

## Definition and Identification of an “Engineering Heritage” – Application to the Region of Brussels

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**ABSTRACT:** Currently, if the concepts of “monumental heritage” and “architectural heritage” are relatively frequently used, the concept of “engineering heritage” is much less used. Therefore the paper focuses on this concept. After a precise definition of the scope of the “engineering heritage”, its importance is discussed and the methodology to select the striking constructions is described in detail. The paper discusses also the application of such a methodology to the Region of Brussels by a multidisciplinary expert committee (civil engineers, architects, historians, etc.). Finally, the results are compared with the already identified monument heritage.

### INTRODUCTION

When people talk about engineering, they often first think to ever longer bridges, to always higher towers, to kilometre long tunnels, to huge dams, etc. (In this document, the word “Engineering” means Civil and Structural Engineering). Beyond these exceptional constructions which are usually excellent examples of engineering, there is another category of constructions that include a lot of less visible engineering productions like short footbridges, small locks, underground constructions, lower buildings, station buildings, etc. These constructions, although more modest, can prove to be technically or technologically as interesting as the first ones.

Following this reasoning, we quickly realize that the quantity of engineering constructions (including the small ones) present in a city, a region or a country is very important. Although it would be very tough, it is possible to make out an inventory of all of them. However a detailed study of each of them (to promote, to protect or to list them for example) would be as complicated as useless. Therefore, it is necessary to select the most remarkable constructions in order to establish an “Engineering Heritage”.

If it is obvious that some reference constructions are technically or technologically remarkable, it is less clear when one has to value the potential of smaller productions or of constructions whose reputation in other domains could influence the evaluation of its real technique value. In order to select the more remarkable constructions in an objective and complete way, it is necessary to follow scientific steps. The present note explains this methodology that we developed in the last months. So, we will try to determine « What is the Engineering Heritage? », « What does it include? » and « How to assure the objectivity and the completeness of this heritage? »

## DESCRIPTION OF THE METHODOLOGY

The targets of the methodology are:

- To define the notion of Engineering Heritage.
- To determine, following scientific steps, what constructions belong to this Engineering Heritage.
- To constitute the basis of possible conservation or even listing steps for some remarkable engineering constructions.

To reach these targets, several steps are followed (cf. Fig. 1). This steps are inspired by a methodology developed by the "Direction des Monuments et Sites" to constitute the Brussels monumental heritage (Direction des Monuments et Sites, 2005). Before getting into the details, a succinct description of the steps is provided in the next paragraphs.

In the first step, a complete inventory of the engineering productions of the city, region or country is established; at the same time, a multidisciplinary expert committee is constituted.

The criteria used in other types of heritage, like the monumental or the architectural heritage, are examined. The aim of the second step is to define a criteria list adapted to the Engineering Heritage.

Then, the expert committee is got together. The first step of the committee is to validate the criteria list after a brainstorming. With this list, they are able to constitute the civil Engineering Heritage list, by selecting the most remarkable realisations of Civil Engineering. Usually this selection cannot be closed in only one meeting because the evaluation of some less known constructions requires to get additional information.

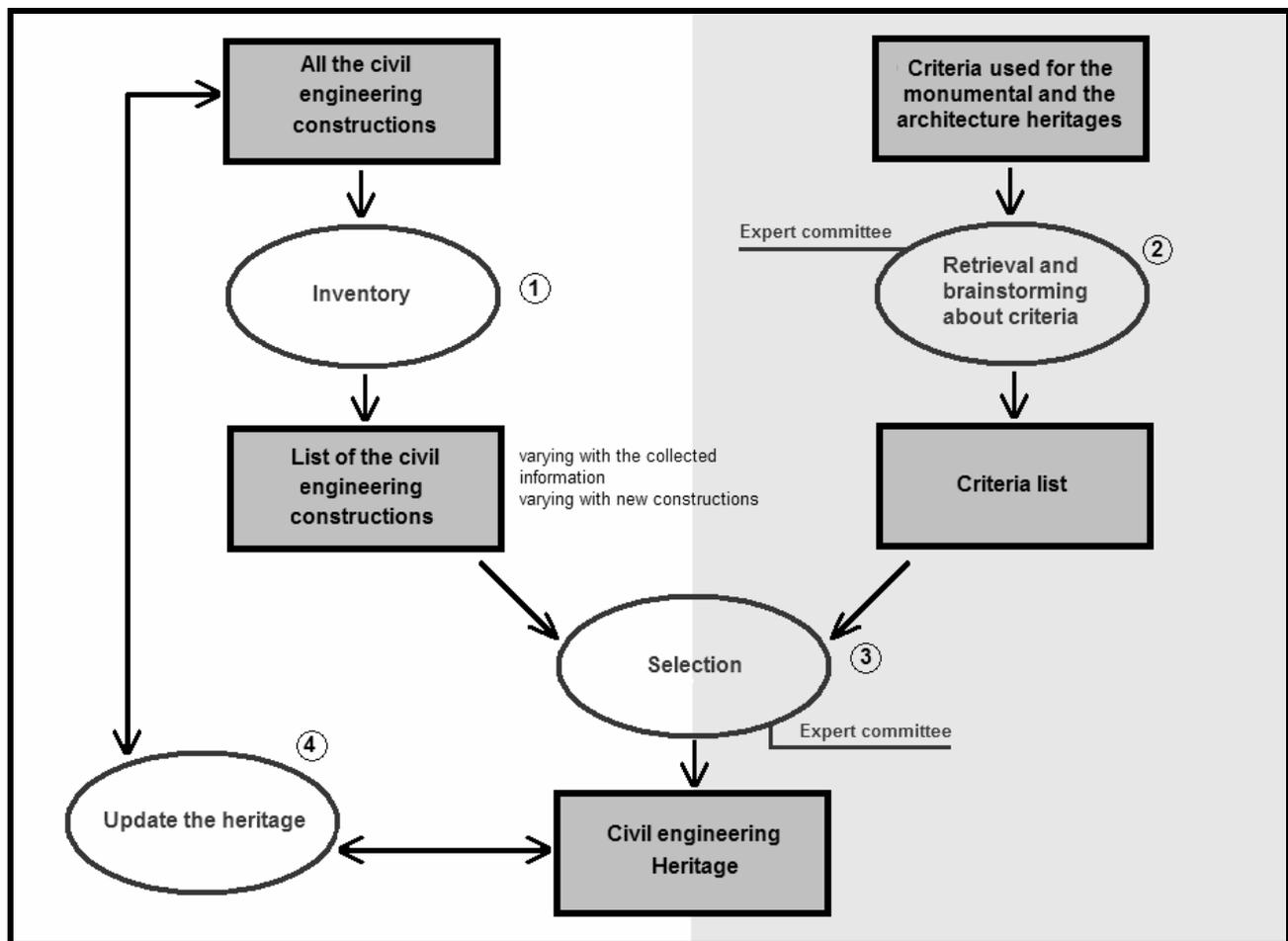


Figure 1: Descriptive diagram of the selection methodology

## CARRYING OUT THE INVENTORY

Carrying out a complete inventory of the civil engineering constructions is a very tough work.

The real estate management and the management of the transport and supply infrastructures can be different from one country to the other. The next paragraphs should be accordingly adapted.

The public constructions inventory can be based on data from the town and regional public administrations. Normally these administrations possess an inventory of the public constructions (like road tunnels and bridges, underground tunnels, footbridges and public buildings) that they have to maintain. Others public engineering productions are managed by companies (like railway companies) or by bodies (like the water supply bodies

or the environment bodies). These companies and bodies generally possess inventories of railway bridges and tunnels, footbridges, aqueducts, drainage basins, dams, etc. As in the previous case, these inventories are held to support the constructions maintenance.

The task is more complex with private constructions. Indeed, an inventory of these constructions is rarely available. In this case, it is necessary to retrieve information from all the engineering offices, construction firms, architectural offices, etc. It is also interesting to scan local engineering magazines as well as the archives of public services and private companies.

In spite of this systematic information retrieval, it is not excluded to miss one or more engineering constructions (especially private ones). In this case, the "missing" realisations will have to be evaluated when detected. On the other hand, new engineering constructions are constantly built: they should also be evaluated later on.

## **CONSTITUTION OF THE MULTIDISCIPLINARY EXPERT COMMITTEE**

The multidisciplinary committee is composed of experts in engineering, architecture, town planning and history. Two main reasons account for creating this committee: objectivity and completeness. Such a committee is always essential to make a selection on the occasion of a publication, as *Anne Van Loo* shows in the "Dictionnaire de l'architecture en Belgique de 1830 à nos jours" (*Van Loo 2003*) or on the occasion of a heritage inventory (e.g. Official website of Unesco).

The choice of a committee composed by a panel of different disciplines (beyond the engineers) allows not to focus only on the technique aspect of the engineering. It is important to realise that a remarkable engineering construction has to possess, in addition to remarkable technique or technologic specificities, a good integration within its environment and has to reply to a real need. The presence of non engineer members allows to reach a more contextual vision.

## **SELECTION OF THE CRITERIA**

### **Determination of the criteria**

When looking for the criteria used to realize the architectural or the monumental heritage in the Brussels region, we find the following criteria list. This criteria list is defined by the *Ministère de la région de Bruxelles-Capitale* (Direction des Monuments et Sites, 2005) and is used to establish the monumental heritage (Direction des Monuments et Sites, 1989, 1993, 1994, 1997a and 1997b):

- A. Architectural value
  - 1. Style
    - Style quality
    - Rank of the construction in the evolution of styles
    - Originality of the architect or of the construction
  - 2. Authenticity
    - Historical criteria
    - Criteria linked to the steps of the building
    - Building material used
    - Building compliant with a program's demands
- B. Documentary value
  - 1. The building is the last example of a style
  - 2. The building is a part of a piece of work interesting as a whole

The criteria used to evaluate constructions to be listed (*M.-N. Neuven, M.-N., Jurion, F., Schoonbroodt, B., 1994*) are closely related to this criteria.

### **Setting up the selection criteria list**

When looking to the criteria above, we notice that they mainly emphasize the aesthetic and historical aspects of the constructions what does not fit well with the constitution of an Engineering Heritage. However, even if not adequate some of these criteria can be used in the context of the Engineering Heritage if adapted, e.g. « quality of style » could become "technical quality", "Rank of the construction in the evolution of styles" could become "Rank of the construction in the evolution of techniques (precursor of a movement)". Criteria linked to the constructions evolution could become a durable construction criteria. Some others criteria can be used without modification: building material used, building compliant with a program's demands.

After a brainstorming with the members of the expert committee, the following criteria list is proposed:

### Technical criteria.

- The use of a new process of execution (generated or not by constraints related to the environment or not).
- The use of a new technique.
- The use of a new material.
- Precursor of a movement (which constitutes an example for other constructions).
- Going beyond a structural boundary such as span, length or height.
- A construction built with a durable concept.
- A structure with an easy to understand functioning what makes it more pedagogical.

### Contextual criteria:

- Optimal respect of the city constraints by the construction site program.
- Ideally answers requests generated by the urban development.

Although the majority of the criteria are technical, it is important to notice the presence of contextual criteria. When evaluating a construction, it is extremely important to consider it as a whole with its environment and to measure its impact on it.

Some constructions, although badly adapted to their environment and not answering to an urban request, owe such exceptional technical characteristics that they could not be rejected from the selection. In this case, it will be essential to mention, when evaluating these constructions, that they do not quite belong together with their environment or that they do not meet an urban request.

### **DEFINITION OF THE CIVIL ENGINEERING HERITAGE**

To be able to determine the civil Engineering Heritage content, it is essential to define this concept. Thanks to the determination of the criteria, we are now able to define the "Civil Engineering Heritage" as follows.

The Civil Engineering Heritage is the whole of the engineering productions which, in order to meet a real need

- can be allocated at least one remarkable technical characteristics and
- belongs together with its environment.

So, the use of a new technique, a new material, a new process of execution, a construction going beyond a structural boundary or a construction with a concept of durability are considered as remarkable technique characteristics.

Will be also regard as Civil Engineering Heritage, all the civil engineering productions even with few remarkable characteristics, with a structure allowing an easy comprehension of its functioning: these constructions acquire a pedagogical purpose which contributes to their integration within the community.

At least, are considered as Civil Engineering Heritage, all the civil engineering contributions which, due to their precocity, are precursors of a movement as far as they meet the same conditions of integration and need than the constructions mentioned before.

This definition can be applied at several levels (regional, national or international), the strictness of the criteria should be adapted to the specific context.

### **UPDATE THE HERITAGE**

Finally, it is important to keep in mind that even if the "Civil Engineering Heritage" is the result of an appropriate methodology, it is not to be considered as a "frozen list".

A permanent reflection on the content of the Civil Engineering Heritage will have to be hold as will be explained later.

Several practical cases show us the importance to maintain interactions between all the existing engineering constructions and the "Civil Engineering Heritage":

- During the inventory process, one or several constructions may be missed (especially during the inventory of private constructions).
- New engineering constructions are constantly built.
- Following new discoveries, some construction can appear to be more interesting than thought at first and vice versa.
- Some constructions may see their potential increase after some years.

In all these cases, one construction may be re-evaluated and possibly inserted in or removed from the "Civil Engineering Heritage".

It is essential to keep a critical view on the established list of remarkable engineering constructions and to realize that it will be supplemented with new retrievals and with constructions to be built later on.

### COMPOSITION OF THE CIVIL ENGINEERING HERITAGE – CASE OF THE BRUXELLES-CAPITALE AREA

The selection of remarkable engineering constructions is carried out by the expert committee using the criteria list established above. The following paragraphs are dedicated to 2 cases that required a debate.

The first case is a railway bridge above the *rue du Miroir* in the center of Brussels (cf. Fig. 2 et Fig. 3). It is a rail-bridge in concrete with a span of less than 25 m. Though trivial at first sight, the construction of this bridge in 1944 allowed to experiment for the first time in Belgium the use of prestressed concrete deck for railway bridges. If we carefully look at Fig. 3, we see that the height of the deck is different along the width of the bridge. This difference results from the fact that 2 techniques were concurrently used during the construction of the bridge; the left side is a test of a deck in prestressed concrete while the right side is a test of a deck in reinforced concrete. This very early use of a new building material, the prestressed concrete, gives quite remarkable characteristics to this bridge: it belongs therefore to the Engineering Heritage of Brussels.



Figure 2: Bridge over the rue du Miroir; (credits D. Attas)

Figure 3: Different height of the deck of the bridge over the rue du Miroir; (credits D. Attas)



Figure 4: Entrepôt A of Tour et Taxis; (credits D. Attas)

The second example is the "Entrepôt A" of the "Tour et Taxis" site (cf. Fig 4). This warehouse built in the beginning of the 20<sup>th</sup> century is located at only a few hundred meters from the Brussels haven. It has long been used to store merchandise arriving from the North sea via the *Willebroeck canal* and bound for the Brussels area by rail. This industrial construction is 230 m. long and 60 m. wide. Its most important technical feature is its roof which is resting only on the walls and the peripheral columns (without intermediary support). It is a metallic "shed" structure spanning 60 m. thus covering a very wide area. The 60 m. span probably makes it one of the largest of this kind worldwide (Halleux, 2001).

### COMPARISON WITH THE MONUMENTAL HERITAGE

When the Engineering Heritage of Brussels is compared with the Listed Buildings in the region of Bruxelles-Capitale (M.-N. Neuvén, M.-N., Jurion, F., Schoonbroodt, B., 1994) only few resemblances appear.

These are not accidental. They concern:

- Constructions with concurrently remarkable aesthetic and technical characteristics,
- Constructions whose undisputed historical impact on the city is in line with remarkable technical characteristics.

However no constructions only remarkable in a technical viewpoint can be found among the Listed Buildings. The conclusion is that not any (or very few) construction is listed only for its technical value. This does not come as a surprise when one reminds the selection criteria in use.

As for the monumental heritage of Belgium (Direction des Monuments et Sites, 1989, 1993, 1994, 1997a, 1997b) (more extended than the Listed Buildings), the conclusions remain exactly the same.

## CONCLUSION

There is no listing of the most remarkable constructions of the engineering available today.

The first phase of the present study has allowed us to lay the basis of a methodology to clearly define the "Civil Engineering Heritage"

This methodology should be seen as the first step to set up an Engineering Heritage definition.

This methodology was developed starting from the case of the region of Bruxelles-capitale. In the next step we will check what definitions are available at the international level; this could bring along some updates to our present definition of the "Engineering Heritage".

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