DIRECT-MAT – sharing knowledge and practices on recycling of road materials in Europe

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Abstract

DIRECT-MAT is a three-year European project aiming to facilitate the sharing of national experiences on dismantling and recycling or safe disposal of road and road related materials at the European level. It was initiated within the EC 7th Framework Programme Transport first call and is comprised of partners from fifteen participating countries for a budget of 1.2 million Euros. The project runs through 2009–2011 and involves building a European Web database and drafting best practice guides on DIsmantling and RECycling Techniques for road MATerials (“DIRECT-MAT”). The intention is that project results shall support the daily work of practitioners, researchers and standardisation bodies.

Several materials are addressed – unbound, hydraulically bound and asphalt road materials, but also other materials related to road use but not commonly recycled in road construction. These include tyre shreds, sediment from ditches, industrial by-products and reinforcement materials. The work programme is organised into seven work packages where four packages focus on the various construction materials, one is devoted to the database and the remaining two work packages to management & coordination and dissemination.

Dissemination activities include cooperation with a Reference Group consisting of end users in several countries; presentations in national and international papers and conferences as well as the arrangement of national seminars and a European workshop for end users. Continuous project information will be available at http://direct-mat.fehrl.org.

At present, many European countries have acquired experience in dismantling and recycling road materials back into roads. However, research results are not widely implemented and national documents are not often available to specialists from other countries. In this European project, twenty partners cooperate to build a web database that will provide access to validated guidelines, national document references, harmonised literature reviews and practical application case studies based on jobsite data sets.

In this way DIRECT-MAT will actively contribute to generating closer cooperation between research and practice within road material recycling and also contribute to reducing the waste disposal associated with roads.

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1 Background

The EU25 main road network is essential for passenger and freight transportation across Europe. However, its maintenance is costly and also responsible for detrimental impacts to the environment relative to waste production and natural resource consumption. As emphasized by ERTRAC\(^1\) in its Research Framework [ERTRAC, 2006], it is necessary to simultaneously optimise the quality-to-cost ratio of road infrastructure and encourage environmentally friendly road maintenance practices. A significant contribution to the ERTRAC view, consists of reducing the proportion of road materials originating from natural resource extraction and increasing the recycling of locally-available road wastes into new road materials.

Over the past few years most European countries have started to work towards this goal by implementing national strategies for dismantling and recycling road materials back into new roads. European projects ALT-MAT [CORDIS, 1999] and, more recently, SAMARIS [FEHRL, 2003] have also made significant contributions to boosting recycling, by issuing selection recommendations and test procedures to assess the mechanical and environmental performance of road construction by-products. At present, many European countries have acquired experience in dismantling and recycling road and road related materials back into roads, especially asphalt materials, either on their own or by applying European research results.

However, depending on available wastes and local regulations, the practice at national level differs significantly from one European country to another. In this way, a wide array of research results on road material recycling has been produced, yet they are dispersed throughout the various Member States and not widely implemented. Furthermore, pertinent databases and available documents are not often translated into a common language and site data are not often available to specialists from other countries. As a result, national experience based on local site data almost never benefits other European countries, and this is especially true for the newer Member States.

2 Objectives

In order to facilitate the sharing of national experiences at the European level, which will provide major benefit to the European economy and environment, a European project entitled “DIRECT-MAT” has started as a Coordination and Support Action (CSA), with a 1.2 million euro budget, within the 7\(^{th}\) Framework Programme.

The objectives of the project are to build a European Web database and draft Best Practice guides on dismantling and recycling road materials and vehicle tyres back into roads. The Best Practice guides are aimed at issuing recommendations for dismantling and recycling those materials in order to offer the highest added value.

The project addresses the recycling of unbound, hydraulically bound and asphalt road materials as well as other road materials not presently recycled to any great extent in road construction. It also addresses strategies for recycling road related materials, such as vehicle tyres in road construction.

\(^1\) European Road Transport Research Advisory Council
3 Benefits
The Web database will provide on-line accessible information to road authorities, practitioners and researchers. Several benefits are expected from the project:

- From a **technical** standpoint, this project will provide stakeholders with online available and validated guidelines, to help them decide and proceed appropriately with the dismantling and recycling of road and road related materials back into new roads. By increasing the confidence of authorities and practitioners in the recycling of road products and road related products, the project will actively contribute to reducing the waste associated with road maintenance.

- From a **scientific** perspective, an integrated and shared view of road material research needs shall be stated in order to improve the coordination of corresponding national research programmes at the European level and establish priorities for European research and technological development. Moreover, the Web database will provide scientists with an online access to: national document references, harmonised literature review, and practical application case studies based on jobsite data sets. These resources will prove helpful for developing research projects, as well as testing and improving models. In turn, scientists will be given the opportunity to upload new laboratory or worksite data for the benefit of the entire European road research community.

- From a **regulatory** point of view, the project results will assist CEN technical committees\(^2\) in defining mechanical, geometrical, physical, chemical and environmental criteria for the purpose of allowing recycled road materials and construction wastes to be used in roads. The experts from these committees, responsible for drafting European standards, will profit from online access to a European database containing validated laboratory and worksite data of various national origins when incorporating scientifically-based requirements into the standards.

4 Partners and organisational strategy
Twenty partners – research institutes, universities and private companies – from fifteen participating countries will contribute to collecting, analysing and sharing international as well as national information for the benefit of Europe (Table 1).

In order to achieve the objectives of the project, the work programme has been organised into seven Work Packages, WPs, (Figure 1).

WP 1 “Management and coordination” will handle all organisational matters associated with the project. By including the coordinating person and all Work Package leaders in WP 1, information flows to all participants will be assured.

WPs 2 to 5 focus on the various road construction materials covered in the project. Skilled experts on identified types of materials used in road construction contexts will collect existing knowledge and practices in the area of dismantling materials and recycling some of these road materials as end products. Then, the experts of each WP will organize the collected data and produce best practice guides on dismantling and recycling strategies of the material they are in charge with.

\(^2\) “Aggregates” (TC 154), “Road materials” (TC 227) “Concrete and concrete products” (TC 104) and “Construction products: assessment of the release of dangerous substances” (TC 351).
Table 1. Partners in the DIRECT-MAT European project.

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<tr>
<th>Partner</th>
<th>Country</th>
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<tr>
<td>French Public Works Research Laboratory (LCPC), Coordinator</td>
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<tr>
<td>Belgian Road Research Centre (BRRC)</td>
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<td>Swedish Geotechnical Institute (SGI)</td>
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<td>National Laboratory for Civil Engineering (LNEC)</td>
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<td>Dresden University of Technology (TUD)</td>
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<td>Forum of European National Highway Research Laboratories (FEHRL)</td>
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<td>Branchevereniging Recycling Breken en Sorteren (BRBS)</td>
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<td>The Research Institute of VOZ</td>
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<td>Transport Research Centre (CDV)</td>
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<td>Swedish National Road and Transport Research Institute (VTI)</td>
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<tr>
<td>Centro de Estudios y Experimentación de Obras Públicas (CEDEX)</td>
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<td>Slovenian National Building and Civil Engineering Institute (ZAG)</td>
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<td>The Highway Institute (IP)</td>
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<td>Road and Bridge Research Institute (IBDiM)</td>
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In WP 2 “Unbound Materials”, the end-of-life strategies of unbound layers are analysed. Since these materials are used in sub-layers on nearly every road in Europe and in surface courses on many minor roads not submitted to heavy traffic loads, they definitely represent the largest quantity of all road materials in use. Furthermore, other reclaimed road materials can easily be recycled as unbound material for sub-layers.

In WP 3 “Hydraulically-Bound Materials”, the experts determine the results stemming from national experiences involving end-of-life strategies for hydraulically bound road materials that are used as: hydraulically bound layers in the sub-base, base courses, and heavy-duty surface courses.

In WP 4 “Asphalt Materials”, knowledge acquired on the assessment, dismantling, disposal, re-use and recycling of asphalt road material, together with the use of other recycled road materials in bituminous-bound layers are detailed. Since these topics have already been researched in many European countries due to the special material properties of the binder, a significant part of the project force will be allocated to WP 4.

In WP 5 “Other Materials not commonly recycled in roads”, the road construction materials not considered in WPs 2 to 4 will be studied along with a number of special technical considerations. This WP will examine many substances capable of causing problems during the dismantling and recycling processes, including hazards for human health and the environment. The existing practices and experiences concerning the use of recycled vehicle tyres in road construction will also be investigated.
WP 6 “Web database on the dismantling and recycling of vehicle tyres and road materials back into roads” will comprise the data assembled and coordinated in WPs 2 to 5, in addition to harmonizing these data and developing database software for displaying the site and laboratory data obtained from partners for the benefit of all future end users.

To ease the project management workload and progress assessment, WPs 2 to 5 will exhibit similar work plans, whose stages are underlined by the following deliverables:

- December 2009: International literature review on existing knowledge.
- August 2010: Reports on practical application case studies regarding dismantling and recycling of materials (from national and European experience). An initial analysis of worksite data will be used to generate reports on the techniques of assessment, dismantling, disposal, re-use and recycling of the various road materials as well as the use of these materials in new road structures.
- June 2011: Best Practice guides: These guidelines will be based on the results of the literature reviews and database analyses. Furthermore, the results from new research projects, published during the project lifetime, will be introduced into the Best Practice guide, so as to ensure that it includes up-to-date data at the end of the project period.

These deliverables will also be used as Milestones to enable assessing progress and results. In addition, a first milestone will be the creation of a questionnaire and database structure, both of which are required for the subsequent work.

5 Dissemination of results

To attract a large number of participating stakeholders, the database and its potential benefits must be promoted. WP 7 “Dissemination, networking and coordination of knowledge
sharing” will therefore make use of the available data resulting from WPs 2 to 5; moreover it will focus on dissemination activities such as cooperation with a Reference Group consisting of end users in several countries. This coordination of research results with jobsite data, as well as their implementation into the Web database built by WP 6, will be presented in national and international papers and conferences (by poster presentation as well) to encourage further progress in data collection by as many stakeholders as possible. National seminars and a European workshop for end users will be arranged in 2011. Continuous project information will be available at http://direct-mat.fehrl.org.

6 Conclusion

By gathering information on every type of road and road related material used along with local experiences, by drafting best practice guides and sharing all those elements on a website, the DIRECT-MAT project will establish a benchmark on the best practices for dismantling and recycling or safe disposal of road and road related materials. The work undertaken will also serve to identify further possible research needs for improving overall system optimisation with regard to material dismantling, manufacturing and implementation processes.

7 Acknowledgements

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References