International Society for Construction with Alternative Materials

Step by Step

ISCOWA's practical guide for the re-use of waste materials in construction

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Introduction

After three WASCON conferences and the theme for WASCON 2000 being 'Science and engineering of recycling for environmental protection', it is possible to derive a practical guide for recycling from the vast amount of results presented. In this respect it is worth re-reading the conference proceedings of the various WASCON conferences.
This Step by Step procedure is intended to be used as a guideline for all parties in the field, researchers and policy makers and also the industry. It may help to structure the problem, to direct research and to be able to make reports in a standardised way. It is evident, that results of research are important for the development of the application of waste materials in construction. Standardisation facilitates the use of these results by the industry and policy makers.

ISCOWA's practical guideline consists of the following steps :

1. Description of the problem
2. Overview of possible applications
3. Material oriented decision tree
4. Literature research
5. Research and development
6. Market introduction and Quality control
7. PR and exchange of know-how

Step 1 : Description of the problem

The first questions that need to be answered in waste recycling problems relate to the physical characterisation. This is important information is needed to describe the 'impact' of the problem being considered.
The following properties have to be assessed:

1. amount of the material in ton per year or month
2. source of the material and process and production data
3. specific weight
4. strength data
5. particle size distribution
6. pore size and water absorption
7. chemical composition (major elements)
8. leaching data
9. variability / heterogeneity of the material

10. other relevant data

The thus gathered information is used to make a first description of the project to be conducted, and the major goals of the project phases have to be described clearly.

Step 2 : Overview of possible applications

For obvious reasons like structure of the industry, engineering work, decision-making and transport of materials, a basic split is made between:

- construction of buildings
- infra-structure works
- various other applications

In the field of construction of buildings the following materials and products are used:

1. binders or cements
2. sand and gravel
3. concrete products (pre-cast or pre-fabricated)
4. concrete
5. clay products (bricks, tiles and pipes)
6. sand-lime bricks
7. gypsum products

Infra-structure works deal with the following materials and products:

1. binders, like cement and bitumen
2. sand and gravel
3. natural soil and rocks
4. asphalt
5. concrete
6. concrete products
7. earth works

In the case of various other applications solidification, stabilisation and general earth works are being considered. There are also numerous small-scale applications, which are often highly specific.

Step 3 : Material oriented decision tree

Based upon the physical characterisation of the material and a view to possible applications a short list can be made. This should highlight the best ways to recycle or reuse the material in question.

Some basic rules are of importance for this analysis :

1. Search for those applications with the highest added value in the market, e.g. material usable in the cement making process should not be used elsewhere. This approach is not only economic worthwhile, but has in terms of environmental aspect also the highest value.
2. Search for those applications with the lowest number of activities in terms of transport, process steps and energy consumption. For example if a material can be used directly after serving in concrete, it is not appropriate to convert it into artificial gravel.
3. Determine for each application the conventional material to be replaced and gather the relevant data about this material.

4. It is recommended that the short list contains no more than 5 options placed in order of feasibility. Make sure at this point that all acquired data are saved and written down and that sound reasons are given for the order of priority.

Step 4: Conduction of literature research

For the selected options on the short list gather the following information and conduct the derived actions :

1. Available research results, e.g. consult the proceedings of the WASCON conferences, International Journals, the ISCOWA Home Page or directly consult a member of ISCOWA.
2. Relevant standards regarding the material to be replaced, the production processes other relevant technical data and requirements as well as policy requirements.
3. Relevant environmental standards and data, including regional, national and international legislation
4. In case it is available a life cycle analysis might be useful and helpful in the project as a whole.
5. Market information on prices and production quantities of the material or product to be replaced.

Based on the information gathered a R&D plan is made. This should include a time schedule and cost breakdown. Try to find an industrial partner to participate in the R&D project and look for international co-operation.

Step 5 : Conduction of the R&D project

Step 5 is the actual research and development work. This will identify the number of technically and environmentally possible options and allow completion of the report underlining priorities in the short list.

In this program it is important to conduct the required environmental research, because these data are needed to optimise the product development. Relevant tests, based on national standards are applicable.

It is important to reduce the amount of possible options to not more then 5 and place these options in an order of relevancy to the initially defined goal of the project. In addition it is important to include a table with strong and weak aspects of the option and a motivated indication of the major problems to be dealt with in relation to this option.

Step 6 : Market introduction and quality control

In this step it is important to fully identify the background and research of the material or product before it is brought to the market. This process can greatly benefit from having an industrial partner in the project. Sometimes a demonstration project facilitates market introduction and the results can also be used for the purpose of optimisation of the product

The aim of quality control is to improve market introduction and establish product confidence by devising a scheme for technical and environmental quality control. Based on such a scheme, a guarantee can then be given that the material or product will meet all the requirements set out in the relevant technical and environmental standards. This will tend to increase the confidence of both interested and regulatory parties

It is also worthwhile in this phase to consider including a life cycle analysis to give data about the fate of the material or product after is application.

Step 7 : PR and exchange of 'know-how'
It is important to have a PR strategy to market the product. Again this step will benefit from an industrial partner in the project.
Finally it is important that 'know-how' is shared with others, ISCOWA is available to assist you with our Website and via our members.
In addition, results of ongoing research and development are important for the education and training of students and those already working in the industry or elsewhere. Thus it is important to publish your results in journals and give presentations on conferences.

Acknowledgement
This publication has been supported by the Dutch Ministry for Housing, Spatial Planning and the Environment.

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