduce the noise levels but they can also be perceived as an obstacle for pedestrians and car drivers alike, with high noise barriers hindering the view and making it harder to navigate in traffic. Building a low-height noise barrier might feel less obtrusive and still give some noise reduction.

There are several evaluation methods available to estimate the health costs related to noise levels. These are used as reference when taking measures to reduce noise levels, such as noise barriers. This thesis set out to compare two of these evaluation models with each other and to see how a low-height noise barrier compares to taller noise barriers with regards to the evaluation models and to see if a low-height noise barrier might even be more cost effective with regards to the evaluation methods presently available.

This is made by collecting existing noise measurement data and prediction results before and after the construction of a low-height noise barrier prototype and two existing tall noise barriers constructed in Sweden. Together with the development and building costs for these projects, and the evaluation models devised by the Swedish Transport Administration (ASEK) and by a European project (HEATCO), a comparison is made to show how the evaluation models real world implementations of high-height noise barriers and how the low-height noise barriers compare to these.

The comparison shows that the two evaluation methods used in this study differ significantly when estimating the health-cost-benefit of reducing noise levels in urban areas. It also shows that regarding the evaluation models, ASEK and HEATCO, a low-height noise barrier can be more cost effective than a high-height noise barrier. Therefore further studies in this area would be advisable.

Keywords: ASEK, HEATCO, Low-height noise barrier, Urban acoustic screen.

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I also want to thank the people at Applied Acoustics who, through their encouragement, made me want to seek knowledge on my own instead of being satisfied with just listening to others.

I especially want to thank Jens Forssén, who helped me to "get the ball rolling" with my thesis and Laura Estévez Mauriz, who helped me with the facade levels at Holmiaparken, which is one of the most important pillars of my thesis.

Sebastian Ek, Gothenburg, May 2018

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1
Introduction

1.1 Background

Traffic noise is a growing problem in society today when city populations grow and both car traffic and lorry transportation increase. This increased traffic load generates higher noise levels and higher noise levels has been linked to several health problems such as cardiovascular disease and sleep disorders[1]. As part of a sustainable urban development it is important to keep noise levels sufficiently low to prevent these increases in health problems. These health problems are not only a concern for the affected individual but also a cost for society in the form of sick leave and medical care.

Reducing the noise levels and thereby reducing costs of noise related medical problems can be achieved by preventive measures such as a noise barrier. A high-height noise barrier will have a higher insertion loss and a higher building cost than a low-height noise barrier, however it is unknown how the health benefits, and cost reduction thereof, is related to the cost of the noise barrier and its height.
The aim of this thesis is to investigate if a low-height noise barrier can be more cost efficient compared to a taller noise barrier, comparing the building cost of the noise barrier and the decrease in health related costs.

1.2 Purpose

The goal of this thesis is to compare the costs of noise barriers with two evaluation models for estimating the cost of health effects due to noise.

To see if and how the two evaluation models differ in practical implementation, and to see if it is plausible that a low-height noise barrier can be more cost efficient than a high-height noise barrier with regards to health effects.

1.3 Demarcations

1.3.1 Evaluation methods

There are several methods to evaluate the cost of noise barriers. Most countries within the European union have their own method, some of which have similar approaches and differ mostly by their boundary values. The two evaluation methods that are studied in this thesis are therefor the two most likely to be used with infrastructure projects in Sweden:

- ASEK
  "Analysmetod och samhällsekonomiska kalkylvärden för transportsektorn"
  An evaluation method provided by Swedish Transport Administration.
- HEATCO
  "Developing Harmonised European Approaches for Transport Costing and project assessment"
  Developed by an European Commission funded project.

1.3.2 Noise barriers

The number of noise barriers examined has been limited by a few external factors. The low-height noise barrier examined in this thesis is a prototype and is assumed to lack comparable noise barriers with the needed sound measurements.

The high-height noise barriers have been limited in numbers due to time restraints in collecting data. The noise barriers have been chosen to have as few differences as possible and thereby minimize sources of error, e.g. straight line barriers with even surfaces. The noise barriers also needed to have sufficient measurements or calculations, with facade noise level measurements for every floor level facing the noise barrier.

2
Evaluation methods

2.1 HEATCO

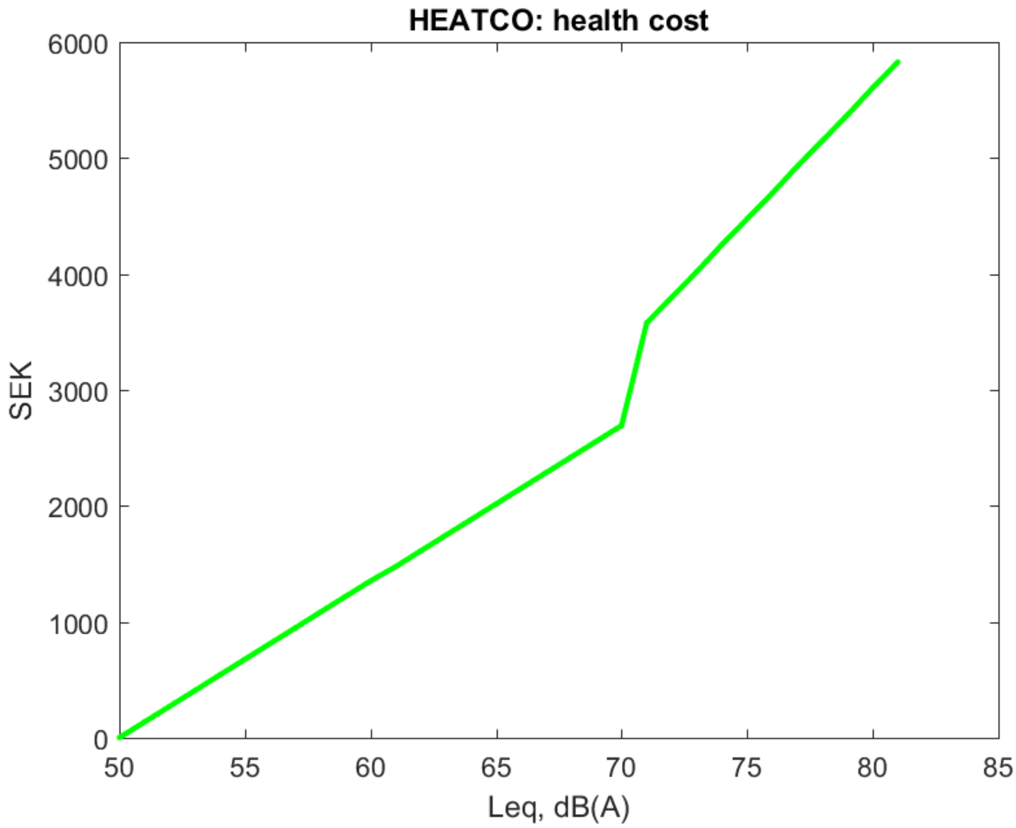

Figure 2.1: HEATCO: The health costs per person and year with regards to noise exposure level. Adjusted for inflation (2017).

HEATCO stands for Developing Harmonised European Approaches for Transport Costing and project assessment, and was a project funded by the European Commission between 2004 and 2006 [2].
The goal was to develop an evaluation tool to be used for trans-European infrastructure projects within the European Union that took into consideration external effects such as congestion, accidents, health risks from pollutant and noise emissions as well as other environmental impacts.

Prior to HEATCO, assessment models varied between countries and not all countries within the union had guidelines for all the external effects mention above. RICARDO-EAE is the most resent update of the guidelines for external transportation costs and is the version that will be used in this report. The HEATCO table can be seen in appendix C.1 and a graphical representation of the HEATCO model is displayed in fig 2.1, the values being adjusted for inflation (2017).

2.2 ASEK

ASEK stands for Analysmetod och samhällsekonomiska kalkylvärden för transportsektorn, and is developed by the Swedish Transport Administration. It stems from the HEATCO report but has evolved on its own. It is updated every three to four years with minor changes, such as correction for inflation[3]. The ASEK model is displayed in fig 2.2 and the table can be seen in appendix B.1 the values being adjusted for inflation (2017).

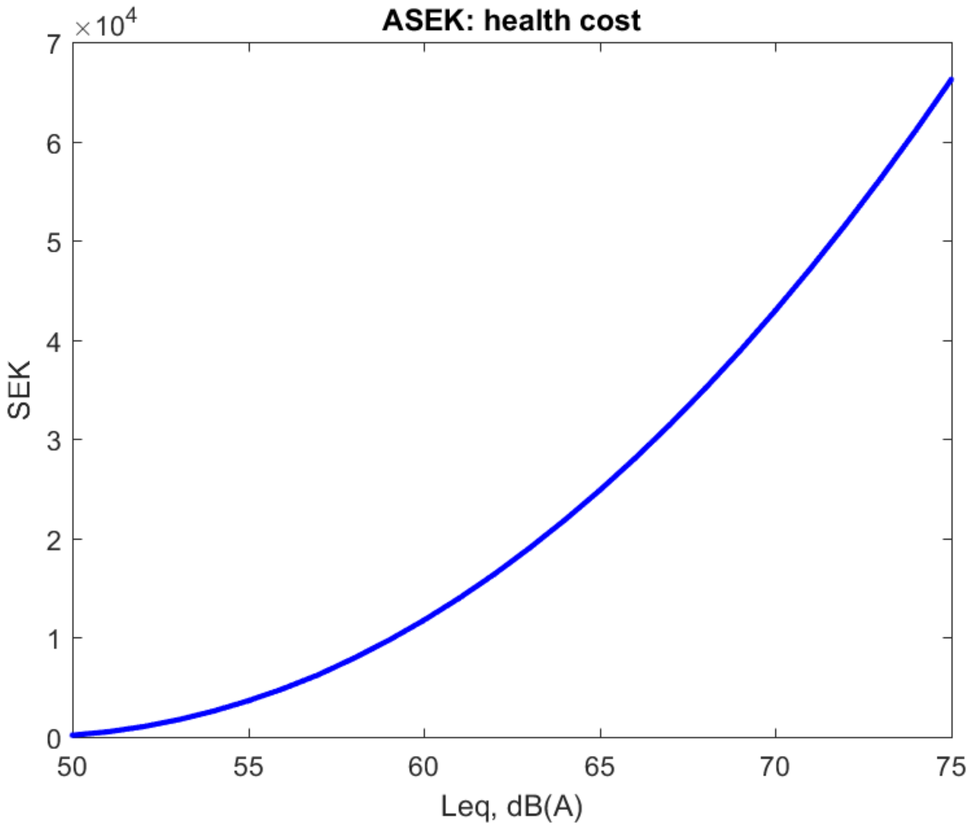

Figure 2.2: ASEK: The health costs per person and year with regards to noise exposure level. Adjusted for inflation (2017).

3

Case studies

3.1 Low-height noise barrier at Holmiaparken

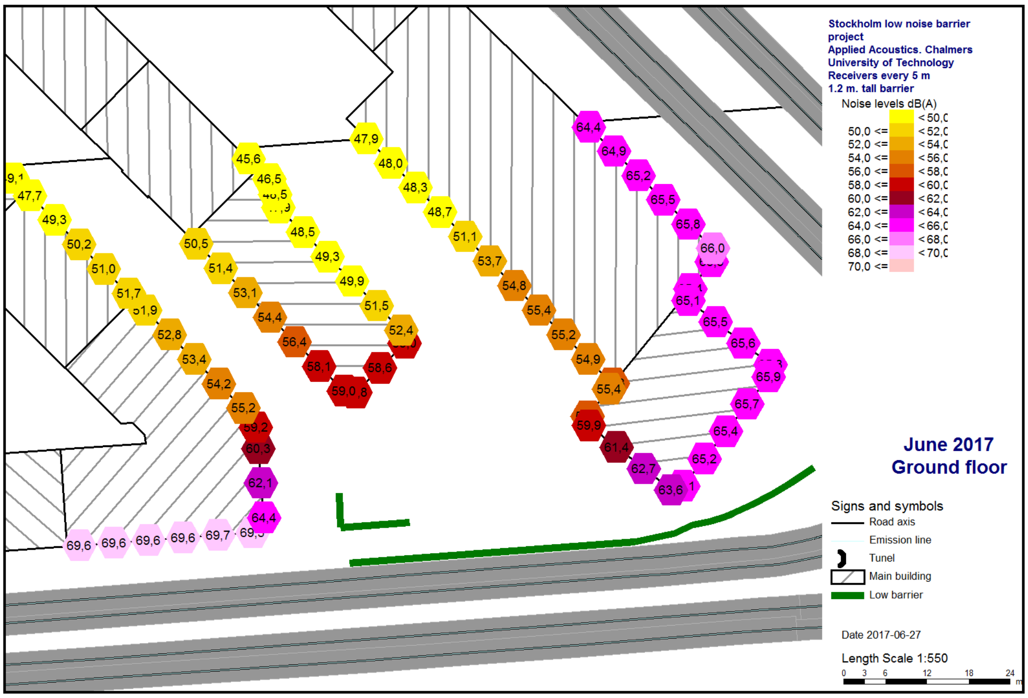

Figure 3.1: Noise barrier at Holmiaparken, green line.

Holmiaparken is a park situated on the north side of Drottningholmsvägen, Stockholm City, between Gyllenborgsgatan and Lindhagensgatan. It is enclosed by Drottningholmsvägen and residential buildings. A temporary concrete barrier was placed along Drottningholmsvägen, see fig. 3.1. It had a total length of 85 m and a total height of 1.4 m above the road surface and was placed as close to the road as possible to shield of the road traffic noise. Drottningholmsvägen has a speed limit of 50 km/h between Gyllenborgsgatan and Lindhagensgatan.

This site was chosen to test a prototype of a low-height noise barrier, to test its performance. The prototype itself was made of concrete modules that had a L-shaped cross section with a width of 0,3 m at the top and a total height of 1,4 m from the road surface [4].

3.2 High-height noise barriers

3.2.1 Partille

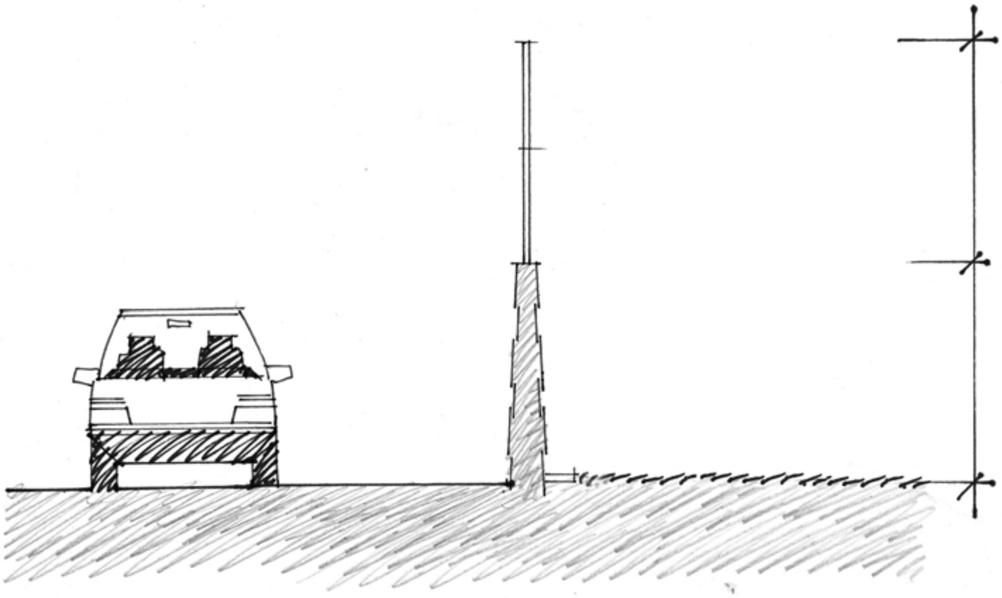

Figure 3.2: Cross section of noise barrier in Partille [6].

The European route E20 goes through Partille and has a speed limit of 80 km/h at the section which will be referred to in this thesis. This makes the road a major source of noise in the community. During the period 2005 to 2008 several noise reducing measures were taken to reduce the traffic noise from E20 in Partille such as new asphalt and new noise barriers. In one residential area a major remodeling was made with interior remodeling of the flat layout and screening between buildings to improve the soundscape in the area [5].
The noise barrier at this road section consisted of a 2 m high concrete wall with a 2 m high glass screen on top which gives the noise barrier a total height of 4 m, see fig. 3.2. The section of the noise barrier relevant to this study is estimated to be 525 m[6, 7]. In connection with this, noise studies were conducted before and after the erection of the noise barrier, with noise measurements made on the facade facing E20 [5].

The noise bariier along the residential area is part of a larger project with noise barriers along E20 which were built by Vägverket konsult AB, a subsidiary of Vägverket, currently known as Trafikverket [7].

3.2.2 Nynäsvägen

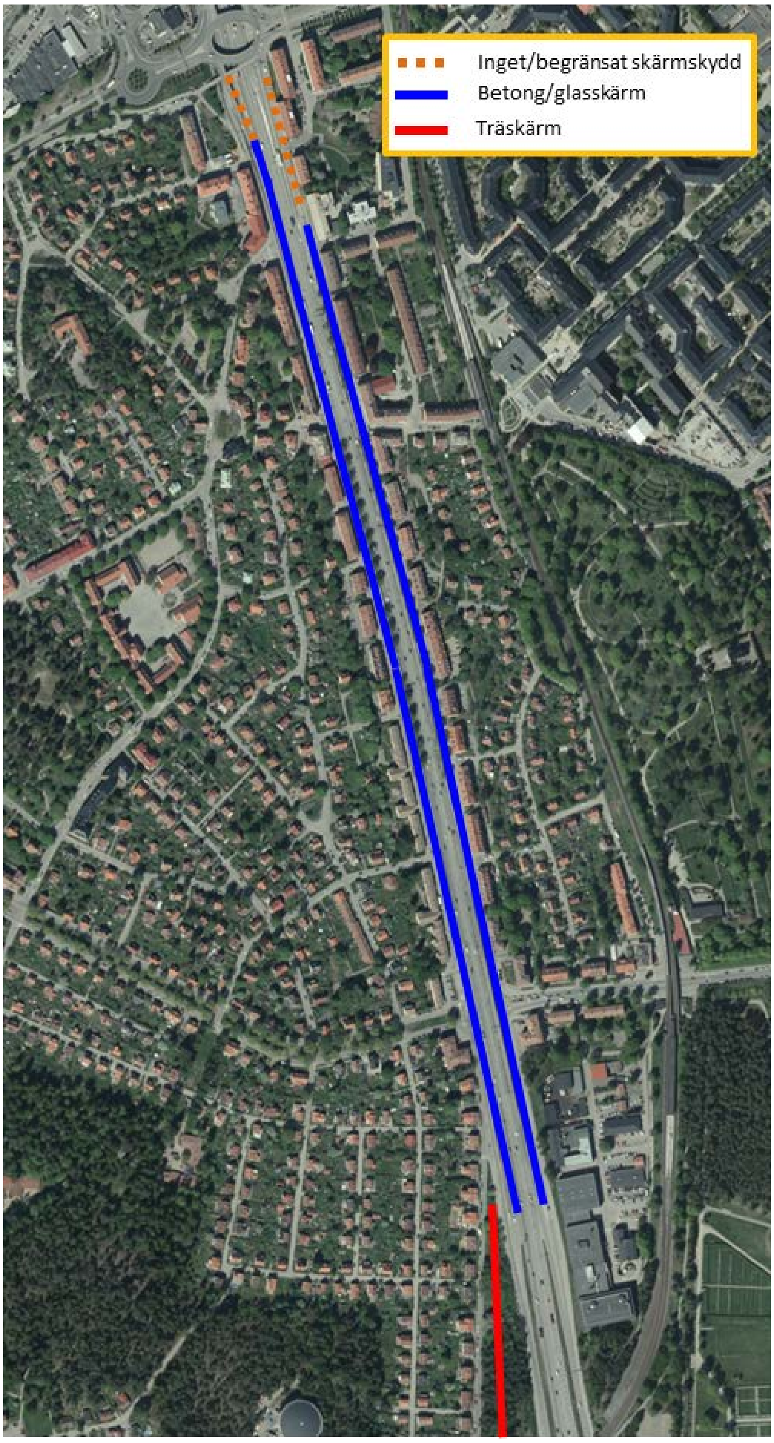

Figure 3.3: The noise barrier along Nynäsvägen [9].

Swedish national road 73, Riksväg 73, goes from Stockholm to Nynäshamn. A section of the road goes through Gamla Enskede which is located within the city limits of Stockholm. There is a residential area between Enskedevägen and Sockenvägen on both sides of Riksväg 73; this road section has a speed limit of 70 km/h. The city of Stockholm built noise barriers along this section of Riksväg 73 during 2012 and 2013. The noise barrier was 3 m high from the road surface and covers both sides of a 1.1 km long road section [8].

4
Methodology

The first part of this study was a literature study consisting of requesting public documents to find noise barriers with well documented noise responses measurements, before and after the erection of the noise barrier, and the building costs that were associated with the projects. With the projects that had sufficient measurement data and where the costs could be directly linked to the noise barriers, as opposed to being incorporated in a larger project without a specific budget for the noise barrier, data on the number of residents were requested. Finally the data was restructured as to make the three cases comparable. The common denominator in all three cases and both evaluation methods are facade levels in dB(A), being 24 hour equivalent sound levels, here denoted Leq [2, 3, 4, 5, 8].

4.1 The case studies

Due to differences in the data sets there are some variations in the procedures for the three different case studies. The goal was to get an estimate of the noise level prior to the noise barrier and how many residents had how much of a noise reduction after the noise barrier was built. (E.g. prior to the noise barrier 100 % off the residents had a noise level of 70 dB and afterwards 50 % had a 0 dB decrease and 50 % had a 5 dB decrease.) This data is then used together with the evaluation methods in section 4.2 to get the estimated health cost of doing nothing (A) and the estimated health cost after the noise barrier was built (B). The estimated health cost benefits (C) is then given by the difference between the two scenarios:

$$A - B = C$$

.

4.1.1 Nynäsvägen

The residents living in the houses facing Nynäsvägen had a noise level at or above 75 dB(A) prior to the noise barrier [9]. ASEK evaluates up to 75 dB(A) and therefore the maximal value is used throughout the Nynäsvägen calculations.
Along this section of Nynäsvägen the residential buildings consist of three story houses, housing 849 residents [10]. An assumption is made that the residents are spread out evenly between buildings and floor levels.

The measurements made after the noise barrier was built, show that the reduction was consistent with regards to floor level as shown in table 4.1 [8].

This project was financed by the city of Stockholm and the final cost was 143 million SEK(2007)[8]

Table 4.1: Effects of the noise barrier at Nynäsvägen (dB(A))

Floor	Reduction	New noise level
3	0	75
2	-4	71
1	-9	66

4.1.2 Partille

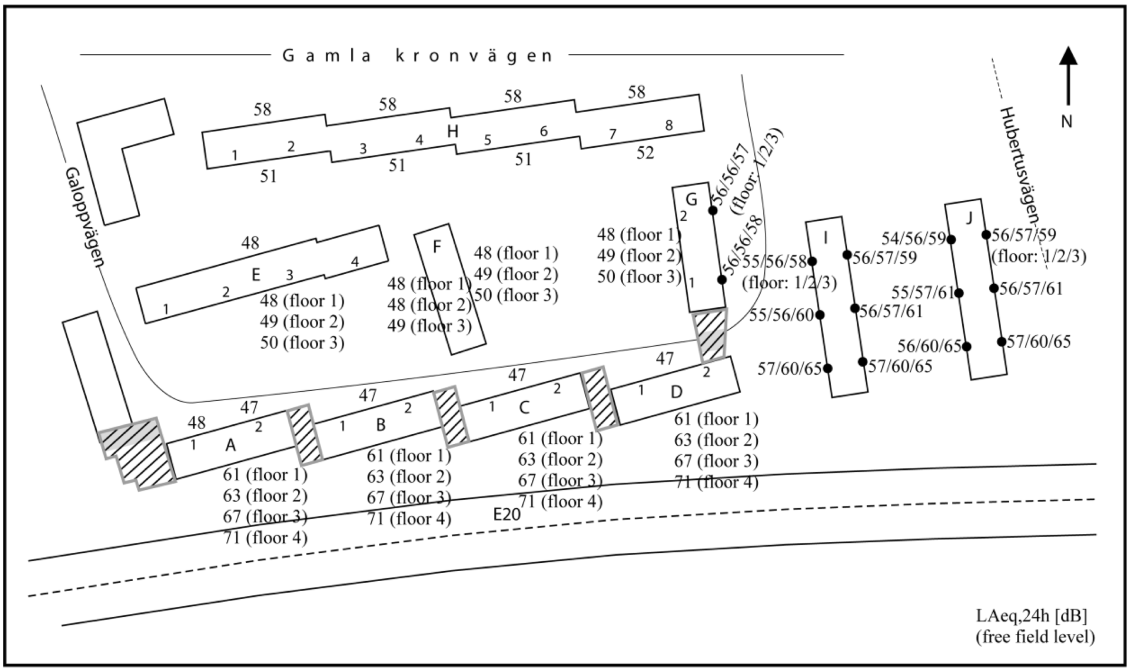

Figure 4.1: Measurements in Partille after erection of the noise barrier. The facades facing E20 on buildings A trough D are the ones referenced in this thesis [5].

In the residential area in Partille several measurements where made, however this thesis only looks at the facade levels facing E20 since the other measurements may be affected by other acoustic measures, see fig. 4.1. In these buildings there are 125 residents, and an assumption is made that the residents are spread out evenly between buildings and floor levels [10]. The reduction used for the calculation is shown in table 4.2.

Table 4.2: Effects of the noise barrier in Partille (dB(A))

Floor	Reduction	New noise level
4	0	71
3	-4	67
2	-8	63
1	-10	61

The section of noise barrier going past the residential are between Galoppvägen and E20 is part of a larger project with noise barriers in Partille along E20, constructed by Vägverket and is the northern half of what Vägverket calls stage A [7]. The development cost for the entire project was 1310955 SEK(2005) where stages A and B account for 950850 SEK(2005) [7]. The total length of stages A and B is estimated by measuring the noise barrier on a map, approximated to be 1710 m. The northern half of stage A is 525 m or circa 30 %. Taking 30 % of the development cost for stages A and B gives a development cost of 291928 SEK(2005) as an approximation [7].

The building cost for stage A was 5.6 million SEK(2005) [6] making the building cost for the northern noise barrier 2.8 million SEK(2005). Giving a total cost of 3.1 million SEK(2005)

4.1.3 Holmiaparken

The noise barrier at Holmiaparken was a temporary construction and measurements were made before and after the noise barrier was erected. The results were compared with those from computer calculations, some of which are shown in appendix A. The residents around Holmiaparken had facade levels ranging from 53 to 69 dB. These lower values, compared to Partille and Nynäsvägen, can be due to that the speed limit on Drottningholmsvägen going past Holmiaparken is lower, 50 km/h. This also gives several values below 50 dB(A) after the noise barrier was erected, which according to both ASEK and HEATCO means that there are no health related costs associated with living there, so all values at or below 50 dB(A) are considered as null costs in the cost calculations [2, 3]. There are five buildings around Holmiaparken with four, five and eleven storeys and a total of 300 residents [10]. Due to the difference in number of storeys, the number of residents for each building is kept separate and an assumption is made that the residents are spread out evenly between floor levels. Then each of the 445 calculated values from appendix A are weighted:

$$\text{weighting factor} = \frac{\text{residents in the building}}{\text{number of data points for the building}}$$

Since the noise barrier at Holmiaparken was a prototype of concrete blocks the cost aspect will be divided in to two examples; a permanent fixture similar to the noise barriers at Nynäsvägen and Partille and a concrete block model currently available from retailers.

4.1.3.1 Permanent fixture

A low-height noise barrier was built at Liljeholmsbron in Stockholm and that budget is used as a price estimate for the noise barrier at Holmiaparken. The noise barrier at Liljeholmsbron is of the same height as the noise barrier at Holmiaparken. The final price for the noise barrier was 1770000 SEK(2017), which gives a price of 14750 SEK(2017)/m. Since the project went over budget, the price of 14750 SEK(2017)/m is assumed to be high enough to cover uncertainties. The total length of the barrier at Holmiaparken was 85 meters giving an estimated cost of 1253750 SEK(2017), using 14750 SEK(2017)/m from the project at Liljeholmsbron.

4.1.3.2 Concrete block model

With a low-height noise barrier it is possible to avoid a permanent fixture and use prefabricated concrete block elements which need little or no foundation work before erecting the noise barrier. This reduces the cost of construction and a model of this is used as a price estimate for Holmiaparken.

The price estimate is for SOUND BLOCK® from Z-Bloc Norden AB. A 140 cm high noise barrier, as the one used at Holmiaparken, costs 5500 SEK(2017)/m; this including installation. That gives an estimated price for the noise barrier at Holmiaparken of 467500 SEK(2017) [11].

Figure 4.2: The SOUND BLOCK® from Z-Block Norden AB[11]

4.2 Evaluation methods

Both ASEK and HEATCO are based on meta studies and the big cost differences between the two methods can be attributed to the use of different source material [2, 3]. Both methods are compared visually in fig 4.3, where the differences between ASEK's exponential model and HEATCO's linear model are shown to diverge with higher noise levels. Both evaluation methods consider measurable health costs, such as increased risk of cardiovascular diseases, and costs that can be linked to annoyance, e.g. one sub-study referred to in both reports compare housing prices to noise level to get a value of annoyance. All costs have been adjusted for inflation to SEK (2017)

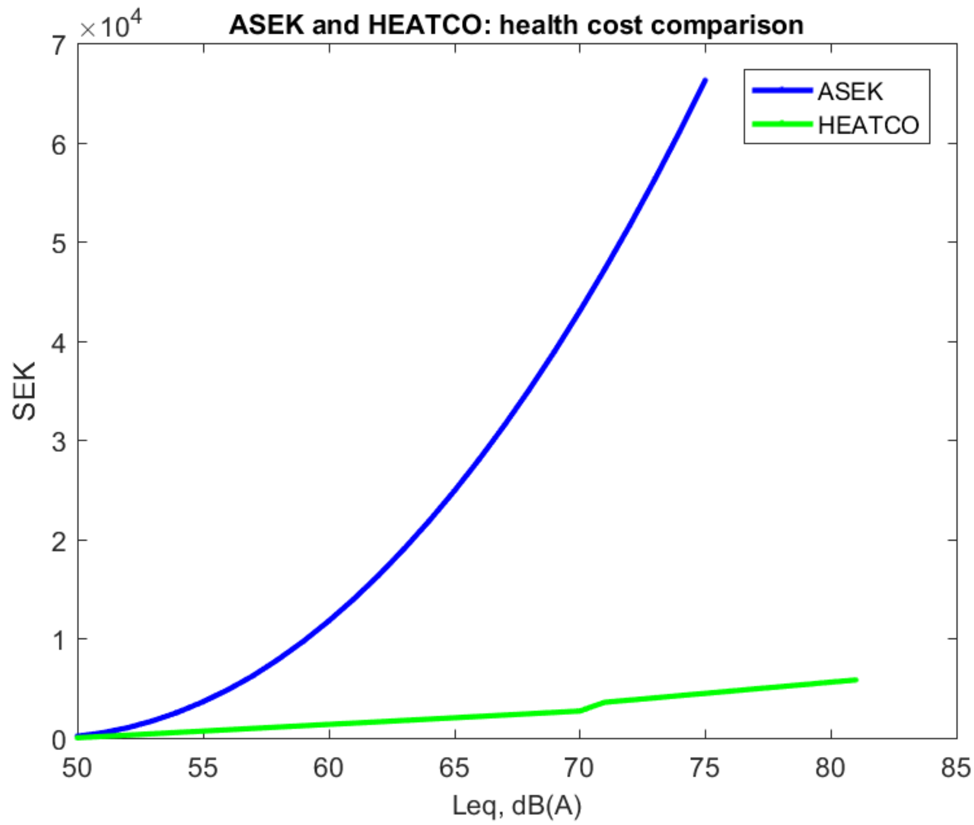

Figure 4.3: Comparison of ASEK and HEATCO: The health costs per person and year with regards to noise exposure level. Adjusted for inflation (2017).

4.3 Results

One cost that is not considered in this thesis is maintenance of the noise barriers. Since noise barriers often are built by the state or a municipality, at least in Sweden, the cost for maintenance is often included in the regions other maintenance work. Therefore, no cost figures were considered in any of the case studies. However, the Swedish Transport Administration has its own estimate at an average of 10 SEK/m² of noise barrier per year [12]. This is supposed to cover things such as cleaning, window cleaning, repainting (wooden barriers only) and graffiti removal. With this estimate the yearly maintenance cost for the projects would be 66000 SEK for Nynäsvägen, 21000 SEK for Partille and 1190 SEK for Holmiaparken.

4.3.1 Nynäsvägen

The total construction cost for the noise barrier at Nynäsvägen, adjusted for inflation, was 158,71 million SEK(2017) and it is a one time cost. The estimated cost benefit according to ASEK is 12,14 million SEK(2017) per year which is 7,65% of the building cost. The estimated cost benefit according to HEATCO is 683893 SEK(2017) per year which is 0,43 % of the building cost [8, 13, 14].

4.3.2 Partille

The total construction cost for the noise barrier in Partille, adjusted for inflation, was 3,55 million SEK(2017) and it is a one time cost. The estimated cost benefit according to ASEK is 2,41 million SEK(2017) per year which is 68% of the building cost. The estimated cost benefit according to HEATCO is 163322 SEK(2017) per year which is 4,60% of the building cost [6, 7, 13, 14].

4.3.3 Holmiaparken

The two cost estimates used for the noise barrier at Holmiaparken vary in building cost but do not affect the benefit estimate for neither ASEK nor HEATCO.

4.3.3.1 Permanent fixture

The total construction cost for the noise barrier at Holmiaparken, adjusted for inflation, would be 1253750 SEK(2017) using the estimate from the noise barrier at Liljeholmsbron and it is a one time cost. The estimated cost benefit according to ASEK is 540766 SEK(2017) per year which is 43,13% of the building cost. The estimated cost benefit according to HEATCO is 46119 SEK(2017) per year which is 3,68% of the building cost.

4.3.3.2 Concrete block model

The total construction cost for the noise barrier at Holmiaparken, adjusted for inflation, would be 467500 SEK(2017) using the SOUND BLOCK® and it is a one time cost. The estimated cost benefit according to ASEK is 540766 SEK(2017) per year which is 115,67% of the building cost. The estimated cost benefit according to HEATCO is 46119 SEK(2017) per year which is 9,86% of the building cost.

4.4 Discussion

The cases chosen in this thesis are biased, since they were chosen as to be a presumed bad case and a presumed good case, as to get a broad range of how the evaluation models work and how the low-height noise barrier at Holmiaparken stands against existing noise barriers.

The noise barrier at Nynäsvägen had several complaints in local news papers in Stockholm. The complaints concerned the unusually high price for the project and also the limited effect it had especially in regards to the proportion of the residents effected. The initial calculations predicted a 14 dB(A) decrease of Leq facade levels and a wide spread decrease of between 5 and 8 dB(A) in the surrounding residential area. The actual outcome was at most a 10 dB(A) decrease of facade levels and an almost immeasurable decrease in the surrounding residential area [8, 9].

The noise barrier in Partille on the other hand met the set requirements and even surpassed the requirements in parts [5, 6].

The average price per meter for these three noise barriers differs from 5500 SEK/m to 72000 SEK/m and the lengths of the nose barriers differ from 85 m to 2200 m. The differences in length and price for the noise barriers have not been taken into account and might affect the results. More noise barriers has to be included in a future study to ensure reliability.

There is a difference between the facade silhouettes between the cases. Since the case at Holmiaparken was given at the start of this project, getting a baseline from other cases with similar silhouettes would have been hard especially since uneven silhouettes is something that most studies have tried to avoid. The uneven silhouette at Holmiaparken gives the case a broader distribution of distances between road and facade which gives some values further away from the noise source, whose counterparts have been excluded from the other cases. However this is assumed to be a minor influence on the economic aspect since these values were close to the lower threshold values, or below, for both ASEK and HEATCO.

The aspect of Holmiaparken using calculated noise levels and the other cases using measured values could also be a source of error but is considered a minor one in this thesis.

The cost benefit from building noise barriers are much higher according to ASEK than HEATCO, more than ten times as high in all three cases. According to ASEK all the noise barriers pay for themselves within a few years as shown in table 4.3. HEATCO however needs a life span of a few decades for the noise barriers in Partille and Holmiaparken to pay for themselves and more than 200 years for the noise barrier at Nynäsvägen to pay for itself. As a comparison, Malmö stad has a minimum life span of 40 years for all noise barriers [15]. This is without increased traffic loads and without adjustment for inflation.

Table 4.3: Number of years before the projects pay for them selves

	ASEK	**HEATCO**
Holmiaparken - SOUND BLOCK®	0,9	10,1
Partille	1,5	21,7
Holmiaparken - Permanent fixture	2,3	27,2
Nynäsvägen	13,1	217,4

Both ASEK and HEATCO focus on the indoor living conditions with regards to the facade levels but neither of the models take into consideration that a noise barrier can have a positive effect on the outdoor environment as well, and that it can give a positive health effect to have lower noise levels in outdoor environments. Parks, playgrounds, walkways and bicycle lanes are just a few examples of areas that have benefited from the three noise barriers in this thesis but is not covered by the ASEK and HEATCO models. Creating an evaluation method for outdoor environments as well would be useful to show the importance of our parks and leisure areas.

Even though neither ASEK nor HEATCO has an actual model to calculate a cost benefit of an outdoor environment, ASEK proposes that 50% of the health related costs can be attributed to the outdoor environment which gives an indication of how important the outdoor environment is for a sustainable urban development.

The noise barrier at Nynäsvägen differed so much from the two other cases because of the big difference in building cost. The building cost per meter for the noise barriers were 5500 SEK/m for Holmiaparkens concrete block element solution, 14750 SEK/m for Holmiaparkens permanent fixture, circa 6800 SEK/m for the noise barrier in Partille where as the building cost for the noise barrier along Nynäsvägen was circa 72000 SEK/m.

A few of the reasons for the noise barrier at Nynäsvägen costing more than the noise barrier in Partille is that it spans several traffic crossings and bicycle lanes and that it had to be built considering trees planted along the road. The project also demanded that the bicycle lanes and connected traffic roads got new street lighting due to the noise barrier obscuring the existing lighting from the main road. There was also a followup study of the effectiveness of the noise barrier which included noise measurements and a survey questionnaire.

Even with the assumption that only half of the building cost was spent on actually building the noise barrier it was still a much more expensive noise barrier and it does not change the main outcome of this study.

5
Conclusion

A low-height noise barrier like the one at Holmiaparken can have a good impact on the noise levels in an urban environment and even surpass the cost effectiveness of high-height noise barriers, with regards to the cost benefit models ASEK and HEATCO, when using a concrete block element solution. Although the noise barrier at Holmiaparken was lower, giving a low average noise reduction per receiver, the low building cost made it comparable to the high-height noise barriers with regards to the cost efficiency of both ASEK and HEATCO.

When looking at the ASEK and HEATCO models, the low building cost of the noise barrier at Holmiaparken and the larger amount of residents benefiting from the noise reduction made the noise barrier at Holmiaparken, which had an average noise reduction for the residents of 1.1 dB(A), comparable to the noise barrier in Partille, which had an average noise reduction for the residents of 5.5 dB(A). Depending on the construction method, the low-height noise barrier at Holmiaparken is comparable to the most cost efficient high-height noise barrier and with the concrete block element solution it even surpassed the high-height noise barriers.

With the high health cost benefits associated with these noise barriers, especially with regards to the ASEK model, a low-height noise barrier can be a good compliment to the more common high-height noise barriers and might even be more cost efficient in some cases. And since a low-height noise barrier can be built in places where a high-height noise barrier would be an obstacle or aesthetically unpleasing it can be a good acoustical tool for a sustainable urban development.

This thesis has only compared one low-height noise barrier and two high-height noise barriers to see the plausibility of a low-height noise barrier being more cost efficient than a high-height noise barrier. To further ensure the accuracy of this, more noise barriers have to be compared and evaluated with the HEATCO and ASEK models.

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A
Data from Holmiaparken

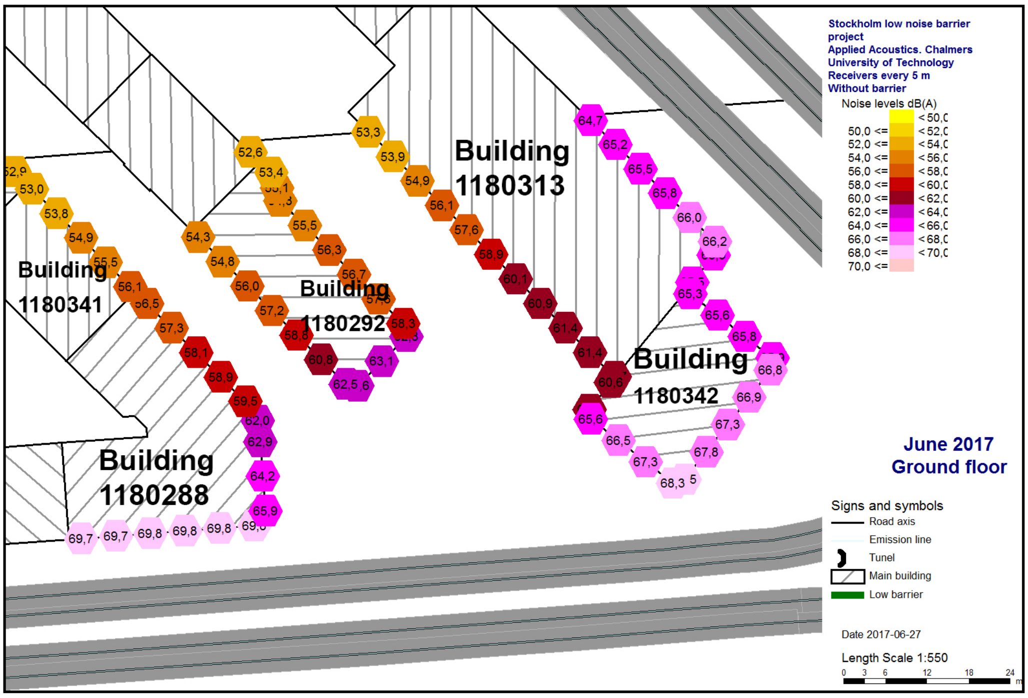

Figure A.1: Buildings at Holmiaparken

The average reduction for each reciver was 1.1 dB(A).

Table A.1: Calculated data from Holmiaparken

Receiver	Fl	Dir	with barrier Leq,24 dB(A)	without barrier Leq,24 dB(A)	difference
Building1180288	GF	S	69,6	69,7	**0,1**
Building1180288	F 1	S	69,2	69,2	**0**
Building1180288	F 2	S	68,6	68,6	**0**
Building1180288	F 3	S	68	68	**0**
Building1180288	F 4	S	67,6	67,6	**0**
Building1180288	GF	S	69,6	69,7	**0,1**

Receiver	Fl	Dir	with barrier	without barrier	difference
			Leq,24 dB(A)	Leq,24 dB(A)	
Building1180288	F 1	S	69,1	69,1	**0**
Building1180288	F 2	S	68,6	68,6	**0**
Building1180288	F 3	S	68	68	**0**
Building1180288	F 4	S	67,6	67,6	**0**
Building1180288	GF	S	69,6	69,8	**0,2**
Building1180288	F 1	S	69,1	69,1	**0**
Building1180288	F 2	S	68,6	68,6	**0**
Building1180288	F 3	S	68	68,1	**0,1**
Building1180288	F 4	S	67,6	67,6	**0**
Building1180288	GF	S	69,6	69,8	**0,2**
Building1180288	F 1	S	69	69,1	**0,1**
Building1180288	F 2	S	68,6	68,6	**0**
Building1180288	F 3	S	68	68	**0**
Building1180288	F 4	S	67,6	67,6	**0**
Building1180288	GF	S	69,7	69,8	**0,1**
Building1180288	F 1	S	69,1	69,2	**0,1**
Building1180288	F 2	S	68,7	68,7	**0**
Building1180288	F 3	S	68,1	68,1	**0**
Building1180288	F 4	S	67,6	67,6	**0**
Building1180288	GF	S	69,5	69,8	**0,3**
Building1180288	F 1	S	69,1	69,3	**0,2**
Building1180288	F 2	S	68,7	68,7	**0**
Building1180288	F 3	S	68,1	68,1	**0**
Building1180288	F 4	S	67,7	67,6	**-0,1**
Building1180288	GF	E	64,4	65,9	**1,5**
Building1180288	F 1	E	65	65,7	**0,7**
Building1180288	F 2	E	65,1	65,5	**0,4**
Building1180288	F 3	E	65,1	65,2	**0,1**
Building1180288	F 4	E	64,8	64,9	**0,1**
Building1180288	GF	E	62,1	64,2	**2,1**
Building1180288	F 1	E	63,3	64,3	**1**
Building1180288	F 2	E	63,8	64,3	**0,5**
Building1180288	F 3	E	63,9	64,3	**0,4**
Building1180288	F 4	E	64	64,2	**0,2**
Building1180288	GF	E	60,3	62,9	**2,6**
Building1180288	F 1	E	61,7	63,1	**1,4**
Building1180288	F 2	E	62,5	63,3	**0,8**
Building1180288	F 3	E	62,7	63,3	**0,6**
Building1180288	F 4	E	62,9	63,3	**0,4**
Building1180288	GF	E	59,2	62	**2,8**
Building1180288	F 1	E	60,5	62,1	**1,6**
Building1180288	F 2	E	61,5	62,4	**0,9**
Building1180288	F 3	E	61,9	62,5	**0,6**

Receiver	Fl	Dir	with barrier	without barrier	difference
			Leq,24 dB(A)	Leq,24 dB(A)	
Building1180288	F 4	E	62,1	62,6	**0,5**
Building1180288	GF	NE	55,2	59,5	**4,3**
Building1180288	F 1	NE	58	59,9	**1,9**
Building1180288	F 2	NE	59,1	60,1	**1**
Building1180288	F 3	NE	59,6	60,3	**0,7**
Building1180288	F 4	NE	59,8	60,4	**0,6**
Building1180288	GF	NE	54,2	58,9	**4,7**
Building1180288	F 1	NE	57,4	59,4	**2**
Building1180288	F 2	NE	58,4	59,7	**1,3**
Building1180288	F 3	NE	59,2	60	**0,8**
Building1180288	F 4	NE	59,5	60,1	**0,6**
Building1180288	GF	NE	53,4	58,1	**4,7**
Building1180288	F 1	NE	56,6	58,6	**2**
Building1180288	F 2	NE	57,5	58,9	**1,4**
Building1180288	F 3	NE	58,4	59,3	**0,9**
Building1180288	F 4	NE	58,8	59,5	**0,7**
Building1180288	GF	NE	52,8	57,3	**4,5**
Building1180288	F 1	NE	56,2	58,1	**1,9**
Building1180288	F 2	NE	56,9	58,2	**1,3**
Building1180288	F 3	NE	57,6	58,6	**1**
Building1180288	F 4	NE	58,2	58,8	**0,6**
Building1180288	GF	NE	51,9	56,5	**4,6**
Building1180288	F 1	NE	55,5	57,3	**1,8**
Building1180288	F 2	NE	56,2	57,5	**1,3**
Building1180288	F 3	NE	56,9	57,9	**1**
Building1180288	F 4	NE	57,5	58,2	**0,7**
Building1180292	GF	SE	59,8	63,6	**3,8**
Building1180292	F 1	SE	62,2	63,8	**1,6**
Building1180292	F 2	SE	63	64	**1**
Building1180292	F 3	SE	63,6	64,2	**0,6**
Building1180292	F 4	SE	63,8	64,2	**0,4**
Building1180292	GF	SE	58,6	63,1	**4,5**
Building1180292	F 1	SE	61,6	63,5	**1,9**
Building1180292	F 2	SE	62,5	63,7	**1,2**
Building1180292	F 3	SE	63,2	63,9	**0,7**
Building1180292	F 4	SE	63,5	63,9	**0,4**
Building1180292	GF	SE	58	62,8	**4,8**
Building1180292	F 1	SE	61,4	63,3	**1,9**
Building1180292	F 2	SE	62,3	63,5	**1,2**
Building1180292	F 3	SE	62,8	63,7	**0,9**
Building1180292	F 4	SE	63,1	63,8	**0,7**
Building1180292	GF	NE	52,4	58,3	**5,9**
Building1180292	F 1	NE	57,7	59,2	**1,5**

Receiver	Fl	Dir	with barrier Leq,24 dB(A)	without barrier Leq,24 dB(A)	difference
Building1180292	F 2	NE	58,6	59,7	**1,1**
Building1180292	F 3	NE	59	59,8	**0,8**
Building1180292	F 4	NE	59,2	60	**0,8**
Building1180292	GF	NE	51,5	57,6	**6,1**
Building1180292	F 1	NE	56,9	58,6	**1,7**
Building1180292	F 2	NE	57,8	58,9	**1,1**
Building1180292	F 3	NE	58,2	59,1	**0,9**
Building1180292	F 4	NE	58,5	59,3	**0,8**
Building1180292	GF	NE	49,9	56,7	**6,8**
Building1180292	F 1	NE	56	57,7	**1,7**
Building1180292	F 2	NE	57	58,2	**1,2**
Building1180292	F 3	NE	57,5	58,3	**0,8**
Building1180292	F 4	NE	57,7	58,5	**0,8**
Building1180292	GF	NE	49,3	56,3	**7**
Building1180292	F 1	NE	55,3	57,2	**1,9**
Building1180292	F 2	NE	56,3	57,6	**1,3**
Building1180292	F 3	NE	56,7	57,8	**1,1**
Building1180292	F 4	NE	57,1	57,9	**0,8**
Building1180292	GF	NE	48,5	55,5	**7**
Building1180292	F 1	NE	54,3	56,5	**2,2**
Building1180292	F 2	NE	55,5	56,8	**1,3**
Building1180292	F 3	NE	56	57,1	**1,1**
Building1180292	F 4	NE	56,4	57,3	**0,9**
Building1180292	GF	NE	47,9	54,8	**6,9**
Building1180292	F 1	NE	53,7	55,8	**2,1**
Building1180292	F 2	NE	54,6	56	**1,4**
Building1180292	F 3	NE	55,1	56,2	**1,1**
Building1180292	F 4	NE	55,6	56,4	**0,8**
Building1180292	GF	SE	48,5	55,1	**6,6**
Building1180292	F 1	SE	54	56	**2**
Building1180292	F 2	SE	54,9	56,3	**1,4**
Building1180292	F 3	SE	55,2	56,4	**1,2**
Building1180292	F 4	SE	55,5	56,6	**1,1**
Building1180292	GF	NE	46,5	53,4	**6,9**
Building1180292	F 1	NE	51,7	54	**2,3**
Building1180292	F 2	NE	52,9	54,1	**1,2**
Building1180292	F 3	NE	53,3	54,3	**1**
Building1180292	F 4	NE	53,8	54,6	**0,8**
Building1180292	GF	SW	50,5	54,3	**3,8**
Building1180292	F 1	SW	51,4	54,1	**2,7**
Building1180292	F 2	SW	52	54,3	**2,3**
Building1180292	F 3	SW	53,2	54,7	**1,5**
Building1180292	F 4	SW	54,2	55,2	**1**

Receiver	**Fl**	**Dir**	**with barrier Leq,24 dB(A)**	**without barrier Leq,24 dB(A)**	**difference**
Building1180292	GF	SW	51,4	54,8	**3,4**
Building1180292	F 1	SW	52,2	54,6	**2,4**
Building1180292	F 2	SW	53,1	54,9	**1,8**
Building1180292	F 3	SW	54,3	55,5	**1,2**
Building1180292	F 4	SW	55,1	55,8	**0,7**
Building1180292	GF	SW	53,1	56	**2,9**
Building1180292	F 1	SW	53,8	55,8	**2**
Building1180292	F 2	SW	54,8	56,2	**1,4**
Building1180292	F 3	SW	55,9	56,8	**0,9**
Building1180292	F 4	SW	56,6	57	**0,4**
Building1180292	GF	SW	54,4	57,2	**2,8**
Building1180292	F 1	SW	55,4	57	**1,6**
Building1180292	F 2	SW	56,3	57,5	**1,2**
Building1180292	F 3	SW	57,2	57,9	**0,7**
Building1180292	F 4	SW	57,8	58,2	**0,4**
Building1180292	GF	SW	56,4	58,8	**2,4**
Building1180292	F 1	SW	57,2	58,7	**1,5**
Building1180292	F 2	SW	58,2	59,2	**1**
Building1180292	F 3	SW	59	59,6	**0,6**
Building1180292	F 4	SW	59,4	59,7	**0,3**
Building1180292	GF	SW	58,1	60,8	**2,7**
Building1180292	F 1	SW	59	60,7	**1,7**
Building1180292	F 2	SW	59,8	61	**1,2**
Building1180292	F 3	SW	60,6	61,2	**0,6**
Building1180292	F 4	SW	60,9	61,3	**0,4**
Building1180292	GF	SW	59	62,5	**3,5**
Building1180292	F 1	SW	60,9	62,7	**1,8**
Building1180292	F 2	SW	61,8	62,9	**1,1**
Building1180292	F 3	SW	62,4	63	**0,6**
Building1180292	F 4	SW	62,6	63	**0,4**
Building1180313	GF	SW	47,9	53,3	**5,4**
Building1180313	F 1	SW	49,8	53,2	**3,4**
Building1180313	F 2	SW	50,7	53,1	**2,4**
Building1180313	F 3	SW	51,3	53,3	**2**
Building1180313	F 4	SW	51,9	53,6	**1,7**
Building1180313	GF	SW	48	53,9	**5,9**
Building1180313	F 1	SW	50,1	53,7	**3,6**
Building1180313	F 2	SW	51,2	53,7	**2,5**
Building1180313	F 3	SW	51,9	53,8	**1,9**
Building1180313	F 4	SW	52,7	54,1	**1,4**
Building1180313	GF	SW	48,3	54,9	**6,6**
Building1180313	F 1	SW	51	54,6	**3,6**
Building1180313	F 2	SW	52	54,8	**2,8**

Receiver	Fl	Dir	with barrier Leq,24 dB(A)	without barrier Leq,24 dB(A)	difference
Building1180313	F 3	SW	52,9	55,1	**2,2**
Building1180313	F 4	SW	53,8	55,5	**1,7**
Building1180313	GF	SW	48,7	56,1	**7,4**
Building1180313	F 1	SW	52,8	55,9	**3,1**
Building1180313	F 2	SW	53,6	56,1	**2,5**
Building1180313	F 3	SW	54,7	56,5	**1,8**
Building1180313	F 4	SW	55,5	56,9	**1,4**
Building1180313	GF	SW	51,1	57,6	**6,5**
Building1180313	F 1	SW	55,2	57,9	**2,7**
Building1180313	F 2	SW	56	58,1	**2,1**
Building1180313	F 3	SW	56,9	58,2	**1,3**
Building1180313	F 4	SW	57,4	58,5	**1,1**
Building1180313	GF	SW	53,7	58,9	**5,2**
Building1180313	F 1	SW	56,9	59,1	**2,2**
Building1180313	F 2	SW	57,6	59,3	**1,7**
Building1180313	F 3	SW	58,4	59,6	**1,2**
Building1180313	F 4	SW	59	59,8	**0,8**
Building1180313	GF	SW	54,8	60,1	**5,3**
Building1180313	F 1	SW	58,7	60,4	**1,7**
Building1180313	F 2	SW	59,4	60,7	**1,3**
Building1180313	F 3	SW	59,9	61	**1,1**
Building1180313	F 4	SW	60,3	61,1	**0,8**
Building1180313	GF	SW	55,4	60,9	**5,5**
Building1180313	F 1	SW	59,3	61,3	**2**
Building1180313	F 2	SW	60,3	61,5	**1,2**
Building1180313	F 3	SW	60,7	61,7	**1**
Building1180313	F 4	SW	61,1	61,7	**0,6**
Building1180313	GF	SW	55,2	61,4	**6,2**
Building1180313	F 1	SW	59,2	61,5	**2,3**
Building1180313	F 2	SW	60,3	61,8	**1,5**
Building1180313	F 3	SW	60,6	61,9	**1,3**
Building1180313	F 4	SW	61	61,8	**0,8**
Building1180313	GF	SW	54,9	61,4	**6,5**
Building1180313	F 1	SW	59,1	61,5	**2,4**
Building1180313	F 2	SW	60	61,7	**1,7**
Building1180313	F 3	SW	60,6	61,6	**1**
Building1180313	F 4	SW	60,9	61,6	**0,7**
Building1180313	GF	SW	56,3	61,7	**5,4**
Building1180313	F 1	SW	59,8	61,6	**1,8**
Building1180313	F 2	SW	60,2	61,4	**1,2**
Building1180313	F 3	SW	60,7	61,5	**0,8**
Building1180313	F 4	SW	61,1	61,7	**0,6**
Building1180313	GF	SE	65,4	65,5	**0,1**

Receiver	**Fl**	**Dir**	**with barrier**	**without barrier**	**difference**
			Leq,24 dB(A)	**Leq,24 dB(A)**	
Building1180313	F 1	SE	64,6	64,7	**0,1**
Building1180313	F 2	SE	64,3	64,4	**0,1**
Building1180313	F 3	SE	64	64,1	**0,1**
Building1180313	F 4	SE	63,7	63,7	**0**
Building1180313	GF	SE	65,8	65,9	**0,1**
Building1180313	F 1	SE	65,2	65,2	**0**
Building1180313	F 2	SE	64,9	64,9	**0**
Building1180313	F 3	SE	64,5	64,5	**0**
Building1180313	F 4	SE	64,1	64,1	**0**
Building1180313	GF	NE	66	66,2	**0,2**
Building1180313	F 1	NE	65,2	65,3	**0,1**
Building1180313	F 2	NE	64,7	64,8	**0,1**
Building1180313	F 3	NE	64,2	64,2	**0**
Building1180313	F 4	NE	63,6	63,6	**0**
Building1180313	GF	NE	65,8	66	**0,2**
Building1180313	F 1	NE	65	65,2	**0,2**
Building1180313	F 2	NE	64,5	64,6	**0,1**
Building1180313	F 3	NE	64	64	**0**
Building1180313	F 4	NE	63,4	63,4	**0**
Building1180313	GF	NE	65,5	65,8	**0,3**
Building1180313	F 1	NE	64,8	64,9	**0,1**
Building1180313	F 2	NE	64,3	64,4	**0,1**
Building1180313	F 3	NE	63,7	63,8	**0,1**
Building1180313	F 4	NE	63,1	63,1	**0**
Building1180313	GF	NE	65,2	65,5	**0,3**
Building1180313	F 1	NE	64,5	64,7	**0,2**
Building1180313	F 2	NE	64	64,1	**0,1**
Building1180313	F 3	NE	63,6	63,6	**0**
Building1180313	F 4	NE	63	63	**0**
Building1180313	GF	NE	64,9	65,2	**0,3**
Building1180313	F 1	NE	64,1	64,3	**0,2**
Building1180313	F 2	NE	63,8	63,9	**0,1**
Building1180313	F 3	NE	63,3	63,3	**0**
Building1180313	F 4	NE	62,8	62,8	**0**
Building1180313	GF	NE	64,4	64,7	**0,3**
Building1180313	F 1	NE	63,9	64,2	**0,3**
Building1180313	F 2	NE	63,5	63,7	**0,2**
Building1180313	F 3	NE	63,1	63,2	**0,1**
Building1180313	F 4	NE	62,6	62,7	**0,1**
Building1180341	GF	NE	47,7	53	**5,3**
Building1180341	F 1	NE	51,8	53,8	**2**
Building1180341	F 2	NE	52,5	54,1	**1,6**
Building1180341	F 3	NE	53	54,3	**1,3**

Receiver	**Fl**	**Dir**	**with barrier**	**without barrier**	**difference**
			Leq,24 dB(A)	**Leq,24 dB(A)**	
Building1180341	GF	NE	49,3	53,8	**4,5**
Building1180341	F 1	NE	52,9	54,5	**1,6**
Building1180341	F 2	NE	53,7	54,8	**1,1**
Building1180341	F 3	NE	54,2	55,2	**1**
Building1180341	GF	NE	50,2	54,9	**4,7**
Building1180341	F 1	NE	54	55,6	**1,6**
Building1180341	F 2	NE	54,8	56	**1,2**
Building1180341	F 3	NE	55,2	56,2	**1**
Building1180341	GF	NE	51	55,5	**4,5**
Building1180341	F 1	NE	54,7	56,2	**1,5**
Building1180341	F 2	NE	55,3	56,5	**1,2**
Building1180341	F 3	NE	55,7	56,8	**1,1**
Building1180341	GF	NE	51,7	56,1	**4,4**
Building1180341	F 1	NE	55,2	57,1	**1,9**
Building1180341	F 2	NE	55,8	57,3	**1,5**
Building1180341	F 3	NE	56,4	57,6	**1,2**
Building1180342	GF	NW	56,4	61,5	**5,1**
Building1180342	F 1	NW	59,9	61,4	**1,5**
Building1180342	F 2	NW	60,3	61,2	**0,9**
Building1180342	F 3	NW	60,8	61,4	**0,6**
Building1180342	F 4	NW	61	61,5	**0,5**
Building1180342	F 5	NW	60,9	61,2	**0,3**
Building1180342	F 6	NW	60,3	60,5	**0,2**
Building1180342	F 7	NW	60	60	**0**
Building1180342	F 8	NW	59,7	59,7	**0**
Building1180342	F 9	NW	59,3	59,3	**0**
Building1180342	F 10	NW	59,1	59,1	**0**
Building1180342	GF	NW	55,4	60,6	**5,2**
Building1180342	F 1	NW	58,9	60,5	**1,6**
Building1180342	F 2	NW	59,3	60,4	**1,1**
Building1180342	F 3	NW	59,8	60,6	**0,8**
Building1180342	F 4	NW	60,2	60,8	**0,6**
Building1180342	F 5	NW	59,5	60	**0,5**
Building1180342	F 6	NW	59,5	59,9	**0,4**
Building1180342	F 7	NW	59,3	59,6	**0,3**
Building1180342	F 8	NW	59,1	59,2	**0,1**
Building1180342	F 9	NW	58,7	58,9	**0,2**
Building1180342	F 10	NW	58,4	58,5	**0,1**
Building1180342	GF	NE	65,1	65,3	**0,2**
Building1180342	F 1	NE	64,4	64,5	**0,1**
Building1180342	F 2	NE	64,1	64,1	**0**
Building1180342	F 3	NE	63,8	63,8	**0**
Building1180342	F 4	NE	63,4	63,5	**0,1**

Receiver	Fl	Dir	with barrier	without barrier	difference
			Leq,24 dB(A)	Leq,24 dB(A)	
Building1180342	F 5	NE	61,8	61,9	**0,1**
Building1180342	F 6	NE	60,8	60,8	**0**
Building1180342	F 7	NE	60,5	60,5	**0**
Building1180342	F 8	NE	60,2	60,2	**0**
Building1180342	F 9	NE	59,9	59,9	**0**
Building1180342	F 10	NE	59,6	59,6	**0**
Building1180342	GF	NE	65,5	65,6	**0,1**
Building1180342	F 1	NE	64,7	64,8	**0,1**
Building1180342	F 2	NE	64,5	64,5	**0**
Building1180342	F 3	NE	64,2	64,2	**0**
Building1180342	F 4	NE	63,8	63,8	**0**
Building1180342	F 5	NE	63,2	63,2	**0**
Building1180342	F 6	NE	61,6	61,6	**0**
Building1180342	F 7	NE	61	61	**0**
Building1180342	F 8	NE	60,5	60,5	**0**
Building1180342	F 9	NE	60,2	60,1	**-0,1**
Building1180342	F 10	NE	59,9	59,9	**0**
Building1180342	GF	NE	65,6	65,8	**0,2**
Building1180342	F 1	NE	65	65,1	**0,1**
Building1180342	F 2	NE	64,7	64,8	**0,1**
Building1180342	F 3	NE	64,3	64,3	**0**
Building1180342	F 4	NE	63,9	63,9	**0**
Building1180342	F 5	NE	63,4	63,4	**0**
Building1180342	F 6	NE	62,2	62,2	**0**
Building1180342	F 7	NE	61,4	61,4	**0**
Building1180342	F 8	NE	60,8	60,8	**0**
Building1180342	F 9	NE	60,4	60,4	**0**
Building1180342	F 10	NE	60,1	60,1	**0**
Building1180342	GF	NE	65,8	65,9	**0,1**
Building1180342	F 1	NE	65,2	65,3	**0,1**
Building1180342	F 2	NE	65	65	**0**
Building1180342	F 3	NE	64,5	64,5	**0**
Building1180342	F 4	NE	64	64	**0**
Building1180342	F 5	NE	63,5	63,5	**0**
Building1180342	F 6	NE	62,6	62,6	**0**
Building1180342	F 7	NE	61,7	61,7	**0**
Building1180342	F 8	NE	61,2	61,2	**0**
Building1180342	F 9	NE	60,8	60,7	**-0,1**
Building1180342	F 10	NE	60,4	60,4	**0**
Building1180342	GF	SE	65,9	66,8	**0,9**
Building1180342	F 1	SE	66,2	66,6	**0,4**
Building1180342	F 2	SE	66,4	66,6	**0,2**
Building1180342	F 3	SE	66,1	66,2	**0,1**

Receiver	Fl	Dir	with barrier Leq,24 dB(A)	without barrier Leq,24 dB(A)	difference
Building1180342	F 4	SE	65,7	65,7	**0**
Building1180342	F 5	SE	65,3	65,3	**0**
Building1180342	F 6	SE	64,9	64,9	**0**
Building1180342	F 7	SE	64,5	64,6	**0,1**
Building1180342	F 8	SE	64,2	64,2	**0**
Building1180342	F 9	SE	63,8	63,8	**0**
Building1180342	F 10	SE	63,5	63,4	**-0,1**
Building1180342	GF	SE	65,7	66,9	**1,2**
Building1180342	F 1	SE	66,4	66,7	**0,3**
Building1180342	F 2	SE	66,6	66,7	**0,1**
Building1180342	F 3	SE	66,3	66,3	**0**
Building1180342	F 4	SE	65,8	65,9	**0,1**
Building1180342	F 5	SE	65,4	65,5	**0,1**
Building1180342	F 6	SE	65,1	65,1	**0**
Building1180342	F 7	SE	64,8	64,7	**-0,1**
Building1180342	F 8	SE	64,3	64,3	**0**
Building1180342	F 9	SE	63,9	63,9	**0**
Building1180342	F 10	SE	63,5	63,5	**0**
Building1180342	GF	SE	65,4	67,3	**1,9**
Building1180342	F 1	SE	66,7	67,1	**0,4**
Building1180342	F 2	SE	66,7	66,9	**0,2**
Building1180342	F 3	SE	66,4	66,4	**0**
Building1180342	F 4	SE	66	66	**0**
Building1180342	F 5	SE	65,6	65,7	**0,1**
Building1180342	F 6	SE	65,3	65,3	**0**
Building1180342	F 7	SE	64,8	64,9	**0,1**
Building1180342	F 8	SE	64,4	64,4	**0**
Building1180342	F 9	SE	64	64	**0**
Building1180342	F 10	SE	63,6	63,6	**0**
Building1180342	GF	SE	65,2	67,8	**2,6**
Building1180342	F 1	SE	67,1	67,5	**0,4**
Building1180342	F 2	SE	67	67,1	**0,1**
Building1180342	F 3	SE	66,7	66,7	**0**
Building1180342	F 4	SE	66,3	66,3	**0**
Building1180342	F 5	SE	66	65,9	**-0,1**
Building1180342	F 6	SE	65,5	65,4	**-0,1**
Building1180342	F 7	SE	65	64,9	**-0,1**
Building1180342	F 8	SE	64,5	64,5	**0**
Building1180342	F 9	SE	64,1	64,1	**0**
Building1180342	F 10	SE	63,7	63,7	**0**
Building1180342	GF	SE	65,1	68,5	**3,4**
Building1180342	F 1	SE	67,7	68,1	**0,4**
Building1180342	F 2	SE	67,4	67,5	**0,1**

Receiver	Fl	Dir	with barrier	without barrier	difference
			Leq,24 dB(A)	Leq,24 dB(A)	
Building1180342	F 3	SE	66,9	67	**0,1**
Building1180342	F 4	SE	66,6	66,6	**0**
Building1180342	F 5	SE	66,1	66,1	**0**
Building1180342	F 6	SE	65,6	65,6	**0**
Building1180342	F 7	SE	65,1	65,1	**0**
Building1180342	F 8	SE	64,7	64,7	**0**
Building1180342	F 9	SE	64,3	64,3	**0**
Building1180342	F 10	SE	63,8	63,8	**0**
Building1180342	GF	SW	63,6	68,3	**4,7**
Building1180342	F 1	SW	67,1	68,1	**1**
Building1180342	F 2	SW	67,2	67,5	**0,3**
Building1180342	F 3	SW	67	67	**0**
Building1180342	F 4	SW	66,6	66,6	**0**
Building1180342	F 5	SW	66,1	66,1	**0**
Building1180342	F 6	SW	65,6	65,6	**0**
Building1180342	F 7	SW	65,2	65,2	**0**
Building1180342	F 8	SW	64,7	64,7	**0**
Building1180342	F 9	SW	64,3	64,3	**0**
Building1180342	F 10	SW	63,9	63,9	**0**
Building1180342	GF	SW	62,7	67,3	**4,6**
Building1180342	F 1	SW	65,8	67,2	**1,4**
Building1180342	F 2	SW	66,3	66,9	**0,6**
Building1180342	F 3	SW	66,2	66,5	**0,3**
Building1180342	F 4	SW	66,2	66,2	**0**
Building1180342	F 5	SW	65,9	65,9	**0**
Building1180342	F 6	SW	65,4	65,4	**0**
Building1180342	F 7	SW	64,9	64,9	**0**
Building1180342	F 8	SW	64,5	64,5	**0**
Building1180342	F 9	SW	64,1	64,1	**0**
Building1180342	F 10	SW	63,8	63,7	**-0,1**
Building1180342	GF	SW	61,4	66,5	**5,1**
Building1180342	F 1	SW	64,7	66,4	**1,7**
Building1180342	F 2	SW	65,5	66,3	**0,8**
Building1180342	F 3	SW	65,5	66	**0,5**
Building1180342	F 4	SW	65,5	65,7	**0,2**
Building1180342	F 5	SW	65,4	65,5	**0,1**
Building1180342	F 6	SW	65,1	65,1	**0**
Building1180342	F 7	SW	64,7	64,7	**0**
Building1180342	F 8	SW	64,2	64,3	**0,1**
Building1180342	F 9	SW	63,8	63,9	**0,1**
Building1180342	F 10	SW	63,4	63,4	**0**
Building1180342	GF	SW	59,9	65,6	**5,7**
Building1180342	F 1	SW	63,7	65,6	**1,9**

Receiver	**Fl**	**Dir**	**with barrier**	**without barrier**	**difference**
			Leq,24 dB(A)	**Leq,24 dB(A)**	
Building1180342	F 2	SW	64,6	65,6	**1**
Building1180342	F 3	SW	64,8	65,5	**0,7**
Building1180342	F 4	SW	64,8	65,3	**0,5**
Building1180342	F 5	SW	64,8	65,1	**0,3**
Building1180342	F 6	SW	64,7	64,9	**0,2**
Building1180342	F 7	SW	64,3	64,4	**0,1**
Building1180342	F 8	SW	63,9	64	**0,1**
Building1180342	F 9	SW	63,5	63,5	**0**
Building1180342	F 10	SW	63,2	63,2	**0**

B
ASEK Table

The original ASEK table is given in SEK(2014), this table is taken from the ASEK report and adjusted for inflation to SEK(2017) [3, 14]. All values are per year per person exposed.

Table B.1: ASEK table adjusted for inflation SEK(2017) [3, 14].

Leq,24 dB(A)	**Cost SEK (2017)**
50	159,20
51	496,08
52	1011,67
53	1704,94
54	2575,90
55	3624,54
56	4850,87
57	6255,91
58	7908,47
59	9725,37
60	11747,68
61	13963,07
62	16383,89
63	19010,12
64	21829,44
65	24838,76
66	28056,59
67	31478,80
68	35107,45
69	38931,25
70	42977,92
71	47217,68
72	51661,83
73	56312,43
74	61169,46
75	66246,29

C
HEATCO Table

The original HEATCO table is given in 2002 EUR, this table is taken from the HEATCO D5 report, table 6.9, and adjusted for inflation to 2017 EUR and then converted to SEK with the exchange rate given at 30 June 2017 [2, 13, 14].
All values are per year per person exposed.

Table C.1: HEATCO D5 6.9 table adjusted for inflation and converted to SEK(2017)[2, 13, 14].

Leq,24 dB(A)	**Cost SEK (2017)**
50	0
51	135,28
52	270,56
53	405,84
54	541,12
55	676,40
56	811,68
57	946,96
58	1082,24
59	1217,52
60	1352,79
61	1475,78
62	1611,06
63	1746,34
64	1881,61
65	2016,89
66	2152,17
67	2287,45
68	2422,73
69	2558,01
70	2693,29
71	3578,76
72	3800,12
73	4021,49
74	4255,15
75	4476,52
76	4697,89
77	4931,55
78	5152,92
79	5374,28
80	5607,95
81	5829,32