

USE OF RECYCLED MATERIALS AS AGGREGATES IN THE CONSTRUCTION INDUSTRY

EDITORIAL

A milestone for the network in the past months has been the successful organization of the first international ETNRecy workshop, which was organised on 11-12 September 2000 in Paris in collaboration with RILEM. The concept of the workshop was to provide a forum for presenting and discussing regulatory, environmental and technical issues with respect to recycling of construction and demolition waste (C&D waste). In total, 95 participants attended this event, a large majority being non-members of the Network. A more detailed analysis of the participants showed that 58% of the participants were from industry, whilst the balance was made up mainly by those from research organisations (14%) and higher education (23%). Most participants came from Europe, but there were also participants from Canada, Japan and Hong Kong. A more detailed report on the workshop may be downloaded from our website.

The workshop showed that extensive research and development work was realised in different member states. The statement in the Symonds report, "...based upon the subsidiarity principle, there was no evidence found of a need for a Commission initiative on research and development..." was strongly disagreed upon. Participants welcomed the conclusion that there was a real need for coordination and exchange of findings on a European scale and ETNRecy.net was expected to keep playing a key role in this regard.

Different presentations demonstrated that "environmental hygiene" and "life cycle assessment" considerations were recognised as key elements for the future development of recycling in all parts of Europe. As far as concerns environmental hygiene, it was clearly demonstrated that important

differences exist in the regulations of the member states. Products which may be recycled and used as secondary products in one country, would not be accepted in another. Whether this is rightfully an implementation of the subsidiarity principle or a barrier to free trade can be debated upon. On the other hand, recycling is an industrial process and environmental impacts are therefore associated with it. The question is "when and where is recycling the better option with regard to environmental performance as opposed to other strategies"? To make an objective balance, the only tools currently available are LCA and LCC (life cycle analysis and life cycle costing).

However, reliable input data are not yet available and methodologies are still under discussion. It was clear that research and development work at this level should be considered as a priority.

In follow up of the first workshop it has now been planned to organise a next workshop in Lisbon on 10-11 December 2001. This event will focus on standardisation efforts and road applications. More information with regard to this workshop will be given later on through our ETNRecy.net website.

As for the present newsletter focus is on some recent and important initiatives with regard to quality control and assurance of recycled aggregates and concrete. Belgian, UK, Dutch and German evolutions are highlighted in this respect. Furthermore, two software tools for construction and demolition waste management are shortly presented. Finally, a recently finished Spanish LIFE training project is presented. In addressing this palette of initiatives ETNRecy.net hopes to be able to cover the different interest off all its members and the readers of the newsletter.

J. Vyncke and Jan Desmyter
ETNRecy.net Secretariat
Belgian Building Research Institute



Volume 3, Issue 5
April 2001

Inside this issue

- 1 Editorial
- 2 Quality and other Developments in UK
- 5 Spanish and Dutch Initiatives
- 6 German Specifications on Concrete with Recy-
- 7 Quality Assurance of Recycled Aggregates in Belgium
- 8 A Norwegian computer-tool



A half-yearly publication of the European Thematic Network on Recycling in Construction with the financial support of DG XII under the BRITE-EURAM programme

The ETN Recycling in Construction website can be found at <http://www.etnrecy.net>



In May 1999, the UK Government published “A better quality of life – a strategy for sustainable development for the United Kingdom”. A strategy for more sustainable construction has been developed in consultation with the construction industry to support “A better quality of life”. Published during National Construction Week in April 2000, “Building a better quality of life” is the UK Government’s blueprint for modernising the way in which buildings and infrastructure are designed, procured, built, maintained and used. It sets themes for action so that the construction industry can contribute to the economic, environmental and social objectives of sustainable development, and become more efficient and competitive as a result. “Building a better quality of life” identifies waste minimisation, lean construction, avoiding pollution as some of the ten priority themes for action.

Quality Control Protocol for the Production of Recycled Aggregates in United Kingdom

In 2000 an important document enabling quality control of recycled aggregates was published in UK. The document has evolved through the efforts of two industry-based working parties, both seeking to produce a quality control procedure that enables recycled aggregates to be specified and used with the confidence that they will continually meet ‘fit for purpose’ criteria.

The first party was the Programme Technical Committee set up in October 1997 within the DETR (Department of the Environment, Transport and the Regions) Partners in Innovation programme to establish a means of controlling the quality of aggregates produced from processing material previously used in the construction process. In 1998, as a separate initiative, the Quarry Products Association (QPA) formed a joint working party with the Highways Agency (HA) and DETR to review the Highways Agency’s Specification for Highways Works. The purpose of this review was to identify and remove any impediments for the use of recycled aggregates that could not be technically justified. The joint working party recognised that the revision process could move forward only with an industry commitment to a formalised quality control procedure.

It made sense for the technical committee and joint working party to work towards a consensus view, which was achieved in the document. In recognising that the recycling industry is a fledgling industry, which needs encouragement and support, rather than the heavy imposition of a mandatory system, the route of a simple quality

control protocol has been adopted. The purpose is to expand and to improve the protocol as the industry grows and quality needs are developed, with the ultimate aim of Quality Assurance Scheme registered under BS-EN9002.

The protocol contains requirements for a quality control of recycled aggregates for sale as construction materials, or as constituents in a product e.g. concrete or asphalt. Following aspects are essential in the QC system:

- *A clear definition of the products being provided.* If possible, the product description shall be in accordance with descriptions used for virgin aggregates. Reference has to be made to the specifications to which these products conform. Internal product specifications may be used as such.
- *Acceptance criteria for incoming materials.* The producers need to have and maintain procedures for acceptance of incoming material. All statutory and regulatory requirements have to be observed and included in the criteria. Furthermore, the types of material that

are accepted as well as the methods of acceptance have to be clearly defined. Visual inspection has to be carried out on every load and records of each consignment delivered and accepted shall be kept.

- *Minimum frequencies of inspection and testing.* The extent of inspection and testing needs to be adjusted to suit the requirements of the finished product, the quality of incoming materials and the complexity of the process. Sampling on the processed product has to be carried out in accordance with BS812:Part 102. Minimum test frequencies are specified (table 1). However, testing rates shall be varied to ensure a controlled process. They shall be increased if the product is used in higher specification applications, e.g. Type 1 or concrete products.



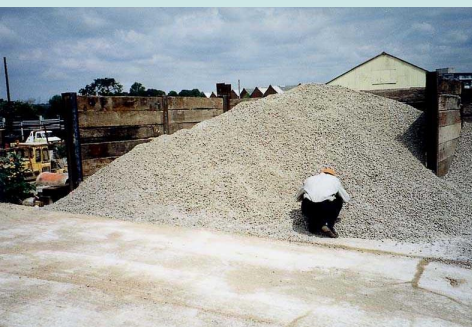
Property Description	Test Method BS812/CEN	Minimum Test Frequency
Aggregate composition including organics	Visual sorting of the plus 10 mm fraction*	1 per week
Bulk density	BS812 Part 2	1 per week
Grading	BS812 Part 103	1 per week
Fines Content	BS812 Part 105	1 per week

*Reference the sorting procedure with Clause Number
If type approval is required, or information to decide or illustrate suitability for a particular end use, other test methods detailed in an appendix to the protocol may prove useful.

Table 1 – Minimum Test Frequencies

- **Records and conformity declaration.** Records of incoming materials and products as well as of all testing carried out have to be kept. As the use of a quality control protocol has the aim of giving adequate assurance that these products conform to the relevant technical specifications or certified characteristics, it is expected that the producer of recycled aggregates would declare use of a quality control protocol as detailed in the document and would make this fact known before making deliveries or at tender stage.

The protocol represents an important step forward to help give clients and contractors greater confidence in specifying recycled aggregates. It is believed to facilitate increased use of recycled aggregates. Adoption of the Protocol makes sound commercial sense. The Highways Agency will in future expect all recycled aggregate in bound and unbound applications to have been produced under the Protocol which the Agency has helped to develop. It is hoped for that other clients and contractors will recognise the benefits and opportunities presented by the Protocol and specify for its use.



Contacts :

Dr. R. Collins
 Building Research Establishment, BRE
 Chair of the Programme Technical
 Committee
 collinsr@bre.co.uk

J. Lay
 RMC Aggregates
 Member of the QPA/HA/DETR
 Working Group
 john.lay@rmc.co.uk

Protocol for the Use of Reclaimed Product in Precast Concrete

The underlying aim of the Protocol, published in 2000, is to enable the precast industry to maximise the environmental benefits of using the proportion of their own product which would otherwise require disposal, as a partial replacement of the natural aggregate in their production process. By replacing natural aggregates with "reclaimed" product the precast concrete industry will make better and more prudent use of natural resources. When taken together with other initiatives, for example ways of minimising waste and more efficient use of energy, which are being investigated within the industry sector, the precast industry are meeting many of the objectives outlined in the Government documents. A related aim, critical to the success of this document, is to provide confidence to clients, insurers, funders and their specifiers that the use of reclaimed product by the structural precast industry has no effect on the performance and serviceability of structures.

product is produced from sound materials of good quality, free from contamination and has a readily traceable history. In practice the vast majority of the concrete used to make reclaimed product would not leave the production plant. In all these respects reclaimed product is far superior to aggregates from "recycled" demolition and a clear distinction between reclaimed product and general construction and demolition waste is justified on this basis. In addition, the good quality nature of the product allows reclaimed product to be treated in most respects in a similar way to a natural aggregate.

The protocol provides guidance on the handling, storage and use of reclaimed product, and incorporates aspects of quality control and assurance. It sets limiting values for levels of natural aggregate replacement (see table 2). The document is not a replacement for existing standards, but is intended to be used in conjunction with existing standards, codes of practice, etc. The guidance given in the document is based on a multi-laboratory technical investigation into the safe use of reclaimed product. The project was funded under the DETR's Partners

Size range of aggregate	Proportion of natural aggregate that may be substituted with reclaimed product (% by mass)*
≥ 5 mm	20
< 5 mm	10

* In any concrete either or both size fractions may be substituted up to the maximum value relevant for that size fraction

Table 2 – Maximum substitution of natural aggregate by reclaimed product

The basis of the document is the safe and effective use of "reclaimed" product in the production process. Reclaimed product is an aggregate made from the crushing and grading of concrete materials originally intended for use in structural concrete elements (or of equivalent good quality) but which after leaving the concrete mixer have not reached the point of sale. There are various reasons for this loss of material from the production line:

- Production off-cuts
- Broken, damaged product
- Waste form ends of slipform or extruded products
- Surplus wet concrete left to harden with other reject concrete
- Residues from mixer washout
- Units damaged in the stockyard

In all of these cases good quality materials will have been used and their rejection from the production process has little or no bearing on the quality of the product to be used as a partial aggregate replacement material. In effect, reclaimed

in Innovation Programme and involved five technical partners, led by BRE, and industrial partners co-ordinated by the Precast Flooring Federation. The technical investigations included a number of physical and chemical tests undertaken on a series of concretes produced at five different UK precast works, from the South of England to Scotland to ensure that a wide range of materials and practice were represented. The concrete specimens for evaluation were cast and cured on site using normal production techniques. At each site a series of concretes were cast to typical precast mix proportions using different partial replacement levels of reclaimed product. More detailed information on the results of these trials is available in BRE report CR43/99.

Contact:

Dr. R. Collins
 Building Research Establishment, BRE
 Chair of the Programme Technical
 Committee
 collinsr@bre.co.uk

SMARTWaste™: A site methodology and software package

SMARTWaste™ is a unique site methodology and software package for auditing, reducing and targeting waste, developed by BRE. SMARTWaste is designed to identify the sources and types of waste, measure the quantities of waste and evaluate the causes. It gives immediate feedback, so maximising the time available for finding ways of reducing site waste and costs. SMARTWaste also provides the waste benchmarks and data needed to do this and to identify priorities for materials recovery. SMARTWaste was launched by BRE in 2000 and was used in two extraordinary property developments – Chiswick Park and the Greenwich Millennium Village – which are from different market sectors but share the goal of reducing waste during construction.

Chiswick Park is a 1.5 million square feet office development for 7000 people with an on-site leisure club, lake, roads and public facilities. Developed by Stanhope Properties and designed by Richard Rogers Partnership and Ove Arup Partners, construction is managed by Bovis Lend Lease and incorporates a host of innovative features. The implementation of SMARTWaste started in July 2000 with an observer on site giving weekly feedback reports. These, plus monthly client and contractor reports, provided the focus for guidance on practical waste minimisation and management strategies. Waste composition and levels are summarised in the table 3 below.



Material Type	% of Waste	% Recycled
Packaging	46,7	27
Miscellaneous	11,0	
Plaster & Cement	10,2	
Insulation	9,3	
Timber	7,5	
Metal	5,6	9,4
Plastic	3,7	
Concrete	2,4	
Ceramic	2,3	
Inert	0,7	

Table 3 – Overall waste composition in % (July-November 2000) Chiswick Park

The Chiswick Park development is in three phases: the three buildings of Phase 1 were completed by the end of 2000, those of Phase 2 will be in 2001 with Phase 3 to follow. A bin distribution and retrieval system (BDRS) for the 200 waste bins on site was specified. The BDRS provides a daily routine of collecting bins and monitoring waste effectively. This system is easily adaptable and can be applied to a range of projects using bins for waste. On completing the data collection for the initial waste benchmark, a material waste management strategy (MRWS) to be adopted during phase 2 of the Chiswick Park projects and future projects was provided. The MRWS identified key waste products, the causes of the waste and its varying cost. Minimisation and management recommendations were also provided.

The 121 hectare (300 acre) Greenwich Peninsula site is being developed with the aim of establishing a new urban quarter for London. The new community will consist of residential and commercial areas with leisure, shopping and recreational facilities linked by a series of parks and extensive pedestrian, cycle, road and public transport routes to all areas in the site and other parts of London. At the southern end of the Greenwich peninsula site, the Greenwich Millennium Village (GMV) is a 500 million EURO private residential development, including homes ranging from one-bedroom apartments to pent-houses, designed to set the national standard for future developments. Minimising environmental impacts and

maximising sustainability are key features of the overall project. The project is being developed by a joint venture of Taylor Woodrow Capital Developments and Countryside Properties.

To give the project a hallmark of sustainability, the GMV team have set a series of innovation targets, including reducing on-site construction waste by 50% over six years. The Hanson Environment Fund and GMV Ltd. Sponsored the implementation of SMARTWaste (by providing funding for a BRE Environmental Manager and a site observer) to help meet this challenging target. The table 4 below provides an overview, produced using SMARTWaste, of the composition of the waste from GMV. This is broken down, for project reports, into more detailed data relating to location and building phase, individual products, amounts and causes of waste.

Type of Waste	% of Overall Waste
Timber	32,9
Miscellaneous	18,0
Concrete	17,9
Plastics	16,7
Packaging	8,3
Metals	3,3
Insulation Materials	1,4
Plaster/Cement	1,1
Ceramic Materials	0,0

Table 4 – Overall waste composition in % (July-November 2000) - Greenwich Millennium Village

Weekly data sheets identify priority areas as they arise and form the basis for further discussions with site management, the client, suppliers and waste managers. These results and the overall data were disseminated each month to the project team. A Recommended Action database forms an integral part of this reporting strategy and allows the status of Recommended Actions to reduce and recover waste to be recorded as the project progresses. In the first three months of the GMV project around 20 Recommended Actions are being progressed. These range from general recommendations for raising awareness on the site to specific advice on, for example, the storage and reuse of metals on site. Most of the Recommended Actions have been taken forward to the point where they are either being implemented or have been found to be not viable. This work will provide a detailed account of how waste reduction was achieved, and will identify the barriers to further reduction and recovery.

Early successes were achieved in the areas of waste reuse and recovery. Waste reduction actions took a little longer to implement because they typically involve changes in the building design and the nature of products supplied to the site.



Contact :

G. Hobbs
Building Research Establishment
hobbsg@bre.co.uk

A LIFE project on construction and demolition waste management in Catalonia, Spain

The Catalonia Institute of Construction Technology (ITeC; <http://www.itec.es>) published in 2000 a Practical Manual with regard to construction and demolition waste management, entitled "How to reduce and manage wastes on construction and demolition jobs". The publication is a direct result of the Life Project 98/351 - *Programme of measures to encourage the valuation, minimizing and selection of wastes originating from construction and demolition jobs*. Its main objectives are to provide the means and to spread concepts which will increase the environmental consciousness of the Catalonia industry. Specifically, it is directed toward the control and reduction of the wastes of varying composition generated by the construction industry. The project was referring to the on-site stage and is thus completing the cycle begun with another ITeC Life Project which focussed on "Teaching Architecture and the Environment at the project planning stage".

The UK Aggregates Advisory Service

The aim of the AAS service, which is funded by the Department of the Environment, Transport and the Regions, is to assist the UK Government to achieve its objective of reducing the construction industry's dependence on land-won primary aggregates and increasing the contribution from secondary and recycled materials.

Information on aggregates efficiency issues, whether relating to primary, secondary or recycled materials, can be obtained from the Aggregates Advisory Service on Freephone (in UK) 0800 374 279, or visit the AAS website at <http://www.planning.detr.gov.uk/aas/index.htm>.

An interesting activity of the AAS is the publication of digests. Interesting digests with regard to ETNRecy.net's activities are Digests nos. 022 (with an overview of large UK information sources), 041 (on current and recent research projects), 042 (on research promoters) and 059 (on the reuse of crushed concrete as aggregate in example projects). All these digests can be downloaded from the web.

In order to achieve the objectives, the Manual attempts to cover two quite different areas:

- On the one hand, it deals with improved waste management issued from construction, renewal and demolition activities by means of bringing up-to-date, developing and making known a methodology for carrying out such activities among all construction industry professionals, bearing in mind environmental parameters and control of wastes.
- On the other hand, it deals with training activities in the construction industry. In order to reach all those in the industry, a kit has been developed as an aid to those who teach in those institutions where subjects related to construction are taught (universities, training colleges, etc.).

Contacts :

E. Vasquez
UPC – Spain
Enric.vasquez@upc.es

Concrete with recycled mixed C&D waste aggregates as coarse aggregates

In the summer of 2001, the existing CUR-Recommendation 58 on the use of mixed aggregates (i.e. a mixture of concrete aggregate and masonry aggregate; in this mixture, the amount of masonry aggregate should not exceed 50% (m/m)) as a replacement of the coarse fraction (4-32 mm) will be withdrawn. Instead, a new recommendation will be published, in which more applications are described and allowed compared to CUR-Recommendation 58.

This new recommendation is based on a research programme which was carried out in the latter years. Construction and design aspects, such as the creep and shrinkage of concrete in which 100% of the virgin gravel was replaced by mixed aggregates, were investigated. The conclusion is that in all indoor applications, including the foundations, 100% replacement of the coarse fraction by mixed aggregates will be allowed. Standard values for the necessary concrete technological calculations using mixed aggregates will be given.

Contact:

E. Vega
CUR – The Netherlands
erwin.vega@cur.nl

German Specification on Concrete with Recycled Aggregates and underlying QA

In August 1998 the German Committee for Structural Concrete (DAfStb) within the German Standardisation Organisation DIN published a "Specification for Concrete with Recycled Aggregates". The document was prepared on the basis of a large, four year national research project known under the acronym BIM "Baustoffkreislauf im Massivbau". After recycled aggregates had been used previously in structural concrete applications only on a very limited scale on the basis of individual technical approval, the BIM project aimed at a general platform for the use of recycled aggregates in plain and reinforced concrete.

The „Specification on Concrete with Recycled Aggregates“ represents a supplementary document to DIN 1045, the German Code for Structural Concrete, and thus opens this field for recycled aggregates as a standardised technology. The Specification may be subject to amendments with the final evaluation of the national research project and as the technology evolves. Furthermore, in future developments it has been considered to deal with recycled aggregates in a special part of the standard on concrete aggregates, i.e. DIN 4226. Recycled aggregates in non-structural concrete. e.g. in roads, are dealt with in separate specifications published for instance by the road authorities.

The DAfStb Specification on Concrete with Recycled Aggregates consists of 2 parts, in which the first part presents the specifications on the use of recycled aggregates in structural concrete, whereas the second part states minimum requirements on the quality of recycled aggregates as well as on their control. According to Part II of the specification only aggregates produced from concrete are covered by this document. Reference is made to the general requirements of DIN 4226-1 (which is applicable to virgin aggregates), furthermore, an additional table with special requirements for recycled aggregates is presented. There, also a maximum of 5 % of foreign material of low density is stated.

Production plants and working procedures have to respect general quality requirements and an internal as well as an external quality control system has to follow the specified test procedures and frequencies.

Part I of the specification focuses on concrete technology and the field of application. In general the use of recycled aggregates is limited to concretes in strength classes up to B 35 (corresponding to C30/37). For indoor exposure no further restrictions on the use of recycled aggregates exist, and depending on the strength class used the replacement level of virgin aggregates by recycled aggregates may extend up to 35 % by volume in strength class B 25 (corresponding to C 20/25). Aside from coarse aggregates also recycled sand may be used for indoor exposure.

For applications in outdoor exposure the use of recycled materials is restricted to recycled materials with known origin of the recycled concrete as well as the contained aggregates.

Furthermore, the alkali-sensitivity of the recycled aggregates has to be evaluated prior to their use. In case of frost attack, the necessary frost resistance of the recycled aggregates must be approved, aside from direct tests on the aggregates itself, tests on the planned concrete mix containing these aggregates are acceptable.

Then, recycled aggregates may be used for water impermeable concrete, concrete with a high resistance to freezing and thawing as well as a high resistance against weak chemical attack. The maximum replacement level for coarse aggregates is 20%, and no recycled sand is accepted. Table 5 summarises the specified replacement levels.

Reclaimed aggregates, i.e. aggregates produced from waste concrete of a concrete production plant, may be used at a replacement level of up to 5 % without any further limitations.

Qualification tests of the concrete have to be performed according to DIN 1045. Some special measurements and precautions are requested in the quality control scheme, such as visual inspections of recycled aggregate deliveries, more frequent aggregate grading and water absorption tests and a regular determination of the moisture content of the aggregates.

Although the specification seems to present a rather conservative approach to the use of recycled materials, the advantage consists in the fact that no adjustments of the design parameters in the structural analysis are necessary since the concrete containing recycled materials are equivalent to concretes with only virgin aggregates. Important for the market image is that no special notes have to be mentioned on the delivery form, with the exception of "not to be used in prestressed concrete".

	Recycled Aggregates and Recycled Sand > 2mm – Vol%	Recycled Sand ≤ 2mm Vol %
Indoor exposure ≤ B25 ≤ B35	35 25	7
Outdoor exposure • Water impermeable elements • Concrete with high resistance to ⇒ freezing and thawing ⇒ weak chemical attack*	20	0

*Also consider other restrictions mentioned in the recommendations

Contact :
J. Kropp
Hochschule Bremen

Quality Assurance of Recycled Aggregates in Belgium

Quality Assurance and Control of recycled products are essential steps for the general acceptance. The Flemish association of C&D waste recyclers (VVS) started already in the beginning of the nineties with the development of a quality control scheme. Collaboration was sought with an independent organisation for quality control of construction products, namely COPRO (<http://www.vzwcoproasbl.be>). Both parties started to develop together a QC scheme which was in the beginning only meant for fixed recycling plants. Important elements of the system were the acceptance criteria for construction and demolition waste, the control of the in-going and out-going flows, the performance of the installation and the organisation of internal and external control procedures.



The QC scheme developed by VVS and COPRO is product based, i.e. a quality label called COPRO-label is attributed to a particular product produced by a particular recycling plant (f.i. recycled concrete 0/32 to be used in foundations according to technical specification SB250). However, the quality assurance scheme does not only cover product-related issues, but also installation and organisation related issues. The COPRO-label is therefore a kind of mix of product and organisation certification.

The certification of the product is not based upon national or European standards because they do not really exist, but on regional technical specifications of the road authorities. Authorities are expected to set the example – certainly in relation to environmental issues – and technical specifications issued by these authorities have therefore an important impact on the market.

Whereas in the beginning of the nineties recycled products were not allowed to be used in public works, nowadays recycled concrete and mixed aggregates may be used in all kinds of applications up to the level of lean concrete.

Research executed by different organisations such as the Belgian Building Research Institute (CSTC-WTCB), the Belgian Road Research Centre and universities and an active waste management policy of the Flemish Waste Agency OVAM were key elements in this evolution.

The technical quality of the product was however not the only concern, environmental hygiene was another. In 1998, the Flemish Regulation for Waste Management and Prevention was published.

Chapter 4 of this regulation is devoted to the acceptance and use of secondary products in general. Recycling of waste products in the construction sector forms a major part of this chapter. Due to the fact that the leaching processes are depending on it, a difference is made between the use of such products in unbound, granular applications and that in bound, shaped applications. All recycled products, industrial as well as those issued from the construction and demolition sector, have to be in accordance with the specifications of the regulations, which cover in general chemical composition and leaching characteristics.

Important to note is that mineral waste products issued from the construction and demolition industry are deemed to satisfy the quality requirements if they were produced with a COPRO-label. As a matter of fact, practically no expensive chemical or leaching tests have to be performed in the framework of the COPRO QC scheme. The strict acceptance schemes used by certified recycling plants proved to be sufficient for guaranteeing the environmental quality of the recycled aggregates on that basis. At the moment, 33 COPRO-certified recycling plants are available in the Flemish region.

The fact that the regional authorities prescribed a voluntary quality scheme (allowing of course equivalent schemes) in the regulation, had a major impact in the recycling sector. Recycled products, which were not processed by COPRO-certified organisations, remain waste, which means that their transport and use is strictly regulated. When using this waste in construction activities, the companies are in fact working illegally. The success of the VLAREA regulation heavily depends on an active control by the authorities, and that's probably the weak point of the system. As construction and demolition waste is by most considered as harmless, it's not really a priority item for control.

In the near future, two important changes are expected :

- On the one hand, efforts have been made in the previous years to develop a BENOR quality control system for recycled aggregates replacing as such the COPRO label. The utility of that is that recycled products would be delivered under the same label as natural products, which would of course be a positive point with regard to their image. The BBRI plays an important role in this regard by doing national supported normative research and by chairing a CRIC standardisation committee on recycled aggregates.
- On the other hand, the new government has decided to review the VLAREA legislation. Main objective of this review is to promote high-level recycling with the idea that by doing this more recycling cycles within the same product chain are possible. The modified version is expected to be published in the second half of 2001.

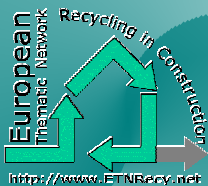
Contacts : *Ing. D. Vandecapelle*
Antwerp Recycling Company
Founding Member of VVS

Ir. J. Desmyter, BBRI, BE
Chair of the CRIC Certification WG on Recycled Aggregates.
Member of the COPRO Management Committee "Recycled Aggregates"

NEXT ISSUE

If you have anything to communicate through this newsletter, please do not hesitate to contact us. If you wish to send us material (text 400 words and pictures), please mail this to the address below.

The next issue will be published in September 2001.



Responsible editor:
J. Vyncke

Editing and Layout:
J. Desmyter
M. Merckx

Editorial Board:
R. Collins
J. Desmyter
G. Hobbs
J. Kropp
J. Lay
M. Tarring
D. Vandecapelle
E. Vega

A Norwegian computer-tool for evaluating the feasibility of recycling

A prototype for a computer program to provide quantitative background information for the planning of demolition and recycling activities has been developed by DEMEX in co-operation with a PhD student from NTNU, Trondheim, Norway, for Statsbygg (the Norwegian Directorate of Public Construction and Property). In its present form (anno 2000), the program presents the following indicators for the consequences of any given scenario:

- *Costs (in total and per ton)*
- *Road distance (on country roads and in the city)*
- *Diesel consumption*
- *Energy consumption (electricity and diesel)*
- *Material flow (savings and waste)*

The following fractions can currently be evaluated in the program:

- between different forms of transport, and moving the material on site
- *Storage*, the material is stored a short term or long term
- *Landfill*, the material is deposited for a long time
- *Material production*, virgin materials are produced (in order to be able to subtract these processes)
- *Transport*, between different sites

In the program the following equipment types are included:

- *Demolition equipment*
- *Crushing equipment*
- *Handling equipment*
- *Transport equipment*

Since the program is also intended for users that have little experience of demolition

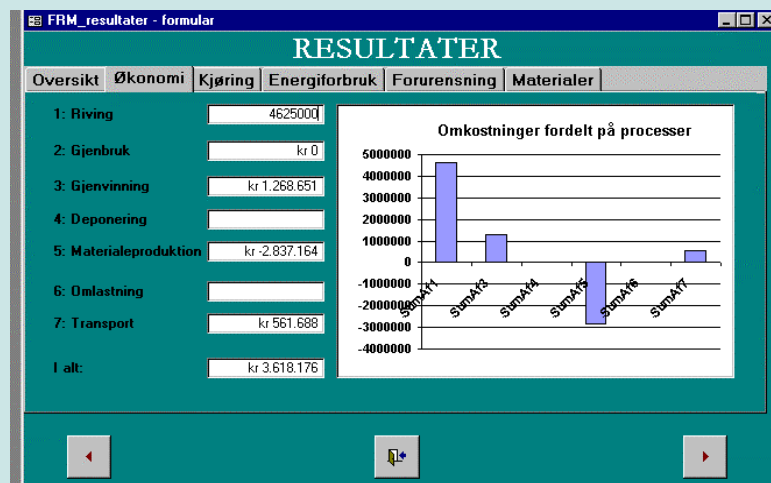


Figure 1 – Presentation of the distribution between different processes for selected indicators

- *High quality concrete*
- *Low quality concrete*
- *Bricks*
- *Mixes of concrete and bricks*

The different applications included in the program are, for:

- *Concrete*: Aggregates for new concrete, road bases, sub-bases, fill, and landfill
- *Brick*: Aggregates for road bases, sub-bases, fill, and landfill
- *Reinforcement Steel*: Recycling, fill (as part of concrete), landfill (as part of the concrete)

Processes included are:

- *Demolition*, generation of waste or raw material for recycling
- *Recycling*, processing of material
- *Use of material*, in new constructions
- *Handling*, the material is reloaded

projects, it has been designed to combine sets of equipment (work packages) instead of merely separate pieces of machinery. Costs for laboratory tests and consultants (for example, in order to identify the quality of material) are currently not included and therefore have to be added when using the program. One application for the program could be to evaluate the importance of additional information such as tests, when results from using the program have been generated. The program does not have a feature to analyse the effects of reusing a product.

Contact :

M. Tarring
DEMEX Consulting Engineers A/S
Mt@demex.dk

Published on behalf of the European Thematic Network on the Use of Recycled Aggregates in the Construction Industry. For further information concerning this network or the distribution of this newsletter please contact the Network Secretariat.

✉ ETN Recycling in Construction, c/o WTCB-CSTC, attn. of Mrs. M. Merckx, rue de la Violette, 21-23, B1000 Brussels, Belgium

☎ +32.2.655.77.11.; 📠 +32.2.653.07.29.; e-mail: martine.merckx@bbri.be

Produced by CSTC-WTCB