EURODEX
Strategic Plan for a EUropean ROad Damage EXperiment

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ABSTRACT

CATRIN (Cost Allocation of Transport Infrastructure Cost), an EU-project running until April 2009, supports the European Transport Policy to assist in the implementation of transport pricing for all modes of transport. For the road sector more effort in research will be necessary to assess sustainable and fair pricing principles. Thus, one of the work packages develops a layout for a European Road Damage Experiment (EURODEX) with an emphasis put on accelerated pavement testing (APT). The paper presents the strategic plan for EURODEX, its objectives and benefits.

Many European pavement design guides still base on the 50-year-old 4^{th} power rule obtained from the AASHO (American Association of State Highway and Transportation Officials) Road Test. EURODEX will help to overcome the well-known shortcomings of the 4^{th} power rule. The project combines extensive material testing by APT with statistical, analytical and numerical methods that have been developed in the last years on an international level. The project will bring together a variety of international partners in pavement research, as well as economists, the European Commission (EC), national representatives and road managers.

A lot of research effort has been made in the last 20 years in pavement research. The problem today is that data and results have not been collected in a common research database and thus results and findings from the last decades are spread in the different research institutes. Within EURODEX a pavement research database will be created. Relevant data from previous research programs will be collected, evaluated and analyzed in a common way by guidelines provided by the project. All future data from EURODEX will be treated the same way. So we will make sure that data from different participating laboratories are consistent and comparable.

Besides the gain in knowledge regarding pavement performance for the research community, EURODEX will provide a solid basis for a source-related cost allocation on roads. Results can be used by road managers to make maintenance work more economic, the road industry can improve its competitiveness in international bidding. Road users will find a fair pricing principle on roads and travel safer if the findings from EURODEX are realized. Results and findings from EURODEX will form a strong tool to improve both, materials and pavement design, as well as tires, suspension systems and other parts of vehicles to extend the life expectancy of roads and vehicle.

INTRODUCTION

Road damage is notably caused by vehicle loading and axle/tire configuration but also by climatic conditions. To design pavements, as well as to quantify pavement deterioration the 50-year-old 4^{th} power rule is still used by the majority of EU member states. This prominent rule states that pavement damage caused by vehicles is related to the 4^{th} power of their axle weight. It was derived from the US AASHO Road Test in the late 1950s. Some criticism against the application of this test to derive Load Equivalency Factors (LEF) today is (1):

- A limited number of pavement designs were constructed on the same soil in one climate.
- It did not consider vehicle characteristics (suspension, tires, axle configuration etc.), which have also changed significantly since the test. Dynamic effects, loaded steering axles, tridem axles and other vehicle related topics are not taken into account.
- Lateral distribution was not considered and is important for both flexible and rigid pavements.
- Pavement design has significantly departed from the practice used at the time of the test.
- The LEFs derived from AASHO Road Test have not been shown to be applicable to specific distress elements, such as rutting.
- Pavement type and structure is needed information in a model for LEF. This is excluded in the simplified form (the 4th power law).

Although it was clear from the beginning that the obtained rule is only valid under the specific conditions of the test with regard to time, place, environment and material properties, it has been used around the world regardless of actual conditions. Later full-scale pavement tests resulted in deterioration exponents between 1.7 and 10 (2).

To overcome the 4^{th} power rule and to provide an improved model is one major objective of a new empirical EURODEX. Therefore the most important performance indicators and distress factors of pavements have to be studied systematically on a European level. This will lead us to a deeper knowledge of the complex material-vehicle-environment interaction. We will make use of literature study to find out about the existing knowledge, as well as of small-scale laboratory testing. Full-scale pavement testing on special test sites (APT facilities) will be the core of the experimental part. Test section on the public road network (RLT - Real-time Load Test) loaded by real traffic will validate the model.

Since EURODEX will bring together European pavement research on a large scale for the first time, it will be necessary to define common standards used by all participants to obtain comparable data from different test sites.

To make sure that the data produced by different participants of EURODEX are comparable, the other major objective of EURODEX is to create a European pavement research database to collect, evaluate and analyze research data in a common and thus comparable way. This database should be accessible to

research teams, economists and the EC to gain maximum profit from the results economically, politically and scientifically.

The strategic plan for EURODEX makes sure that the approach is coordinated and that research funds are used most efficiently

EUROPEAN FULL SCALE APT FACILITIES

As shown in FIGURE 1 the number of APT facilities in Europe grew steadily from the mid 1960s on.

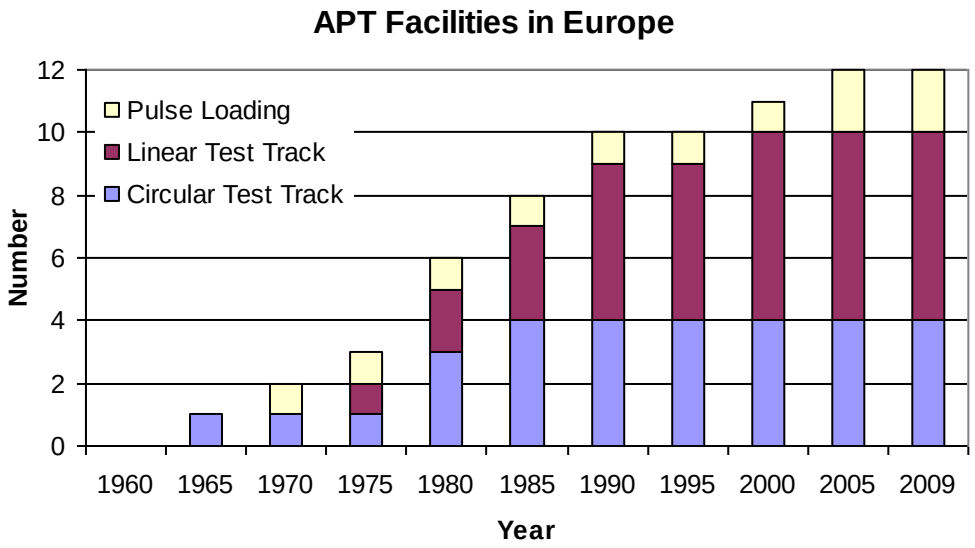


FIGURE 1 Growth of European full-scale APT facilities, acc. to (3).

According to (3) today 12 full-scale APT facilities operate in 9 European countries. Four of them are considered as circular test tracks. These facilities use chassis with arms rotating around a central axis with loaded wheels. Larger facilities usually operate outdoors while smaller facilities (diameter up to 16 m or 52.5 ft) can be housed in a building. Indoor facilities can be equipped with a system to control the climatic conditions.

Six European APT facilities work with linear test tracks. They use constructions with a straight line arrangement. The test wheel runs back and forth over a linear test track. Most linear facilities are placed indoors due to their reduced dimensions compared with circular test facilities. CEDEX (Centro de Estudios y Experimentación) in Spain represents a hybrid type, a combination of a linear and circular test facility. The track consists of two straight stretches joined by two circular curves with an overall track length of 288 m (944.9 ft).

Two German institutes operate pulse loading devices with a hydraulic pulsed load equipment. The sinusoidal load generated by a hydraulic jack is applied by a circular plate to the pavement surface. The loading device can be equipped with a longitudinal displacement device to simulate moving traffic.

Tables with detailed information and characteristics for each of the facilities can be found in (4).

Strengths and Weaknesses of European APT Facilities

COST (European Cooperation in Science and Technology) action 347 (Improvements in Pavement Research with Accelerated Load Testing) carried out a Strength-Weakness-Analysis for the European APT facilities in 2002 (3). It shows that the European facilities when working together and bundling their strengths are excellently equipped. Still, some factors identified by the project are hardly covered by European facilities, especially when it comes to appropriate environmental control. This factor has not been achieved for any type of facility in a satisfactory way. Pavement temperature is commonly monitored, sometimes controlled indirectly by air temperature, rarely directly controlled, as are freeze-thaw cycles and rainfall. None of the test sites can change the suspension or propulsion system of the wheels and only one facility in France can use different axle types, like single, tandem or tridem axles.

A general problem for pulse loading facilities is the lack of realistic loading, since rolling wheels are substituted by pulse loading. This limits the potential of pulse loading devices considerably.

Summing up the analysis, there is no need to build any new facilities in the EU but to adapt one facility or the other and install additional equipment according to a detailed plan of action.

DATA GUIDELINES

For a European Road Damage Experiment to be carried out in a successful way scientifically as well as economically, it is of crucial importance to provide definitions and guidelines. Today data are generally facility specific or even project specific. Differences in definitions of test parameters and the format in which data are collected, recorded and stored make it difficult for others to use and interpret the data. This often leads to duplication of efforts.

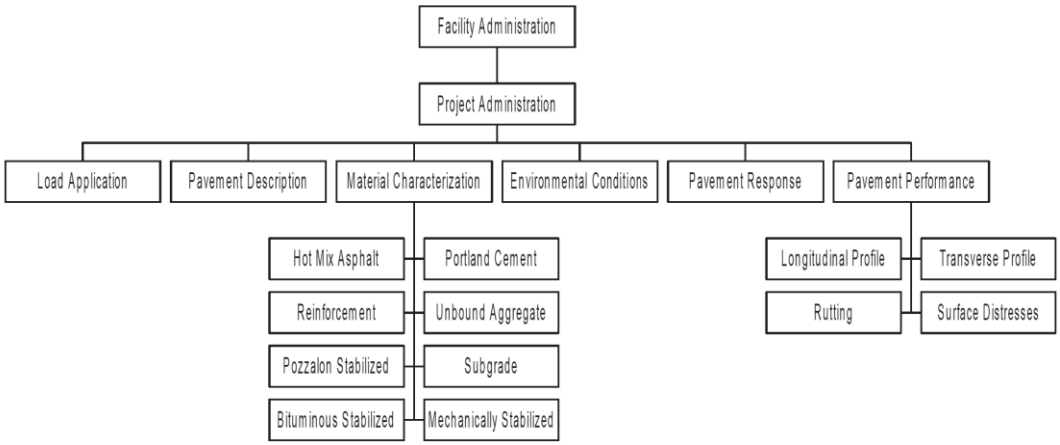


FIGURE 2 Data categories with detailed guidelines and definitions, (5).

(5) provides detailed guidelines and definitions for full-scale pavement test facilities. They were adapted to the special situation of European APT facilities and will be implemented in the practice of participating pavement test facilities. FIGURE 2 shows data categories for which definitions and guidelines exist. These

guidelines will ensure proper interpretation of the data and facilitate their use by different pavement research facilities and the international scientific community. Data from different laboratories will be compatible and make sure that funds for EURODEX are spent efficiently. Duplication of research efforts can be reduced and therefore benefits pavement research will be enhanced.

STRATEGIC PLAN FOR EURODEX

Previous and present research in the field of pavement is mostly laboratory specific and produces results for materials and designs used by the lab's member state. This may be sufficient for the development of new materials and pavement design, but when it comes to a complex matter like deterioration models the resources of a single laboratory regarding time, financial and human capacity will always be too scarce to find satisfying results.

The problem we are facing now is that the data produced by hundreds of research projects in the past cannot be used for a European analysis as the data – although high in quality – are not comparable. Nearly every laboratory has its own code of practice and common European standards for material testing are implemented in individual ways by the member states.

The question arises why previous attempts to implement a common code of practice in the European pavement research community have failed and what makes us sure that EURODEX will not be just another well-intentioned yet unrealizable effort. As an example, COST 347 had the objective to develop a European code of practice to optimize the use of APT facilities and improve the European application of results. Started in 2000 the project never made it to a complete final report after the scheduled 3.5 years. Still significant findings were found by the different work packages (WP). In order not to lose the work of more than 3 years we extracted the most important results and implemented them in the strategic plan.

On the other hand we found excellent examples how comprehensive testing programs can be carried out successfully including many different partners with various interests in the project.

First, the US Long-Term Pavement Performance (LTPP) program started in 1984. The objective was to find out why some pavements perform better than others and therefore to find improved ways to build and maintain the US highway system. After 3 years of planning the actual test program started in 1987 with 20 years of data acquisition on over 2,000 test sections on the public road network across the US and Canada. Besides a better understanding of pavement performance another major objective was to strengthen the co-operation of different partners in road construction and research.

The WesTrack accelerated pavement testing experiment (Accelerated Field Test of Performance-Related Specifications for Hot-Mix Asphalt Construction) is another example of successful long-term pavement research programs. It was started in 1994 and consisted of a test track which includes 26 HMA test sections. Again an intense planning phase of 2 years was the basis for this project. Traffic was initiated in March 1996 and was completed in February 1999. One outcome is a comprehensive database which contains all test results.

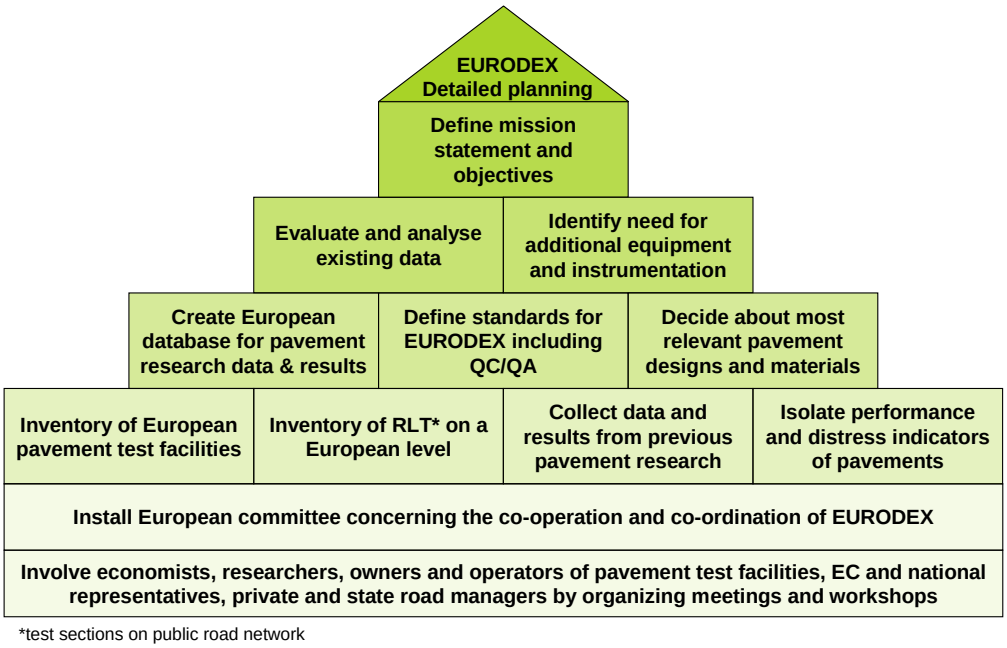
(6) describes every stage of the project including results and findings in great detail.

We gathered information about each of these projects mentioned above and analyzed their strengths and weaknesses to find out how we can optimize the way to EURODEX. All successful research projects have in common that the planning was carried out in great detail and lasted for a relatively long time – at least 2 years.

Especially from COST 347 we started to understand that it will be of crucial importance to involve potential scientific and financial partners from an early stage on. Only if they know that they can participate from the early planning process on they are willing to contribute. Another finding from the analysis of COST 347 was that the more details we know about European pavement research facilities the more efficient we can find out about what European facilities can account for EURODEX and where we lack in equipment at the present point.

The US research projects mentioned above show that a common database for data and results is absolutely necessary to make sure that storage, evaluation and analysis is done in a common way. Also we learned from LTPP as well as from WesTrack that it does not make sense to restart research from zero. Even a comprehensive project like EURODEX can only close gaps in knowledge. That is why we have to collect useable data and results from previous pavement research and find out where we stand.

By taking into account the present situation in European pavement research, we provide a profound strategic plan for EURODEX. It is the framework and we believe that it will lead to a research project with consistent findings on an international level if it is carried out step by step.



*test sections on public road network

FIGURE 3 Strategic Plan for EURODEX.

First steps have been completed within the EU-project CATRIN; on this basis further actions have to be taken. FIGURE 3 outlines the necessary elements that – if assembled correctly and with high quality – will lead to a successful European Road Damage Experiment. The way to EURODEX consists of a foundation with basic and most important elements and four levels of planning, each relying on the level below, producing more pertinence and serving as input for the next level.

Foundations of EURODEX

First of all economists, researchers in the field of pavement testing as well as owners and operators of full-scale pavement test facilities have to be involved from an early stage on. This does not only include European but also international professionals who can contribute to EURODEX with their experience. Meetings and workshops should be held to bring together people from different fields of research and to let them know that they will have a say in the process of EURODEX if they are willing to. It will also bring personal and more informal contacts and it will help to strengthen the co-operation of pavement test facilities. Furthermore the idea of EURODEX can be spread and promoted. Especially for the pavement research database to be filled with the most important previous test data and results meetings and workshops will be helpful. A more detailed inventory of test facilities, equipment and instrumentation can be gathered and information about the present code of practice and used standards for pavement construction, testing, evaluation and statistics will be obtained. The sooner the idea of the database and EURODEX itself is promoted, the more people involved in pavement research can be convinced to work together for it.

From these meetings a second foundation of EURODEX should be developed: a European committee concerning the co-operation and co-ordination of EURODEX. This committee will be the central point to co-ordinate the scientific and financial planning and realization of EURODEX. Representatives of APT owners and operators, researchers concerned with pavement testing, economists, representatives from the EC, from the national ministries of transport, as well as private and state road managers responsible for test sections on the public road network (RLT) should be part of it. All further steps to EURODEX will be discussed, negotiated and decided by the committee. The detailed planning will be coordinated by the committee and the research assignments will be split into small-scale laboratory testing by university or private labs, APT and RLT programs. To spend funds efficiently, lab testing should cover as much research work as possible, as it is the most inexpensive way of testing. Nevertheless as this is a road damage experiment, a comprehensive APT program will be necessary to provide useful data. To verify results derived from APT, RLT on in-service pavement under real traffic conditions will be inevitable. Since the tasks of the committee are most important for EURODEX, it is crucial that it is manned by a variety of experts and people who have the authority to decide. It is of particular importance that the countries with APT facilities and a large public road network are represented in this organization.

First Level – Basics

The first level contains basic knowledge about the present situation in full-scale pavement testing in Europe and consists of four elements.

An inventory of European APT facilities can be found in (4). It may be necessary to update the inventory at the beginning of EURODEX to check whether presently existing facilities have been closed or new test sites have been commissioned.

The inventory of RLT on a European level will be another important task. Since the lack of such an inventory on a European or even national level, it will take time and research resources to complete this task. Still it is important to prepare this inventory with pavement material used, research objectives, etc. to get an idea about the existing data and knowledge in this research area. RLT on the public road network is often coordinated by national ministries of transport or road administration. By contacting these ministries and administrations, people concerned with RLT can be informed about EURODEX and potential members from the ministries' of transport as well as private and state road managers for the committee can be found.

To gather data and results from previous pavement research projects is the first step towards a pavement research database. A lot of research on this topic has already been done by COST 347. (7) includes a bibliography of over 760 papers on previous APT tests around the world. Also the NCHRP Synthesis 235 (8) and 325 (9) give detailed information about APT and RLT programs carried out over the past 20 years. Considering the abundance of data and results, the committee will have to sort out generously and keep only the most important findings and also only the results that can be used for further evaluation for EURODEX.

Since EURODEX will have to concentrate on the most important research topic to prevent it from getting unmanageable in size, most important performance indictors and distress functions should be isolated.

The higher the quality of the four research items given in this level is, the easier it will be for the next steps to be carried out.

Second Level – Framework

The second package contains large pieces of research and administrational work. First of all the international database for pavement research results will be established on this level. The database will be the core of EURODEX since it will contain every piece of data and findings of the damage experiment as well as significant results from previous research.

Since the database, its efficiency and longevity are highly important for the success of EURODEX, IT and database experts have to be involved for the installation of the research database. Experts in this field will have to decide which database system is the optimum for EURODEX data and results. It is considered as essential to store data in its raw format (ASCII) to make sure it can be used by different systems as well as in a processed format for the database itself.

To make sure that the code of practice is the same for every test no matter whether it is from small-scale lab testing of pavement materials, from full-scale

APT or RLT test sites, one package of European standards has to be defined which will be obligatory for every participant of EURODEX. Standards must cover every step of the damage experiment from pavement construction and material testing, to instrumentation, data acquisition, evaluation and storage up to statistical methods. Standards for nearly all parts of the damage experiments already exist on a European level but with different implementation in the member states. Therefore the participants of EURODEX have to find an agreement upon which standards to use. To assure the quality of data and results a QC/QA (Quality Control and Quality Assurance) system will have to be implemented.

The first concrete planning will happen in Level 2, when it comes to decide about most important pavement designs and materials. There are hundreds of materials and designs for layered pavements in use all over the European Union. It can never be the objective of EURODEX to test and evaluate all available material and design. We rather have to concentrate on the most important materials and designs and find correlations between results of materials and design tested within EURODEX and materials and designs used in different member states. Engineers and international experts in pavement testing have to discuss this topic thoroughly and find an agreement on 10 to 12 designs representing the European road network in the best possible way. EURODEX should contain rigid and flexible pavements. As semi-rigid pavements are not common for high-level road infrastructure, this kind of pavement will not be part of the research project.

Third Level – Preparation

By creating the database and defining common standards for the damage experiment in the level below, now the existing, relevant data from previous full-scale tests can be evaluated and analyzed. As there are guidelines for evaluation and statistics and a database for storage of processed data at this point of time, existing test data can be processed. By feeding the database with these data, shortcomings of the database can be detected and it can be adjusted to actual demands. This task brings to light what we actual know about pavement performance and deterioration, in other words the existing knowledge of the pavement research community.

Before actual test programs of EURODEX can start we also have to isolate the need for additional equipment and instrumentation for the existing APT facilities and European pavement research laboratories. With the inventory from Level 1 which includes a Strength-Weakness-Analysis, there will be a precise knowledge about what European APT-facilities can contribute to EURODEX and what they cannot account at this point.

Fourth Level – Launching EURODEX

As a last step before EURODEX can be started with a detailed project and test program gaps and missing knowledge have to be identified. On the level below, data from previous full-scale pavement tests have been evaluated and analyzed. Scientists, pavement research experts and economists now have to

analyze what we lack in knowledge, what we need to know to find out more about pavement performance and deterioration.

On this stage it has to be decided how to link laboratory small-scale testing, APT and RLT (instrumented roads, road service measurements,…) in an optimal way to get data for a wide field of analysis, such as maintenance strategies, marginal cost analysis, optimization of vehicles, etc. Finally, a mission statement and all objectives have to be defined distinctively and precisely to guarantee the success of this pioneering European road infrastructure experiment.

BENEFITS FROM EURODEX

EURODEX will rely on time, human and financial resources. In detail we consider 2 to 3 years of planning followed by 4 to 5 years of test programs.

From the present point of view we are sure that all players in European road infrastructure will profit from EURODEX, its findings and the implementation of results.

Benefits for Politics and Taxpayers

Today we rely on rough estimations about pavement deterioration due to vehicles when it comes to source-related cost allocation. EURODEX will overcome the 4^{th} power rule and find an enhanced and more reliable pavement performance and deterioration model adequate for the road infrastructure of the 21st century. The experiment will result in a more detailed knowledge about how much each factor (e.g. temperature, moisture content, axle weight, axle configuration, etc.) contributes to the damage of a certain pavement material/design. This provides a solid basis for a fair system of transport pricing on European roads; fair in terms of source-related cost allocation. Road users will have to pay for the damage caused by their vehicle taking parameters like axle and wheel configuration, suspension system, axle weight, etc. into account.

Another output for legislation from EURODEX is to provide guidelines for the optimal weights and dimensions of HGVs. For example, adequate axle weights and tire pressures to optimize road life expectancy versus CO_2-emissions can be investigated.

A basic requirement of EURODEX will be for the participants to agree on one package of standards used for each step of the experiment as a common code of practice. Furthermore a European database for pavement research will be developed within the project. This ensures that research data and results from EURODEX and future projects will be comparable and can be used for a European analysis. With the database the EC has a strong tool for the review of future project proposals. The reviewer can find out whether a proposed research item has already been covered by previous programs by simply taking a look into the database. Therefore research funds will be spent more efficiently. The common code of practice for pavement research labs can be used for future projects as an obligation for participating partners. This ensures that data are collected, evaluated and analyzed in a comparable way.

As the EU will give guidelines for a common pricing principle on European roads based on the findings from EURODEX, the member states have a strong basis upon they can implement national transport pricing. As an analytical deterioration model will be the basis for transport pricing, today's common criticism about arbitrary tolls for road users will be obsolete. Another advantage for the member states is that costs for road construction and especially maintenance will be covered in a source-related way. Financing for these matters can be split in a more accurate and fair way between road-users and other tax sources. It will be more certain to decide which fraction of costs is related to deterioration by vehicles and which fraction is related to other sources such as climate or construction quality.

As all member states will implement their transport pricing based on a common pricing principle, the present problem of shifting HGV-traffic from one member state's road network to another's due to different transport pricing can be solved.

Taxpayers will also be on the winning side of EURODEX. Even before source-related transport pricing based on an improved deterioration model will be installed in the member states, the findings of EURODEX will be used to develop more efficient strategies for road construction and maintenance. Through an enhanced understanding of pavement performance and why certain pavement types perform better then others by then, the application of materials and renewal of road infrastructure can be optimized. Therefore especially pavement rehabilitation will require less tax money.

With the implementation of transport pricing on European roads taxpayers will no longer have to pay for road infrastructure costs related to deterioration by road-users. Taxpayers will only have to cover costs for road construction and maintenance that is related to general factors such as the specific climate. All other costs will be paid by actual source of damage – by each user or – if the construction quality was found to be poor – by the construction consortium.

More efficient spending of research funds on a European and national level means that each Euro paid in taxes will bring more payback.

Benefits for the Road Infrastructure

Private and state managers of road infrastructure will benefit from EURODEX in several ways, strategically as well as operationally.

EURODEX will provide a pavement performance model that allows road managers to update and optimize their design guides and maintenance standards. Pavement management systems will get improved knowledge how to divide funds up into maintenance, rehabilitation and renewal of pavements in the most efficient way.

For the first time the effects of material variability, construction quality and maintenance levels on pavement distress and performance will be determined in a consistent way. Road operators will have a strong tool at hand to decide when the perfect time for maintenance works in terms of safety and cost efficiency arrives. They will know more about how construction quality (e.g. compaction

rate, etc.) influences the lifespan of a certain material or design and can use this knowledge for tendering. This fact combined with the improved deterioration models will lead to more sustainable and efficient strategies for the rehabilitation of existing pavements on an enhanced life-cycle cost approach.

A constantly updated pavement research database keeps road operators up-to-date and findings from research can be implemented more quickly.

EURODEX will evaluate existing designs and pavement materials on a European basis for the first time. Therefore the road industry will learn more about designs and materials used in different member states. This is especially important when it comes to international tendering and bidding.

As the road industry can enhance their knowledge about the effects of various factors (e.g. loading, environment, construction quality, etc.) on pavement performance, more efficient strategies for construction and maintenance can be developed based on this knowledge. It improves the competitiveness of the road industry and makes road works more economic.

In case of private research labs which are willing to share their results within the research database, they will be granted access to data and findings from other public and private research projects which means a significant advantage in competition. In addition enterprises' spending of research funds will be more efficient as they can find out easily if a certain research item has been covered by previous research.

Last but not least in road infrastructure the actual users will have their share of benefits from EURODEX. The project will provide the basis for an improved pricing principle on European roads. This does not mean that EURODEX turns against European road users. In fact most of the member states have already implemented their tolling systems for passenger cars and HGVs. The problem nowadays is that in many cases these systems are based on rough estimations of cost allocation. EURODEX will provide an analytical deterioration model taking into account all major distress factors. A fair pricing principle can be installed based on the findings of EURODEX. Road users will only have to pay their share of costs caused by the vehicle type.

EURODEX will also show in which ways tires, suspension systems and other parts of vehicles can be optimized to reduce vehicle and pavement deterioration and therefore increase the life expectancy of vehicles and pavement structures.

Moreover as road operators know more about the optimal time to start road maintenance and improved strategies and materials for rehabilitation, this will increase the safety on European roads significantly for all users.

Benefits for the Research Community

Since the European road damage experiment will be a shared research project, the research community will profit strongly by EURODEX.

First of all the pavement research database will be accessible to all research facilities that are willing to share their data. It is a strong tool to stay up-

to-date with the latest findings and make sure that already existing results are not being duplicated. The progress in pavement research will considerably speed up which means an advantage for research around the world.

EURODEX will strengthen the co-operation of test facilities and pool resources of laboratories. This advantage of coordinated international research can be used by future projects to enhance the outcome.

With the improved pavement performance and deterioration model the international research community has the chance to overcome the 50-year-old 4th power rule with its well-known shortcomings. The improved model will set new standards when it comes to pavement deterioration in Europe and throughout the world.

Benefits from Improved Performance Models

Besides from the perspective of different stakeholders, there is yet another way to look at benefits from EURODEX.

FIGURE 4 gives an overview of benefits from the improved performance model and how different benefits are connected and interact. It also shows who of the stakeholders benefits from a certain item.

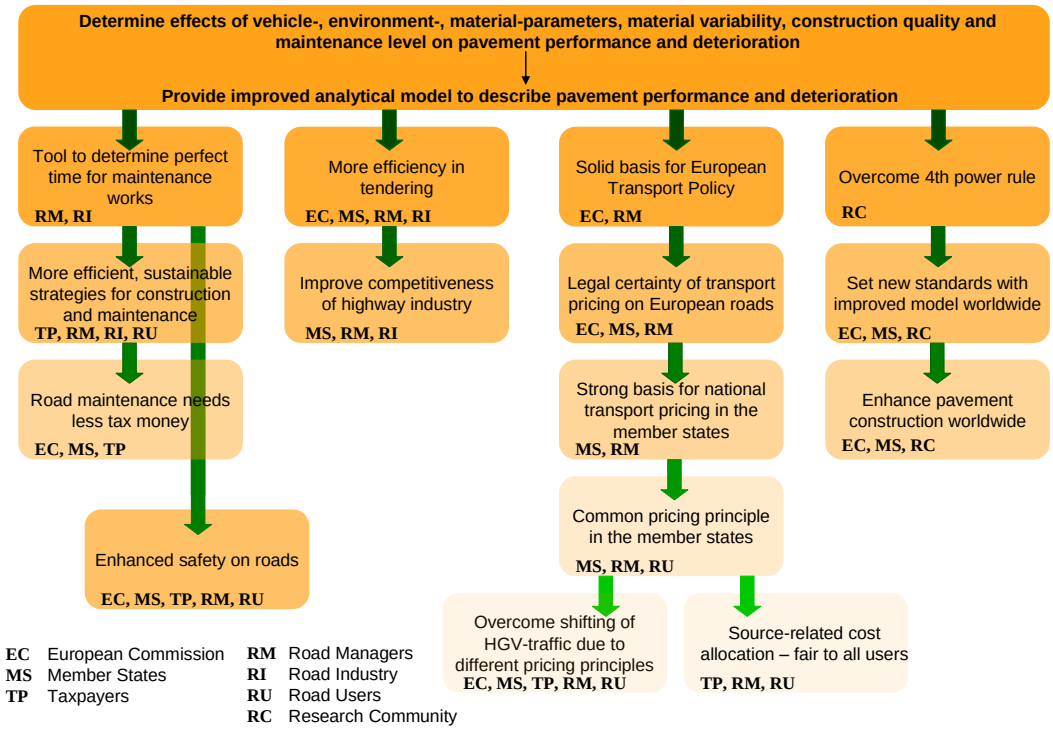


FIGURE 4 Benefits from EURODEX findings (performance model).

On the one hand, an improved pavement performance and deterioration model will give a good tool to determine the optimal time for maintenance or renewal works. This leads to more efficient and sustainable strategies for road construction and therefore maintenance and reconstruction will consume less tax money. Besides that, this will enhance the safety on European roads.

On the other hand, we will know more about how construction quality (e.g. compaction rate, etc.) influences the lifespan of a certain material or design. This brings more efficiency for tendering. The road industry can enhance their knowledge about the effects of various factors (e.g. loading, environment, construction quality, etc.) on pavement performance, more efficient strategies for construction and maintenance can be developed based on this knowledge. It improves the competitiveness of the road industry and makes road works more economic.

As EURODEX will quantify the influence of different factors on pavement deterioration, the share of different vehicle types in the process of deterioration is determined. This gives a solid basis for a European Transport Policy and legal certainty of transport pricing on roads. It is an excellent basis for the implementation of a common pricing principle in the different member states and will overcome today's problem with shifting HGV-traffic from one member state to the other due to different pricing principles. Moreover this type of transport pricing is source-related and therefore fair to all users.

Benefits from Research Database

FIGURE 5 shows benefits from the research database and the common code of practice developed within EURODEX.

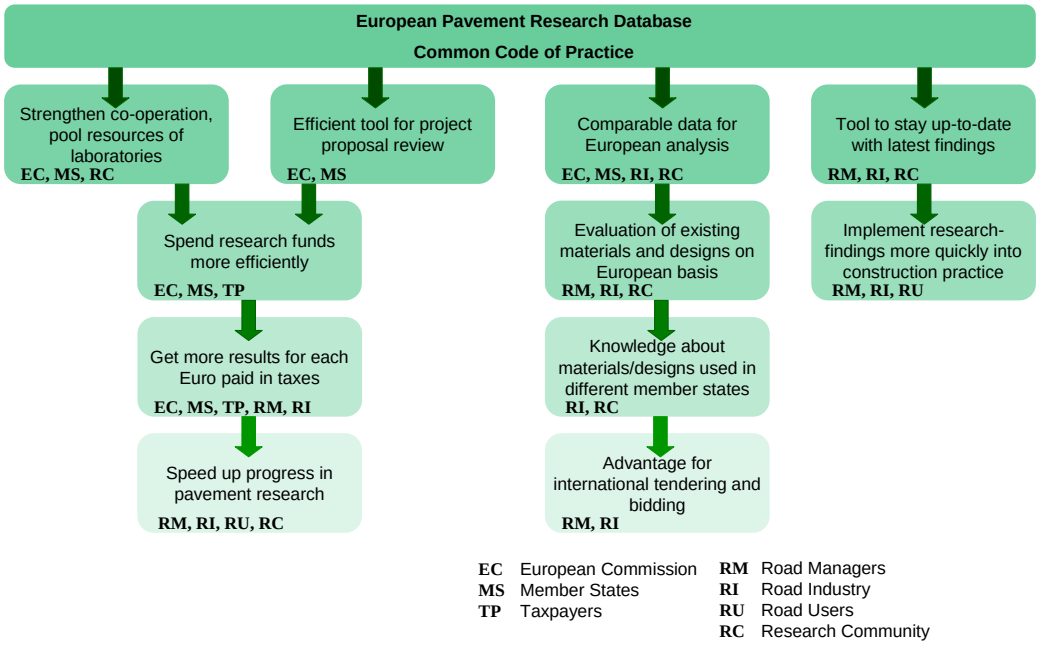


FIGURE 5 Benefits from EURODEX findings (research database).

As the database will contain all findings from EURODEX itself, important previous projects and should be constantly updated, it is an efficient tool for project proposal review. Just by taking a look into the database the reviewer can find out whether a proposed research item has already been cared about in a different project. The common code of practice and EURODEX strengthens the co-operation of European pavement research laboratories. All of this means that

research funds can be spent more efficiently and we will obtain more results for each Euro paid for research. It will speed up the progress of international pavement research.

The common code of practice is a precondition to get comparable data for a European analysis. Data from different test programs carried out within EURODEX lead to the evaluation of existing materials and design on a European basis. We can enhance our knowledge about materials and designs used in the different member states. Road managers and the road industry can use this knowledge as an advantage, when it comes to international tendering and bidding.

The database is also a tool for different stakeholders who are willing to share their results in the future to stay up-to-date with the latest findings in pavement research. These findings can be implemented more quickly into the practice of road construction.

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