

Handling environmental requirements in rolling stock procurement projects

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The PROSPER and REPID 'twin' projects are the joint result of a unique cooperation between railway operators and manufacturers to improve environmental performance of new rolling stock through developing common guidelines, specifications, indicators, tools and data formats. The cooperation is showing the proactive lead taken by the railway sector to secure its environmental advantage for the future.

In the last two decades the focus on environmental issues has gradually forced business in general to take initiatives to react to market requirements or public opinion. In the railway sector, with its public service obligation and close links to national and regional governments, it is even more important to be able to respond to political as well as market requirements.

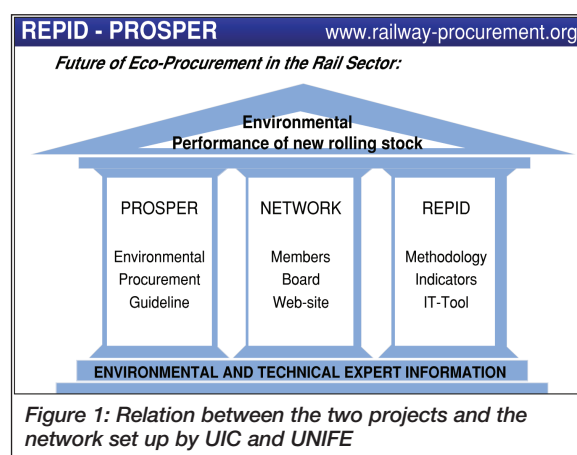
Rail transport has clear environmental advantages compared to other modes of transport, but competitors make great efforts to improve their environmental performance. To hold and enhance the environmental advantage of rail transport, continuous environmental improvements and documentation of these efforts made in the rail sector is needed. This can only be achieved if environmental aspects are a fully integrated part of procurement projects at railways and product development at manufacturers.

The UIC funded project PROSPER will facilitate this improvement of environmental performance of rail transport by providing process support for all relevant steps when procuring rolling stock. The results of the project are compiled as an environmental guideline for railways, including a set of harmonised environmental specifications.

In order to implement these environmental specifications efficiently railways and manufacturers need a common environmental methodology. In

this light, the REPID project has been launched. Based on the defined methodology, which includes environmental performance indicators (EPI's), the REPID project develops a software tool for handling Design for Environment (DFE) and a web-based solution for environmental communication between the different railway stakeholders.

The target audience for both projects is engineers, designers, project managers, procurement and environmental experts involved in the development and procurement of railway rolling stock. A network has been set up by UIC and UNIFE to gather all their experts around this topic. To use the synergies between both projects is a success criteria for REPID and PROSPER to have a close cooperation (see Figure 1).



Need for increased environmental performance of rail

The environmental performance of railways is becoming increasingly important due to the need to transfer more passenger and freight transport to rail in conjunction with increased public awareness, resulting in substantial political pressure.

Furthermore, from a cost efficiency point of view, environmental issues can be a driver for different

measures to cut the railways' costs e.g. for use of energy, water, chemicals and waste.

But, in fact, environmental requirements are still often not a systematically integrated part in procurement projects in rail business today. In particular this is caused by a lack of harmonised specifications and systematic methodology to measure and verify environmental performance of rolling stock as it already partly exists today for

PROSPER: UIC environmental guideline and specifications

With the now finalised first phase of the UIC project PROSPER an environmental guideline has been developed which assists railways in handling environmental aspects in the procurement process of new rolling stock. Applying the guideline will provide the user with a detailed overview on the environmental priorities for railways and how to handle the aspect efficiently.

Starting from February 2002 this 'environmental guideline for the procurement of new rolling stock' was elaborated by a project team of five European railways until summer 2003.

The approach of the PROSPER project was in particular to:

- Determine the relevant environmental key areas for railways
- Coordinate a set of prioritised environmental specifications for these key areas (without defining performance values)
- Develop a procedure to integrate environmental requirements into the procurement process at railways

Environmental key areas and specifications

The most relevant environmental areas for railways at the moment are noise emissions and exhaust emissions as legislation has come into force (e.g. Technical Specification Interoperability, national laws) or further regulations are

being discussed in these two environmental fields.

In the case of energy consumption, railway transport has very clear advantages compared to other modes of transport. Nevertheless competitors are putting a lot of work into reducing energy consumption. In view of that, energy efficiency has top priority for railways as well, because cutting energy consumption will:

- Strengthen the competitive position of railways compared to other modes of transport
- Decrease Life Cycle Costs (LCC) of railway operation
- Make visible that railways are in line with international agreements on climate protection, such as the Kyoto Protocol

The environmental aspect of materials/recycling and waste has also become a priority over the last decade. Since the concept of an Integrated Product Policy (IPP) is becoming more and more relevant in the EU, resource consumption and the ability to re-

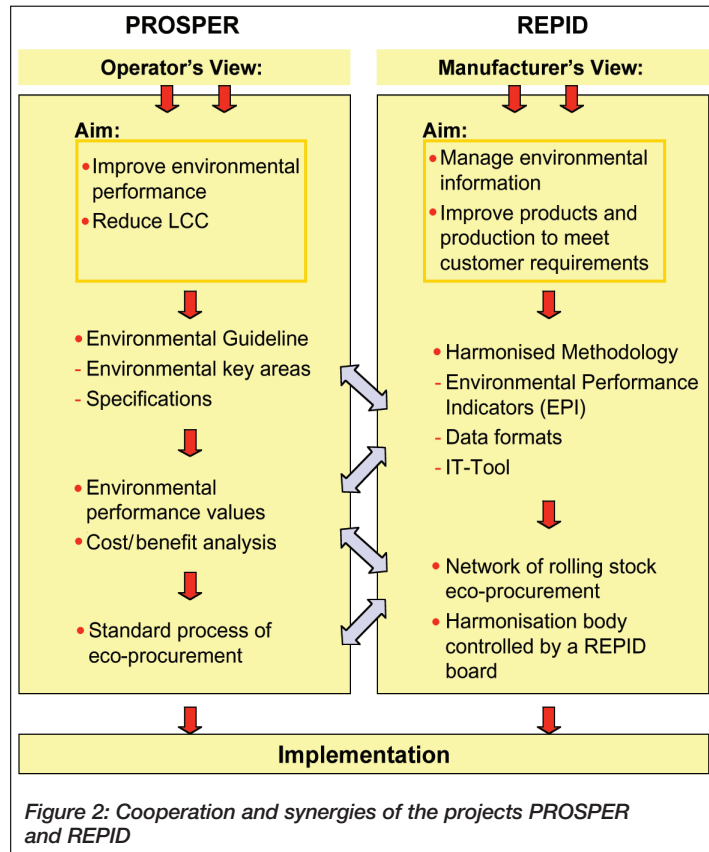


Figure 2: Cooperation and synergies of the projects PROSPER and REPID

other modes of transport. E.g. for road transport a standard to measure and verify the energy consumption of cars has existed for years.

In order to efficiently improve the whole process in the rail business there is a need for a common environmental language and procedure used by both railways and manufacturers to integrate environmental considerations into procurement projects and product development of rolling stock. In this context the two projects PROSPER and REPID were started to fill this gap (see Figure 2). Now a framework for eco-procurement exists in the rail sector which provides a unique opportunity for joint activities with respect to improving environmental compatibility of rail transport.

Furthermore, the two projects provide the basis for identifying future research needs as described in the environmental cluster of the Strategic Railway Research Agenda (issued 2002 by ERRAC). The results of the projects achieved so far will be described in the following.

PROSPER specifications	REPID indicators (as of October 2003)
Noise Emissions (top priority)	
– All noise measurements shall be carried out according to prEN ISO 3095 with defined deviations for the reference track	
– Limit/target value for passing-by noise (according to applicable legislation)	– <i>Pass by Noise*</i>
– Limit/target value for stationary noise with all equipment running (e.g. engine, compressors, ventilators)	– <i>Stationary Noise*</i>
– Limit/target value for starting noise	– <i>Starting Noise*</i>
Exhaust Emissions (top priority)	
– According to UIC Leaflets 623-2/624 or to current EU emission legislation for diesel railcars and locomotives respectively (in preparation)	
– Limit values for NO _x , CO, HC, PM emissions	– <i>Exhaust emissions from diesel engines*</i>
Energy Efficiency (top priority)	
– Defined value for vehicle mass	– Total vehicle mass
– Defined value for traction unit efficiency at different load factors	– <i>Traction energy use*</i>
– Calculation of traction energy consumption by manufacturer for specified operation pattern	
– Defined value for average diesel consumption referring to EN ISO 8178-4, F-cycle (test bench) or another applicable test mode specified in the invitation to tender	
– Energy management/control system for comfort functions at longer standstills	– <i>Energy use for comfort functions*</i>
– Calculation of on-board energy consumption by manufacturer for defined conditions	
Materials/Recycling/Waste	– Materials inventory degree – Total number of materials
– Exclusion of prohibited materials used in construction (black list)	– Amount of forbidden/restricted materials
– Defined values (weights/ratios) for restricted materials used in construction (grey list)	
– Target value for material recycling rate after use and material that can be incinerated	– Material recycling rate/can be incinerated with energy recovery – Fraction renewable/recycled material – Marking of polymers – Amount of potential hazardous waste
Other environmental impacts (incl. manufacturing)	– Emissions from wear – <i>Electromagnetic fields*</i> – <i>Suppliers with Env. Management System*</i> – <i>Existence of environmental product information*</i>

* Indicators in italics can only be applied on vehicle level

Figure 3: Top priority specifications from PROSPER linked with the current set of REPID Indicators

integrate materials into the material cycle have appeared on the agenda. The significance for railways is the need to especially improve the knowledge of forbidden and restricted materials that are used in vehicles to avoid hazardous waste and to improve vehicle recyclability and therefore cut resource consumption and disposal costs.

For the above mentioned environmental aspects a set of functional and measurable specifications has been elaborated for the use in invitations to tender of new rolling stock. Using these top priority specifications will determine the most important aspects of environmental performance of new rolling stock.

By close cooperation of both projects the PROSPER specifications have been linked with the Environmental Performance Indicators (EPI)

can be calculated down to component level, noise, exhaust emissions and energy efficiency specifications can only be analysed on vehicle level.

Economic aspects and environmental performance values

The relationship between enhanced environmental performance of rolling stock and the impact on investment and LCC is of vital interest for railways. First results of the PROSPER project have shown that energy-related specifications seem to have clear benefits with respect to LCC.

In order to avoid expensive solutions, strategies have to be developed to increase environmental performance at constant investment costs.

Considering this the PROSPER project will, in its second phase until 2005, coordinate together with UIC and UNIFE experts environmental performance values for the now present specifications.

Process integration

Given that environmental aspects are often not fully integrated into the procurement process of railways it is necessary to clarify and define the roles and interfaces of the different players in the process. In view of that, the PROSPER project has proposed an approach for railways that defines tasks and interfaces in the process to make integration of environmental aspects more efficient. Figure 4 shows a simplified description of the approach.

To further facilitate this process and to provide the information needed at the different steps is a task of the second phase of PROSPER until 2005. This will be done in close cooperation with the REPID project.

REPID: Harmonised methodology and IT-tool

The REPID project started in August 2002 and is 100% funded by the European Commission. It is a two-year project bringing railways and industry together with the help of a consultant and university (both from Sweden). The objectives of the REPID project are to provide:

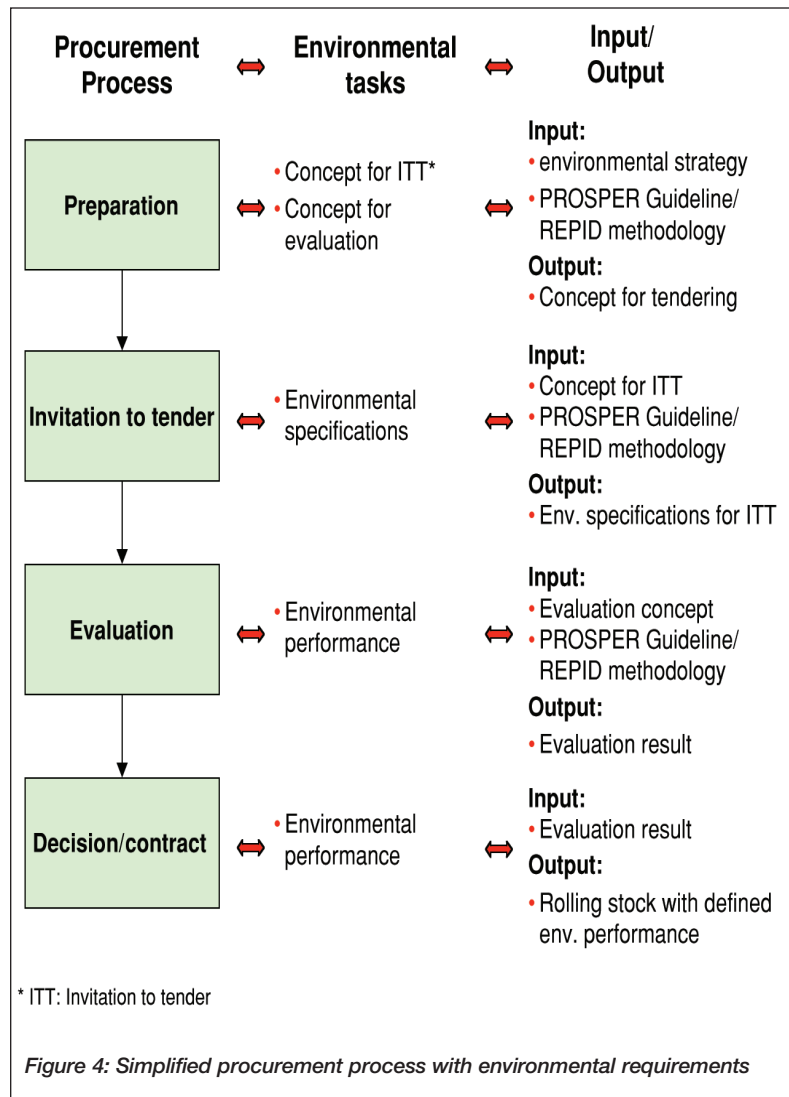


Figure 4: Simplified procurement process with environmental requirements

defined in the REPID project (see Figure 3). Using the REPID EPIs enables the manufacturer to break down the operator's specifications into the different levels of the rolling stock (vehicle, system, sub-system etc.) and to analyse the results of a design solution. Material related specifications

- A framework with a juridical body for dealing with harmonisation of EPIs and data formats within the railway industry
- A professional software tool for improving usability of EPI and data formats
- End of life phase – recycling, waste management (e.g. amount of potential hazardous waste)

The REPID project was launched as the follow up to the successful EU funded RAVEL project running from 1998 to 2001. The RAVEL project developed a framework methodology for handling Design for Environment (DFE) and a pilot version of a web-based solution for environmental communication between the different railway stakeholders. As the results of RAVEL were very promising to be applied in the design process of rail vehicles, the REPID project now refines and adjusts the results of RAVEL and will bring them to marketability.

REPID methodology

The common ‘environmental language’ in the railway industry will be provided by the REPID methodology. It is developed to support all companies involved in the complete supply chain of rail vehicle manufacturing. The main principle of this methodology is the link between the concept of eco-efficiency and EPIs for the railway industry. An initial set of indicators has been defined in the REPID project based on the policy of UNIFE and UIC and using results of the PROSPER project.

In this way certain rolling stock will have a number of EPIs describing the environmental performance for the entire life cycle as shown in Figure 5 .

To further enable the REPID methodology a standardised data format for electronic communication and material list in the design process of rolling stock is being elaborated.

Design for environment using EPIs

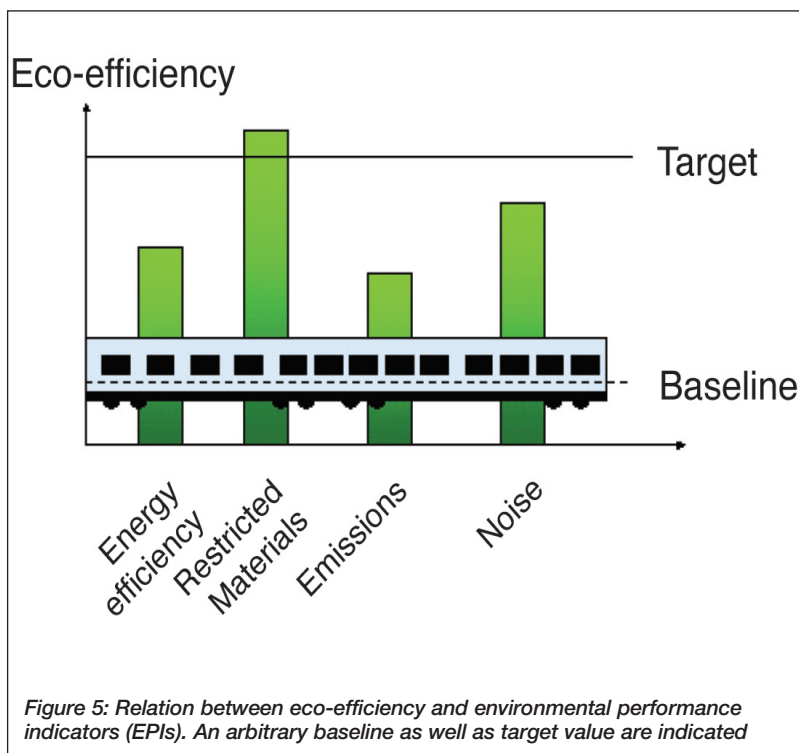
The REPID indicators can be divided into three groups following the life cycle phases of a train:

- Production phase – environmental impact from the production process (e.g. fraction recycled material)
- Operation – environmental impact during operation (noise, emissions, energy consumption)

Generally, EPIs are used for the comparison of environmental impact. This comparison takes place at different levels of a rail vehicle, depending on the indicator: complete train, vehicle, subsystems and component level.

The indicators related to noise, emissions, and energy are so far applied on the vehicle level (top down approach). The indicators for materials, recycling, waste and manufacturing are calculated based on information on material and component level (bottom up).

This means in practice, when constructing a vehicle the designer is able to control the material related indicators depending on which construction material he has chosen. For example the indicator ‘material recycling rate’ can be



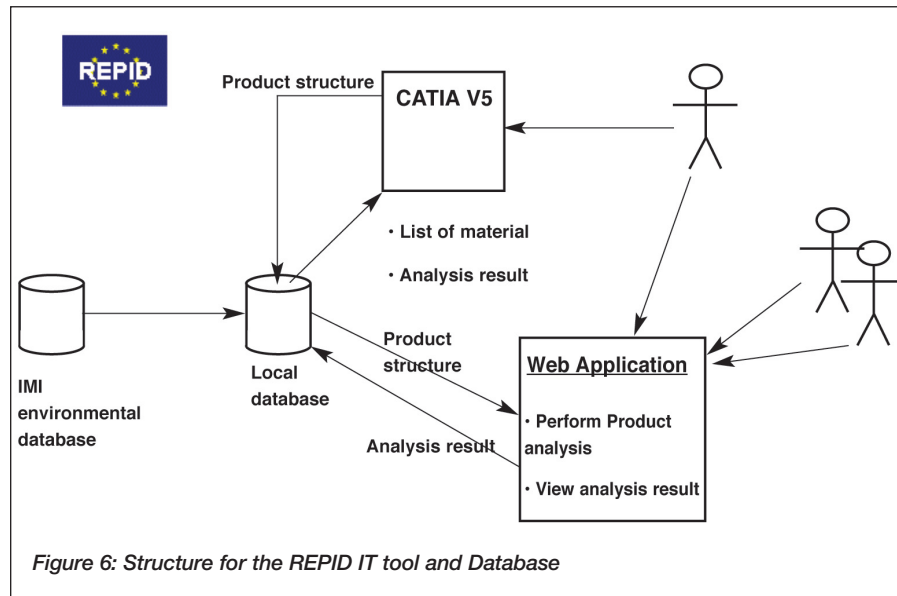
calculated for the whole vehicle based on the materials that were used in construction. Please see Figure 3 for the entire list of REPID indicators.

REPID tool

A database and a software solution support the REPID methodology. The database is the foundation of all functionality in the REPID system and supports a structured management of design projects. These designs can be analysed and compared in order to generate reports and achieve environmental targets.

REPID has developed a web interface that will be used for the creation and input of product structures and materials, to create designs for analysis, to generate reports, and extract data from the tool into other systems (e.g. PDM systems). The

body to treat the aspects of harmonised EPIs and material lists, as this work is not done by other parties in or outside the railway sector. The legal body will be hosted by UIC and UNIFE and governed by a 'Railway Board for DFE &



Environmental Procurement Information' (REPID Board). It is the role and responsibility of the board to serve and advise the UIC and UNIFE members with the required decisions for the development and maintenance of the REPID software, data formats, and related services. The REPID Board should also have a formal relation to the CEN and ISO organisations.

first step has been to demonstrate the usability of the application by making an integration with CAD software (Catia V5), but using the XML and EXPRESS format as the interface, the software can easily be tailored to other PDM systems.

A structure for formatting data from product data management systems has been created, which facilitates the import of product structures and material information into the database for analysis without further need for manually inserting of data.

As can be seen from Figure 6, there are basically two types of users. The web application is mainly to be used by railway operators and sub-suppliers and the CAD/PDM tool is mainly to be used by manufacturers.

Network of rolling stock eco-procurement

A functioning network is a condition for a successful dissemination of results. The REPID Network started April 2003 with a meeting at UIC. A web-site (www.railway-procurement.org) brings together the following partners:

- Players within the rail sector (suppliers, manufacturers of rolling stock, owners and operators of trains, refurbishment companies)
- Authorities (and consultants) acting as independent assessors for environmental standardisation

A legal body for REPID

In order to make the REPID results work in reality after the project ends, there is a need for a legal

Next steps for the two projects

In the remaining part of the REPID project the focus will be development and testing of the software and the production of manuals for basic training, REPID data management and material database. Furthermore, UIC and UNIFE will agree upon a strategy and business plan for the implementation of the REPID IT tool, framework and legal body.

The first version of the REPID software is free for all UIC and UNIFE members, however the application will require certain implementation costs for the manufacturers (system integrators). The costs of later versions of the software will be negotiated between the software and data supplier(s), UIC, UNIFE and their members.

The PROSPER project will, in its second phase, agree with the various railway expert groups on recommended environmental performance values for the identified environmental key areas. Together with documentation of legal aspects, the results of PROSPER phase II are planned to be compiled as a UIC Leaflet in 2005.

Both projects REPID and PROSPER will, together with an active network, facilitate the rail sector to integrate environmental aspects into rolling stock procurement, enhancing future environmental performance of railways.■

For more information please visit www.railway-procurement.org