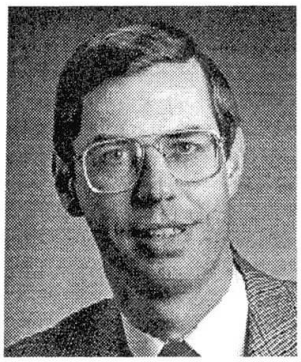
Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 83 (1999)

Artikel: Sustainable engineering: tools and aids
Autor: Reij, Arie W.F.
DOI: https://doi.org/10.5169/seals-62850

Sustainable Engineering: Tools and Aids

Arie W.F. REIJ
Programme Manager
Sust. Constr. at Rijkswaterstaat
Utrecht, The Netherlands



Arie Reij, born in 1947, has a master's degree in civil engineering from Delft University of Technology. He worked in research at TNO and joined Rijkswaterstaat in 1983. After occupying various functions, both in research and management, he was appointed head of the Policy Analysis Section of the Civil Engineering Division of Rijkswaterstaat in 1991.

Summary

In this abstract, I discuss the approach towards sustainable construction in the Netherlands in general and at the Directorate-General for Public Works and Water Management in particular, and then focus on sustainable engineering. The current situation in the field of road and waterway engineering is presented, highlighting the progress made so far and the major ongoing developments. An overview of the tools and aids available is given, paying particular attention to a recently developed method for expressing the environmental impact of a structure in terms of money.

Keywords: Sustainable building; environmental impact analysis; engineering; monetary analysis; design aids.

1. Introduction

Since 1990, a comprehensive programme regarding sustainability at Rijkswaterstaat has been running, aiming at an operationalization of the rather abstract notion "sustainable." The ultimate goal is for the topic to need no further special attention, because it is just as *natural* as cost reduction. The main issues that we have been focusing on are understanding of the topic, communication, and tools. Although the importance of an environmentally responsible engineering and construction practice is no longer questioned, choices for sustainable engineering are not straightforward. Therefore, instruments rather than instructions are required.

2. Tools and aids

If sustainable engineering ought to become common practice, sufficient tools and aids should be available. At Rijkswaterstaat, we defined the following items as "anchor points", suitable for daily practise: raw materials, waste, energy and space and external appearance. They are all of a qualitative nature. Projects where a particular item has been given special attention were awarded the status of "demo-project" as working examples for field workers.
Another broadly useful general aid is the sustainable building help desk we have set up, for passing questions through to specialists on specific topics. Internal to our Rijkswaterstaat organisation, we can provide project teams, with so-called "sustainable building consultants".

Targets were stated in order to get better results and enabling to make the right decision in the face of various options. For energy conservation at Rijkswaterstaat a "company target" of minus 20% within 12 years has been stated. For the designer, we have developed a "Guide for energy-lean design of civil engineering installations" to tackle technical problems.

To assist the designer and the contractor in achieving a sustainable structure in the Netherlands, a number of packages of standard measures and preferred options have been developed, having a similar structure; the core consists of a number of measures that can be taken. They serve the purpose to obtaining a minimum level of sustainability by measures that all relevant parties have agreed upon. The ultimate goal is to specify so-called "durability performance requirements".

3. Monetary evaluation

As to respond to the increasing demand to quantify the environmental performance of structures, a study to "develop a method that would enable a designer to assess the environmental impact of a structure, in such a way that it can assist in making the right design decisions" was carried out by the Dutch Organisation for Applied Scientific Research (TNO).
An initial survey reveiled that various methods already exist. These are mostly based on the outcome of an Environmental Impact Analysis (EIA), that is highly standardised, at least in the Netherlands, and thus appeared to be a sound basis for further development. A number of methods showed sufficient potential to justify further examination, among others "eco-indicator" ("Eco-Punkten") and Building Environmental Diagnosis System (BEDS). However, due to various reasons these were considered inappropriate for applying on building structures.
A decision had to be made as to what sort of quantification would be used. Expressing things in money has clear advantages, such as the connection to the normal monetary evaluation of projects, opportunities for optimisation and possibilities to calculate the environmental efficiency. A method was developed with the aid of a pilot structure (design "Second Stichtse Brug", Netherlands) that served as test case and data source. This is a high-strength concrete box-girder bridge with a length of 320m and a main span of 160m. For the study, the design freedom was limited to the choice of materials, so no alternative construction methods or locations were taken into account. The environmental impact is expressed in the magnitude of aspects (following from an EIA) that have an effect on the environment, with the limitation that only the materials necessary for construction were taken into account, as other data were unavailable.
For the next step, to express the derived quantities in terms of cost or money, various methods are available, so no new method needs to be developed. One could look at the damage that is caused to the environment, but it could also be evaluated by the prevention or substitution cost.
A choice was made to valuate all different environmental effects individually, and not to add them up first in an arbitrary way, and then to multiply by unit environmental cost, as is done in e.g. Greencalc.

4. Concluding remarks

The pilot application showed that a monetary evaluation of environmental aspects is possible. It also demonstrated that the energy content might be used as a practical measure for the environmental impact of structures. However, because of limitations of the pilot, further research is needed to establish the latter conclusion.
For a more widespread application of this method, a number of requirements have to be fulfilled: A reliable and up to date databases with standardised environmental data on materials and processes is necessary, the method (esp. EIA) should become less time consuming, and the acceptance of a monetary valuation of environmental aspects should increase. Not to replace other, more subjective or emotional, valuations, but as an aid to optimising the environmental performance of building structures.

In my view, there is a remarkable resemblance between the project budget in real money and in "environmental" money. Both reflect a certain boundary condition for the project. Both give an opportunity for optimising the performance at equal or lower cost. And both will never be the sole criterion for a final decision.
I feel that the environment could benefit a lot by a more comprehensive analysis of the environmental impact of structures, particularly such long-lasting structures as bridges, tunnels, and waterworks. Monetary valuation of these affects could help to reduce them, even, or perhaps especially, if this would require more "ordinary" money.