Management of Noise barriers in Wallonia

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ABSTRACT

Since 2014, the « Walloon Road Noise Division » has been responsible for the definition of the state of art of the Noise barriers along the roads in Wallonia. After building a database with all their characteristics and locations, a procedure was developed to determine the “health” of each one in order to remove them. The process focuses only on the structural and material aspects of the noise barriers.

A final list of the most current defects was defined for each part of the barrier and also its environment. Using an illustrated catalogue of these and the list, the both sides of the noise barriers are inspected and the defects located. After that, all these information are compiled in a report to the road manager offering him an interactive overview of the barrier.

In order to characterize all the barriers in a common way a “health indicator” is given to each barrier. Combining this analysis with other criteria in order to characterize a project the Walloon Administration is able to prioritize the investments to restore the devices along its roads for the next years.

Keywords: Noise barriers, inspection

1. INTRODUCTION

Since long time investments have been made to installed noise barriers along roads and we inherit now of devices to restore or replace. Sometimes the choice between these two options is difficult.

Since 2013, a new « Noise Division » is in charge of running the European Directive 2002/49/EC for the roads in Wallonia. Indeed this new division is also responsible for the management of the existing and future noise barriers along the roads in Wallonia. The management of the noise barriers has to consider the new and the old devices in order to insure the quality of the devices. Taking this approach into account the Road Noise division of the “Service Public de Wallonie” has developed a method to define the health of a barrier. For the new devices the method will be used in the provisional acceptance and before the end of the warranty.

All these old devices have evolved and many impairments appeared on multiple places. The results are noise barriers highly degraded or completely destroyed along roads without reducing anymore the noise coming from the road. For the new ones the most important aim is to insure the long service life of the material.

In 2014, the Ministry of public works of Wallonia asked the Administration and especially, the « Road Noise Division » to establish a state of art of the Noise barriers along the roads in Wallonia. Taking into account the experience in inspections of bridges of the Administration reflections have been initiated to define a method of investigation.

After the development of a database including all their characteristics and locations, different ways were explored to define a procedure in order to determine the health of the noise barriers. The process

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was constructed by following two keywords: easy and complete.

All the procedures must reach to define the health of the device. Taking this into account the “Road Noise division” has defined a method composed of three complementary main-documents to define the inspection’s report which help to associate a “health indicator”. This one will help to determine and prioritize the future investments to restore and remove the barriers in order to have the most efficient devices.

2. NOISE BARRIERS IN WALLONIA

With years different noise barriers have been installed with different structures and environments. As shown on Figure 1 we observe a concentration of devices near Liège, Charleroi and Mons three important cities of the Region.

![Figure 1 Locations of the noise barriers along major roads in Wallonia](image)

After having made the identification of the devices we count about sixty kilometers of barriers along the major roads in Wallonia. As indicated before, there are concentrated near cities.

It is also interesting to analyze which kinds of devices have been placed. By considering five categories of materials we obtain the results illustrated on Figure 2.
The results show that timber barriers and metal barriers are the major noise barriers installed in Wallonia. This information is very important and helpful in the way to identify the main sicknesses of the devices. The Table 1 gives the amount of barriers for each material.

<table>
<thead>
<tr>
<th>Material</th>
<th>Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td>43.9924</td>
</tr>
<tr>
<td>Concrete</td>
<td>0.524</td>
</tr>
<tr>
<td>Timber</td>
<td>13.434</td>
</tr>
<tr>
<td>Plexyglas</td>
<td>0.3817</td>
</tr>
<tr>
<td>Plastic</td>
<td>1.2331</td>
</tr>
<tr>
<td>TOTAL</td>
<td>59.5652</td>
</tr>
</tbody>
</table>

Due to economical history of the Region metal barriers are the most common kind of device used. Because of their low cost and the “rural” aspect, timber barriers are also widespread in Wallonia.

3. METHODOLOGY OF INSPECTION

After having made a summary of the different kinds of barriers in the Region, different ways were investigated in order to inspect the material. The “Service public de Wallonie” has a long experience in bridge inspections and the ways to define the major degradations of a structure. Taking into account this experience and applying it to a simpler structural device the Road Noise division has developed a process to characterize the structural and “material” state of a noise barrier.

As explained earlier, all the developments were made by following two keywords: easy and complete. After several versions, the final one is composed of three main-documents to compile in order to implement the inspection’s report.

3.1 Main-documents

3.1.1 List of defects

This first main-document contains a list of the major defects found after having investigated several barriers of different kinds. So as to characterize each parts of the barrier the defects are linked to them with an associated code. The document is illustrated on Figure …
As shown on Figure 3 a unique color is attached for each defect. This will be useful in the inspection’s report.

3.1.2 Illustrations of the defects

Till now the Road Noise Division is in charge of the inspections of all the devices along the roads in Wallonia. In the future this responsibility may be transferred to the local Road Divisions. To insure a same way to investigate and identify the defects a second main-document containing an illustration of each defect has been developed (Figure 4). By this way all the inspections done or to be done will be realized on a same draft.
3.1.3 Working document

This third document is an Excel sheet on which inspectors indicate the defects of the barriers their positions and comments (Figure 5). To facilitate the work of inspectors this document is available on tablet.

![Figure 5 Main-document n°3 - Working document](image)

3.2 Inspection’s report

All the information collected during the inspection are compiled to produce the inspection’s report containing all the remarks and observations about the barrier. This document is composed of eight sheets and an explanation of each of them is given using the example:

- Two Encoding files (Front and back sides) (Figure 6)

The two first ones « Encod_Avt » and « Encod_Arr » are encoding files. The first one collects all the defects found on the front side of the noise barrier and the second one all defects of the back. The files on Tablet are downloaded and corrections are made by the inspectors to finalize the documents and associate the pictures to the right defects.

![Figure 6 Example of encoding file](image)

- Location and characteristics sheets (Figure 7)

The sheet « Localisation » refers to the location of the noise barrier. This sheet has to be considered as the ID-card of the noise barrier with its ID-Number, the start and end roads, the kilometers positions and also the responsible road division. Complementary an aerial view of the position is also included.
The sheet « Caractéristiques » gives all the characteristics of the noise barrier including the number of caissons/panels, the number of column the length of the barrier, the lengths of the caissons and columns, etc. To complete the given information, two pictures of the barrier are also included to illustrate the device.

- **List of defects**

This sheet is a copy of the first main-document reminded to ensure a good understanding of the codes and defects linked to (Figure 3).

- **Overview sheet**

An overview of the inspection is available on the « Bilan » sheet. The list of all the defects found during the inspection is also given and the number of these on the front and the back of the device too. A general comment of the inspection helps the road responsible to know the general health-state of his device. An example of this sheet is given on Figure 8.
The next file « Schema » gives a diagram of the entire noise barrier. This sheet has been developed to give an overview of the device and all the defects identified during the inspection using their codes in the catalogue of defects. All the comments and pictures linked to the defects are included in the schema.

In order to facilitate the location of specific defects a tool helps the user to highlight the defects he wants to see. On Figure 9, the diagram of the barrier with defects 220 and 240 respectively “Impact on caisson” and “Vegetation on caisson” is illustrated.
4. MANAGEMENT OF NOISE BARRIERS

The development of the inspection’s report is the first step of the larger process about the management of the noise barriers. As explained at the beginning of the document, road administrations inherit of a fleet of noise barriers in different health. To fix which ones have to be repaired removed or changed by increasing their height it is necessary to define their state. A new approach has been developed for the new devices in order to improve the quality of the materials.

4.1 Existing devices

The developed tool explained at section 3 has helped us to define on a common basis the health of each barrier. By this way we are able to compare the barriers and define which ones are the most degraded and have to be restored or removed.

The Wallonia’s government will disburse about EUR 3 million the next two years in order to repair or remove in a same way some noise barriers. To define the chosen ones a prioritization of the investment was necessary. For this reason, by crossing the noise barriers’ database and the list of hotspots, the devices included in hotspots were putted out of the list and a restricted list of about 25 kilometers long was defined.

After having inspected all of the devices and built their inspection’s report it is necessary to define their “health indicator”. Different ways can be explored to achieve to define this parameter. In the reports different tools have been developed to help the inspector to have the best overview of the state of the device.

The way chosen by the Road Noise Division to define this indicator is quite general. To facilitate the analysis the following points are studied and analyzed to define the parameter in order:

- Photos’ report (Figure 10)

The last sheet « Photos » is a report with the most important pictures illustrating the defects found during the inspection. The pictures are also referred in the sheet « Schéma » to be complete.
1. **Structural and stability aspects:** we insure that the structure is in good condition and the stability of the device too. If not a warning has to be indicated.

2. **Acoustical aspects**
   a. **Absorbing material:** essential in the absorption function of the barrier, this part must be in a perfect condition. If not a warning has to be indicated.
   b. **Sound insulation:** all the elements placed to insure the insulation between the foundation and the first caisson/panel or between the elements and the columns must be good placed. If not a warning has to be indicated.

3. **Settings of elements:** this part is very particular and a widespread problem is the devices in Wallonia. Having bad settings may generate more noise by allowing the caissons to move and beat between the columns.

4. **Visual aspects**
   a. Rust: this problem is half a structural problem and half a visual problem. Rust can appear without generating the collapse of the barrier. But when it is widespread and when the back side of the caisson is contaminated the problem becomes serious and have to be taken seriously into account.
   b. Gap between elements: this element is a acoustical aspect and also a visual aspect and may in some cases be indicator of a structural problem.

After having analyzed following this approach all the barriers and prioritization of the repairs will be established. An indicator A, B, C or D will be attributed to characterize their health taking into account that A is the worst “health” and D the best one.

As explained the first part of the program will concerned about 25 kilometers long of barriers. Then we will pursuit the work by inspecting all the 35 remaining kilometers in order to have a first state of the “health” of the barrier. All this study will help the Road Noise Division to improve its experience and also improve the requirements in the contracts. Everybody has to learn of their faults but the most important is considering these to improve its approach. That’s the way we chose for our barriers.

4.2 **New devices**

For the new devices a new approach has been set up in order to control the whole life of the barrier. First of all, when a new barrier is built, an inspection’s report is now done before the provisional acceptance. This document will help the Road Noise Division to deliver an opinion about the device. Afterwards, the remarks and the location of the defects will help the contractor to make the modifications and needed repairs.

All the barriers in Wallonia are 5 years warranty. The inspection before the provisional acceptance is the first step and the second will concern the end of the warranty period. Indeed just before the end of this period an inspection will be done by the Road Noise Division. The entire barrier will be inspected in order to insure that it evaluates in good condition. If defects are indentified the contractor will make all the necessary repairs and removes.

By this way the Road Noise Division of the Walloon Region will follow the devices from the beginning and during their entire life. This project will also help us to improve our requirements and to expertise to always insure the longest life to our devices.
5. CONCLUSIONS

The principal aim of the project “Management of Noise barriers in Wallonia” is to establish an overview of the health of all the barriers in Wallonia. A first step will be made by spending EUR 3 million for barriers to repair and remove in a same design and be done for June 2016.

The next step will be achieve at the end of 2016 when all the devices will be inspected and the Road Noise Division will have a first complete overview of the situation. By this way it will be possible to define the further investments to restore or improve the existing devices to insure the insulation of people.

The “inspection’s report” we developed is a complete and essential tool to help the Road Noise Division to define the health of the barriers. As explained it evolved by the past and will probably also evolved in the next months. About the “health indicator” the way defined to determine it must be improved. Maybe in the next years the procedure will be refined in another way using a statistical approach of the problem.

The Road Noise Division is at the beginning of a wide project including several partners in order to improve the quality of the noise barriers and finally to improve the protection of people against the noise.