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| <b>Deliverable 2.1</b>   | WP2 | <b>D 2.1</b> | rev3 |
| State of the art of interurban infrastructure design, construction and maintenance<br><b>FOR NR2C PROJECT USE ONLY</b> |     | 2005-05-20   | PP   |

## NR2C New Road Construction Concepts

### Work Package 2 – Interurban infrastructures

#### Deliverable 2.1

### State of the art of interurban infrastructure design, construction and maintenance

#### Modifications follow-up

| Ref draft      | date       | date of submitting to approval or date of approval | Comments and/or brief description of the modifications<br>Ex : “sending for approval to...”, “approved by ...”<br>or “Comments from ... dated ...taken in account”   |
|----------------|------------|--|--|
| first          | 2004-12-01 |  | Appendix of the current document is copied from the final version of the working document WD "collected information as received", dated 2004-11-30. Column 9 is deleted, because attached information is no longer relevant.<br>Sent by e-mail to WP2 members for comments.<br>Comments deadline: 2004-12-03 at 12:00.<br>Sent by e-mail to Project Manager (B. Mahut) |
| rev1           | 2004-12-03 | Pre-approved (TMB/PMB meeting 2005.01.31)          | Comments and corrections from WP2 members on "first" version taken into account.<br>Sent by e-mail to WP2 members and TMG.<br>Sent by e-mail to PMB with request to approve the distribution of the deliverable among the survey participants.<br>Pre-approved by WP2, TMG and PMB.  |
| rev2           | 2005-05-13 |  | More contributions, a preface and a general conclusion added. The syntheses were updated based on the new contributions.<br>Sent by e-mail to WP2-members and Project Manager (B. Mahut) for a final review and comments. Comments deadline: May 20 <sup>th</sup> , 2005.  |
| rev3/<br>final | 2005-05-20 | 2005-06-20 (TMG/PMB meeting)                       | Comments and corrections from WP2 members on revision 2 taken into account. Approved by WP2.<br>Distribution: same as "rev2" + WP0 leader.<br><b>APPROVED at TMG+PMB meeting – 20 June 2005</b>  |



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# 1 - Preface

This document starts with an **important notice** for anyone who wants to consult it. This is a NR2C internal document, created by NR2C partners **for use within the NR2C project only**. The history or “making of” of this state of the art of European innovation is explained below. The NR2C project is described later on in this document.

The purpose of the survey is to give a state of the art of ongoing or recent innovation in European interurban infrastructure. This information is transferred within NR2C working groups as a support for the work they have to perform: the development of a Vision 2040, information for the specific innovations that are developed within the project, and for the proposal of new innovative research projects for the near future.

Representatives from all the European countries were asked to give an overview of the work on innovations on interurban infrastructure that is going on in their countries. These overviews can contain research topics, pilot projects or applications. The representatives are mostly from research institutes in the field of road engineering, and not from the transport industry. As a consequence the innovation in the domains of telematics, mobility, or vehicles are less represented in this state of the art.

All the information is gathered and put in the appendix of this document, without changing anything to contents of the information received. As a consequence, the data is not represented in a scientific way.

The different representatives were free to fill out the survey the way they wanted. For example, France decided to distribute the blank survey document to manufacturers and several researchers. As a result, France reported more research projects and innovative and commercial products. Moreover, not all the European countries responded to our demand (15 countries responded). This could be misleading and the danger exists that wrong conclusions could be drawn from the data.

The countries responded from a national point of view. Therefore it may occur that an innovative topic in country X is not considered as an innovation in country Y, because it is not relevant there, or because the topic has been already generally applied there.

Also, the representatives were asked to link their innovations with 13 possible fields within the interurban infrastructure that were clearly defined. The allocation of the 13 fields can differ according to the person who filled out the documents. The innovations could be linked to more than one field, but some participants chose a single domain for each innovation, while others emphasized the multi-disciplinary nature of the innovation. Some of the innovations were even linked to 4, 5 or 6 domains.

To help the reader, the participants of the work package that worked on this survey, made 13 syntheses based on the 13 fields. The work was divided to all the work package members. Naturally, this results in different synthesis styles.



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## 2 - Introduction

### 2.1 NR2C project

European countries contain a large amount of surface transport infrastructure, which sometimes appears inappropriate to meet public demands. Road-building techniques have developed slowly, due to a limited number of significant technical breakthroughs, poor coordination among stakeholders and a focus directed primarily on resolving current problems. No global European road concept has yet come to the fore; the enlargement of the European Union should heighten the acute need for a sustainable integrated European surface transport network. Road-related budgets have been steadily decreasing while user expectations become more demanding and contradictory: increased transit capacities, higher safety levels, pollution mitigation (sound, air), and aesthetic integration.

Creating a global vision for the road of the future and confronting both technological and societal problems within a single research process have thus taken on urgency; such is the objective behind the "New Road Construction Concepts (NR2C)" project. Based on a large survey among road stakeholders, this project is aimed at selecting safe, environment-friendly and subtle concepts in order to strike a compromise between reduced global construction/maintenance costs, safety and environmental criteria. A number of innovations targeted for different social and geographical environments will be selected to achieve pilot applications in support of a long-term perspective. NR2C will consider urban and interurban areas as well as needs specific to Western and Central Europe; bridges, considered as single network nodes, will be studied separately.

### 2.2 Objectives

The main objective of the first task of Work Package 2 "Interurban infrastructures" (WP2) of the NR2C project is to conduct a survey at the national level to assess the state-of-the-art as regards interurban infrastructure innovations. This will allow further investigation on innovative fields regarding interurban infrastructures. In fact, this document is an introduction to task 2 which aims at developing some specific research in the field of interurban infrastructures and more precisely on innovation themes that are in accordance with the short-term innovation needs listed from the state-of-the-art enquiry results and from the survey on the long-term vision ("Vision 2040") that will be carried out by Work Package 0 (WP0).

A contribution to the long-term vision of the road carried out by WP0 is also an important objective of task 1. This objective will be achieved by providing information on the state-of-the-art and on ongoing and future innovation research projects in the field of interurban road infrastructures. Since the idea is to have the widest possible view of the innovative research projects all over Europe, the national survey is to be carried out by all European countries and gathered in a unique document "State of the art of interurban infrastructure design, construction and maintenance".

### 2.3 Collection of data

It is indisputable that collecting all the possible data from all European countries is a key parameter in task 1 since it is the basis for drawing up the state of the art on interurban infrastructure. Hence a precise and easy to use survey was prepared: the general idea was to obtain a document that is understandable, applicable to all countries and facilitating collected data analysis. On the one hand, this survey was handed to WP2 members to be filled out considering innovations on interurban infrastructures in their countries. On the other hand, it was also sent to all European countries that do not actively participate in WP2. All the data collected is shown in the appendix of this document.



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## 2.4 A living document

As mentioned before, all European countries were involved in the process of collecting data on innovative project on interurban infrastructures through one or more contact persons. European countries members of FEHRL and not active in NR2C were contacted through FEHRL research coordinators.

To establish contact with countries members of FEHRL not active on NR2C project was not an easy task. Hence the deadline to fill out the survey for those countries is different than for those active in NR2C: countries not active have until the end of the year to respond and it was decided that according to the responses, a revision of this first report will be made by month 14.

Updating the current document should therefore always be possible during the four years of the NR2C projects. Indeed, new interesting information concerning innovations in interurban infrastructure can arise at any time, modification on the existing information, on the statistics or on the discussions may be necessary and should therefore be possible during the NR2C project. As a consequence, this deliverable is not a closed document, but open for comments or suggestions by NR2C participants or other people involved in the project. Deliverable 2.1 is a "living" document.

The appendix ends with a blank table, which can be used to introduce new information.

## 2.5 Explanation of the analysis

Once the information from all the countries that responded was gathered it was important to make a brief but pertinent analysis of the innovative projects on interurban infrastructures. The classification of the projects into thirteen different domains, listed in table 1 below, helped to classify the information received. It is for that reason that the survey was analysed domain per domain. Seven WP2 members made a synthesis document considering only innovations for one, two or three domains. The domain distribution and the synthesis document guideline were established during a WP2 meeting. Following the guideline document the 7 WP2 members produced a synthesis document that resumed in a few words the general trends of innovations in that field. It was also important to make a general comment about the phases of the projects in each domain: is the majority ongoing or is there any commercial application already available? The list of the different phases considered in the survey is summarized in table 2 below. Finally a general conclusion for the innovations on the concerned domain was proposed.

This document is very useful as people interested in one or more domains can take a look at the synthesis document (no more than 2 pages) and collect basic information about the field and the trend of research in Europe. For more detailed information the reader has to refer to the collected information in the appendix, concerning the field he is interested in.

This analysis is important since it allows having a general perception of innovations in different fields all over Europe. Furthermore it is helpful for the WP0 vision and for WP2 task 2 since the specific innovations developed in task 2 should be different from the ones that already exist in European countries.

## 2.6 Distribution

This document is the report of task 1 from WP2: interurban infrastructures. The content of the document should be distributed to WP0 and is for internal use only. It is worth mentioning here that it was proposed to distribute this report to all the organisations, persons that were involved or contacted to fill out the survey. WP2 members agree but final decision is expected from PMB.



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**Table 1: Defined domains**

| Domain code | Domain of Application of the Innovation | Definition  |
|-------------|---|---|
| A           | Design - Concept                        | Design: road structure design (calculation) and road layout<br>Concept: concept in the frame of interurban road infrastructures   |
| B           | Road structure                          | All innovation on the structure of roads, new or improved road structure concepts   |
| C           | Material science                        | Basic materials, mixtures, and layers used in road construction and maintenance   |
| D           | Surface characteristics                 | All measurable road surface characteristics (that allow to preserve the comfort and the safety of road users, but also to maintain the integrity of the infrastructure in all traffic and weather conditions) |
| E           | Maintenance                             | Techniques and products for road maintenance and repair, including monitoring and inspection techniques   |
| F           | Environment - Sustainability            | All innovations mitigating the environmental and ecological impact from roads, and preserving natural resources   |
| G           | Vehicles                                | All means of transport circulating on interurban road infrastructures   |
| H           | Telematics                              | Driving aids and automation for increasing safety, as well as the traffic capacity of roads   |
| I           | Mobility                                | Innovations facilitating or optimising the movement of persons and goods, or reducing obstacles for traffic   |
| J           | Safety                                  | All techniques or measures that improve road users' and workers' safety   |
| K           | Tests                                   | Equipment and procedures to determine road structure and material characteristics on site and in the laboratory   |
| L           | Road signs                              | Vertical and horizontal systems to improve the visibility and readability of the road   |
| M           | Winter serviceability                   | All techniques or measures that preserve or maintain the serviceability of road network during winter   |

**Table 2: Phases**

| Phase | Description                 |
|-------|-----------------------------|
| I     | Research project            |
| II    | Ongoing research            |
| III   | Finished research           |
| IV    | Pilot project / development |
| V     | First application           |
| VI    | In use: first experiences   |
| VII   | Commercial application      |



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## 3 - Synthesis of the collected information

### 3.1 Introduction

This synthesis is based on the contributions from Belgium, France, Denmark, Germany, Hungary, Switzerland, the Netherlands, Slovenia, Sweden, Finland, Norway, Serbia & Montenegro, Italy, Austria and Bulgaria (see appendix)

| <u>Synthesis authors:</u> | <u>Organisation</u> | <u>WP2 task</u> |
|---------------------------|---------------------|-----------------|
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| Paul Bauweraerts          | BRRC (BE)           | Task 1 leader   |
| Joop Van Zwieten          | DWW (NL)            | Member          |
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| Jean Dumoulin             | LCPC (FR)           | Member          |



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### 3.2 Domain A: "Design – Concept"

#### Description

The design is the operation allowing to conceive a road: including structural design (by calculation) and road layout design.  
Concept deals with the conception of all infrastructures attached to interurban roads (for example resting areas) and new ideas of conceiving and integrating the road in the surrounding environment.

#### Number of reported innovations

| Phase                     | Number of innovations |
|---------------------------|-----------------------|
| Research project          | 2                     |
| Ongoing research          | 10                    |
| Finished research         | 15                    |
| Pilot project/development | 11                    |
| First application         | 4                     |
| In use first experience   | 10                    |
| Commercial application    | 16                    |
|                           | <b>Total : 68</b>     |

#### Table comments

68 innovations were reported, 31 from France, 10 from Slovenia, 8 from The Netherlands, 4 from Bulgaria, 3 from Belgium, 3 from Italy, 2 from Denmark, 2 from Norway, 2 from Finland, 1 from Austria, 1 from Germany and 1 from Sweden.

From the 68 innovative projects 24 are exclusive to domain A, 24 are correlated with another domain (especially B and C) and the rest are multidisciplinary projects (more than 3 domains are concerned). Table 1 shows that more than half of the innovations are finished or have already commercial applications. On the other hand there is only two research project and a few ongoing researches.

#### Innovation trends

##### Road structure design

###### Design method

The research (4 innovations from Bulgaria, 2 from Belgium and 1 from Austria) is more oriented to determine performance requirements of bituminous materials for existing design methods than developing new design methods.

A special research is based on a life time factor for road design considering pavement life time (Norway)

###### Models

Technical guides for each type of approach have been written (France)

###### Empirical approach

Innovations deal with reinforcement of existing road structure using in-situ deflexion measurements (FWD)

###### Rational approach

Innovations concern of a new rational approach for airport runways to be used in the design of flexible road pavement with untreated base layers (France) and a new incremental approach for semi-rigid and flexible pavement design that simulates deterioration (Denmark).

A theoretical approach for predicting rutting is being developed (1 from Sweden and 1 from Finland)



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**Numerical**

There are no innovations on specific numerical approach but a mathematical calculation program, simulating pavement deterioration, correlated to an existing incremental approach was developed and know is in use first experience.

**Structure type**

In this main topic projects deals with minimum layer thickness for road infrastructure and evaluation of road durability for each type (rigid, semi-rigid and flexible). Ongoing projects aims to develop new type of structure (floating road, modular road, silent road pavement). (Italy and The Netherlands)  
Almost the majority of commercial applications are products improving structure characteristics: roughness, skid resistance, high rigidity, etc. All this products are developed in France.

**Road layout**

A project dealing with road layout in general (safety, environment,...) is the one who uses 3D leading of the road laying out.

**Capacity**

One innovation focus on multidisciplinary tool solution for bottlenecks (The Netherlands) and for cross section design (Norway).

**Safety**

Many of road layout projects face the safety problem: there are technical guides for increasing road safety and also considering all roads' users for a more safety environment (especially considering motorcycles).

**Environment**

The majority of innovations deals with environmental issues as water drainage, noise barrier, cut and cover and trench design for reducing material waist,...

**Perspective**

Evolution of road network and road infrastructure in the next 30 years under different scenarios (The Netherlands)

**Conclusion**

Design and concept field is very large and very often correlated with others fields. It is then difficult to classify innovative projects in main topics. What emerges from this domain is that road structure improvement is much related to materials. On the other hand road concept focuses on integrating road and road facilities as added value for users and society in general.



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### 3.3 Domain B: "Road Structure"

**Description**

All innovations on the structure of roads: new or improved road structure concepts, or new combinations of layers.

**Number of reported innovations**

| Phase                       | Number of innovations |
|-----------------------------|-----------------------|
| Research project            | 4                     |
| Ongoing research            | 8                     |
| Finished research           | 7                     |
| Pilot project / development | 11                    |
| First application           | 0                     |
| In use: first experiences   | 6                     |
| Commercial application      | 40                    |
|                             | <b>Total : 76</b>     |

**Table comments**

76 innovations were reported, 49 from France. Italy reported 5 innovations, Germany and Slovenia and Bulgaria 4, Switzerland and the Netherlands 2, Belgium, Hungary, Sweden, Finland and Austria 1. One cost action is also introduced in the survey.

From the 75 innovative projects 10 are exclusive to domain B, the remaining are mainly correlated with domain C "Materials" (#51). Other links are made with domains A "Design-Concept" (#25), F "Environment-Sustainability (#20), D "Surface characteristics" (#18) and E "Maintenance" (#8). One innovation from domain B is linked with J "Safety" concerning porous asphalt, and one with K "Tests" concerning non-destructive testing (NDT) surveys.

A lot of links between B and C projects are made by France (43 out of 51 B-C linked projects). France reported mainly commercial applications (38 in total, 36 of which are combined with domain C). An innovation in used materials has of course an impact on the road structure when the material is applied. Turning it round, one can also say that an innovative road structure has an impact on the materials used. The link between the two domains is very clear, especially in the phase of application.

There are 37 multidisciplinary projects (49%); these projects in the domain of road structure are linked with 2 or more other domains.

**Innovation trends**

This discussion concerns all innovations in domain B, including those combined with domain C.

10 innovations are exclusive to domain B. They concern new types of structure with certain specific characteristics like rut-resistance, noise reduction, less maintenance, limited sub base erosion, reinforcement and durability. Innovative in-situ placing techniques and thin overlays of concrete ("white toppings") are also reported.

51 innovations from domain B are combined with domain C, because of the clear link of the topic "road structure" with the materials used in the structure. 18 innovations from domain B are exclusively linked with domain C. 36 of the "B-C" linked innovations are commercial applications and most of them relate to innovative materials tuned for specific applications in the road structure. Other applications are drainage systems and recycling techniques. The researches or pilot projects



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concerning materials for road structure (B & C) are focused on high stiffness modulus mixes, hot in-place recycling, surface coating techniques, bituminous multi-layers, combined linings, modular road surface, durability of geosynthetic materials, soil stabilisation and reservoir structures.

7 innovations from domain B are linked exclusively with domain A "Design – concept". Research or pilot projects reported are dealing with new concepts for water control or stocking in the road structure or with road structures in general (concrete roads, floating roads, inverted roads).

One innovation concerns a new silent porous multilayer pavement type and is linked with both domains A "Design – Concepts" and F "Environment". Another innovation is linked with domains E "Maintenance" and J "Safety" and deals with new road restraint systems.

Finally, 4 innovations from domain B are linked exclusively with domain D "Surface characteristics", domain E "Maintenance", domain F "Environment" or domain K "Tests". The first one is a recent new technique to improve skidding resistance at young age by micro-incrustation. The second one concerns a finished research work on the repair and strengthening of a concrete surface by asphalted covering. The third one is a recent application on cable anchoring for slope stabilisations. Finally, the last one is a research project on non-destructive testing (NDT) surveys, as already mentioned.

**Conclusion**

Innovations on road structure are clearly linked with innovations on the materials used in road structures. Innovations in this field are also related with design, concept, surface characteristics, maintenance, environment sustainability and safety. France reported a lot of commercial applications. Research topics concerning road structures focuses mainly on the road structure characteristics, non-destructive testing, in-situ placement, soil stabilisation, nuisance mitigating pavements, surface coatings and the control of surface water.



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### 3.4 Domain C: "Materials"

#### Description

Basic materials, mixtures, and layers used in road construction and maintenance

#### Number of reported innovations

| Phase                       | Number of innovations |
|-----------------------------|-----------------------|
| Research project            | 10                    |
| Ongoing research            | 31                    |
| Finished research           | 9                     |
| Pilot project / development | 6                     |
| First application           | 4                     |
| In use: first experiences   | 6                     |
| Commercial application      | 45                    |
|                             | <b>Total : 111</b>    |

#### Table comments

111 innovations were reported, 54 from France, 13 from Switzerland, 9 from Bulgaria, 6 from Slovenia and Norway, 5 from Sweden and Serbia & Montenegro, 4 from Belgium and 2 from Finland, Italy and Austria. Denmark, Germany and the Netherlands reported 1 innovation.

From the 111 innovative projects 33 are exclusive to domain C, the remaining are mainly correlated with domain B "Road Structure" (#51). Other links are made with domains F "Environment-Sustainability" (#27), A "Design-Concept" (#25), D "Surface characteristics" (#20), and E "Maintenance" (#12). Two innovations from domain B are linked with K "Tests" one of which concerns the coupling of the mix design of high module asphalt with a series of laboratory tests and another innovation is linked with J "Safety", concerning porous asphalt.

As discussed in the previous paragraph concerning domain B "Road structure", a lot of links between B and C projects are made by France (43 out of 51 B-C linked projects). France reported mainly commercial applications (40 in total, 36 of which are combined with domain C) and ongoing research (8).

There are 37 multidisciplinary projects (33%); these projects in the domain of material science are linked with 2 or more other domains.

#### Innovation trends

This discussion concerns all innovations in domain C, except those combined with domain B, because they are discussed in the previous paragraph on "Road Structure".

33 innovations are exclusive to domain C. They concern new, modified or recycled materials sometimes with certain specific or tuned characteristics like aggregate shape, rut-resistance, low wearing coarse thickness, bond, durability, low density, noise reduction, workability, shear modulus, dynamic properties, thermal properties, waterproofing, reinforcement and their evolution in time. Other reported topics are the development of performance based specifications of materials and the mix design or mix technology of materials.

A lot of innovations are naturally linked with domain F "Environment – Sustainability", 8 of which are linked exclusively with this domain. Of course, environmental and sustainability are very important issues especially in material research and this clearly comes forward in the survey. Some innovations



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with the exclusive link are dealing with the use of bio-materials, industrial by-products, resource-saving binders and rubber. Others deal with noise reduction and with the identification of environmental considerations in the overall road concept and especially in the recycling and use of alternative materials. One "C-F" innovation concerning on site cold road mixing is also linked with domain E "Maintenance", another one is linked with domain A "Design – concepts" and treats the use of crumb rubber in traditional asphalt mixes.

8 innovations from domain C are linked exclusively with domain A "Design – concept" and they include research on behaviour prediction by fundamental asphalt tests, high modulus asphalt mixtures, noise reducing asphalt layers, recycled asphalt mixtures and performance based requirements for bituminous materials. One "A-C" innovation concerning the reinforcement of the edge of a steep-sloped pavement is also linked with domain E "Maintenance".

Finally, 7 innovations from domain B are linked exclusively with domain D "Surface characteristics", with domain E "Maintenance" or with domain K "Tests". The three topics linked with D are a research on the evaluation and prediction of the performance of surface layer materials and techniques, a recent application and a research of low noise emitting asphalt. This research focuses on the use of car tire recycled rubber modified asphalt. The two innovations linked with E concern researches on the status of the material behaviour on existing roads. One of the two projects linked with K, with a recent first application, is coupling the mix design of high module asphalt with a series of laboratory tests. The other one is a project to establish a information data bank with data from quarry-samples for facilitation of new road construction decision making.

**Conclusion**

Innovations on materials for road constructions are clearly linked with innovations on the road structures. Research on materials is performed to improve road structure characteristics. Innovations in this field are also related with design, concept, surface characteristics, maintenance, environment sustainability, safety and tests. France reported a lot of commercial applications. Research topics concerning materials used in roads focuses mainly on the use of recycled or alternative materials, on performance based requirements, and on the mix design.



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### 3.5 Domain D: "Surface Characteristics"

#### Description

All measurable road surface characteristics (that preserve the safety and comfort of road users, but also maintain the structural integrity of the infrastructure in all traffic and weather conditions).

#### Number of reported innovations

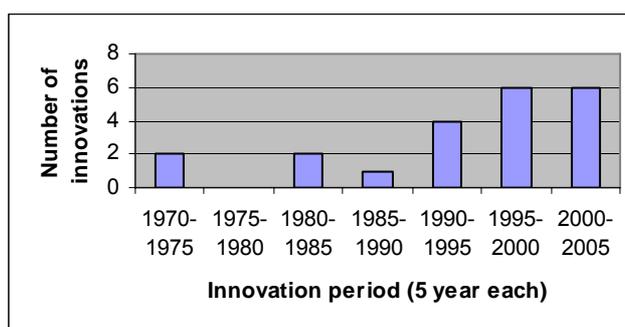
| Phase                             | Number of reported innovations |
|-----------------------------------|--------------------------------|
| Research project                  | 0                              |
| Ongoing research                  | 8                              |
| Finished research                 | 2                              |
| Pilot project/development         | 1                              |
| First application                 | 0                              |
| In use: first experience          | 2                              |
| Commercial application            | 23                             |
| <b>Total reported innovations</b> | <b>36</b>                      |

#### Reported innovations - general comments

36 Innovations were reported from 7 European countries. The innovations came from Austria (2), Bulgaria (1), France (28 of which 25 from industry/road enterprises, and commercially implemented), Germany (1), Italy (1), Slovenia (1) and Switzerland (2).

The table shows that 70% (25 out of 36) of the reported innovations are already commercially applicable (all products coming from industry/road enterprises).

As regards those pertained to the French experience, the date of initial application of the products varies from 1970 to 2004. The following figure presents the distribution of the innovations over the last 7 5-year periods and shows an increase in products for surface characteristics carried out in France during the last 10 years.



Most of these innovations concern enhanced skid resistance, the abatement of road-noise generation and improved absorption of noise propagation, improvements to surface evenness or reductions in rutting. They mainly act on the nature of the wearing course. Not all the innovations can be considered as real innovations for purposes of today's technology but some are already applicable, such as a) surface bituminous materials using the differential wearing aggregates, which need to be validated in terms of pavement life time and maintenance operations- such as recycling - or b) the technique to improve skidding resistance after the first laying of the pavement due to the presence of bitumen film on flat aggregates in curves with non-uniform grading.

The innovations made to materials and mixtures, including surface characteristics, by contractors and material suppliers were facilitated in France thanks to the "Charter of Innovation" system (which is now being upgraded in order to comply with European rules) whereby government and industry share the



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experimental risks entailed by the development of innovative products. Requests for proposals are issued annually for new products, and consequently test sections have been constructed. Surveys are conducted and the company and the government share the costs. Successful products are then accepted nationally for inclusion in the preventive maintenance program.

The more recent innovations, still in the research & development phase, only represent 30% of the answers.

**First observation:** the classification into the different domains of each innovation was made by the authors who have limited the pertinent field of the new methodologies/products/processes to a few domains. For this reason this synthesis of domain D can be completed also with the cross-link with a considerable numbers of reported innovations referred to in other domains, such as for example design/concept, road structure, materials, maintenance, environment & sustainability and safety, which are connected with the surface characteristics.

**Second observation:** the innovative trends reported that derive from the analysis of the questionnaire answers will be integrated/supplemented by reference to the pre- and post- standardisation research at present being conducted in the field of surface characteristics and culled from direct knowledge, scientific/technical literature and the international/European scientific and standardisation committees activities [i.e. PIARC TC 4.2 on Interaction vehicle-pavement chaired by Bjarne Schmidt, CEN TC227/WG2 on slurry surfacing and surface dressings, CEN TC227/WG5 on Surface characteristics chaired by Michel Boulet, CEN TC 178 on Pavings, ISO TC 22 (Road vehicle), ISO TC 31 (Tyres, rims and valves) and ISO TC 43 (Acoustics), ASTM TC E17 on Vehicle-pavements systems].

**Third remark:** taking into account that the more recent innovations, still in the research & development phase, only represent 30% of the survey answers, the conclusions will contents also a contribute to define the axis for the innovations researches in the field of surface characteristics for the 30-year vision of developments in surface characteristics.

**Reported innovation trends**

The main topics were acoustic performance (in order to reduce road traffic noise), drainability (drainage capacity provide for the rapid runoff of storm water so as to prevent the build-up of water and standing water accumulating on the surface) and skid-resistance (friction) which are connected with the textural aspect of the mixtures. A few innovations were reported on evenness, rutting and monitoring systems.

**1. Acoustic properties (in order to increase the control/abatement/attenuation of road traffic noise)**

The property of the road surface that develops a reduced noise emission during the interaction between tyre and pavement and /or noise absorption during the noise propagation phase

Road traffic noise is strongly affected by surface and mixture characteristics (macro and mega-texture, void content, size of aggregates, grading) and the condition of the road. A road surface in poor condition will produce more tyre-road noise than a surface in a good shape.

It is useful to recall some of the above-mentioned definitions of texture such as:

- ✓ Macrotexture, which is a deviation of a pavement surface from a true planar surface with characteristic surface dimensions of 0,5 mm to 50 mm, corresponding to texture wavelengths with one-third-octave bands including the range 0,63 mm to 50 mm of centre wavelengths
- ✓ Megatexture, which is a deviation of a pavement surface from a true planar surface with the characteristic surface dimensions of 50 mm to 500 mm, corresponding to texture wavelengths with one-third-octave bands including the range 63 mm to 500 mm of centre wavelengths

8 innovations on road traffic noise have been reported from France and Slovenia. They partly concern improvements on the durability and noise properties of porous asphalt mixtures. The other innovations refer to dense graded mixtures and slurry seals. In these cases, the use of finer aggregates to obtain the optimisation of anti noise properties of the thin layer pavements



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is addressed. Some of these products can also be found in other European countries (i.e. Denmark, German, Italy, The Netherlands, Spain and Sweden),

LCPC (France) mentions a wide-ranging research project on traffic noise. This project will provide a better understanding of the effects of surface characteristics on noise emission and will be integrated into a large national noise research programme named PREDIT. It is also possible to mention two other national programmes referring to this item such as the Dutch Noise Innovation Program addressing road surfaces aiming at reductions of up to 6 dBA, and the German research network named Quiet Traffic.

Future requirements regarding typical noise-reduction potential in relation to road pavements comprise the improving of new concepts for silent pavement including the industrial applications of the solutions. Starting from optimised design & materials aspects, the durability of the acoustic behaviour of pavements can be assured by a balanced management cycle as between cleaning operations and operations to maintain acoustic properties.

Anti-noise remedial potential can be monitored and assessed over time by introducing the noise indicator in question into a comprehensive pavement maintenance-management system such as in the innovative approach pursued in Italy, which upon the completion of the road surface type approval system as followed in United Kingdom, will enable quiet surfaces to be ranked through the use of the HAPAS system.

For porous road pavements, the on-site noise absorption measurement methodologies can be further improved in order to assess the low frequencies selected by silent pavement through new mobile test equipment to be used for extended surface method (semi dynamic approach).

## 2. Drainability (on-site drainage capacity)

The property of the road surface that develops relative in-situ hydraulic conductivity, at specific locations, of road surfacing is designed to be permeable; a pavement's in-situ ability to drain water (drainability) is measured.

Drainability has different aspects. The first is safety. Standing water on a road surface is known as aquaplaning and a safety hazard for road users. This hazard can be minimized by a porous or coarse textured wearing course. The other aspect concerns the infiltration of water in the supporting layers of a road pavement, which has a very negative effect on their useful life due to the rain/snow precipitations or liquid pollutants.

In this case 5 solutions - innovative mixtures, all from France - are reported to have good drainage qualities. 4 of these mixtures concern porous layers. The remaining one is a slurry seal with a coarse aggregate.

As regards infiltration there are 2 innovative products, both from France. The products are used to capture and dispose infiltration water along roadways.

For porous pavement, on-site noise and drainability measurement methodologies can be further improved to assess hydraulic capability through the use of mobile test equipment for the extended surface method (semi-dynamic approach). This facilitates monitoring and assessment over time by introducing the hydraulic indicator in question in a comprehensive pavement maintenance -management system as the research innovative approach proposed in Italy

The hydraulic behaviour of noise absorbing porous asphalt has given rise to research & development, still in an experimental phase, of water-storage pavements introduced in Italy in the eco-technical new pavement typology, which also contributes towards the exploitation of the phenomenon of transversal accumulation for two purposes:

- a. To further impede the clogging of the draining structures under traffic,
- b. To collect any "hazardous" liquids from accidental or wilful spillages before they reach gravitational water or watercourses in the territory.



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### 3. Skid resistance & friction

The property of the road surface that develops friction between a moving tyre and the pavement surface.

Friction is the resistance to relative motion between two bodies in contact. The frictional force is the force, acting tangentially in the contact area, which is measured by a friction-measuring device.

The results from the friction-measuring device are commonly known as a device coefficient or friction value.

Skid resistance is influenced by the macro and micro texture of a road surface. A decrease in skid resistance over time is often caused by the loss of micro texture caused by the polishing of the aggregate.

It is useful to recall a definition of the above-mentioned texture :

- ✓ Microtexture which is a deviation of a pavement surface from a true planar surface with characteristic surface dimensions of less than 0,5 mm, corresponding to texture wavelengths with one-third-octave bands with up to 0,5 mm of centre wavelengths

France mentions 9 products with good skid-resistance. One of these products is designed for accident-prone road sections.

Germany reports innovative concrete and bituminous wearing courses with good skid-resistance.

France (LCPC) and Switzerland (LAVOC) report a research program on skid-resistance.

Innovation at the level of the mixtures for wearing courses can be detected through a partial substitution of natural aggregates by artificial ones or by the compensation of special materials such as expanded clay with poorer quality local natural aggregates. This blend is made viable by the adoption of an optimised type approval procedure regarding the aggregate mixtures from the point of view of a polished value evaluation.

From the standpoint of the surface design of the road pavement, it would be interesting to investigate the equivalent coefficient for passenger cars and three types of truck (small, medium and heavy) for traditional and new types of the pavement skid resistance loss. These aspects will be taken into consideration also with regard to the wear resistance of pavements during the interaction vehicle-road.

### 4. Texture

The property of a road surface that develops the deviation of a pavement surface from a true planar surface, with a texture wavelength less than 0,5 m, and divided into micro-, macro- and megatexture.

The innovations on this item derive from bituminous mixture grading and maximum size optimisation in order to achieve texture characteristics able to reduce noise generation and increase the friction level as in the innovations reported from France.

### 5. Evenness

Evenness of pavements is important for reasons of safety, comfort and vehicle behaviour, loads, road and bridge constructions, fuel consumption etc.

Evenness requirements are related to speed limits, types of traffic, climatic conditions, accepted limits of comfort etc.

The innovations on this item derive from a longitudinal evenness control system mentioned in French prescribed governmental procedure.



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## 6. Deformations

### Unevenness

Unevenness is the deviation of a pavement surface from a true filtered planar surface in a wavelength range of 0,5-50 m.

No related innovations have been reported in the answers to the questionnaire either as concerns monitoring equipments or evaluation results. Only a French solution referring to bituminous mixtures with high modulus for the load-bearing layer can be correlated to maintenance techniques to preserve pavement unevenness.

## 7. Resistance to wear

No related innovations have been reported in the answers to the questionnaire either as regards the physical aspect of pavement wear or regarding special moving equipment to evaluate the effects of the tyre rolling with respect to pavement wear. Only a French solution referred to bituminous mixtures for thin layers could be correlated to the maintenance techniques for preserving pavement wear from the action of studded tyres rather than to its stated anti-rutting properties.

## Conclusions and auspices for future innovations

The reported innovations on surface characteristics are solutions to today's problems, rather than to problems in, say, 30 years.

Road surface characteristics have a significant impact on safety performance, noise level and the comfort level of the road user. Researches are needed to further add to the good performance of pavements in this respect, including the development of functional test methods for pavement materials characterisation, formulation and control, modelling and monitoring the performance, improving the construction, maintenance and upgrade technologies to enhance the surface performance management.

### Materials and mixtures technologies

The use of reliable and harmonised test methods to control and demonstrate the surface characteristics of bituminous mixtures either by laboratory or field tests must be improved. The first relates to deformation, road wear, loading, thermal cracking, adhesion, ageing, compaction etc. The latter refer to pavement profiles, evenness, texture, friction, brightness, drainage, noise etc. The development of accelerated laboratory test methods is important, as they could provide rational or fundamental based information on functional pavement characteristics.

In particular, factors critical for the success of pavement surface maintenance include strict requirements for the quality, size and gradation of the aggregates used in surface courses, even if they must be transported long distances.

The development of differential-wear aggregate mixtures for wearing courses using specialized aggregates to increase friction and improve skid resistance, calls for well-established characterization procedures and laboratory life –length evaluation with accelerated tests (to assess the decay friction wear with a full scale validate methodology) in order to guarantee a correct fit between natural aggregates and cost savings in relation to the safety performance level of surface mixtures.

Polymer-modified binders are used extensively for hot-mix asphalt. The hot applied bitumen is modified with a number of different types of additives. The elastic and poroelastic pavement, such as dense and porous bituminous mixtures produced by a binder modified with small rubber particles from scrap tyres, appears to provide considerable noise reduction and durability. New measurement methodologies must be carried out on these road surfaces so as to determine their characterisations as regards: mechanical impedance, surface wear under studded tyres and friction under wet condition at high-speeds.

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The use of an intermediate layer between the surface and deep layer of the ecotechnic pavement to perform a better noise and drainability capabilities requires an industrialisation approach similar to that required for the easy and quick replacement of the upper layer (wearing course as a rolled up bundle) or resonant systems obtained from the euphonic pavement.

**Pavement laying and compaction equipment**

Construction technologies influence a large part of the total life cycle costs for road construction and have long-term consequences for the life cycle of the whole product.

In order to obtain the pavement surface characteristics required the present system must be improved to control the factors influencing paving performance during road construction and maintenance (quality control techniques and statistical data interpretation techniques) also using construction plant and equipment automation through the wireless communications and new satellites services for positioning laying equipment and monitoring works by administrators.

**Pavement condition survey and monitoring equipment**

Early and accurate detection of pavement surface conditions through high-efficiency and moving vehicles is essential if an effective pavement preventive maintenance program is to be obtained. Due to significant amounts of resources used for the collection of information on road conditions a constant search for more reliable, efficient and cost-effective ways of collecting this information has become an ongoing requirement at European level in order to enlarge the potentiality of the measurement of pavement evenness, skid resistance, noise absorption, texture and distresses.

**Pavement construction and maintenance strategies**

The philosophy is to build a strong bearing capacity layer so that repaving will only concern the wearing surface in order to reduce not only the construction time but also the number of interventions and time. Several overlay types (thin, ultra thin, etc.) are used already, with a specific course thickness assigned to each, but we need to industrializing and optimising the use of added-value materials and techniques (i.e. wearing course from a roll). Pavement preservation and maintenance activities focus on surface issues, such as improved skid resistance, noise reduction, and enhanced ride with a differentiated-layer functional approach.

**Institutional approach to the development of innovative pavement methodologies, products and processes and performance indicators based on demonstration projects**

The development of a mechanism to evaluate and implement innovative methodologies, products and processes is urgently needed; in particular for road-pavement surface characteristics. A European institutional process needs to be established to foster and manage innovation in this field. This process should include proprietary products developed by private-sector investment. The concept of risk sharing, as illustrated by the foregoing French Charter of Innovation system should also be considered including a validated risk assessment instruments. This would encourage innovation by giving contractors and suppliers greater opportunities to market new technology. The development of performance based or related specifications and standards including warrant contracts and liable insurance policies can be useful to remove the barriers to innovation.

**Synthesis**

The 30-year vision of developments in surface characteristics must consider developments in vehicle and road pavement characteristics by reviewing the evolutions possible in private cars and trucks (from the power engine to the tyres) and their impact on the characteristics desired for pavements in which new high-value materials, production/laying/compacting technologies and multi-functional performances be reached.



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For example in order to reduce noise uniform methods to characterise road noise should be put in place while developments in vehicles, tyres, pavement and their interaction should be considered so that significant reduction in road noise can be envisaged.

Recent technological developments will lead to a knowledge-intensive orientation towards the field of surface characteristics. Information technology will be introduced at the construction stage and over the entire life of the pavement and will, for example, involve the use of intelligent wireless communications and embedded electronics sensors for monitoring techniques.

To make the Vision a reality a series of indicators can be assumed during the next activity years in order to translate NR2C project strategy into operational terms.

**"The goal of futuring is not to predict the future but to improve it. We want to anticipate possible or likely future conditions so that we can prepare for them. We especially want to know about opportunities and risks that we should be ready for." — Edward Cornish, Futuring**



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### 3.6 Domain E: "Maintenance"

#### Description

Techniques and products for road maintenance and repair, including motorway and inspection technologies

#### Number of reported innovations

|                           | Number of innovation |
|---------------------------|----------------------|
| Research project          |                      |
| Ongoing research          | 13                   |
| Finished research         | 17                   |
| Pilot project/development | 4                    |
| First application         | 1                    |
| In use first experience   | 7                    |
| Commercial application    | 9                    |
| Total :                   | 51                   |

#### Table comments

Innovations are mainly research – in a high share finished research – projects, there are, however, many with commercial application.

#### Innovation trends

- Monitoring and inspections techniques
  - Management
  - Continuous monitoring and inspection
  - Occasional monitoring and inspection
- Maintenance
- Repair
  - Techniques
  - Products
  - Materials

The innovations on monitoring and inspection techniques concentrate on network level methods assisting the information gathering on the condition of road network. These high volume techniques allow a quick and efficient performance monitoring. However, some of the innovations relate on the detailed investigation of a given (eventually experimental) section. Also several computerised management systems have been developed.

The innovative maintenance techniques typically use up-to-date, high performance materials, in some cases sophisticated machinery is applied. As an important trend, it can be mentioned that more and more theoretical and empirical studies and innovations concentrate on the reduction of delays due to maintenance-rehabilitation actions. The aim to decrease user costs during intervention seems to be more important than the cost of maintenance itself. The durability and the efficiency of maintenance techniques come also to the front partly due to the reduction the of whole life costs, and partly for the minimization of traffic delays during maintenance actions.

Several innovations concentrate on the environment-friendly cold or hot recycling techniques, as well as the winter maintenance techniques with minimum environmental harm.



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Only a limited number of innovations deals with pavement repair, a localised intervention. These less efficient condition improving actions are usually proposed if either a temporary intervention is urgent and the actual weather does not allow yet a final solution or a repair of very small area is needed (e.g. mechanical damage of pavement surface). The use of high performance, extremely durable materials seems to be widespread; the application techniques are generally quick in order to minimise traffic disturbance.

**Conclusion**

As a final conclusion, the innovations on maintenance are generally connected with high-tech, high performance materials and major concern to road users.



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### 3.7 Domain F: "Environment – Sustainability"

#### Description

All innovations mitigating the environmental and ecological impact from roads, and preserving natural resources.

#### Number of reported innovations

|                           | Number of innovations |
|---------------------------|-----------------------|
| Research project          | 5                     |
| Ongoing research          | 16                    |
| Finished research         | 11                    |
| Pilot project/development | 11                    |
| First application         | 3                     |
| In use first experience   | 9                     |
| Commercial application    | 17                    |
|                           | Total: 72             |

#### Table comments

Most of the 72 reported innovations for this domain are either ongoing or finished research projects or products/systems that are already in commercial application. All the commercial applications are reported by France.

#### Innovation trends

**Main topics:** the following overall categories are proposed for the innovations:

|                                   | Number of innovations |
|-----------------------------------|-----------------------|
| Noise reduction                   | 18                    |
| In-situ recycling etc.            | 8                     |
| Recycling of waste materials etc. | 13                    |
| Environmentally friendly products | 5                     |
| Mitigation of pollution           | 15                    |
| Long-life pavements               | 5                     |
| Other                             | 8                     |

A few concluding comments will be given for each of these categories:

Regarding noise, most projects are concerned with euphonic or noise reducing road surfaces, mainly different porous asphalt solutions and thin asphalt concrete with good acoustic properties. There are also examples of more overall projects where noise barriers, tires etc. are treated.

Recycling projects involve both hot and cold recycling of road materials (asphalt and concrete) and also recycling of waste materials from other sectors like municipal waste, demolition sites, old tires, tunnel excavations.

There are a few examples of substitution of harmful substances by other more environmentally friendly products like e.g. vegetable oil.

Reduction of pollution from traffic, especially treatment of run-off water and measures for improvement of air quality is treated in some projects.



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The achievement of long life for pavements is also in some cases categorised as environmentally friendly. Life Cycle Analysis and environmental indicator projects are also reported.

### **Conclusion**

Looking at all the proposed innovations in this category, it is evident that the vast majority of projects deal with various technical solutions/products aiming at two objectives: 1) reducing the impact to environment (about half of the innovations) and 2) preserving natural resources (other half). Dominant themes are noise reduction, recycling and mitigation of pollution. There are only very few examples of projects that take a more overall perspective involving both political and economical considerations.



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### 3.8 Domain G: "Vehicles"

#### Description

Vehicles - All means of transport circulating on interurban road infrastructures. To be focused in the interaction between vehicles and interurban infrastructures.

#### Number of reported innovations

|                           | Number of innovation |
|---------------------------|----------------------|
| Research project          | -                    |
| Ongoing research          | 1                    |
| Finished research         | -                    |
| Pilot project/development | -                    |
| First application         | -                    |
| In use first experience   | -                    |
| Commercial application    | -                    |
|                           | Total : 1            |

#### Table comments

The only innovation that could be included within "Vehicles" domain will be a result of an ongoing research carried out in France.

#### Innovation trends

Driving aid systems aim at improving safety and optimising use of the infrastructure, in order to remedy driver deficiencies, what can be done by providing to driver basic information, by shared driving (between driver and onboard automated systems) or by fully automated driving. The vehicle control functions being developed are intended to provide the driver with a lane-specific guidance device in order to avoid leaving the roadway or colliding with obstacles; relying on better management of both speeds and inter-object distances.

#### Conclusion

Anyhow we look to the new ideas and innovations regarding vehicles that are carried out, the focus is not put in building-in electronics or devices that would lead a vehicle onto adequate way. Research is focusing into changing or upgrading driver's environs, road infrastructure that signals to the driver and the vehicle information helping to improve traffic safety and road capacity.



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**3.9 Domain H: "Telematics"**

**Description**

Telematics - Driving aids and automation for increasing safety, as well as the traffic capacity of roads

**Number of reported innovations**

|                           | Number of innovations |
|---------------------------|-----------------------|
| Research project          | 1                     |
| Ongoing research          | -                     |
| Finished research         | 3                     |
| Pilot project/development | 2                     |
| First application         | 1                     |
| In use first experience   | 1                     |
| Commercial application    | -                     |
|                           | Total : 8             |

**Table comments**

Innovations within this domain were replied from three countries, Netherlands, Norway and Slovenia, where three innovations came from the first one, one from the second one and four from the latter one. When looking to the innovations' state, it can be found out that one is in a phase of research, three of them are results of finished researches, two will be results of pilot projects, one has been applied for the first time and one is already in use.

**Innovation trends**

Telematics devices on a large scale are driving aids for increasing the traffic capacity of roads by managing and controlling traffic. Innovations in this domain are mainly meant to make traffic flow more fluid by restoring electronic signalling, electronic toll collecting systems or free flow electronic tolling. Controlling traffic results also in positioning vehicles, calculating travel times and to supply them to the public, which then decides what route to use. Vehicle dynamics simulation in virtual 3D environment with visibility analyses helps to understand the situation from drivers' point of view, while Advanced Driver Assistance systems (ADA Systems) are considered to be promising for supporting drivers when driving through narrow lanes and keeping in a safe distance.

**Conclusion**

Innovation trends in field of telematics are twofold: to reduce traffic disturbance by giving effect to electronic tolling or free flow tolling and to support drivers to drive safely in more difficult conditions using Advanced Driver Assistance systems.



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### 3.10 Domain I: "Mobility"

#### Description

Mobility - Innovations facilitating or optimising the movement of persons and goods, or reducing obstacles for traffic

#### Number of reported innovations

|                           | Number of innovation |
|---------------------------|----------------------|
| Research project          | 2                    |
| Ongoing research          | 1                    |
| Finished research         | 13                   |
| Pilot project/development | 11                   |
| First application         | 1                    |
| In use first experience   | 1                    |
| Commercial application    | 2                    |
|                           | Total : 31           |

#### Table comments

Innovations within this domain were replied from six countries: Bulgaria, France, Italy, Netherlands, Norway and Slovenia. Number of innovations that come from those countries are one, seven, three, thirteen, two and five, respectively. In the survey, for two innovations the status/phase was indicated as a research project, for one ongoing research, for thirteen finished research, for eleven as pilot project, one as applied for the first time and one as already in use. Two innovations (from Italy) are already commercially applied. Seven innovations, all surveyed in France, are in form of technical guides.

#### Innovation trends

When thinking about *removing or reducing obstacles* from road and its environs, efforts are put in such an obstacle treatment or posting the road signs (in curves), to make it possible to road users to travel safely. Connected to traffic disturbance is also vehicle weighing, so devices for weighing-in-motion are more than welcome for traffic controlling without disrupting traffic itself. In some countries interurban roads cross natural tracks, where wildlife animals move. So, mitigation measures (as ecoducts or green bridges are) for safer crossing of interurban roads by brown bear, wolf, roe deer and other large animals, are also to be taken as reducing obstacles to traffic.

Facilitating movement can be done from *traffic management centre*. In France they have technical guides for design and working of such centres and for traffic management system telecommunication networks. In Slovenia they developed traffic management and control system and free flow electronic tolling system, while in the Netherlands efforts are put in giving as much as possible useful on-board information to the drivers (what includes also collecting information for vehicle positioning for traffic management purposes). In Italy, the traffic in urban limited traffic zones is managed on the basis of the Telepass System. The Telepass technology is also used to detect the transit of vehicles equipped with a Telepass on-board unit, to calculate travel times and to determine the overall traffic status on the motorway network. In Bulgaria there are trying to create an open-to-public model of cross-border transport corridors information services.

Apart broad traffic management systems there are large *transportation optimisation programmes* going on (mainly again in the Netherlands) that include: goods transport optimisation, optimisation of transport chains or corridors, improving transport connections among road networks, modal interchange infrastructure and systems, intelligent networks for improving traffic circulation and finding solutions to bottlenecks. To these activities can be also added calculation of capacity reserve of roads.

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Dynamic optimisation of the goods transport sector is being investigated, and the regional transport model handling intermodal transport of persons is now being implemented in Norway.

Using different *driving and travelling aid* tools can help drivers' behaviour in a lot more efficient use of road infrastructure. Advanced driver system helps drivers to use roads safely, by driving closer together on narrower lanes. Anticipating travels is an outcome of the system that provides complete and multimodal traffic projections, offering travellers information in advance on various travel and route alternatives along with relevant travel times, as well as updated projections while en route. Implementing in-car communication will result in informing, advising and assisting individual road users. In Italy, the road accident location detection system permits to increase the motorway safety level by decreasing the time of the data collection, thus spending less time to remove the non-operating vehicles.

Again in the Netherlands there are going on very interesting activities which can contribute to more satisfactory and efficient transportation, that could be denoted with *less unneeded travelling*. These activities include introducing systems for virtual conferences instead of travelling around and optimising virtual contacts.

Facilitating or optimising the movement of persons and goods can be done by taking advantages from today's and tomorrow's *perspectives* of transportation: systems for driving simulations with particular visibility analyses can in one way help to move unneeded obstacles to traffic, on the other hand, visions or different scenarios of future roads can show which way to focus researches, other innovations and developments.

**Conclusion**

From our survey it can be concluded, that innovations facilitating or optimising the movement of persons and goods follow several directions: from reducing obstacles to traffic, restoring traffic management centres, programmes and systems, through optimisation of transportation, use of driving and travelling aids to implementation of systems for contacting to each other virtually.



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### 3.11 Domain J: "Safety"

#### Description

All techniques or measures that improve road users' and workers' safety

#### Number of reported innovations

| Phases                    | Number of innovations |
|---------------------------|-----------------------|
| Research project          | 4                     |
| Ongoing research          | 12                    |
| Finished research         | 14                    |
| Pilot project/development | 5                     |
| First application         | 2                     |
| In use first experience   | 2                     |
| Commercial application    | 7                     |
| <b>Total</b>              | <b>46</b>             |

#### Table comments

Innovations listed in the inquiries are for 65% counted in the research domain and 35% issued from development to commercial application. Nonetheless, in the research domain one will notice that 30% of the innovations are finished research.

#### Innovation product's nature and repartition

##### Literature (research publications, technical guides) :

61% of the listed innovations have driven to research publications or in some case in use first experience reports. It has to be noticed that among these publications 26% are technical guides for professional use.

##### Innovation concerning materials and structures :

24% of the listed innovations are linked to this category of product. It concerns the commercial application of innovations.

##### Other products (Software, apparatus, data base) :

58% of the listed innovations can be classified in such category of products. 27% are software, 11% database and 20% apparatus. When these products are listed in a phase of the research domain, they generally have also driven to literature production.

#### **Synthetic table for products : percentage of innovation per category**

| Product category       | 1           | 2           | 3           |
|------------------------|-------------|-------------|-------------|
| <b>% of innovation</b> | <b>61 %</b> | <b>24 %</b> | <b>58 %</b> |

When analysing the information given in the enquiries about the nature of the innovation, one should remark that research's project produce principally literature, but also software and apparatus, completed by few database. Nonetheless, it is difficult to determine if these software and apparatus are operational one's or are still tools in the research domain.



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## Innovation trends per main topics

### Topic 1 : Improving safety conditions during road works

This topic represents 4% of the listed innovations (see : [SETRA : 23 and 31]). They deal with earthworks in road works.

### Topic 2 : Pavement surface characteristics and infrastructure equipment properties

This topic represents 18% of the listed innovations (see : [SETRA : 29]; [APPIA : 6]; [COLAS : 1, 2 and 6], [NORWAY : 11], [ITALY : 8] and [LCPC-TEXIER : 7]). Most of these innovations are focused on the increase of the skid resistance or the improvement of the evenness. They mainly act on the nature of the wearing course. Nonetheless, one innovation deal with the visibility and the behaviour of the infrastructure in various weather conditions in relation with its physical properties. Another innovation is focused on flowery edges studies. A pilot project is treating of new wearing course material to reduce icing during winter time.

### Topic 3 : Road design and maintenance

This topic represents 28% of the listed innovations (see : [SETRA : 33, 34, 35, 45, 46, 50, 53, 58]; [LCPC-TEXIER : 1]; [SWITZERLAND : 1], [NORWAY : 26], [ITALY : 9] and [SLOVENIA : 23]). A major part of these innovations are technical guides for safety check of road design. Nonetheless, in this safety check approach, it as to be notice that one innovation deal with real road implementation in driving simulator. It includes evaluation and preventive measures for pavement surface and infrastructure equipment for different category of road network. One is focused on the study of tools for making on road security check. The enhancement of the safety of European road network during road works is treated in another innovation. It intends to provide the means to reduce the number, the duration and the size of maintenance road works. Some studies are undergone on road restraint systems such as safety barriers.

### Topic 4 : Interaction between infrastructure, vehicle and driver – ITS approach

This topic represents 30% of the listed innovations (see : [CG22 :2]; [LCPC-TEXIER : 4, 5, 6, 8 and 9], [NORWAY : 28], [ITALY : 14, 15 and 16] and [SLOVENIA : 8, 12,13 and 16]). Half of these innovations are linked to traffic management system such as traffic monitoring, travel time computing, automatic toll collection and road accident survey. Some focus on the study of on road measurement system, others on tools for network manager to inform them and the driver depending of the traffic. Some deal with the study of the visibility of the road under various solicitations. They include the study of driver behaviour. Some are tools (software and apparatus) to assess safety measure taken at the level of the infrastructure, the vehicle or the driver. One studies, on a real road network, the effects of some safety improvement.

### Topic 5 : Sustainability approach

This topic represents 7% of the listed innovations (see : [SLOVENIA : 17] and [ITALY : 12 and 13]). One innovation deals with ecoduct-green bridge for safer over crossing of wildlife on highway network. A second one is lighting system at tunnel entry by using a sunlight reflecting apparatus. The last one is an innovative system that integrates containment and anti-noise components/capacities in a single barrier.

### Topic 6 : Acting on driver's behaviour

This topic represents 13% of the listed innovations (see : [THE NETHERLANDS : 15], [NORWAY : 22, 23, 24 and 25] and [BULGARIA : 4]). One is a pilot study to gain a picture of the possibilities of influencing drivers' driving behaviour through rewards. The other ones are focused on the use of driver simulators to study driver's behaviour placed in different physiological conditions, or solicitations or to experiment training course. The last one deals with the public perceptibility of road marking visibility using on road test site.

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**Synthetic table for trends : percentage of innovation per topic**

| <b>Topic</b>           | <b>1</b>   | <b>2</b>    | <b>3</b>    | <b>4</b>    | <b>5</b>   | <b>6</b>    |
|------------------------|------------|-------------|-------------|-------------|------------|-------------|
| <b>% of innovation</b> | <b>4 %</b> | <b>18 %</b> | <b>28 %</b> | <b>30 %</b> | <b>7 %</b> | <b>13 %</b> |

**Conclusion**

In the safety field, the trends observed on listed innovations show that more than half of the works are done on pavement surface characteristics, road design and maintenance and interaction between infrastructure, vehicle and driver. Research developed this last year in the field of ITS and telecommunication has favoured the emergence of new research on the interaction between infrastructure, vehicle and driver. Driver's behaviour study is another domain of research that is favoured by the enhancement of driver simulator performance.



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### 3.12 Domain K: "Tests"

#### Description

Equipment and procedures to determine road structure and material characteristics on site and in the laboratory.

#### Number of reported innovations

|                           | Number of innovation |
|---------------------------|----------------------|
| Research project          | 4                    |
| Ongoing research          | 2                    |
| Finished research         | 2                    |
| Pilot project/development |                      |
| First application         | 2                    |
| In use first experience   | 3                    |
| Commercial application    |                      |
| Total :                   | 13                   |

#### Table comments

Due to the relatively low number of innovations on tests there is no determined trend on their phases.

#### Innovation trends

Pavement layers (surfacing and base types) are investigated using ALT and laboratory tests. The main emphasis is laid on asphalt structures, however, various stabilisation layers are also dealt with. The results are utilized in developing new specifications and evaluating their performance properties.

Up-to-date site monitoring techniques as high-speed deflectograph and WIM measuring methodology are also among the innovations in the field.

The innovative catalogue allows the planning of measurements connected with a project.

#### Conclusion

As a summary, it can be stated that just a few innovations were registered, however, the importance of up-to-date site and laboratory test methods is indisputable.



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### 3.13 Domain L: "Road signs"

#### Description

Vertical and horizontal systems to improve the visibility and readability of the road

#### Number of reported innovations

| Phases                    | Number of innovations |
|---------------------------|-----------------------|
| Research project          |                       |
| Ongoing research          | 1                     |
| Finished research         | 10                    |
| Pilot project/development | 2                     |
| First application         |                       |
| In use first experience   |                       |
| Commercial application    |                       |
| <b>Total</b>              | <b>13</b>             |

#### Table comments

Innovations listed in the inquiries are for 85% counted in the research domain and 15% issued from development to commercial application. Nonetheless, in the research domain one will notice that 77% of the innovations are finished research.

#### Innovation product's nature and repartition

##### Literature (research publications, technical guides) :

85% of the listed innovations have driven to research publications. It has to be noticed that among these publications 69% are technical guides for professional use.

##### Innovation concerning materials and structures :

8% of the listed innovations are linked to this category of product. It is related to the pilot project phase.

##### Other products (Software, apparatus, data base) :

38% of the listed innovations can be classified in such category of products. 8% are software and 30% apparatus. When these products are listed in a phase of the research domain, they generally have also driven to literature production.

#### **Synthetic table for products : percentage of innovation per category**

| Product category | 1    | 2   | 3    |
|------------------|------|-----|------|
| % of innovation  | 85 % | 8 % | 38 % |

When analysing the information given in the enquiries about the nature of the innovation, one should remark that research's project produce principally literature, but also software and apparatus.



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Nonetheless, it is difficult to determine if these software and apparatus are operational one's or are still tools in the research domain.

**Innovation trends per main topics**

Topic 1 : Temporary signing during road works

This topic represents 46% of the listed innovations (see : [SETRA : 37, 42, 51, 52 and 54] and [The NETHERLANDS : 24]). 38% are technical guides that intend to formalize the practice in road works. They aim to be helpful for the professional set and the technology in use mixes active and passive system. 8% of the listed innovations for that topic concern an active system for temporary signing during road works. It fits the traffic information sent to road users according to the requirement of the maintenance works undergone.

Topic 2 : Horizontal signing

This topic represents 38% of the listed innovations (see : [SETRA : 35, 38 and 47]; [LCPC-TEXIER : 4] and [The NETHERLANDS : 10]). 23% are technical guides. This literature is at the purpose of the professional set. It intends to normalize the current practise. It deals with active and passive system for horizontal road signing. 15% of the innovations deal with the visibility and the readability of the pavement surface road signing. 8% deals with the passive properties under various weather and lighting conditions. 8% deals with a smart land marking (active system) that change the information given to the driver according to the traffic observed.

Topic 3 : Vertical signing

This topic represents 38% of the listed innovations (see : [SETRA : 35, 38 and 47]; [LCPC-TEXIER : 4] and [CG22 : 2]). 23% are technical guides. This literature is at the purpose of the professional set. It intends to normalize the current practise. It deals with active and passive system for vertical road signing. 8% of the innovations deal with the visibility and the readability of the vertical road signs by studying their passive properties under various weather conditions. 8% deals with smart vertical panels (active system) that inform the driver of one against direction vehicle.

Topic 4 : Road signs maintenance and management

This topic represents 8% of the listed innovations (see : [SETRA : 43]). This innovation concerns a computer-aided method to make an inventory of the road signs during maintenance operation.

**Synthetic table for trends : percentage of innovation per topic**

| <b>Topic</b>           | <b>1</b>    | <b>2</b>    | <b>3</b>    | <b>4</b>   |
|------------------------|-------------|-------------|-------------|------------|
| <b>% of innovation</b> | <b>46 %</b> | <b>38 %</b> | <b>38 %</b> | <b>8 %</b> |

One will remark that in that paragraph four innovations are classified in two different topics : vertical and horizontal signing. That's why the sum of the percentage of innovation per topic is more than 100%.

**Conclusion**

Trends observed in that field show the emergence of research on active road signs system. Nonetheless, due to the weight of the standard in that field, innovation in matter of passive system is still present.



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### 3.14 Domain M: "Winter serviceability"

#### Description

All techniques or measures that preserve or maintain the serviceability of road network during winter

#### Number of reported innovations

| Phases                    | Number of innovations |
|---------------------------|-----------------------|
| Research project          |                       |
| Ongoing research          | 2                     |
| Finished research         | 1                     |
| Pilot project/development | 1                     |
| First application         |                       |
| In use first experience   | 1                     |
| Commercial application    |                       |
| <b>Total</b>              | <b>5</b>              |

#### Table comments

Just two ongoing research works, one in use first experience, one pilot project and one European finished research work have been listed in the enquiries. Only three countries have answered that they had project in that domain.

#### Innovation product's nature and repartition

1. Literature (research publications, technical guides) :

100% of the listed innovations have driven to research publications or in some case in use first experience reports. It has to be noticed that among these publications half are issued from a European COST action.

2. Innovation concerning materials and structures :

40% of the listed innovations are linked to this category of product.

3. Other products (Software, apparatus, data base) :

40% of the listed innovations can be classified in such category of products. It concerns software, road weather database and de-icing apparatus. These products are listed in a phase of the research domain, so they have also driven to literature production.

#### **Synthetic table for products : percentage of innovation per category**

| Product category | 1     | 2    | 3    |
|------------------|-------|------|------|
| % of innovation  | 100 % | 40 % | 40 % |

When analysing the information given in the enquiries about the nature of the innovation, one should remark that research's project produce principally literature, but also software and apparatus, completed by few database. About half of the innovations identified are operational.



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### Innovation trends per main topics

Between both innovations listed, one was a European project (see : [COST ACTIONS : 2]). It was focused on the assessment of the wintertime practises in Europe. This work was done by eighteen countries and overall objectives of this innovation were :

1. Review of existing international practices
2. Definition of snow and ice control requirements in different European climatic regions.
3. Specification of 'Best Practice' in different European climatic regions.
4. Development of guidelines for the integration of specified snow and ice control methods into network level road management and maintenance systems.
5. Recommendations for improvements to driver information and traffic management systems
6. Recommendations for future research.

Here are the seven most important future short-term research topics identified in that project :

Topic 1 : *Forecasting, measuring and modelling the road surface condition.*

Topic 2 : *Winter maintenance and management policies and strategies (service performance, harmonised quality levels etc).*

Topic 3 : *Costs and benefits of operational practice in rural and urban areas.*

Topic 4 : *Effects of road weather conditions and winter maintenance on traffic flow and safety, capacity and road user behaviour.*

Topic 5 : *More cost-effective, efficient and environmentally friendly friction improvement products.*

Topic 6 : *Weather-related traffic management and information systems optimal for traffic safety and efficiency.*

Topic 7 : *New methods of winter maintenance management through the use of the latest technologies for data management, communication and positioning.*

According to this short-term research topics list, research works undergone in the innovation [LCPC-TEXIER : 7] are linked to the topics 1, 6 and 7. In the topic 5, three innovations are listed (see [NORWAY : 29 and 30] and [ITALY : 8]). One is dealing on a new sanding method for winter operation of roads by using sand combined with hot water. The second deal with research works on an alternative salting method by using Magnesium Chloride. The third one is a pilot project that operates with a modified porous asphalt, produced using special bituminous mortar including chloride-based chemical agent/admixture, to perform self protection against ice and snow.

### Conclusion

In the winter serviceability field, the lack of data collected does not favour the analysis of the trends. Nonetheless, tendencies observed in the innovations listed are works to enhance prediction model for road serviceability during wintertime. Wintertime maintenance tools such as de-icing with a sustainable approach are studied and a particular approach using a dedicated material formulation to prevent from icing is listed. Studies on wintertime tools for road network managers and road user's information are evocated.



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## 4 - Conclusion

We have listed 513 projects concerning interurban infrastructures all around Europe (from 15 different countries). These projects were classified into thirteen different domains and seven phases in order to specify the nature and the advancement of every project (Table 1). By observing the results of this classification we can remark that 25% of the reported projects are research studies or ongoing research. From this observation we could presume that a small part of the research deals with new and innovative ideas for the interurban infrastructure and can be potentially used in the forecast of research directions in Vision 2040. In fact the rest of the projects are in first use, pilot projects or have already commercial applications which means that they have been developed or conceived a few years ago.

| Project Domain               | Number of innovations | Phase I to II | Phase III to VII |
|------------------------------|-----------------------|---------------|------------------|
| Vehicles                     | 1                     | 1             | 0                |
| Winter serviceability        | 2                     | 1             | 1                |
| Telematics                   | 8                     | 1             | 7                |
| Tests                        | 13                    | 6             | 7                |
| Road signs                   | 13                    | 1             | 12               |
| Mobility                     | 31                    | 3             | 28               |
| Safety                       | 31                    | 8             | 23               |
| Surface characteristics      | 36                    | 7             | 29               |
| Maintenance                  | 51                    | 13            | 38               |
| Design-Concept               | 68                    | 12            | 56               |
| Environment - sustainability | 72                    | 21            | 51               |
| Road structure               | 76                    | 12            | 64               |
| Material science             | 111                   | 41            | 70               |
| <b>TOTAL</b>                 | <b>513</b>            | <b>127</b>    | <b>386</b>       |

**Table 1: Number of reported innovations by domain and phase**

We remind here that the requested representatives during this state of the art are mostly from research institutes in the field of road engineering, and not from the transport industry. As a result this state of the art allows drawing an overview of fields that are strongly dominant in the road research area. Indeed the last 6 domains listed in the table (Design-Concept, Road Structure, Materials, Surface Characteristics, Maintenance and Environment-Sustainability) are clearly dominant in European research since they represent 80% of all the projects listed in this report and are strongly correlated to each other (Figure 1). These domains have two main trends:

- **society related:** safety (drivers and road) and environment (mitigation and recycling);
- **agency related:** material performance and maintenance.

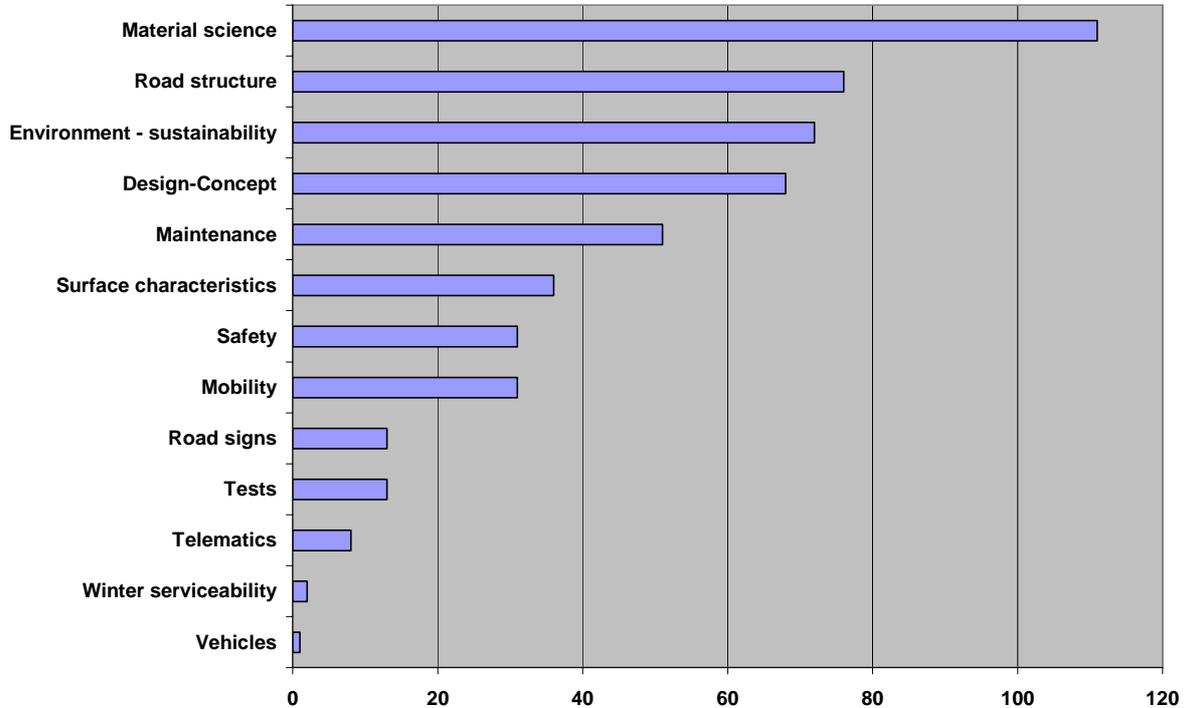
We can presume that in the future, road authorities and constructors will focus on one hand on driver's safety and environmental issues. On the other hand they will focus on increasing material performance and durability and at the same time reducing costs. Of course these are not the only concerns of users and constructors but we believe that for the moment these remain the major concerns. Solutions for these objectives should be developed in future research projects and future innovations.

Other domains (vehicles, telematics and mobility) are also important for interurban infrastructures but there was a limited response because of the fact that mainly representatives of road research institutes were contacted, as already mentioned in the preface. Moreover, some innovations that are related to the main trends can have a secondary link with the other domains, but this link was not always made by the representatives. Therefore it is more difficult to predict the future of these fields.



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According to the results, projects from other domains seem to be solutions to today's problems rather than solution for future's problems.



**Fig 1: Project distribution by domain as reported by representatives from mainly road research institutes**

In a certain way, innovations to be developed in task 2 follow this trend. Indeed a first innovation deals with low cost pavement construction and maintenance techniques. The aim is to develop materials for structural layers with a high percentage of recycled materials and high performance. A second innovation that will be studied in detail is Roadway Perception Technology Using the Infrared Know-how which aims at improving driver's vision and enhance driver's safety under poor weather conditions. The final innovation that will be carried out in task 2 is the improvement of pavement construction and maintenance management during various weather conditions.

Nobody can tell what the future will look like but considering the feedback obtained with this survey we believe that the innovations that will be studied in task 2 are possible solutions for future major challenges. The use of recycled materials leads to a sustainable development and enhancing material performance will allow the road to have a longer life. The improvement of maintenance management allows reducing intervention time for road rehabilitation under all weather condition. Finally, the improvement of techniques and performance must always come with a safety improvement. Materials and structure should be designed taking into account the development of Intelligent Transport Systems (ITS) and new road instrumentation techniques. This is what will be partially treated in the innovation concerning the use of infrared technology (task 2).

Generally one can state that recent and current innovations and research are trying to find solutions for current or near future problems but they do not consider a long-term vision for road construction. NR2C develops a vision for 2040, which will be used to propose new road research programmes. These developments will have a short-term effect, but also answer to the long-term vision. This is a different way of thinking compared with current and recent research.



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## 5 - Appendix: collected information

### CONTRIBUTIONS

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The appendix ends with a blank table, which can be used to introduce new information.



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| Innovation Nr  | Field Nr – see Table 1 | Title and short description (max. 300 char)  | Keywords   | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)  | Publication(s) | Phase – see Table 2 | Date of initial application |
| <b>BELGIUM</b> |                        |  |  |   |                |                     |                             |
| <b>1</b>       | B, C,F                 | <p><b>High stiffness modulus bituminous mixes</b></p> <p>High stiffness modulus mixes were introduced in France a few years ago to increase the bearing capacity and the resistance to permanent deformation of bituminous pavements. The purpose of this BRRC-project is to implement these mixes in Belgium. Road trials (about 10 sections) will be constructed on a motorway. In parallel extendedextended research is foreseen in the laboratory to study the performance of these mixes. New is also that reclaimed asphalt (however still limited) will be applied.</p> | Bituminous underlayers, experimental trials, performance aspects | <p>C. De Backer , BRRC, tel. 0032 2 7660364 ; <a href="mailto:c.debacker@brrc.be">c.debacker@brrc.be</a></p> <p>A.Vanelstraete, BRRC, see above</p> | Too early      | II, IV              | 2005 ?                      |



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| <b>BELGIUM</b> |                        |   |  |  |                   |                     |                             |
| <b>2</b>       | A,C                    | <p><b>Performance based requirements for bituminous mixtures and binders</b></p> <p>The specifications for bituminous materials are currently based on empirical characteristics rather than on performance. The aim of this project is to come to performance based requirements. Hence for all relevant performance characteristics, test methods, test conditions and output parameters have to be defined that are related to performance.</p>  | Performance tests and requirements, bituminous materials | A.Vanelstraete, BRRC, see above  | See attached list | III                 | /                           |
| <b>3</b>       | A,C                    | <p><b>Bitumen Test Validation Project</b></p> <p>As a prolongation of the project mentioned under 2, the Bitval-project, will be concentrated on the bitumen performance tests. The aim is to come to performance tests and requirements for bituminous binders. This project is a common research project of Fehrl-institutes and is coordinated by TRL. The three phases of this project are: 1: analysis of existing information ; 2: validation of selected test methods by CEN TC 336 ; 3: research on durability aspects.</p> | Performance tests bituminous binders                     | A.Vanelstraete, BRRC, see above<br>or coordinator of Bitval-project: Ian Carswell, TRL : icarswell@trl.co.uk | Too early         | II                  | /                           |



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| <b>BELGIUM</b> |                        |  |                             |  |  |                     |                             |
| <b>4</b>       | A, C                   | <p><b>Paramix EC-project</b><br/>The “PARAMIX” (Road Pavement Rehabilitation Techniques Using Enhanced Asphalt Mixtures) project aimed at optimizing the pavement rehabilitation techniques for asphalt pavements using reclaimed asphalt. The project was coordinated by S.A. COPCISA, Spain. Emphasis was put on the following aspects:</p> <ul style="list-style-type: none"> <li>• New hot and cold recycled asphalt mixtures</li> <li>• Innovative machinery and improved milling, layout and compaction procedures;</li> <li>• New methodology for design and life cycle assessment of the rehabilitated pavement using new asphalt mixtures.</li> </ul> <p>For that purpose, experimental tracks were constructed in Spain and Sweden for hot and cold recycled mixtures, where several mix formulas, selected from a preliminary laboratory study were produced.</p> | Recycling, bituminous mixes | <p>A.Vanelstraete, BRRC, see above<br/>L. De Bock, BRRC<br/>(l.debock@brrc.be)</p> <p>coordinator of this EC-project:<br/>E. Soms (Copcisa)<br/>Ernest.soms@copcisa.es</p> | <p>M. Bou Jové and L. De Bock, "The PARAMIX project", proceedings of the 5th Intern. Conference on the Environmental and Technical Implications of Construction with alternative Materials WASCON 2003, San Sebastian , Spain, 4 - 6 June 2003. Proceedings edited by G. Ortiz de Rubina - INASMET and J.J.J.M. Goumans - ISCOWA.</p> <p>F. Perez et al. "Design and performance of hot mix asphalt with high percentages of reclaimed asphalt: approach followed in the Paramix project", Eurobitume &amp; Eurasphalt conference, Vienna, May 2004;</p> <p>J. De Visscher et al. "Selection of binders for asphalt mixes with reclaimed asphalt as studied in the Paramix project, Eurobitume &amp; Eurasphalt conference, Vienna, May 2004;</p> <p>REWAS 2004 (Global Symposium on Recycling, Waste Treatment and Clean Technology), Madrid, September 2004, paper submitted " The Paramix project: enhanced recycling techniques for asphalt pavements";</p> <p>RILEM 2004 (Conference on the Use of recycled Materials in Building and Infrastructure), Barcelona, November 2004, paper submitted "The Paramix project: enhanced recycling asphalt</p> | IV                  |                             |
|                |                        | 03-EPFL & 06-BBRC  |                             |  | Contract TST3-CT-2003-505831 for pavements   |                     |                             |
|                |                        | Authors : A.Junod & P.Bauweraerts  |                             | Page 42 of 174   | File : d21_interurban infrastructure-state of the art of innovations   |                     |                             |



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| <b>FRANCE (SETRA)</b> |                        |   |  |   |  |                     |                             |
| <b>1</b>              | A,C                    | Product : BITULASTIC RA→<br>Company : SCREG | Road design<br>Surface dressing Binder | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail :<br><a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment –<br>July 2003<br>See : <a href="http://www.setra.fr">www.setra.fr</a>    | VII                 |                             |
| <b>2</b>              | B,C                    | Product : MICROLASTIC→<br>Company : SCREG   | Surface dressing binder                | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail :<br><a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment –<br>June 2003<br>See : <a href="http://www.setra.fr">www.setra.fr</a>    | VII                 |                             |
| <b>3</b>              | B,C                    | Product : SACERSEAL EX→<br>Company : SACER  | Surface dressing modified binder       | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail :<br><a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment –<br>May 2003<br>See : <a href="http://www.setra.fr">www.setra.fr</a>     | VII                 |                             |
| <b>4</b>              | B,C                    | Product : COMPOSTYRENE→<br>Company : SCREG  | Materials for lightweight fill         | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail :<br><a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment –<br>January 2003<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | VII                 |                             |



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| <b>FRANCE (SETRA)</b> |                               |   |  |  |  |                            |                             |
| <b>5</b>              | A,B,C                         | Product : COMPOMODULE H<br>Company : SCREG      | Base bituminous mixture for structure reinforcement                            | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment – December 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | VII                        |                             |
| <b>6</b>              | B,C,D                         | Product : PACDRAIN<br>Company : WAVIN           | Drainage system  | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment – November 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | VII                        |                             |
| <b>7</b>              | B,C,D                         | Product : DRAINCOTEX 200<br>Company : AFITEX    | Drainage system  | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment – November 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | VII                        |                             |
| <b>8</b>              | B,C                           | Product : RUFLEX→<br>Company : COLAS            | Rough asphalt for thin course wearing  | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment – March 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a>    | VII                        |                             |
| <b>9</b>              | C                             | Product : MULTIPPHALTE 35/30<br>Company : SHELL | Special bitumen for binder and surface course to get better rutting resistance | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment – July 2001<br>See : <a href="http://www.setra.fr">www.setra.fr</a>     | VII                        |                             |



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| <b>FRANCE (SETRA)</b> |                               |  |  |  |  |                            |                             |
| <b>10</b>             | A,B,C                         | Product : COMPOMAC R (M2)<br>Company : SCREG                                       | Cold asphalt for wearing course                          | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment – January 2001<br>See : <a href="http://www.setra.fr">www.setra.fr</a>  | VII                        |                             |
| <b>11</b>             | B,C                           | Product : PRACTIPLAST M40 for thin and very thin asphalt surfacing<br>Company : BP | Special bitumen for thin and very thin asphalt surfacing | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment – July 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a>   | VII                        |                             |
| <b>12</b>             | A,B                           | Product : ENKADRAIN FINDRAIN P3 C100<br>Company : COLBOND GEOSYNTHETICS            | Drainage system  | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment – July 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a>   | VII                        |                             |
| <b>13</b>             | C                             | Product : ESTERE<br>Company : JEAN LEFEBVRE  | Very thin or ultra thin wearing course application       | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Assessment – June 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a>   | VII                        |                             |
| <b>14</b>             | B,D                           | Product : MICRO-INCRUSTATION<br>Company : SACER                                    | Techniques to improve skidding resistance at young age   | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | On road construction site experimentation certificate – Delivered by the SETRA in March 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | VI                         |                             |



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| <b>FRANCE (SETRA)</b> |                               |   |  |   |  |                            |                             |
| <b>15</b>             | B,C,D                         | Product :RUGOCOMPACT<br>Company : SACER     | Compact and rough bituminous mixture for surfacing   | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail :<br><a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | On road construction site experimentation certificate – Delivered by the SETRA in March 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | VII                        |                             |
| <b>16</b>             | B,C                           | Product :COLASMAC<br>Company : COLAS        |  | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail :<br><a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | On road construction site experimentation certificate – Delivered by the SETRA in July 2001<br>See : <a href="http://www.setra.fr">www.setra.fr</a>  | VI                         |                             |
| <b>17</b>             | B,C,D                         | Product :MICROGRIP<br>Company : SACER       | Very thin bituminous for wearing course to improve skidding resistance<br>2 types of aggregate .<br>One of the two types is more soft than the other to regenerate the skid resistance | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail :<br><a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | On road construction site experimentation certificate – Delivered by the SETRA in July 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a>  | VII                        |                             |
| <b>18</b>             | C,E,F                         | On site cold road mixing of old pavement    | Old pavement<br>Road mixing<br>Pavement maintenance  | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail :<br><a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Guide – July 2003<br>See : <a href="http://www.setra.fr">www.setra.fr</a>  | III                        |                             |



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| <b>FRANCE (SETRA)</b> |                        |  |                           |  |  |                     |                             |
| 19                    | E                      | Choice assistance of maintenance techniques for pavement surface layers    | Pavement maintenance      | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Guide – July 2003<br>See : <a href="http://www.setra.fr">www.setra.fr</a>    | III                 |                             |
| 20                    | A                      | New pavement construction on national network – Alternative specifications | New product specification | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Guide – March 2003<br>See : <a href="http://www.setra.fr">www.setra.fr</a>   | III                 |                             |
| 21                    | E                      | Concrete pavement maintenance – Road and airfield pavement                 | Conception guide          | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Guide – October 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                 |                             |
| 22                    | A                      | Guide for civil engineering conception of cut and cover                    | Cut and cover             | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Guide – July 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a>    | III                 |                             |
| 23                    | A,J                    | Blasting earthworks in road works  |                           | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Guide – January 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                 |                             |



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| <b>FRANCE (SETRA)</b> |                        |   |   |  |   |                     |                             |
| 24                    | A                      | Trench design and implementation                              |   | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Guide – November 2001<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                 |                             |
| 25                    | E                      | High speed urban motorways rehabilitation – Theme : cleansing | Cleansing                                     | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Guide – April 2001<br>See : <a href="http://www.setra.fr">www.setra.fr</a>    | III                 |                             |
| 26                    | E,F                    | Phytosanitary treatment in road area                          | Phytosanitary                                 | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Guide – November 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                 |                             |
| 27                    | A                      | Fill design and implementation on compressible soil           | Compressible soil                             | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Guide – November 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                 |                             |
| 28                    | A,B                    | Road surface water imperviousness of structure by geomembrane | Environment<br>Geomembrane for water stocking | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a> | Technical Guide – November 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                 |                             |



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| <b>FRANCE (SETRA)</b> |                               |  |          |   |  |                            |                             |
| <b>29</b>             | D,E,J                         | New wearing course longitudinal evenness control                       |          | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a>          | Technical Guide – May 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a>     | III                        |                             |
| <b>30</b>             | A,B                           | Concrete pavement  |          | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a>          | Technical Guide – March 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a>   | III                        |                             |
| <b>31</b>             | A,J                           | Quality assurance organization in earthworks                           |          | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a>          | Technical Guide – January 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                        |                             |
| <b>32</b>             | A,B                           | Soil treatment by lime and/or cementitious binder                      |          | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a>          | Technical Guide – January 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                        |                             |
| <b>33</b>             | A,J                           | Road design safety check – Audit before opening - Methodological guide |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – July 2003<br>See : <a href="http://www.setra.fr">www.setra.fr</a>    | III                        |                             |



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| <b>FRANCE (SETRA)</b> |                        |  |          |   |  |                     |                             |
| 34                    | J                      | Road design safety check – Safety evaluation implementation after opening - Methodological guide |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – July 2003<br>See : <a href="http://www.setra.fr">www.setra.fr</a>      | III                 |                             |
| 35                    | I,J,L                  | Side obstacle treatment on main interurban roads   |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – October 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a>   | III                 |                             |
| 36                    | E,I                    | For a quality road service   |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – September 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                 |                             |
| 37                    | L                      | Temporary signing – Handbook of the site foreman – Volume 2 : divided carriageway roads          |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – July 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a>      | III                 |                             |
| 38                    | L,I                    | How to signpost the curves ?<br>Traffic signing  |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – July 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a>      | III                 |                             |



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| <b>FRANCE (SETRA)</b> |                               |  |          |   |  |                            |                             |
| <b>39</b>             | E,K                           | Road operation evaluation – Element method   |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – June 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a>    | III                        |                             |
| <b>40</b>             | I                             | Interurban traffic travel plan   |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – June 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a>    | III                        |                             |
| <b>41</b>             | I                             | Capacity reserve of a route – Calculation method   |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – May 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a>     | III                        |                             |
| <b>42</b>             | L                             | Temporary signing - Volume 6 : Choice of an operation mode – Minimize the traffic disruption due to the road works |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – January 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                        |                             |
| <b>43</b>             | L                             | Road signs computer aided capture  |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Catalogue – January 2002<br>See : <a href="http://www.setra.fr">www.setra.fr</a>       | III                        |                             |



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| <b>FRANCE (SETRA)</b> |                        |  |          |   |  |                     |                             |
| 44                    | I                      | Design and working of engineering and traffic management centre  |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – November 2001<br>See : <a href="http://www.setra.fr">www.setra.fr</a>  | III                 |                             |
| 45                    | J                      | Safety barrier for lorry restrained (H2 or H3 level barriers) – update note number 1                         |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – September 2001<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                 |                             |
| 46                    | J                      | Safety barrier for light vehicles restrained – Level N barriers on shoulder – Median reservation improvement |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – September 2001<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                 |                             |
| 47                    | L                      | Landmarking signing – Animation signing  |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – June 2001<br>See : <a href="http://www.setra.fr">www.setra.fr</a>      | III                 |                             |
| 48                    | K                      | Activity and measurement operation catalogue   |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – May 2001<br>See : <a href="http://www.setra.fr">www.setra.fr</a>       | III                 |                             |



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| <b>FRANCE (SETRA)</b> |                               |   |          |   |  |                            |                             |
| 49                    | I                             | Traffic management system telecommunication networks on high speed roads                |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – March 2001<br>See : <a href="http://www.setra.fr">www.setra.fr</a>   | III                        |                             |
| 50                    | J                             | Statistics contribution in road safety at local level                                   |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – January 2001<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                        |                             |
| 51                    | L                             | Temporary signing – Volume 5 : Traffic diversion design and implementation              |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – October 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                        |                             |
| 52                    | L                             | Temporary signing – Handbook of the site foreman – Volume 1 : two-way carriageway roads |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – April 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a>   | III                        |                             |
| 53                    | A,J                           | Motorcyclist consideration in infrastructure design and management                      |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Technical Guide – April 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a>   | III                        |                             |



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| <b>FRANCE (SETRA)</b> |                               |  |          |  |  |                            |                             |
| <b>54</b>             | L                             | Temporary signing – Volume 4 : Shuttle working                         |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a>        | Technical Guide – April 2000<br>See : <a href="http://www.setra.fr">www.setra.fr</a>     | III                        |                             |
| <b>55</b>             | B,C,F                         | Hot in-place recycling   |          | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a>                 | Technical Guide – May 2004<br>See : <a href="http://www.setra.fr">www.setra.fr</a>       | III                        |                             |
| <b>56</b>             | B,C,F                         | Retread process pavement and recycling bituminous material of pavement |          | Yves GUIDOUX<br>SETRA<br>CSTR/TCE<br>Phone : (33) 1 46 11 34 67<br>E-mail : <a href="mailto:yves.guidoux@equipement.gouv.fr">yves.guidoux@equipement.gouv.fr</a>                 | Technical Guide – July 2004<br>See : <a href="http://www.setra.fr">www.setra.fr</a>      | III                        |                             |
| <b>57</b>             | E,F                           | Green ancillaries maintenance  |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) 1 46 11 33 64<br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a>        | Practical Guide – February 2004<br>See : <a href="http://www.setra.fr">www.setra.fr</a>  | III                        |                             |
| <b>58</b>             | E,J,F                         | Straight planting plan in Department Public Works Authority (DDE)      |          | Philippe JEROME<br>SETRA<br>CSTR/CEI<br>Phone : (33) <u>1 46 11 33 64</u><br>E-mail : <a href="mailto:philippe.jerome@equipement.gouv.fr">philippe.jerome@equipement.gouv.fr</a> | Enquiry results – September 2003<br>See : <a href="http://www.setra.fr">www.setra.fr</a> | III                        |                             |



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| <b>FRANCE (APPIA)</b> |                        |   |   |   |  |                     |                             |
| <b>1</b>              | B,C,D                  | Product : DRAINOPRENE→                      | Porous asphalt<br>PmB<br>Classical                  | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jvaniscote@appia.eiffage.fr">jvaniscote@appia.eiffage.fr</a>   | Technical Assessment<br>Published by the SETRA<br>in June 2003                                       | VII                 |                             |
| <b>2</b>              | B,C,F                  | Product : MICROPHONE                        | Thin Asphalt Concrete<br>Acoustic properties<br>PmB | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jvaniscote@appia.eiffage.fr">jvaniscote@appia.eiffage.fr</a>   | Technical Assessment<br>Published by the SETRA<br>in November 2002                                   | VII                 |                             |
| <b>3</b>              | C,F                    | Product : BIOSTOC                           | Stockable Asphalt Mix<br>Vegetable Oil<br>Bioflux   | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jvaniscote@appia.eiffage.fr">jvaniscote@appia.eiffage.fr</a><br><br>Triquigneaux JP – 04 72 21 24 31<br><a href="mailto:jptriquigneaux@appia.eiffage.fr">jptriquigneaux@appia.eiffage.fr</a> | Technical Assessment<br>Published by the SETRA<br>in January 2001                                    | VII                 |                             |
| <b>4</b>              | B,C,D,F                | Product :DRAINOPHONE                        | Porous Asphalt<br>Acoustic Properties<br>PmB        | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jvaniscote@appia.eiffage.fr">jvaniscote@appia.eiffage.fr</a><br><br>Antoine JP – 04 72 21 24 36<br><a href="mailto:jpantoine@appia.eiffage.fr">jpantoine@appia.eiffage.fr</a>                | On road construction site<br>experimentation certificate<br>– Delivered by the SETRA<br>in June 2002 | VII                 |                             |



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| <b>FRANCE (APPIA)</b> |                               |   |  |  |   |                            |                             |
| <b>5</b>              | B,C,D                         | Product :TAPIGRADE                          | Asphalt Concrete<br>Mutigrad Bitumen<br>Anti Rutting                         | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jvaniscote@appia.eiffage.fr">jvaniscote@appia.eiffage.fr</a>  | On road construction site experimentation certificate – Delivered by the SETRA in April 2002                        | VII                        |                             |
| <b>6</b>              | B,C,D,F,<br>J                 | Product :EPSIBEL                            | Porous Asphalt<br>Twin Layers<br>Acoustic Properties<br>Hydraulic Capability | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jvaniscote@appia.eiffage.fr">jvaniscote@appia.eiffage.fr</a><br><br>Antoine JP – 04 72 21 24 36<br><a href="mailto:jpantoine@appia.eiffage.fr">jpantoine@appia.eiffage.fr</a> | On road construction site experimentation certificate – Delivered by the SETRA in April 2002                        | VII                        |                             |
| <b>7</b>              | A,B,C                         | Product :RAFTED                             | Asphalt Concrete with RAP<br>High RAP content<br>Recycling                   | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jvaniscote@appia.eiffage.fr">jvaniscote@appia.eiffage.fr</a><br><br>Antoine JP – 04 72 21 24 36<br><a href="mailto:jpantoine@appia.eiffage.fr">jpantoine@appia.eiffage.fr</a> | On road construction site experimentation certificate – Delivered by the SETRA in April 2002                        | VII                        |                             |
| <b>8</b>              | B,C                           | Product :LUMICHAPE                          | Thin Asphalt Concrete  | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jvaniscote@appia.eiffage.fr">jvaniscote@appia.eiffage.fr</a>  | On road construction site experimentation certificate – Delivered by the SETRA in March 2001                        | VII                        |                             |
| <b>9</b>              | B,C,D,F                       | Product :BIOFLUX→ and BIOFLEX→              | Bitumen with Fluxing Oil<br>Vegetable Oil<br>Surface Dressings               | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jvaniscote@appia.eiffage.fr">jvaniscote@appia.eiffage.fr</a><br><br>Antoine JP – 04 72 21 24 36<br><a href="mailto:jpantoine@appia.eiffage.fr">jpantoine@appia.eiffage.fr</a> | APPIA'S information available at the WEB address<br><a href="http://www.appia.fr/info">http://www.appia.fr/info</a> | VII                        |                             |



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| <b>FRANCE (APPIA)</b> |                               |   |  |   |   |                            |                             |
| <b>10</b>             | B,C,F                         | Product :CITYCHAPE→                         | Thin Asphalt Concrete<br>Acoustic Properties<br>PmB<br>Rubber Powder | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jcvaniscote@appia.eiffage.fr">jcvaniscote@appia.eiffage.fr</a>   | APPIA'S information available at the WEB address<br><a href="http://www.appia.fr/info">http://www.appia.fr/info</a> | VII                        |                             |
| <b>11</b>             | B,C,D                         | Product : MODULOPRENE→                      | Asphalt Concrete<br>PmB+Additives<br>High Modulus<br>Anti Rutting    | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jcvaniscote@appia.eiffage.fr">jcvaniscote@appia.eiffage.fr</a><br><br>Triquigneaux JP – 04 72 21 24 31<br><a href="mailto:jptriquigneaux@appia.eiffage.fr">jptriquigneaux@appia.eiffage.fr</a> | APPIA'S information available at the WEB address<br><a href="http://www.appia.fr/info">http://www.appia.fr/info</a> | VII                        |                             |
| <b>12</b>             | B,C                           | Product : EMULPROPPE→                       | Spraying Emulsion<br>Tack Coat<br>Quick Rupture                      | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jcvaniscote@appia.eiffage.fr">jcvaniscote@appia.eiffage.fr</a><br><br>Triquigneaux JP – 04 72 21 24 31<br><a href="mailto:jptriquigneaux@appia.eiffage.fr">jptriquigneaux@appia.eiffage.fr</a> | APPIA'S information available at the WEB address<br><a href="http://www.appia.fr/info">http://www.appia.fr/info</a> | VII                        |                             |
| <b>13</b>             | B,C                           | Product : ECOCHAPE→                         | Cold Asphalt Concrete<br>Emulsion<br>RAP                             | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jcvaniscote@appia.eiffage.fr">jcvaniscote@appia.eiffage.fr</a><br><br>Triquigneaux JP – 04 72 21 24 31<br><a href="mailto:jptriquigneaux@appia.eiffage.fr">jptriquigneaux@appia.eiffage.fr</a> | APPIA'S information available at the WEB address<br><a href="http://www.appia.fr/info">http://www.appia.fr/info</a> | VII                        |                             |
| <b>14</b>             | B,C                           | Product : ACTICHAPE→                        | Cold Asphalt concrete<br>Emulsion                                    | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jcvaniscote@appia.eiffage.fr">jcvaniscote@appia.eiffage.fr</a><br><br>Triquigneaux JP – 04 72 21 24 31<br><a href="mailto:jptriquigneaux@appia.eiffage.fr">jptriquigneaux@appia.eiffage.fr</a> | APPIA'S information available at the WEB address<br><a href="http://www.appia.fr/info">http://www.appia.fr/info</a> | VII                        |                             |



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| <b>FRANCE (APPIA)</b> |                        |   |   |   |                |                     |                             |
| <b>15</b>             | A,B,C,D                | Product : ORTHOCHAPE→                       | Asphalt Concrete<br>Orthotropic Bridges<br>High PmB content<br>Anti cracking<br>Fatigue | Vaniscote JC – 01 41 08 38 33<br><a href="mailto:jcvaniscote@appia.eiffage.fr">jcvaniscote@appia.eiffage.fr</a> |                | VII                 |                             |



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| <b>FRANCE (CG22)</b> |                        |   |                               |  |                |                     |                             |
| <b>1</b>             | B<br>C                 | The road of the future in two parts:<br>1/ One with coated vegecol<br>2/ One with a very adhesion cover<br><br>On the road, brilliant road markings | Coated biological<br>Adhesion | Claire Crumiere,CG22, DIT,<br>0296626333,<br>Crumiereclaire@cg22.fr                  |                | IV                  |                             |
| <b>2</b>             | J, L                   | Panels to warn of one against direction which work with sun panels  | Safety<br>Autonomy            | Claire Crumiere,CG22, DIT,<br>0296626333,<br>Crumiereclaire@cg22.fr                  |                | IV                  | June 2004                   |
| <b>3</b>             | B<br>C                 | Coated Vegecol on road opened to the traffic  | Vegetable                     | Claire Crumiere,CG22, DIT,<br>0296626333,<br>Crumiereclaire@cg22.fr                  |                | IV                  |                             |
| <b>4</b>             | F                      | Acoustic screens anti pollution   | Pollution<br>Noise            | Claire Crumiere,CG22, DIT,<br>0296626333,<br>Crumiereclaire@cg22.fr                  |                | IV                  |                             |



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| <b>FRANCE (COLAS)</b> |                        |   |  |  |                             |                     |                             |
| <b>1</b>              | D E F J                | Product : COLGRIP                           | High skid resistance<br>Safety<br>High performance surface dressing with resin and artificial aggregates | G HOMO<br>Tél: 33 (0)2 35 74 61 49<br><br>JP HENRAT<br>Tél 33 (0)1 39 30 93 02       | RGRA N° 791<br>Janvier 2001 | VII                 |                             |
| <b>2</b>              | D E F J                | Product : COLMAT HA                         | High skid resistance<br>Safety<br>Enrobe de surface améliorant l'adhérence                               | A CHAMBON<br>Tél: 33 (0)4 72 47 21 12  | Notice technique            | VII                 | September 2001              |
| <b>3</b>              | D E F                  | Product : COLNAK                            | Oil- and fuel-resistant surface  | JF GAL<br>Tél: 33 (0)1 39 30 93 20   | RGRA N° 804<br>Mars 2002    | VII                 |                             |
| <b>4</b>              | D F                    | Product : COLSOFT                           | Noise  | JF GAL<br>Tél: 33 (0)1 39 30 93 20<br>M BALLIE<br>Tél: 33 (0)1 39 30 93 00           | RGRA N°779<br>Décembre 1999 | VII                 |                             |



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| <b>FRANCE (COLAS)</b> |                        |   |  |   |   |                     |                               |
| <b>5</b>              | B                      | Product :MULTICOL                           | Rut-resistant structure                                | JP HENRAT<br>Tél 33 (0)1 39 30 93 02<br>M BALLIE<br>Tél: 33 (0)1 39 30 93 00<br>J BILAL<br>Tél: 33 (0)1 39 30 94 00 | RGRA N°801<br>Décembre 2001   | VII                 | -                             |
| <b>6</b>              | DJ                     | Product :RECCOL                             | Cold renovation<br>Evenness/ Profile<br>Low Traffic    | Y MORLOT<br>Tél: 33 (0)2 43 76 48 87<br>E GODARD<br>Tél: 33 (0)1 34 82 74 99  | Notice technique<br>Route actualité<br>Mars 2002 N° 112   | VII                 | Octobre<br>1999<br>RN121 (79) |
| <b>7</b>              | DF                     | Product :RUGOSOFT                           | Enrobé mince ou très mince<br>Noise<br>Skid resistance | JF GAL<br>Tél: 33 (0)1 39 30 93 20<br>M BALLIE<br>Tél: 33 (0)1 39 30 93 00  | Protocole d'accord SETRA<br>30 Mars 2004<br>Route actualité<br>Juin 2004 N°135<br>IRF The 2003 IRF<br>GRAA TROPHY | VII                 | Juillet<br>2000               |



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| <b>FRANCE (EUROVIA)</b> |                        |   |  |  |   |                     |                             |
| <b>1</b>                | A B C D<br>E           | Product : GRIPFIBRE<br>Slurry surfacing of grading 0/6 or 0/10 mm, continuous or discontinuous, with fibre addition | - slurry surfacing<br>- surfacing<br>- fibre<br>- skid resistance<br>- proofing<br>- durability            | Samir SOLIMAN<br>EUROVIA<br>00.33.(0)1.47.16.46.70<br><a href="mailto:ssoliman@eurovia.com">ssoliman@eurovia.com</a>   | Technical Assessment<br>Published by the SETRA<br>in June 2003  | VII                 | 1985                        |
| <b>2</b>                | B C                    | Product : POLYBITUME P<br>Modified binder by EVA polymer for coating  | -modified bitumen<br>-polymer<br>-coating<br>-improved macadam   | Bernard ECKMANN<br>EUROVIA<br>00.33.(0)1.47.16.49.67<br><a href="mailto:beckmann@eurovia.com">beckmann@eurovia.com</a> | Technical Assessment<br>Published by the SETRA<br>in March 2002 | VII                 | 1980                        |
| <b>3</b>                | A B C D<br>E           | Product : MICROVIA TM<br>Very thin asphalt surfacing for wearing course with modified binder                        | - thinness<br>- coated material surfacing<br>- polymer bitumen<br>- skid resistance<br>- rolling noise     | Samir SOLIMAN<br>EUROVIA<br>00.33.(0)1.47.16.46.70<br><a href="mailto:ssoliman@eurovia.com">ssoliman@eurovia.com</a>   |   | VII                 | 1990                        |
| <b>4</b>                | A B C D<br>E F         | Product : VIAPHONE<br>Acoustic sound asphalt  | - acoustic<br>- thinness<br>- coated material surfacing<br>- fibre<br>- skid resistance<br>- rolling noise | Nathalie PAQUET<br>EUROVIA<br>00.33.(0)1.47.16.46.89<br><a href="mailto:npaquet@eurovia.com">npaquet@eurovia.com</a>   | Technical Assessment<br>Published by the SETRA<br>in April 2000 | VII                 | 1996                        |



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| <b>FRANCE (EUROVIA)</b> |                               |   |  |   |   |                            |                             |
| <b>5</b>                | A B C D<br>E                  | Product : SEALVIA (old name : SLURRYVIA)<br>Slurry surfacing  | - Slurry surfacing<br>- resurfacing<br>- skid resistance<br>- proofing   | Samir SOLIMAN<br>EUROVIA<br>00.33.(0)1.47.16.46.70<br><a href="mailto:ssoliman@eurovia.com">ssoliman@eurovia.com</a>                            | Technical Assessment<br>Published by the SETRA<br>in April 2000                                 | VII                        | Start in years<br>70        |
| <b>6</b>                | A B C D<br>F                  | Product : MODULOVIA<br>High-modulus asphalt with modified binder, structural contribution in a pavement as wearing or base course | - rigidity modulus<br>- coated material surfacing<br>- base course<br>- founding power<br>- hard bitumen<br>- fatigue<br>- rutting | Honoré GOACOLOU<br>EUROVIA<br>00.33.(0)1.47.16.45.73<br><a href="mailto:hgoacolou@eurovia.com">hgoacolou@eurovia.com</a>                        | On road construction site experimentation certificate – Delivered by the SETRA in November 2002 | VII                        | Début<br>années 90          |
| <b>7</b>                | A B C E<br>F                  | Product : ECOLVIA<br>Cold-mix asphalt whose binder is a pure bitumen emulsion, without flux                                       | - coated material surfacing<br>- emulsion<br>- cold coating<br>- flux<br>- sustainable development                                 | Bernard ECKMANN<br>EUROVIA<br>00.33.(0)1.47.16.49.67<br><a href="mailto:beckmann@eurovia.com">beckmann@eurovia.com</a>                          | Eurovia's information brochure  | VII                        | 2000                        |
| <b>8</b>                | A B C D<br>E                  | Product : VIAGRIP<br>Surfacing based on epoxy resin and bauxite for accident-prone area treatment                                 | - epoxy resin<br>- calcined bauxite<br>- roughness<br>- skid resistance<br>- safety<br>- accident-prone area                       | Pierre-Marie SPILLEMAECKER<br>EUROVIA<br>00.33.(0)1.47.16.41.19<br><a href="mailto:pmspillemaecker@eurovia.com">pmspillemaecker@eurovia.com</a> | Eurovia's information brochure  | VII                        | 2002                        |



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| <b>FRANCE (EUROVIA)</b> |                        |   |  |  |                                |                     |                             |
| <b>9</b>                | A B C F                | Product : RECYCAN<br>Self-fitting in material to fill in trench, based on materials extracted from the trench | - ecology<br>- economy<br>- trench<br>- urban works  | Honoré GOACOLOU<br>EUROVIA<br>00.33.(0)1.47.16.45.73<br><a href="mailto:hgoacolou@eurovia.com">hgoacolou@eurovia.com</a> | Eurovia's information brochure | VII                 | 2003                        |
| <b>10</b>               | A B C F                | Product : SCORMAT<br>Line of road products elaborated with household refuse incinerator ash                   | - valorisation<br>- household refuse incinerator ash<br>- ecology<br>- sustainable development                     | Honoré GOACOLOU<br>EUROVIA<br>00.33.(0)1.47.16.45.73<br><a href="mailto:hgoacolou@eurovia.com">hgoacolou@eurovia.com</a> | Eurovia's information brochure | VII                 | 1996                        |
| <b>11</b>               | A B C F                | Product : TRICOUCHE<br>High-volume road structure   | - pavement structure<br>- pavement mechanics<br>- design<br>- base course<br>- foamed bitumen<br>- fatigue holding | Honoré GOACOLOU<br>EUROVIA<br>00.33.(0)1.47.16.45.73<br><a href="mailto:hgoacolou@eurovia.com">hgoacolou@eurovia.com</a> | Eurovia's information brochure | VII                 | 1999                        |



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| <b>FRANCE (LCPC – Piau)</b> |                        |   |  |   |   |                     |                             |
| 1                           | C                      | The objective of this project is to acquire a greater scientific understanding and recognition of bonding; the work performed lies more in the fundamental domain than other LCPC research activities, especially as regards Project 11B001 (composite materials). In the long run, it should enable anticipating the use of durable bonded assemblies in the field of civil engineering.   | <b>Bonded assemblies in civil engineering</b>                      | Thierry CHAUSSADENT [LCPC]<br><a href="mailto:thierry.chaussadent@lcpc.fr">thierry.chaussadent@lcpc.fr</a>                            | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |
| 2                           | C,B                    | The problem area being targeted by this project is the ageing and durability of (polymer-based) geosynthetic materials, in particular the geotextiles and geomembranes used in civil engineering. In the realm of geotechnical applications, (permeable) geotextiles may provide a whole array of functions, encompassing the reinforcement of earthen structures, filtering, separation layer, drainage element; (impermeable) geomembranes, on the other hand, allow waterproofing various types of earthen structures in addition to protecting natural settings from the effects of road runoff (retention basins, ditches, embankments, pavement subgrades) and sealing waste storage facilities, dams and hollow tunnels. | <b>Durability of geosynthetic materials</b>                        | Jean-Paul BENNETON [LRPC de Lyon]<br><a href="mailto:Jean-paul.benneton@equipement.gouv.fr">Jean-paul.benneton@equipement.gouv.fr</a> | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |
| 3                           | E                      | The Technical network has been set up to develop the second generation of road maintenance management assistance systems, where major advances lie in the possibility of conducting two types of analyses: a pluriannual analysis (evaluation and scheduling) by adopting laws governing both pavement deterioration and maintenance effects; and an economic analysis by introducing so-called "technico-economic" models.   | <b>Technical and economic management of highway infrastructure</b> | Philippe LEPERT [LCPC]<br><a href="mailto:philippe.lepert@lcpc.fr">philippe.lepert@lcpc.fr</a>  | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |



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| <b>FRANCE (LCPC – Piau)</b> |                        |  |   |  |   |                     |                             |
| 4                           | C                      | The objectives herein are to generate ageing simulation methods for polymer-modified bitumen (PmB), to be validated through observations both in the field and from experimental testing. This approach serves to characterize physicochemical and rheological properties with respect to the evolution in performance of these materials as well as to the resultant overlay mixes.   | <b>Durability of polymer modified bitumen</b>   | Virginie MOUILLET [LRPC d'Aix-en-Provence]<br><a href="mailto:virginie.mouillet@equipement.gouv.fr">virginie.mouillet@equipement.gouv.fr</a>   | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |
| 5                           | A                      | The objective inherent in this project is to optimize the maintenance of homogeneous road sections. The initial focus has been placed on drawing up a state of the art as regards currently-practiced maintenance solutions. Alongside this effort, work will be undertaken to better understand the level of damage of a pavement (fatigue, cracking) as well as the evolution of this damage. The models to be developed will predict the fatigue evolution of a pavement, along with the behaviour and evolution of a cracked pavement.   | <b>Structural durability of pavements</b>   | Philippe TAMAGNY [LCPC]<br><a href="mailto:philippe.tamagny@lcpc.fr">philippe.tamagny@lcpc.fr</a><br>Rolf KOBISCH [LRPC de Saint-Brieuc]<br><a href="mailto:rolf.kobisch@equipement.gouv.fr">rolf.kobisch@equipement.gouv.fr</a> | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |
| 6                           | A                      | This research project is primarily intended to improve and/or develop rational design methods applicable to airport runways, of both the flexible and rigid type, which have now become mandatory largely because of the significant increase in air traffic and reliance upon heavier aircraft. Accordingly, the present project serves to integrate the construction, monitoring and interpretation of full-scale testing programs. Closely related to this topic area, other research (particularly the study and prediction of permanent deformations within pavement layers made of unbound materials) has been associated with this effort; such work focuses on the design of flexible road pavements with untreated base layers, which may be seen as reduced-scale structures of flexible aeronautical pavements. | <b>Design methods for airport runways and road pavements with untreated base layers</b> | Jean-Maurice BALAY [LCPC]<br><a href="mailto:jean-maurice.balay@lcpc.fr">jean-maurice.balay@lcpc.fr</a>  | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |



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| <b>FRANCE (LCPC – Piau)</b> |                        |  |   |  |   |                     |                             |
| <b>7</b>                    | C                      | The objective herein is to develop methods for investigating pavement materials that allow defining performance-based specifications, in the aim of deriving materials whose mix designs are better adapted to the functional requirements imposed by structures, in addition to generating product standards based less on composition or empirical characteristics. In light of current conditions as regards the issuance of standards, this project focuses not only on improving current tests and methodologies, but also on undertaking prospective-type actions in order to prepare the subsequent generations of standards and specifications.  | <b>Tests and mix design of pavement materials</b>       | Louissette WENDLING [LRPC - Autun]<br><a href="mailto:louissette.wendling@equipement.gouv.fr">louissette.wendling@equipement.gouv.fr</a> | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |
| <b>8</b>                    | C                      | This research effort encompasses the design and evaluation of pavement foundation characteristics, whether they be composed of soils or untreated materials, within the scope of road and airport foundations or ballast for rail foundations. The project is aimed at studying not only the mechanical behaviour of such foundations and their component materials, but also the evolution in their characteristics when submitted to the effects of environmental conditions (water content variations, freezing effect, etc.). Treatment techniques, intended to improve the mechanical characteristics of pavement foundations, will also be raised. | <b>Pavement foundation for transport infrastructure</b> | Gilles. LACASSY [LRPC de Bordeaux]<br><a href="mailto:Gilles.lacassy@equipement.gouv.fr">Gilles.lacassy@equipement.gouv.fr</a>           | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |



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| Innovation Nr               | Field Nr – see <b>Table 1</b> | Title and short description (max. 300 char)   | Keywords  | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)  | Publication(s)  | Phase – see <b>Table 2</b> | Date of initial application |
| <b>FRANCE (LCPC – Piau)</b> |                               |   |   |   |   |                            |                             |
| <b>9</b>                    | C,D                           | The objectives set forth as part of this project are to evaluate both the performance and durability of the various surface layer techniques by means of pavement monitoring or accelerated testing, as well as in developing new laboratory tests. The present work is to reflect the different functional characteristics and will serve to complement research performed on the topic of adherence, in association with Program C. The agenda of this project has been split into three orientations: i) evaluation of performance and behaviour of the various surface layer materials and techniques over time, by reliance upon the Pavement Technical Resource centre; ii) prediction of surface layer resistance to the dual phenomena of stripping and debonding; and iii) development of a mechanics-based approach for predicting the permanent deformations of surface layers.                    | <b>Materials and techniques applied to surface layers</b>             | Yves BROSEAUD [LCPC]<br><a href="mailto:Yves.brosseaud@lcpc.fr">Yves.brosseaud@lcpc.fr</a>                                      | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                         |                             |
| <b>10</b>                   | K                             | This project combines work on finalized studies with more developmental-type research as a means of upgrading the study tools and methods employed by CETE technical staff when undertaking missions assigned in road-building on behalf of project owners and supervisors. These efforts are also intended to enable the external dissemination of resultant products. The present work serves to complete the development program carried out in road-building that corresponds to the concerns of other program committees. It has thereby been set up to perform two sorts of actions: i) reflective sessions, to explain the nature of advances recognized as useful for the research network and which can be held, depending on the case, either within the framework of this project or proposed to another program committee; and ii) creation of methodological studies or hardware/software tools. | <b>Evolution in the tools and methods applied to pavement studies</b> | Bernard ROUSSEL [LRPC de Blois]<br><a href="mailto:bernard.rousseau@equipement.gouv.fr">bernard.rousseau@equipement.gouv.fr</a> | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                         |                             |



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| Innovation Nr               | Field Nr – see Table 1 | Title and short description (max. 300 char)  | Keywords  | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)                             | Publication(s)  | Phase – see Table 2 | Date of initial application |
| <b>FRANCE (LCPC – Piau)</b> |                        |  |   |  |   |                     |                             |
| 11                          | E                      | This project is dedicated to localizing heterogeneities within soils and civil engineering structures by means of non-destructive techniques.  | Detection of faults and discontinuities in structures | Xavier Dérobert [LCPC]<br><a href="mailto:xavier.derobert@lcpc.fr">xavier.derobert@lcpc.fr</a>                   | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |
| 12                          | E,K                    | This project lies at the interface between general research conducted by the Program A Committee and the set of needs expressed within the other program committees; in particular, it serves to transfer the acquisition of new investigation or monitoring techniques to either regional laboratories or industry by means of participating in the development of applied products (instrumentation, software and methods).  | Assessment of structure and soil conditions           | Jean-Michel Simonin [LCPC]<br><a href="mailto:jean-michel.simonin@lcpc.fr">jean-michel.simonin@lcpc.fr</a>       | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |
| 13                          | E                      | The fields of instrumentation and metrology are undergoing considerable transformation. Demands placed in this area along with underlying concepts are also evolving. The notion behind a sensor no longer connotes reality. Global information tends to be preferred over local-level information, wherein lies the notion of sensor networks. The facility operator or user expresses increasing demands on measurement system adaptation to better meet needs. The availability of a battery of decision-making tools constitutes a major orientation for future development. | Measurement and information processing                | Jean-Marie Caussignac [LCPC]<br><a href="mailto:jean-marie.caussignac@lcpc.fr">jean-marie.caussignac@lcpc.fr</a> | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |



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| <b>FRANCE (LCPC – Raimbault)</b> |                        |   |   |   |   |                     |                             |
| <b>1</b>                         | D, F                   | <p><b>Road noise reduction</b></p> <p>Low-noise road surfaces and noise barriers are focuses of investigation. The purpose of these researches project is threefold: to provide better knowledge about the sound generated by road traffic, to develop models for the prediction and optimization of noise-reducing solutions, and to propose evaluation methods for the resultant noise reduction.</p> <p>Optimization strategies nonetheless require a better understanding of the physical phenomena created by the interaction between a rolling tire and a road surface.</p> <p>Predicting the noise levels in the vicinity of roads requires taking into account the atmospheric conditions, the surrounding surfaces and the relief.</p> | <p><b>low noise road surfaces, noise barriers, acoustic propagation, atmospheric conditions</b></p> | <p>Fabienne ANFOSSO-LEDEE, LCPC, 0240845792, <a href="mailto:fabienne.anfosso@lcpc.fr">fabienne.anfosso@lcpc.fr</a></p> <p>Michel BERENGIER, LCPC, 0240845903, <a href="mailto:michel.berengier@lcpc.fr">michel.berengier@lcpc.fr</a></p> | <p>Fabienne ANFOSSO-LEDEE, 1997, Application de la méthode des équations intégrales à la modélisation du bruit aux abords des routes: interaction chaussée/écran antibruit LCPC, ERLPC EG14.</p> <p>M. BÉRENGIER, F. ANFOSSO-LÉDÉE, 1998, State of the art on the prediction and control of the road traffic noise in France. Transportation Research Board Record, n° 1626, pp. 71-77.</p> <p>M. BERENGIER, B. GAUVREAU, P. BLANC-BENON, D. JUVÉ Outdoor sound propagation: A short review on analytical and numerical approaches. <i>Acta Acustica united with Acustica</i>, 2003, vol 89, n°6, pp.980-991.</p> | II                  |                             |
| <b>2</b>                         | B,C,F                  | <p><b>Porous pavements and reservoirs structures</b></p> <p>If porous road surfaces can reduce road noise, porous pavements allow to reduce the runoff flow rate related to storms. They also reduce the pollution carried to the rivers by the storm waters. Different types of reservoir structures, using various porous materials, have been designed and modelled in order to increase the runoff reduction even if the road is not flat</p>   | <p><b>storm water runoff reduction, water pollution, water retention</b></p>                        | <p>Georges RAIMBAULT, LCPC, 0240845863, <a href="mailto:georges.raimbault@lcp.fr">georges.raimbault@lcp.fr</a></p> <p>Michel LEGRET, LCPC, 0240845866, <a href="mailto:michel.legret@lcpc.fr">michel.legret@lcpc.fr</a></p>               | <p>Georges RAIMBAULT, 2000, Bilan de la chaussée à structure-réservoir de la rue de la Classerie à Rezé, LCPC, ERLPC EG16.</p> <p>Michel LEGRET, 2001, Pollution et impact d'eaux de ruissellement de chaussées, LCPC, ERLPC CR27</p>   | II                  | 1988                        |
| <b>3</b>                         | A,E                    | <p><b>Draining screens on pavement edges</b></p> <p>The classical internal drainage of road pavements is not often efficient. These new screens intercept water saturated levels that may appear in the roads and evacuate water.</p>   | <p><b>Internal road drainage</b></p>  | <p>Georges RAIMBAULT, LCPC, 0240845863, <a href="mailto:georges.raimbault@lcp.fr">georges.raimbault@lcp.fr</a></p>  | <p>Ecrans drainants en rives de chaussées. Guide technique, 1992, LCPC-SETRA,</p>   | II                  | 1986                        |



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| <b>FRANCE (LCPC – Raimbault)</b> |                        |   |  |   |  |                     |                             |
| <b>4</b>                         | C,F                    | <p><b>Recycling and unconventional materials</b></p> <p>This project combines all of the research focusing on a greater understanding and control over the technical, technico-economic and environmental aspects relative either to the recycling of road-building materials or to the use within road structures of natural materials non-compliant with specifications or made from industrial by-products.</p>                      | <p><b>Industrial by-products, recycling, environmental impact, mechanical properties</b></p> | <p>Jean-Claude AURIOL,<br/>LCPC,<br/>0240845721,<br/><a href="mailto:jean-claude.auriol@lcpc.fr">jean-claude.auriol@lcpc.fr</a></p> <p>Denis FRANCOIS,<br/>LCPC,<br/>0240845636,<br/><a href="mailto:denis.francois@lcpc.fr">denis.francois@lcpc.fr</a></p> | <p>Observatoire Français pour le recyclage dans les infrastructures routières, 2003, LCPC, website : <a href="http://ofrir.lcpc.fr">http://ofrir.lcpc.fr</a></p>   | II                  | 2000                        |
| <b>5</b>                         | F                      | <p><b>Global approach analysis for road environmental problems</b></p> <p>The generation of a global environmental approach as part of this project will stem from a multiplicity of approaches conducted at a local scale, to which a globalization method, built during the present research work, will be applied. One family of infrastructure, interurban roads, will be given special emphasis over the course of this study.</p> | <p><b>Material life cycle analysis,</b></p>  | <p>Agnès JULLIEN,<br/>LCPC,<br/>0240845938,<br/><a href="mailto:agnes.jullien@lcpc.fr">agnes.jullien@lcpc.fr</a></p>  | <p>Agnès JULLIEN et al., Recyclage dans la route: vers une économie des ressources naturelles?, Ed. INRETS, actes du 1<sup>er</sup> colloque scientifique international Environnement et Transports, Avignon, 2003</p> | II                  |                             |



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| <b>FRANCE (LCPC – Texier)</b> |                        |   |              |  |   |                     |                             |
| 1                             | J                      | The focus on upgrading road safety, a priority of the national government widely shared by all road facility operators, has necessitated deriving assessments of road safety conditions at various scales, including a network, a trip itinerary, a road section or even a time of day. Collecting and interpreting the data used to evaluate characteristics of both the infrastructure geometry and pavement surface, along with the road environment, constitute the basic elements for establishing a road safety diagnostic. The services currently offered within the LCPC's "RST" Divisions in this area need to be further developed and better structured in order to enhance the decision-making aid expected in the field by facility operators. This project will assist in improving the technical protocol that serves to shape the infrastructure evaluation required to proceed with the road safety diagnostic exercise. | Route safety | Lionel PATTE<br><br><a href="mailto:lionel.patte@equipement.gouv.fr">lionel.patte@equipement.gouv.fr</a> | See :<br><br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |
| 2                             | G                      | The objective behind this project is to develop driving aid systems aimed at improving safety and optimizing use of the infrastructure. In order to remedy driver deficiencies, measures entailing various levels of co-operation will be proposed: basic information, shared driving (between driver and onboard automated systems), fully automated driving. The vehicle control functions being developed are intended to provide the driver with a lane-specific guidance device in order to avoid leaving the roadway or colliding with obstacles; moreover, they rely on better management of both speeds and inter-object distances. The "automated road" concept constitutes a long-term response that enables guaranteeing optimal safety conditions while maintaining high traffic levels.  | Driving aids | Jacques EHRlich<br><br><a href="mailto:jacques.ehrlich@lcpc.fr">jacques.ehrlich@lcpc.fr</a>              | See :<br><br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |



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| <b>FRANCE (LCPC – Texier)</b> |                        |  |                                    |   |   |                     |                             |
| <b>3</b>                      | D                      | This research project is intended to identify and then quantify the influence of both geometrical and pavement surface state parameters under various environmental and climatic conditions (rain, wind, etc.), making it possible to predict the level of vehicle adherence that can be mobilized. It has been broken down into three topics: 1) influence of the pavement and its condition (dry, wet) on global tire performance; 2) the texture/adherence relationship; and 3) conventional texture and adherence measurements.  | Skid resistance                    | Yves DELANNE<br><a href="mailto:yves.delanne@lcpc.fr">yves.delanne@lcpc.fr</a>                          | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |
| <b>4</b>                      | J, L, K                | This research project seeks to identify and assess the photometrical parameters of road signals and surfaces, in addition to evaluating the impact of road visibility under various driving conditions. It has been structured into three topic areas: 1) photometric characterization of road signals and surfaces, 2) photometric simulation of the driver's visual environment, and 3) assessment of infrastructure performance based on road visibility.   | Road environment perception        | Eric DUMONT<br><a href="mailto:eric.dumont@lcpc.fr">eric.dumont@lcpc.fr</a>                             | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | II                  |                             |
| <b>5</b>                      | J                      | The objective behind this project consists of developing a set of resources for use by traffic managers in order to better control traffic flows under adequate safety conditions for road users. Research work carried out herein is aimed at improving knowledge about road traffic: type, vehicle loads and speeds, impact assessment of certain dysfunctions (by use of traffic simulators), along with proposals for detecting excess loads, user information, and ultimately alerts during potentially-hazardous situations. The project has been categorized into four topic areas: characterization of traffic, weighing of rolling loads, road-related information and alerts, and contributions to traffic simulation modelling. | Road equipment and instrumentation | Jean BERTRAND<br><a href="mailto:jean.bertrand@equipement.gouv.fr">jean.bertrand@equipement.gouv.fr</a> | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a> | I                   |                             |



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| <b>FRANCE (LCPC – Texier)</b> |                        |   |   |   |   |                     |                             |
| 6                             | J                      | The "TRUCKS" research project is aimed at studying how best to improve the safety of both traffic and infrastructure with respect to risks caused by the presence of trucks, and to contribute to increasing the effectiveness of road freight transport by means of controlling impacts on both facilities and the environment.  | Truck and heavy vehicle impacts on infrastructure and road safety                   | Victor DOLCEMASCOLO<br><a href="mailto:victor.dolcemascolo@lcpc.fr">victor.dolcemascolo@lcpc.fr</a> | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a>           | II                  |                             |
| 7                             | M,J                    | This project is intended to analyze the visibility of driving spaces and the impact of circumstantial elements that serve to modify the state of repair, uses and perception. In particular, a study will be conducted on the combined effects of meteorological conditions, the road and rolling movements of mobile objects, which generate abnormal situations.  | Metrology and road operation  | Jean LIVET<br><a href="mailto:jean.livet@equipement.gouv.fr">jean.livet@equipement.gouv.fr</a>      | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a>           | II                  |                             |
| 8                             | J                      | The "INFRASURE" project (which stands for Infrastructure, Simulations, Uses and Research on controlling the Environment) has been set up to offer experimental resources adapted for both studying the role of infrastructure in accident generation and introducing remedial solutions. The research programmed, to make use of specialized INFRASURE equipment, is aimed at highlighting the safety measures provided by this infrastructure, in comparison with the mobility provided, and then making appropriate adaptations to meet social demands. | INFRASURE   | Marie-Line GALENNE<br><a href="mailto:marie-line.galenne@lcpc.fr">marie-line.galenne@lcpc.fr</a>    | See :<br><a href="http://www.lcpc.fr">www.lcpc.fr</a>           | I                   |                             |
| 9                             | J                      | Project "SARI" :<br>Automated surveillance of roads for drivers and network managers information  | PREDIT :<br>Programme of research, experimentation and innovation in land transport | Marie-Line GALENNE<br><a href="mailto:marie-line.galenne@lcpc.fr">marie-line.galenne@lcpc.fr</a>    | See<br><a href="http://www.predit.prd.fr">www.predit.prd.fr</a> | I                   |                             |



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| <b>DENMARK</b> |                        |  |  |  |   |                     |                             |
| <b>1</b>       | A                      | <i>Mechanistic Design for Semi-Rigid Pavements – an Incremental Approach.</i><br>Most semi-rigid pavements (in Danish motorways from the 1970'ies) have performed well, but until now no satisfactory design model existed. A model was developed based on data from existing pavements and a full-scale test section. | Semi-rigid pavements, cement treated base, long-life pavements, design model | Finn Thøgersen<br>Danish Road Institute<br>+45 46 30 71 19<br><a href="mailto:fit@vd.dk">fit@vd.dk</a>     | Until now only internal reports. Will be made publicly available later.   | IV                  | Hopefully 2005              |
| <b>2</b>       | E<br>K                 | <i>High Speed Deflectograph</i><br>Bearing Capacity measurements at normal traffic speeds using the laser Doppler technique.   | Bearing capacity<br>Measurement vehicle                                      | Gregers Hildebrand<br>Danish Road Institute<br>+45 46 30 71 75<br><a href="mailto:ghb@vd.dk">ghb@vd.dk</a> | <a href="http://www.vejdirektoratet.dk/dokument.asp?page=document&amp;objno=63778">http://www.vejdirektoratet.dk/dokument.asp?page=document&amp;objno=63778</a> | VI                  | 2004                        |
| <b>3</b>       | A                      | <i>MMOPP – Mathematical Model of Pavement Performance</i><br>The new Danish Design Procedure which is based on the incremental recursive method. Simulation of pavement deterioration is included.   | Design Method<br>Computer program  | Gregers Hildebrand<br>Danish Road Institute<br>+45 46 30 71 75<br><a href="mailto:ghb@vd.dk">ghb@vd.dk</a> | Computer program and documentation available, but only in Danish  | VI                  | 2003                        |



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| <b>DENMARK</b> |                        |   |                                   |  |  |                     |                             |
| <b>4</b>       | C<br>F                 | <p><i>Green Concrete</i></p> <p>A concept with the aim of reducing the environmental impacts of concrete through the development of new resource-saving binder systems and increased recycling and energy recovery of waste materials.</p> <p>A highway bridge has been constructed using these principles.</p> | Concrete<br>Environment<br>Bridge | <p>Mette Glavind<br/>Danish Technological Institute<br/>+45 72 20 22 20<br/><a href="mailto:mette.glavind@teknologisk.dk">mette.glavind@teknologisk.dk</a></p> | <p><a href="http://www.teknologisk.dk/root/media/Environmentally%20Green%20Concrete%20Structures%2C%20Berlin%202001.pdf">http://www.teknologisk.dk/root/media/Environmentally%20Green%20Concrete%20Structures%2C%20Berlin%202001.pdf</a></p> | VI                  | 2002                        |



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| <b>GERMANY</b> |                        |   |  |   |                |                     |                             |
| <b>1</b>       | A                      | Calculation of asphalt and concrete layers including continuously reinforced concrete pavements | Calculation of road constructions              | Ekkehard Noske<br>Bundesanstalt für Straßenwesen,<br>fon 0049+2204+43+732<br>mail noske@bast.de |                | II                  |                             |
| <b>2</b>       | E                      | Quick setting concrete for fast repairing of concrete highway sections in one-day-sites         | Quick setting concrete                         | Ekkehard Noske<br>Bundesanstalt für Straßenwesen,<br>fon 0049+2204+43+732<br>mail noske@bast.de |                | VI                  |                             |
| <b>3</b>       | B                      | Sustainable surface characteristics on highways: concrete surface with exposed aggregates       | Noise reduction especially for truck tyres     | Nina Sliwa<br>Bundesanstalt für Straßenwesen,<br>fon 0049+2204+43+268<br>mail sliwa@bast.de     |                | II                  |                             |
| <b>4</b>       | B                      | Continuously Reinforced Concrete on highways with overlay                                       | Sustainable construction with less maintenance | Ekkehard Noske<br>Bundesanstalt für Straßenwesen,<br>fon 0049+2204+43+732<br>mail noske@bast.de |                | I                   |                             |



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| <b>GERMANY</b> |                        |   |  |   |                |                     |                             |
| <b>5</b>       | D                      | Durable concrete and asphalt wearing courses          | Evenness, skid resistance, noise reduction     | Nina Sliwa<br>Bundesanstalt für Straßenwesen,<br>fon 0049+2204+43+268<br>mail sliwa@bast.de       |                | IV                  |                             |
| <b>6</b>       | C                      | Open porous concrete                                  | Silent wearing course                          | Nina Sliwa<br>Bundesanstalt für Straßenwesen,<br>fon 0049+2204+43+268<br>mail sliwa@bast.de       | yes            | II                  | 1997                        |
| <b>7</b>       | B                      | Geotextile below concrete pavement                    | Bond separating, no erosion of subbase bedding | Stefan Höller<br>Bundesanstalt für Straßenwesen,<br>fon 0049+2204+43+734<br>mail hoellers@bast.de | yes            | VII                 |                             |
| <b>8</b>       | B                      | Construction of binder and wearing course in one step | Compact paver                                  | Oliver Ripke<br>Bundesanstalt für Straßenwesen,<br>fon 0049+2204+43+751<br>mail ripke@bast.de     |                | IV                  |                             |



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| <b>HUNGARY</b> |                        |   |                  |  |                |                     |                             |
| 1.             | B                      | Asphalt mixture with Syntumen – plastomer type recycled plastic in bitumen and in asphalt mixture for enhancing their resistance to deformation. Successful trial sections in wearing and binder course since 1999. | Syntumen asphalt | Ms. Ágnes Görgényi KTI, +361-204-7982,<br>v.gorgenyi@freemail.hu                     |                | VI                  |                             |



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## SWITZERLAND



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| <b>SWITZERLAND</b> |                        |  |  |   |                |                     |                             |
| <b>1</b>           | B,C                    | <p><b>Composite pavement</b><br/>A goal of the research project is the development of bases for a new standard. For this purpose, in one hand, a catalogue of different variants of combined linings including both new linings ("Compositlining") and repaired existing linings is to be provided. This will contain the description of the area of application as well as the definition of limitations of use of different lining superstructures. On the other hand the structural design of "Compositlining" in form of a catalogue is to be provided as well. The research work covers four different subtasks: - composition of a list of the implemented variants of concrete linings with bituminous coat - elaboration of decision bases for the application of combined linings - completion of experimental work for the evaluation of the boundary surface problems: Group and bypass of the joint ranges - elaboration of suggestions for the structural design of "compositlining".</p> | lining coats, concrete linings, structural design, catalogue | <p>Werner Rolf<br/>Tél 01 700 14 02<br/>E-mail <a href="mailto:werner@bevbe.ch">werner@bevbe.ch</a><br/>Organisatio n BEVBE<br/>Beratung und Expertisen für Verkehrsflächen in Beton<br/>Rue Herenholzweg 5<br/>NPA / 8906 Bonstetten<br/>Lieu<br/>Pays Schweiz</p> |                | II                  |                             |



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| <b>SWITZERLAND</b> |                        |  |  |  |                |                     |                             |
| <b>2</b>           | <b>C</b>               | <p><b>Relation between binder properties and distress characteristics of pavements (Performance orientated methods)</b></p> <p>The connection between binder properties and distress type is investigated with classical (Softening point ring and ball, penetration, Fraass breaking point, viscosity) and more recent test methods (DSR, BBR, chromatography) on binders of approx. 10 damaged road pavement sections. Principal focus is placed on rutting and fatigue cracking. Two sections with low temperature cracking are included as well. Pavement sections with modified and non-modified binders will be investigated.</p> <p>The resulting data will show which binder properties are relevant for the pavement behaviour. The dependence of the climate on damage risk will be taken into account, as the type of damage will change under different climatic conditions. Suggestions for national standards and requirements will be proposed.</p> | Binder properties, distress type, transfer to practice | <p>Hugener Martin</p> <p>Tél 01 823 44 87</p> <p>E-mail <a href="mailto:martin.hugener@empa.ch">martin.hugener@empa.ch</a></p> <p><b>Organisatio</b>n Eidg. Materialprüfungs- und Forschungsanstalt</p> <p><b>Rue</b> Überlandstrasse 129</p> <p><b>NPA / Lieu</b> 8600 Dübendorf</p> <p><b>Pays</b> Schweiz</p> |                | II                  |                             |



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| <b>SWITZERLAND</b> |                        |   |   |   |                |                     |                             |
| 3                  | C                      | ELLPAG European Long-Life Asphalt Pavements   |   | Turtschy J.-C.<br>Tél 021 693 23 45<br>Courriel <a href="mailto:jean-claude.turtschy@epfl.ch">jean-claude.turtschy@epfl.ch</a><br>Organisation EPFL-LAVOC<br>Laboratoire des voies de circulation<br>Rue Bat. GC<br>NPA 1015 Lausanne<br>Lieu<br>Pays Suisse  |                | I                   |                             |
| 4                  | E                      | <b>Unterhalt 2000; More durable structures with zero-maintenance</b><br>On the area of the durability of structures today extensive knowledge, which must be evaluated and prepared however for a conversion to the practice, insists. Since infrastructure objects represent like the national route an economical investment over several generations, are indispensable thereby views of the economy and environmental compatibility of structures over their entire life span - not least in the sense of the concept of the "lasting development". | Structures, zero-maintenance, durability, economy, environmental compatibility, shifting of knowledge, recommendations. | Brühwiler E., Prof.<br>Tél +41 21 693 28 82<br>E-mail <a href="mailto:eugen.bruehwiler@epfl.ch">eugen.bruehwiler@epfl.ch</a><br>Organisation Ecole Polytechnique Fédérale de Lausanne<br>MCS - Maintenance Construction et Sécurité des ouvrages<br>Rue GR-Ecublens<br>NPA / 1015 Lausanne<br>Lieu<br>Pays Suisse |                | II                  | 2005                        |



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| <b>SWITZERLAND</b> |                        |   |   |  |                |                     |                             |
| <b>5</b>           | C,E                    | <p><b>Unterhalt 2000; Research package 1: Status of the behaviour of pavement on the national road network.</b></p> <p>A goal of the available work is an analysis of the existing age structure and the appropriate conditions of the linings on the national route net as concrete answer to the question "like for a long time actually building method/lining XY held?". As far as possible (and at according to existing condition values briefly before execution of a preservation measure) linings renewed also meanwhile are to be considered.</p> | Status behaviour, material/building methods, road condition, durability | <p>Scazziga I.</p> <p><b>Tél</b> +41 52 245 10 00</p> <p><b>E-mail</b> <a href="mailto:ivan.scazziga@viagroup.ch">ivan.scazziga@viagroup.ch</a></p> <p><b>Organisation</b> Viagroup AG</p> <p><b>Rue</b> Technoramastrasse 8</p> <p><b>NPA / Lieu</b> 8404 Winterthur</p> <p><b>Pays</b> Schweiz</p> |                | II                  | 2005                        |



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| <b>SWITZERLAND</b> |                        |  |   |  |                |                     |                             |
| <b>6</b>           | C,E                    | <p><b>Unterhalt 2000; Research package 2: Durable components</b></p> <p>Durability and performance of asphaltic surfacing depend considerably on the durability the individual mixing property components as well as their mutual group. The goal of this research package consists of it, constructing on FP1 and as basis for FP 3 and FP4, the project maintenance 2000 modern criteria for the evaluation and evaluation more durably compiling high-quality mixing property goods in order to reduce on the one hand roadway by run gene significantly for part or total set of linings and to secure and extend on the other hand the know-how considerable in our country with view of the developments of Europe. Different component item numbers relevant for Switzerland are to be examined. The research package is if possible on basis of existing methodologies to accomplish technical literature and practical experiences and is installation, enterprise and recycling to consider. To examine is the durability:</p> <ul style="list-style-type: none"> <li>- the individual components</li> <li>- the group between bonding agents</li> </ul> | Aging, bonding agent, durability, components, mineral materials, mixing property, examinations, group | <p>Partl Manfred N., Dr.</p> <p><b>Tél</b> +41 1 823 55 11</p> <p><b>E-mail</b> <a href="mailto:manfred.partl@empa.ch">manfred.partl@empa.ch</a></p> <p><b>Organisation</b> Eidg. Materialprüfungs- und Forschungsanstalt<br/>Abteilung Strassenbau</p> <p><b>Rue</b> Überlandstrasse 129-133</p> <p><b>NPA / Lieu</b> 8600 Dübendorf</p> <p><b>Pays</b> Schweiz</p> |                | II                  | 2005                        |



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| <b>SWITZERLAND</b> |                        |  |   |  |                |                     |                             |
| 7                  | C                      | <p><b>Unterhalt 2000; Work package PR3: Durability of bituminous mixes</b></p> <p>The development of procedures for the optimization of the mix design formulas making it possible to obtain powerful and durable bituminous mix constitutes the essential goal of this project PR3. The principal efforts of this package of research aiming at an optimization of the performances of the mixtures are:</p> <ul style="list-style-type: none"> <li>- development of a model of the stress/strain generated by the traffic</li> <li>- selection of the most adapted tests allowing the optimization of the bituminous mix formulas in the direction of the performance and durability</li> <li>- determination of the requirements to be applied to the selected tests on the basis of the performance measured in the bituminous mix.</li> </ul> | Bituminous mix, test, performance, modelling, durability, load, model, traffic, formulation, requirements | <p>Turtschy J.-C.</p> <p>Tél 021 693 23 43</p> <p>E-mail <a href="mailto:jean-claude.turtschy@epfl.ch">jean-claude.turtschy@epfl.ch</a></p> <p>Organisation Ecole Polytechnique Fédérale de Lausanne<br/>Laboratoire des voies de circulation (LAVOC)</p> <p>Rue Bât. DGC</p> <p>NPA / Lieu 1015 Lausanne</p> <p>Pays Suisse</p> |                | II                  | 2005                        |
| 8                  | E,K                    | <p><b>Unterhalt 2000; Research package 4: Durable pavements</b></p> <p>In a full-scale test on the cyclic testing plant of the IVT of the ETH Zurich the behaviour of different lining superstructures under same conditions is to be compared directly. The attempt serves for to the evaluation and evaluation of durable linings and structure systems. Superstructures which can be tested are selected FP2 and FP3 due to results and experiences of the research packages FP1, whereby if necessary also recycling materials are to be used.</p>   | maintenance, highly loaded roads, new Material  | <p>Caprez Markus, Dr.</p> <p>Tél 01/633 25 32</p> <p>E-mail <a href="mailto:caprez@igt.baug.ethz.ch">caprez@igt.baug.ethz.ch</a></p> <p>Organisation Institut für Verkehrplanung, Transporttechnik, Strassen- und Eisenbahnbau</p> <p>Rue ETH-Hönggerberg</p> <p>NPA / Lieu 8093 Zürich</p> <p>Pays Schweiz</p>                  |                | II                  | 2005                        |



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| <b>SWITZERLAND</b> |                        |   |   |  |                |                     |                             |      |
| <b>9</b>           | C,F                    | <p><b>SAMARIS: Sustainable and Advanced Materials for Road Infrastructures</b></p> <p>The societal needs that are specifically targeted here are to support EU policy on sustainable development, waste management and energy efficiency in road construction. The primary means is by encouraging a greater use of recycled components in pavement materials and by explicit consideration of environmental performance in the design. Attention is also paid to the situation within CE countries for which the RETRA-EST programme has identified environmental considerations in recycling and use of alternative materials as a first priority for co-operative actions. The second key objective is to prepare for the harmonisation of European approaches of material specification within the next generation of CEN standards. This will involve moving from a recipe approach to a more general performance-based approach of the in-place products.</p> | Economic Aspects; Social Aspects; Transport | <p>Prof. Eugen Brühwiler</p> <p>Tél 021 693 28 82</p> <p>E-mail <a href="mailto:eugen.bruehwiler@epfl.ch">eugen.bruehwiler@epfl.ch</a></p> <p>Organization EPF Lausanne<br/>ENAC - IS - MCS<br/>Maintenance, Construction et Sécurité des Ouvrages - MCS</p> <p>Rue Bâtiment GC</p> <p>NPA / Lieu 1015 Lausanne</p> <p>Pays Suisse</p> |                |                     | II                          | 2005 |
| <b>10</b>          | C,F                    | <p><b>Re-use of tires in road construction - Evaluation of the possibilities of the re-use of crumb rubber in bituminous layers</b></p>   |   |  |                |                     | I                           |      |



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| <b>SWITZERLAND</b> |                        |   |          |  |   |                     |                             |
| 11                 | E                      | <p><b>FORMAT: Fully optimized road maintenance</b></p> <p>This project is designed to enhance the efficiency and safety of the European road network by providing the means to reduce the number, duration and size of road works for pavement maintenance purposes. This has the potential to improve safety of both road workers and road users at road maintenance sites. The research also focuses on reducing the associated delays and hence the costs for road users as they negotiate these work zones. In order to achieve these wide ranging objectives, all aspects of the planning and execution of the pavement maintenance process will be optimised in a fully integrated usable set of pavement maintenance procedures. Four topics key to road pavement maintenance form the subject of this extensive research effort: pavement condition monitoring, maintenance techniques, safety at work zones and the surrounding areas and cost benefit analysis.</p> |          | <p>Turtschy J.-C.</p> <p>Tél 021 693 23 43</p> <p>E-mail <a href="mailto:jean-claude.turtschy@epfl.ch">jean-claude.turtschy@epfl.ch</a></p> <p>Organisation Ecole Polytechnique Fédérale de Lausanne<br/>Laboratoire des voies de circulation (LAVOC)</p> <p>Rue Bât. DGC</p> <p>NPA / Lieu 1015 Lausanne</p> <p>Pays Suisse</p> | <p><a href="http://www.minvenw.nl/rws/dww/home/format/">http://www.minvenw.nl/rws/dww/home/format/</a></p> <p><a href="http://www.cordis.lu/cost-transport/src/cost-343.htm">http://www.cordis.lu/cost-transport/src/cost-343.htm</a></p> | II                  | 2005                        |



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| <b>SWITZERLAND</b> |                        |   |   |  |                |                     |                             |
| <b>12</b>          | C,F                    | <p><b>ALT-MAT: Alternative materials in road construction</b></p> <p>In road construction enormous quantities of mineral materials are needed, in order to manufacture road surfacing. Switzerland is in the lucky situation that it does not know lack of qualitatively good mineral materials, but leads the dismantling of so large quantities to substantial interferences in nature. Other European countries like the Netherlands have to import mineral materials. On the other hand large quantities of rock-similar materials result in industrial processes: Cinders from the waste incineration and steelmaking, concrete abort, etc.. The use of such alternative recycling products encounters however for different reasons resistance: - feared leaching of pollutants - doubt concerning the mechanical quality of the road surfacing to high prices of the recycling building materials. The re-use of alternative recycling products is desirably: it can preserve natural resources and introduce former waste materials as recycling products into the raw material cycle flow. A goal of the project ALT.MAT</p> | Road construction; Recycling; Secondary building materials; Cinder; European Union project; bituminous road surfacing | <p>Dr. Martin Hugener</p> <p><b>Tél</b> 01 823 55 11</p> <p><b>Organisation</b> Eidg. Materialprüfungs- und Forschungsanstalt EMPA Strassenbau/Abdichtungen</p> <p><b>Rue</b> Überlandstrasse 129</p> <p><b>NPA / Lieu</b> 8600 Dübendorf</p> <p><b>Pays</b> Schweiz</p> |                | II                  |                             |



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| <b>SWITZERLAND</b> |                        |  |   |  |                |                     |                             |
| 13                 | D                      | <p><b>Skid-resistance requirement for road pavements. Requirements in skid-resistance and assessment of procedures of optimization of the parameters affecting skid-resistance of bituminous wearing courses.</b></p> <p>En considérant les données d'adhérence disponibles en Suisse et les valeurs fixées dans les pays étrangers, il doit être possible d'optimiser les valeurs d'adhérence en fonction de la situation du type de trafic. Une campagne de mesures d'adhérence sera réalisée par l'IVT. Une coordination étroite sera menée avec le SETRA en France qui dispose d'une longue expérience et termine actuellement le suivi de planches d'essais.</p>                        | Wearing courses, skid-resistance, test, procedures, pavements   | <p>Turtschy J.-C.</p> <p>Tél 021 693 23 43</p> <p>E-mail <a href="mailto:jean-claude.turtschy@epfl.ch">jean-claude.turtschy@epfl.ch</a></p> <p>Organisation Ecole Polytechnique Fédérale de Lausanne<br/>Laboratoire des voies de circulation (LAVOC)</p> <p>Rue Bât. DGC</p> <p>NPA / Lieu 1015 Lausanne</p> <p>Pays Suisse</p> |                | II                  |                             |
| 14                 | E                      | <p><b>Effect and influence of maintenance actions on the in-situ behaviour of asphalt pavements</b></p> <p>The aim of the research project is the determination of the influence of maintenance actions on the in-situ behaviour of asphalt pavements as well as the development of standards criteria for the evaluation of their mechanical contribution to the long term performance of pavements. Within the framework of the project typical hot and cold process maintenance actions, as thin surfacing in order to repair deformations, cracks and loss of material are evaluated regarding their influence on the properties of asphalt pavements in-situ and in the laboratory.</p> | Maintenance measures, pavement behaviour, pavement characteristic values, mechanical characteristic values, layer group, replacement of surface layers, hot laying, cold laying | <p>Raab Christiane</p> <p>Tél 01 823 55 11</p> <p>E-mail <a href="mailto:christiane.raab@empa.ch">christiane.raab@empa.ch</a></p> <p>Organisation Eidg. Materialprüfungs- und Forschungsanstalt<br/>Abteilung Strassenbau/Abdichtungen</p> <p>Rue Überlandstrasse 129</p> <p>NPA / Lieu 8600 Dübendorf</p> <p>Pays Schweiz</p>   |                | II                  |                             |



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| <b>SWITZERLAND</b> |                        |   |  |   |                |                     |                             |
| <b>15</b>          | F                      | <p><b>Lifetime project</b><br/>The overall objective of the LIFETIME Thematic Network is to contribute to European and world-wide development of a more sustainable built environment. The Network will involve all key stakeholders of buildings and civil infrastructures, including mining, whose activities concern investment planning, design, facility management and maintenance, reuse and recycling. The network will focus on application of lifetime principles into these areas. The aim is to help to activate on this issue national, European and even world-wide development processes, which will continue in a long perspective still after the Network.</p> <p>Lifetime engineering is an innovative idea and a concretisation of this idea for solving the dilemma that currently exists between very long-term infrastructures and current short-term approach to design, management and maintenance planning. The integrated lifetime engineering methodology concerns the development and use of technical performance parameters to optimise and guarantee through the life cycle, the requirements arising from human conditions, economy, cultural and ecological considerations. With the aid of lifetime engineering we thus can control and optimise the human conditions (safety, health and comfort), the monetary (financial) economy and the economy of the nature (ecology).</p> | Economic Aspects;<br>Environmental Protection;<br>Industrial Manufacture;<br>Innovation; Technology Transfer; Safety | <p>Roland Stulz<br/>Tél 01 305 93 55<br/>E-mail <a href="mailto:roland.stulz@amstein-walthert.ch">roland.stulz@amstein-walthert.ch</a><br/>Organisation Amstein + Walthert AG<br/>Rue Leutschenbachstrasse 45<br/>NPA / 8050 Zürich<br/>Lieu<br/>Pays Schweiz</p> |                | II                  |                             |



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| <b>SWITZERLAND</b> |                        |   |   |  |                |                     |                             |
| 16                 | F                      | <b>Retention of water pollutants in future roadways according to the system "road side infiltration". In situ checking and Optimization.</b><br>The aim of the project is: - to test the aptitude of various alternatives of structures of edge of roadways on an experimental site (hydrous flow, polluted flow, from the roadway to the ground water) - to transpose the results in other situations to Switzerland - particularly to test the ground set up, the foundation and the infrastructure, the not-saturated geological substrate   | Infiltration, water pollution, underground water, retention, pollutants, soil | Parriaux Aurèle, Prof.<br>Tél 021 693 23 25<br>E-mail <a href="mailto:aurele.parriaux@epfl.ch">aurele.parriaux@epfl.ch</a><br>Organisation EPFL - GEOLEP<br>Rue Ecublens<br>NPA / 1015 Lausanne<br>Lieu<br>Pays Suisse |                | II                  | 2005                        |
| 17                 | C                      | <b>Bituminous recycled mixes with reclaimed asphalt high percentage</b><br>The aim of the research work was to improve the standards "SN 640,741: Recycling of bituminous materials from demolition" and encourage the acceptance from linings manufactured with recycling mixing property. They covered to the main thing: - evaluation of test results over the homogeneity of bitumen granulates and recycling mixing property, raised with lining suppliers. - collection and evaluation of the past experiences with the production of warm mixing property for sub-base and base layers with large portion of bitumen granulates. | Recycling, aggregates, high percentage, mix                                   | SMI: Schweizerische Mischgut-Industrie<br>Tél 041 280 17 12<br>E-mail<br>Organisation SMI<br>Rue<br>NPA / 6023 Rothenburg<br>Lieu<br>Pays Suisse   | VSS 1998/412   | V                   | 1998                        |



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| <b>SWITZERLAND</b> |                        |   |   |  |                |                     |                             |
| 18                 | C                      | <b>Influence of the shape of the aggregates on the characteristics of bituminous mixtures</b><br>Influence of – cubicity, - state of the edges, - surface conditions, on the performance of an asphalt concrete, in particular its susceptibility to rutting.   | Aggregates, cubicity, surface conditions, rutting, properties | LAVOC - ERTEC<br><b>Tél</b><br><b>E-mail</b><br><b>Organisation</b> Ecole Polytechnique Fédérale de Lausanne<br>Laboratoire des voies de circulation (LAVOC)<br><b>Rue</b> Bât. DGC<br><b>NPA / Lieu</b> 1015 Lausanne<br><b>Pays</b> Suisse | VSS 1999/424   | V                   | 1999                        |
| 19                 | F                      | <b>Soil handling in civil engineering</b><br>The soil in the future must be better protected against unnecessary interferences and loads. The protection of the soil and its natural fertility is just as important as the protection of air and water. The research report offers bases for the revision of appropriate standards. The legal bases for the protection of the soil are put on several levels. - the quantitative protection of the soil, the preservation of the surface, is basic idea of the RPG (space planning law) - the quantitative protection was so far limited to the pollution impact after VSBo (regulation on pollutants the soil) - today it, clearly more comprehensively, is in the regulation over loads of the soil (VBBö) regulated. | Soil, protection, pollution, loads regulation                 | Terre AG<br><b>Tél</b><br><b>E-mail</b><br><b>Organisation</b> Terre AG<br><b>Rue</b><br><b>NPA / Lieu</b> Egliswil<br><b>Pays</b> Suisse  | VSS 1999/425   | V                   | 1999                        |



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| <b>SWITZERLAND</b> |                        |  |  |  |                |                     |                             |
| 20                 | F                      | Recycling of road pavements containing tar conform regarding environmental requirements  | Recycling, tar, toxicity                     | Tél<br>E-mail<br>Organisation<br>Rue<br>NPA / Lieu<br>Pays<br>EMPA<br>IMP<br>ERTEC<br>8600 Dübendorf<br>Suisse   | VSS 1999/433   | III                 | 1999                        |
| 21                 | K                      | Test "Rundlauf" N°6; sub-base layers with reclaimed asphalt aggregates and coarse sand, stabilized with hydraulic cement under thin bituminous layer<br>The goal of the tests was to examine the behaviour of hydraulically stabilized sub-base layer of bitumen granulates and gravelly sand under thin surface layers. | Test, stabilized layer, mechanical behaviour | Caprez Markus, Dr.<br>Tél 01/633 25 32<br>E-mail <a href="mailto:caprez@igt.baug.ethz.ch">caprez@igt.baug.ethz.ch</a><br>Organisation Institut für Verkehrplanung, Transporttechnik, Strassen- und Eisenbahnbau<br>Rue ETH-Hönggerberg<br>NPA / Lieu 8093 Zürich<br>Pays Schweiz | VSS 1999/451   | III                 | 1999                        |



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| <b>SWITZERLAND</b> |                        |   |  |   |                |                     |                             |
| <b>22</b>          | C,F                    | <p><b>Behaviour of various pavements regarding noise.</b><br/>The goal was to investigate the potential of keeping motor and rolling noise emissions (from both tyre and surface) at their current levels, or even reduce them, despite rising traffic.</p>   | Noise, tertiary band spectra, surfaces, noise measurements   | <p>M. Shojaati, Dr.<br/>Tél<br/>E-mail<br/>Organisation Institut für Verkehrplanung, Transporttechnik, Strassen- und Eisenbahnbau<br/>Rue ETH-Hönggerberg<br/>NPA / 8093 Zürich<br/>Lieu<br/>Pays Schweiz</p> | VSS 2000/462   | III                 | 2000                        |
| <b>23</b>          | E,B                    | <p><b>Repairing and reinforcement of concrete pavement by bituminous pavement</b><br/>In the context of the research work experiences were gained over the roadways behaviour with which the concrete cover was repaired and strengthened by asphalted surfacing. The results of this analyse showed, with which measures a good long-term behaviour is ensured and the maintenance expenditures minimized.</p> | Maintenance, asphalt pavement, concrete, long time behaviour | <p>TFB<br/>Tél<br/>E-mail<br/>Organisation TFB Technische Forschung und Beratung für Zement und Beton<br/>Rue<br/>NPA / Wildegg<br/>Lieu<br/>Pays Suisse</p>  | VSS 2000/468   | III                 | 2000                        |



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| <b>SWITZERLAND</b> |                        |   |  |   |                |                     |                             |
| 24                 | C,K                    | <b>Performance assessment of new pavement materials: 1st part: high module bituminous mix.</b><br>The research starts with a mix design procedure coupled with a series of laboratory tests leading to the establishment of recipes for mixes corresponding to the two types of EME (High module asphalt). This study is also the basis for the recommendations for EME's formulations. Laboratory tests on materials taken by cutting the surface tested in the pit-hall enabled to show relations between results of full-size tests and those of laboratory tests. The last part of the study offers bases for standardisation of this type of bituminous mix, as much for the mix design as for the structure design. | High performance material, mix design, structure design, laboratory tests, modelling | Dumont, Prof., André-Gilles<br>Tél +41 21 693 23 45<br>E-mail <a href="mailto:andre-gilles.dumont@epfl.ch">andre-gilles.dumont@epfl.ch</a><br>Organisation Ecole Polytechnique Fédérale de Lausanne<br>Laboratoire des voies de circulation (LAVOC)<br>Rue GR-Ecublens<br>NPA / Lieu 1015 Lausanne<br>Pays Suisse | VSS 2001/1000  | V                   | 2000                        |
| 25                 | F                      | <b>Use of tunnel excavation materials in road construction. State of the art.</b><br>The importance of sustainable development mean that during the planning of tunnel projects the question of recycling of tunnel excavation material is of increasing importance. The aim of this project, which should be followed by a guide for the use of tunnel excavation material as a function of geology, excavation method and proposed future use, is to give an overview of research carried out in this field, as well as of research projects carried out in Switzerland.  | Recycling, excavation materials, tunnel, sustainable development, road               | Dumont, Prof., André-Gilles<br>Tél +41 21 693 23 45<br>E-mail <a href="mailto:andre-gilles.dumont@epfl.ch">andre-gilles.dumont@epfl.ch</a><br>Organisation Ecole Polytechnique Fédérale de Lausanne<br>Laboratoire des voies de circulation (LAVOC)<br>Rue GR-Ecublens<br>NPA / Lieu 1015 Lausanne<br>Pays Suisse | VSS 2001/1006  | III                 | 2001                        |



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| <b>SWITZERLAND</b> |                        |   |  |   |                |                     |                             |
| <b>26</b>          | K                      | <p><b>Comparative test on site with modified binder.</b></p> <p>A large observation field was made available for the constructions of 16 different test sections, each 300m long. Twelve modified and four pure bitumen, as references, were selected for the construction of the wearing course. With the aim of following the evolution of long-term behaviour, systematic measurements, as well as sampling and analyses, were scheduled over a period of 10 years. The observation of the long-term behaviour of these sections has enabled the evaluation of the economic viability of using modified binders rather than pure bitumen in the mix for the wearing course. The investigations carried out concerning the components and the mixes were aimed at studying the parameters which determine the behaviour of the wearing courses and, therefore, the tests served to predict the evolution of degradation</p> | Test sections, modified binder, long-term behaviour, prediction, degradation, economic viability | <p>Dumont, Prof., André-Gilles</p> <p><b>Tél</b> +41 21 693 23 45</p> <p><b>E-mail</b> <a href="mailto:andre-gilles.dumont@epfl.ch">andre-gilles.dumont@epfl.ch</a></p> <p><b>Organisation</b> Ecole Polytechnique Fédérale de Lausanne<br/>Laboratoire des voies de circulation (LAVOC)</p> <p><b>Rue</b> GR-Ecublens</p> <p><b>NPA / Lieu</b> 1015 Lausanne</p> <p><b>Pays</b> Suisse</p> | VSS 2002/1035  | III                 | 2001                        |
| <b>27</b>          | F                      | <p><b>Composition of reclaimed materials and appreciation of their influence on the environment in the long run</b></p> <p>For lasting management of our building materials we must ensure that, besides recycling to preserve natural resources, no ecologically inadmissible accumulation of pollutants in our buildings and in the environment takes place. In what way the today procedures in management of the building materials have respected these criteria was examined in this research work.</p>   | Recycling. Ecology, materials management, pollutants   | <p><b>Tél</b></p> <p><b>E-mail</b></p> <p><b>Organisation</b> SC+P Sieber Cassina + Partner AG, Olten<br/>IMP Bautest AG, Institut für Materialprüfung, Oberbuchsitzen</p> <p><b>Rue</b></p> <p><b>NPA / Lieu</b></p> <p><b>Pays</b> Suisse</p>   | VSS 2002/1036  | III                 | 2001                        |



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| <b>SWITZERLAND</b> |                        |   |   |  |                |                     |                             |
| <b>28</b>          | D                      | <p><b>Improvement of the skid-resistance on road pavement in Switzerland</b></p> <p>The IVT has experiences of many years with skid-resisting property measurements. The available report describes due to the extensive data collection of the IVT the development bases regarding - behavioural models for the development of the pavement grip of different linings - which periodicity, with which skid-resisting property measurements should be accomplished - the production of a new evaluation pattern, which is based on lining conditions of the last years. For this purpose an extensive data base was provided, measuring sections with repetition measurements were segregated and arranged, if admits lining and installation data were, for a first overview. Thus the bases for further work are given.</p> | Skid resistance, measurements, new evaluation method, modelling | <p>Caprez Markus, Dr.</p> <p>Tél 01/633 25 32</p> <p>E-mail <a href="mailto:caprez@igt.baug.ethz.ch">caprez@igt.baug.ethz.ch</a></p> <p>Organisation Institut für Verkehrplanung, Transporttechnik, Strassen- und Eisenbahnbau</p> <p>Rue ETH-Hönggerberg</p> <p>NPA / 8093 Zürich</p> <p>Lieu</p> <p>Pays Schweiz</p> | VSS 2002/1037  | III                 | 2001                        |



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| <b>THE NETHERLANDS</b> |                        |  |                 |  |  |                     |                             |
| <b>1</b>               | F                      | <p>The Dutch Noise Innovation Program - Road Traffic (IPG) (2003 – 2006)</p> <p>In the Netherlands the Ministry of Transport, Public Works and Water Management and the Ministry of Environmental Affairs have initiated a sizeable research and development program to reduce road traffic noise. This program has to result noise-reducing measurements that enable to reach strong strategic goals on the influence of road noise on inhabitants. The focus is on source-oriented measures, which are generally more cost-efficient than effect related measures.</p> <p>The Innovation Program, with a budget of more than 50 million euros, will address the following topics:</p> <ul style="list-style-type: none"> <li>• investigation of the possible noise reductions by road surfaces, tyres and vehicles and enhanced noise barriers;</li> <li>• scientific research into the knowledge needed to realize the reduction effects;</li> <li>• development of the technologies and products to a level of general application in the national main road and vehicle population.</li> </ul> <p>The program must result in a significant reduction of the noise production (including shielding effects) of the main road network system. In case of combinations of measures after 4 years of IPG for every location the technology and products for 8 dB(A) noise reduction will be feasible.</p> | Noise reduction | Ruud Nijland, +31 15 2518217 or e-mail<br><a href="mailto:j.r.p.nijland@dww.rws.minvenw.nl">j.r.p.nijland@dww.rws.minvenw.nl</a> | “Noise Innovation Program Road Traffic”<br>DWW-report number<br>2002-073, May 2002 | I                   |                             |



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| <b>THE NETHERLANDS</b> |                        |   |               |   |                |                     |                             |
| <b>2</b>               | A,B                    | Roads to the Future Programme; Pilot 'The New Waterway' in the theme 'Flexible Infrastructure'<br><br>Holland, water-land. How can we make better use of this natural situation? Climatic developments can prompt the revision of present water management of dike and drain, and give the water more space. Floating roads offer another way of water management and a flexible solution for different problems in the present road building. The aim of the pilot 'The New Waterway' is to demonstrate the surplus value of floating roads in specific situations | Floating road | Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:studio.wnt@edt.nl">studio.wnt@edt.nl</a> |                | IV                  |                             |
| <b>3</b>               | A,I                    | Roads to the Future Programme; Pilot 'Route 26' in the theme 'Flexible Infrastructure'<br><br>The pilot seeks innovative solutions to structural bottlenecks in the road network based on increasing network flexibility. Route 26 develops a multidisciplinary toolbox for better solutions for real bottlenecks. Furthermore Route 26 develops an 'invitation process approach' providing handles that can unlock a jammed process. Parties can tailor this to their own location.  | bottlenecks   | Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:studio.wnt@edt.nl">studio.wnt@edt.nl</a> |                | IV                  |                             |



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| <b>THE NETHERLANDS</b> |                        |   |                 |   |                |                     |                             |
| <b>4</b>               | I (?)                  | Roads to the Future Programme; Pilot 'Virtual Project Team' in the theme 'Virtual Mobility'<br><br>The aim of this pilot is to make projects more efficient by optimising the coordination of physical and virtual contact between the project members who are geographically wide spread. This coordination is reached by introducing high quality ICT-appliances. By introducing high quality ICT-appliances in the project environment, not only relocation behaviour will change, but also organisational changes will take place.  | Virtual contact | Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:studio.wnt@edt.nl">studio.wnt@edt.nl</a> |                | IV                  |                             |
| <b>5</b>               | I                      | Roads to the Future Programme; Pilot 'Goods Clearing House' in the theme 'Virtual Mobility'<br><br>A Goods Clearing House (GCH) separates the transport of goods from the transport of ownership, aiming to reduce costs by avoiding unnecessary replacements. In GCH, just like in banking clearance, all mutual transactions are registered and settled apart from the product placement. The key of a GCH is a decision supporting system that, based on the warehouse, the handling layers and the final destination, advises the shipper at which time and moment it is necessary to transfer the goods. | Goods transport | Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:studio.wnt@edt.nl">studio.wnt@edt.nl</a> |                | IV                  |                             |



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| <b>6</b>               | I (?)                  | Roads to the Future Programme; Pilot 'Virtual conference' in the theme 'Virtual Mobility'<br><br>The pilot demonstrates virtual mobility as an alternative for physical mobility. The virtual conference demonstrates techniques forming the basis of applications that can lead to a decrease of the volume of traffic. For example: virtual training, product demonstration, presentations, meetings, etc. Furthermore, virtual conferencing can be seen as a forerunner of a new wave of internet applications that will reach us in the short term and for which we should be prepared. | Virtual contact | Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:studio.wnt@edt.nl">studio.wnt@edt.nl</a> |                | IV                  |                             |



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| <b>THE NETHERLANDS</b> |                        |  |                                   |   |   |                     |                             |
| <b>7</b>               | A                      | <p>Roads to the Future Programme; Pilot 'The Motorway House' in the theme "Road Architecture 2030"</p> <p>Public Ideas competition on the concept of 'The Motorway House',</p> <p>The pilot study focuses on living and working in the immediate vicinity of a motorway, with the emphasis on the living function. The most important component of the study is the launch of an ideas competition. This involves the design of an ensemble with multifunctional capacity and accommodation areas in the immediate vicinity of a motorway. The road provides added value to the living function. The pilot study also includes taking stock of the administrative/legal obstacles affecting implementation and possible solutions to them.</p> <p>The competition on this topic, which has been launched in 2000, has yielded a multitude of new visions and plans and some interesting futuristic visions</p> | combining space-related functions | Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:studio.wnt@edt.nl">studio.wnt@edt.nl</a> | "The Motorway House" (living in the fast lane); Publisher: Ministry of Transport, Public Works and Water management, Roads to the Future, February 2002 | IV                  |                             |



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| <b>8</b>               | F                             | Roads to the Future Programme; 'Noise pilot study' in the theme "Road Architecture 2030<br><br>The Noise pilot study is intended to show that living alongside roads will be possible in the future as far as noise is concerned. Innovative measures can be used to limit both the noise level and the perceived noise nuisance. Market players have been invited to submit innovative measures for combating road traffic noise. An expert jury has then selected the most promising measures from the entries submitted. The selected entries have been applied in a practical situation and demonstrated to a wide audience during a special event  | traffic noise                  | Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:studio.wnt@edt.nl">studio.wnt@edt.nl</a> | "Stil Transport en Weg met Geluid"<br>A Roads to the Future publication, available in Dutch language only | IV                         |                             |
| <b>9</b>               | A,B,C                         | Roads to the Future Programme; pilot 'Modular Road Surface' in the theme 'Road Surface of the Future'<br><br>New road surfaces will be developed within this pilot project. The project is seen as a first step towards a road surface consisting of various layers, each having a different function, such as wear resistance, noise reduction, water permeability, energy storage or detection. Because not every road surface has to be composed of the same layers – noise reduction being more relevant in some areas than others, for instance – such a road surface can be adapted to meet desired functions: only necessary layers are applied. Thus, a modular road surface can be made to order and adapted to changing local conditions. | Pavement, modular road surface | Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:studio.wnt@edt.nl">studio.wnt@edt.nl</a> |   | IV                         |                             |



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| <b>THE NETHERLANDS</b> |                        |   |                       |   |                |                     |                             |
| <b>10</b>              | H,L                    | Roads to the Future Programme; pilot 'Smart Road Surface' in the theme 'Road Surface of the Future'<br><br>'Zipping up with electronic guides'. The project is about a road surface that anticipates and helps the road user to <i>zip up</i> . The road surface observes, interprets, decides and acts, thus trying to influence the road user's behaviour in order to help him or her to travel safely and comfortable in traffic.                      | Electronic signalling | Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:studio.wnt@edt.nl">studio.wnt@edt.nl</a> |                | IV                  |                             |
| <b>11</b>              | A,F (?)                | Roads to the Future Programme; pilot 'Energetic Road Surface' in the theme 'Road Surface of the Future'<br><br>Energy recovery from infrastructure is a live issue. Key goal of this project is to recover as much renewable energy as possible from a kilometre of motorway. Various market players were invited to submit ideas, complete with cost-benefit analysis and a feasibility studies. The best ideas were selected for a real size execution. | Energy recovery       | Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:studio.wnt@edt.nl">studio.wnt@edt.nl</a> |                | IV                  |                             |



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| <b>THE NETHERLANDS</b> |                        |  |                |   |   |                     |                             |
| <b>12</b>              | H, I                   | <p>Roads to the Future Programme; pilot 'The Guided Vehicle' in the theme 'Transport in the future', to be carried out in 2005</p> <p>Advanced Driver Assistance Systems (ADA Systems) are considered to be promising technological features that support the driving function. There are various ADA Systems, but the rough idea behind them all is that they promote traffic safety and throughput as drivers are assisted while driving through (narrow) lanes and in keeping a safe distance. The systems are therefore expected to offer a calmer (and therefore safer) traffic scene. In the later future, it may be possible for more vehicles to use roads safely than is currently the case, since they will be able to drive closer together, while using narrower lanes. This could, for example, offer drivers useful support in the event of road works</p> <p>The objective of the pilot study is to assess which promising ADA systems can feasibly be applied on the roads in the relatively near future. A central issue is what the guidance systems can mean with respect to the comfort and safety of individual road users.</p> | guided vehicle | Gerben Bootsma at Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:g.bootsma@avv.rws.minvenw.nl">g.bootsma@avv.rws.minvenw.nl</a> | (Pilot The Guided Vehicle) <a href="http://www.wegennaardetoekomst.nl/data/docs/lib/1-1090503546.doc">www.wegennaardetoekomst.nl/data/docs/lib/1-1090503546.doc</a> | IV                  |                             |



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| <b>THE NETHERLANDS</b> |                        |  |                        |  |   |                     |                             |
| <b>13</b>              | I                      | <p>Roads to the Future Programme; pilot 'Travel Time Expectation' in the theme 'Tailored Info', to be carried out in 2005</p> <p>Can information technology help us break out of routines and make conscious choices to travel at a particular time, using a particular mode of transport and route? It is aimed to explore how the provision of tailored information could better equip travellers to make such choices, through which travel could become more efficient and pleasant. At this time, traffic responds to current situations. But much better use could be made of the road network by anticipating what could be happening tomorrow. This would be to the advantage of both managers and travellers. The pilot project Travel Time Expectation involves developing and testing a system that will provide complete, multimodal and reliable traffic projections. The point of the pilot is to offer travellers information in advance on various travel and route alternatives along with relevant travel times, as well as to provide updated projections while en route.</p> | information technology | Katya Ivanova at Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:k.ivanova@agi.rws.minvenw.nl">k.ivanova@agi.rws.minvenw.nl</a> | (Pilot – Travel Time Expectation)<br><a href="http://www.wegennaardetoeekomst.nl/data.docs.lib/1-1090507165.doc">www.wegennaardetoeekomst.nl/data.docs.lib/1-1090507165.doc</a> | IV                  |                             |



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| <b>THE NETHERLANDS</b> |                        |  |  |   |   |                     |                             |
| <b>14</b>              | I                      | <p>Roads to the Future Programme; pilot 'RoadWise' in the theme 'Tailored Info', to be carried out in 2005</p> <p>In the future, as vehicles are increasingly fitted with positioning and communications equipment, sensors, on-board computers, etc, the scope of the road network's current technical infrastructure (signs, portals, systems, and so forth) on, above or alongside the road is expected to decrease sharply. These systems will make it evermore possible to offer road users tailored information. This pilot is intended to open a window onto the future of in-car communication methods; an intelligent car in an information society. Research will be performed into the possibilities and consequences of presenting far more information in the car, including traffic management-related information. With respect to traffic management, the emphasis lies on informing, advising and assisting individual road users. This concept will offer traffic managers additional options to optimally manage traffic flows.</p> | information technology, intelligent cars | Coen Raaphorst at Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:c.raaphorst@agi.rws.minvenw.nl">c.raaphorst@agi.rws.minvenw.nl</a> | (Pilot – Roadwise) <a href="http://www.wegennaardetoeekomst.nl/data/docs/lib/1-1090575610.doc">www.wegennaardetoeekomst.nl/data/docs/lib/1-1090575610.doc</a> | IV                  |                             |



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| <b>15</b>              | J                      | <p>Roads to the Future Programme; pilot 'Belonitor' in the theme 'Enriched Travelling Time', to be carried out in 2005</p> <p>The pilot study Belonitor aims to make a contribution to the reduction of the negative impact of traffic and transport by urging traffic participants to change their behaviour. In the world of traffic, the standard method of influencing the behaviour of traffic participants is to use (price increasing) financial penalties. This pilot will investigate whether the opposite approach works. The objective of the pilot study is to gain a picture of the possibilities of influencing drivers' driving behaviour through rewards. In order to achieve this objective, it is necessary to gain a picture of drivers' behaviour. The behaviour to be measured is distance and speed. The supposition is as follows: by rewarding desired behaviour, changing one's behaviour becomes attractive.</p> | drivers' behaviour | Undine Mazureck at Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:u.mazureck@avv.rws.minvenw.nl">u.mazureck@avv.rws.minvenw.nl</a> |                | IV                  |                             |



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| <b>THE NETHERLANDS</b> |                        |  |                              |   |  |                     |                             |
| <b>16</b>              | A                      | <p>Roads to the Future Programme; pilot 'Future Service Areas' in the theme 'The Multifunctional Road', to be carried out in 2005</p> <p>As a result of changing social conditions, roads and the environment are constantly in development. It is believed that a greater social return is possible if new functions (social, economic, cultural and ecological) are added to the motorways. After all, society is placing increasingly high demands on its living environment. This is the subject of the theme The Multifunctional Road. The pilot Service Areas of the Future addresses this issue by investigating how the current 'P-places' can become true service areas. The aim of the pilot is to generate innovative ideas for the layout, the design, the offered facilities and the management and maintenance of a service area in the category 'basic'. These ideas should guarantee a clean, complete, safe and pleasant service area for the road user 24 hours a day.</p> | New functions, service areas | Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:studiownt@avv.rws.minvenw.nl">studiownt@avv.rws.minvenw.nl</a> | (Contest Service Area of the Future)<br><a href="http://www.wegennaardetoeekomst.nl/data/docs/lib/2-1090498223.pdf">www.wegennaardetoeekomst.nl/data/docs/lib/2-1090498223.pdf</a> | IV                  |                             |



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| <b>THE NETHERLANDS</b> |                        |   |                                       |   |  |                     |                             |
| 17                     | F                      | <p>Roads to the Future Programme; pilot 'The Remediating Road' in the theme 'The Multifunctional Road', to be carried out in 2005</p> <p>In this pilot contaminated dredged material will be used as building material for road construction, whereby the dredged material will be remediated at the same time. The space under or nearby the roads could be well utilized for remediating contaminated dredged material. It is aimed to produce a detailed concept of a method for using and remediating contaminated dredged material in road construction. This concept will then be implemented and tested on a section of road.</p>  | remediation, contaminated material    | Margriet Kruidierink at Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:g.t.kruidierink@dww.rws.minvenw.nl">g.t.kruidierink@dww.rws.minvenw.nl</a> | (Pilot – The Remediating Road)<br><a href="http://www.wegennaardetoeekomst.nl/data/docs/lib/1-1090504953.doc">www.wegennaardetoeekomst.nl/data/docs/lib/1-1090504953.doc</a> | IV                  |                             |
| 18                     | I                      | <p>Roads to the Future Programme; pilot 'Citybox' in the theme 'Intelligent Networks', to be carried out in 2005</p> <p>While municipalities try to keep through traffic out of residential and shopping areas by making use of provincial roads and ring roads around the city, the central government's focus is on ensuring good traffic flow on the motorways. How can smart solutions bring about improved traffic circulation and more efficient use of the road networks? It is tried to find an answer to this question and others as part of the theme Intelligent Networks. The Citybox pilot study aims to look for a concrete answer to this question with regard to goods transport.</p> | intelligent networks, goods transport | Pieter Hiddinga at Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:p.h.hiddinga@bwd.rws.minvenw.nl">p.h.hiddinga@bwd.rws.minvenw.nl</a>            | (Pilot – Citybox)<br><a href="http://www.wegennaardetoeekomst.nl/data/docs/lib/1-1090505795.doc">www.wegennaardetoeekomst.nl/data/docs/lib/1-1090505795.doc</a>              | IV                  |                             |



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| Innovation Nr          | Field Nr – see Table 1 | Title and short description (max. 300 char)   | Keywords                            | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)  | Publication(s)  | Phase – see Table 2 | Date of initial application |
| <b>THE NETHERLANDS</b> |                        |   |                                     |   |   |                     |                             |
| 19                     | I                      | <p>Roads to the Future Programme; pilot 'Optimal Corridor' in the theme 'Intelligent Networks', to be carried out in 2005</p> <p>Transport networks do not always interconnect everywhere as well as they should. Different parties, partly on a profit-making basis, manage transport networks. This results in sub optimisation, leaving gaps in the transport chain as a consequence.</p> <p>The pilot project Optimal Corridor aims to connect networks to each other better through smarter management, so that traffic flow can be controlled more easily. The point of the pilot is to select a chain or corridor and then optimise it completely.</p> | transport networks, transport chain | Ton Rodewijk at Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:a.g.l.m.rodewijk@bwd.rws.minvenw.nl">a.g.l.m.rodewijk@bwd.rws.minvenw.nl</a> | (Pilot – Optimal Corridor) <a href="http://www.wegennaardetoekomst.nl/data/docs/lib/1-1090506238.doc">www.wegennaardetoekomst.nl/data/docs/lib/1-1090506238.doc</a> | IV                  |                             |
| 20                     | I                      | <p>Roads to the Future Programme; pilot 'Missing Link' in the theme 'Intelligent Networks', to be carried out in 2005</p> <p>The pilot <i>Missing link</i> is looking for possibilities to improve the cohesion of road networks. Assuming the expected increase in mobility, road users will benefit if the chances of congestion are reduced, and the route from door to door becomes more reliable. This will be possible if the capacity of the road network as a whole become more flexible (primary routes and secondary routes) through more efficient use and greater numbers of alternative routes. Junctions must no longer be bottlenecks.</p>     | interconnection road networks       | Wim Groen at Studio WnT, +31 15 251 74 25 or e-mail <a href="mailto:w.groen@bwd.rws.minvenw.nl">w.groen@bwd.rws.minvenw.nl</a>                      | (Pilot – Missing Link) <a href="http://www.wegennaardetoekomst.nl/data/docs/lib/1-1090506627.doc">www.wegennaardetoekomst.nl/data/docs/lib/1-1090506627.doc</a>     | IV                  |                             |



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| State of the art of interurban infrastructure design, construction and maintenance<br><b>FOR NR2C PROJECT USE ONLY</b> |     | 2005-05-20   | PP   |

| 1                      | 2                      | 3   | 4            | 5  | 6                   | 7                   | 8                           |
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| Innovation Nr          | Field Nr – see Table 1 | Title and short description (max. 300 char)   | Keywords     | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)   | Publication(s)      | Phase – see Table 2 | Date of initial application |
| <b>THE NETHERLANDS</b> |                        |   |              |  |                     |                     |                             |
| <b>21</b>              | A, I                   | Roads to the Future Program; Pilot project " Perspectives on Highways in 2027"<br><br>A view is given on how the main road network could look like in the year 2027. Three scenarios are elaborated, respectively with the government in full control of the road network management, with a strong participation of private parties, and with a mixture of governmental and private influences. The pilot has resulted in an interactive movie, showing you the future when your personal wishes would be satisfied. | Perspectives | A. de Winter, +31 15 2518356<br>or e-mail:<br><a href="mailto:A.dWinter@dww.rws.minvenw.nl">A.dWinter@dww.rws.minvenw.nl</a> | CD-ROM is available | III                 |                             |



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| Innovation Nr          | Field Nr – see Table 1 | Title and short description (max. 300 char)   | Keywords                  | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)   | Publication(s) | Phase – see Table 2 | Date of initial application |
| <b>THE NETHERLANDS</b> |                        |   |                           |  |                |                     |                             |
| <b>22</b>              | A, I                   | <p>Roads to the Future Program; Project “Customized Infrastructure”</p> <p>Customized Infrastructure is an image of the future outlining solutions for traffic problems around the year 2030. The idea involves fine-tuning the various transport options at modal interchange site and improving road use.</p> <p>At a modal interchange site transport modalities (car, train, bus, bike) are excellently geared to each other. The user decides which means of transport he will choose on the basis of cost and time. In order to be able to offer customized infrastructure to road traffic as well, traffic lanes are created for certain target groups, such as car-poolers, high quality collective transport and automatically guided vehicles.</p> <p>The project includes a pilot on “Variable Cross Sections” (VCS), carried out in 2000. VCS is based on the use of flexible road markings. The lanes are marked with illuminated lines instead of painted lines. This makes it possible for the road manager to react to the demand from the road users. He can easily increase the number of lanes in one direction at the expense of the opposite direction, or he can transform two wide lanes into three narrow ones.</p> | Customized Infrastructure | A. de Winter, +31 15 2518356<br>or e-mail:<br><a href="mailto:A.dWinter@dww.rws.minvenw.nl">A.dWinter@dww.rws.minvenw.nl</a> |                | III                 |                             |



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| Innovation Nr          | Field Nr – see Table 1 | Title and short description (max. 300 char)  | Keywords             | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)   | Publication(s) | Phase – see Table 2 | Date of initial application |
| <b>THE NETHERLANDS</b> |                        |  |                      |  |                |                     |                             |
| <b>23</b>              | H, I                   | <p>Roads to the Future Program; Project “On-board Information”</p> <p>One of the solutions to cope with the increasing traffic volumes is a smarter use of the roads. Having correct and reliable traffic information is an important precondition for that. When a road user is supplied with accurate travel information he will know what travel time he can expect and he can make choices on modality, route, travel time, etc.</p> <p>The project includes a pilot on “Floating Car Data” (FCD), carried out in 1998. FCD aimed at collecting accurate travel information. 60 Cars were used to measure traffic flow and traffic speed. The cars were travelling around continuously. Their position was measured frequently, using GPS and GSM. The collected information was processed into expected travel times on road sections and supplied to the public.</p> | On-board Information | A. de Winter, +31 15 2518356<br>or e-mail:<br><a href="mailto:A.dWinter@dww.rws.minvenw.nl">A.dWinter@dww.rws.minvenw.nl</a> |                | III                 |                             |



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| Innovation Nr          | Field Nr – see Table 1 | Title and short description (max. 300 char)   | Keywords                                | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)   | Publication(s) | Phase – see Table 2 | Date of initial application |
| <b>THE NETHERLANDS</b> |                        |   |   |  |                |                     |                             |
| <b>24</b>              | E, L                   | <p>Roads to the Future Program; Pilot “Cheops”</p> <p>Cheops is a project on diminishing hindrance to road users during maintenance activities. The project encloses three elements;</p> <ul style="list-style-type: none"> <li>- Flexible traffic signs</li> <li>- Alternative vehicle detection (not using inductive loops)</li> <li>- Separate lane, dedicated to maintenance activities</li> </ul> <p><b>Flexible traffic signs</b> are useful during maintenance works, particularly when the cross section of a road has to be changed temporarily (change in number of lanes, lateral shift of lanes). The project has resulted in a prototype electronic board, placed above the road, showing traffic signs and traffic information.</p> <p><b>Detection and control of traffic flows</b> is generally done using inductive loops in de road. Very often these loops cannot be used during maintenance works, because of a temporal change in the number and/or in the lateral position of the lanes. Alternative systems for the detection of vehicles have been developed and tried out, based on radar and infrared techniques.</p> <p>Road/lane closures cause a lot of hindrance to the traffic. These closures decrease the capacity of the road and are a safety hazard, both to road users and to road workers. For this reason it is looked into the possibility to do as much maintenance as possible from the side of the road, preferably from a lane which is physically separated from the road. It is studied whether such a <b>lane, dedicated for maintenance activities</b>, can be created, for instance in the central verge of the road. The study has resulted in a video-animation.</p> | Hindrance during maintenance activities | A. de Winter, +31 15 2518356<br>or e-mail:<br><a href="mailto:A.dWinter@dww.rws.minvenw.nl">A.dWinter@dww.rws.minvenw.nl</a> |                | III                 |                             |



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| <b>SLOVENIA</b> |                        |  |   |  |                |                     |                             |
| <b>1</b>        | C                      | SELF COMPACTING CONCRETE (SCC), used in column base for highway bridges                                | self compacting concrete, SCC                   | Jana Šelih<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 463<br>jana.selih@zag.si         | /              | V                   | 2004                        |
| <b>2</b>        | F                      | CONCRETE RUBBLE, recycling of rigid pavement rubble and re-using it in embankment and/or capping layer | concrete rubble, recycling, waste materials     | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si       | /              | VI                  | August 2004                 |
| <b>3</b>        | A                      | VERTICAL INJECTION, used for pre-stressed vertical cables in columns for highway bridges               | vertical injection, viaduct and bridges columns | Vera Verbovšek<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 499<br>vera.verbovsek@zag.si | /              | V                   | 2003                        |



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| <b>SLOVENIA</b> |                        |  |                                   |  |  |                     |                             |
| 4               | F                      | BLACK STEEL SLAG, used as crushed aggregate in bituminous layers | black steel slag, waste materials | Ana Mladenovič<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 394<br>ana.mladenovic@zag.si | VIŽINTIN, Nada, MLADENOVIČ, Ana. The potential use of metallurgical slag in civil engineering projects in Slovenia. V: PIRJO, Kuula-Väisänen (ur.), RAIMO, Uusinoka (ur.). Proceedings of Aggregate 2001 - Environment and Economy, (Tampere University of Technology, Laboratory of Engineering Geology, Publication number 50, 51). Tampere: Tampere University of Technology, Laboratory of Engineering Geology, 2001, zv. 2, str. 463-467. [COBISS.SI-ID 607847] MLADENOVIČ, Ana, VIŽINTIN, Nada, PETKOVŠEK, Ana. Investigation of steel failures caused by beta to gamma dicalciumsilicate phase transformation, using optical microscopy. V: Proceedings of the 8th Euroseminar on Microscopy Applied to Buildings Materials : September 4-7, 2001, Athens, Greece. Athens: M. Stamatacis (N.U.A.) [etc.], cop. 2001, str. 225-230. [COBISS.SI-ID 603239] KRAJNC BRODAR, Vesna, TRIPLAT, Jože, MLADENOVIČ, Ana, VIŽINTIN, Nada, DRNOVŠEK, Sabina, MIRTIC, Breda. Karakteristike in uporabnost črne jeklarske žindre iz podjetja Acroni v cestogradnji. V: HORVAT, Aleksander (ur.), KOŠIR, Adrijan (ur.), VREČA, Polona (ur.), BRENCIČ, Mihael (ur.). 1. slovenski geološki kongres, Črna na Koroškem, 9.-11. oktober 2002. Knjiga povzetkov. Ljubljana: Geološki zavod Slovenije, 2002, str. 48. [COBISS.SI-ID 762727] ŠELIH, Jana, DUCMAN, Vilma, MLADENOVIČ, Ana, SEVER ŠKAPIN, Andrijana, PAVŠIČ, Primož, MAKAROVIC, Matjaž, LEGAT, Andraž. Možnosti uporabe odpadkov v gradbeništvu in industriji gradbenih materialov = The use of waste materials in building and civil engineering. Mater. tehnol., 2004, letn. 38, št. 1/2, str. 79-86, ilustr. | IV                  | 2004                        |
|                 |                        | 03-EPFL & 06-BBRC  |                                   |  | Contract TST3-CT-2003-SO5831423  |                     |                             |
|                 |                        | Authors : A. Junod & P. Bauweraerts                              |                                   | Page 118 of 174  | File : d21_interurban infrastructure-state of the art of innovations   |                     |                             |



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| <b>SLOVENIA</b> |                        |   |   |  |   |                     |                             |
| <b>5</b>        | F                      | CRUSHED BUILDING RUBBLES, used as crushed aggregate for embankments for low trafficked roads  | crushed building rubbles, recycling, waste materials                    | Ana Mladenovič<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 394<br>ana.mladenovic@zag.si | /   | IV                  | 2004                        |
| <b>6</b>        | C, F                   | application of the CYCLONE DUST from the metal industry as chemical stabilizer to the unbound granular materials of low dynamic quality | unbound granular materials, cyclic load triaxial test, waste, recycling | Primož Pavšič<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 245<br>primoz.pavsic@zag.si   | Možnosti uporabe ciklonskega prahu za izboljšanje dinamičnih karakteristik nevezanih materialov v cestogradnji (Usability of cyclone dust for improvement of dynamic characteristics of unbound granular materials), Možnosti uporabe odpadkov : zbornik = Waste application and treatment : proceedings<br>IMPRESUM : Ljubljana : Cetera, Center za tehnični razvoj, izobraževanje in organizacijo, 2002 | III                 | 2002                        |



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| Innovation Nr   | Field Nr – see <b>Table 1</b> | Title and short description (max. 300 char)   | Keywords   | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)  | Publication(s)  | Phase – see <b>Table 2</b> | Date of initial application |
| <b>SLOVENIA</b> |                               |   |  |   |   |                            |                             |
| <b>7</b>        | C                             | determining dynamic properties of UNBOUND GRANULAR MATERIALS (gravel from river Mura), defining the lowest percent of crushed particles for known load, use of WASTE CYCLONE DUST AND GEOGRID for reinforcement of unbound granular layer | unbound granular materials, permanent deformation, cyclic load triaxial test | Primož Pavšič<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 245<br>primoz.pavsic@zag.si  | Uporaba murskih prodiv za voziščne konstrukcije (Use of Mura gravels for pavement construction), R&D project, Final report, ZAG Ljubljana, Ljubljana, 2004  | III                        | 2004                        |
| <b>8</b>        | H, I, J                       | TRAFFIC MANAGEMENT AND CONTROL SYSTEM on highways (TMC) with basic functions: traffic and weather data acquisition, control of traffic and weather conditions, traffic management and informing the users                                 | ITS, mobility, safety, traffic management                                    | Robert Rijavec<br>University of Ljubljana, Faculty of Civil and Geodetic Engineering<br>Traffic Technical Institute<br>+386 1 476 85 70, +386 1 425 07 01<br>rrijavec@fgg.uni-lj.si | Demšar, M., Kastelic, T., Rijavec, R.. Sistem za nadzor in upravljanje prometa na avtocestah = Traffic management and control system on highways. 6 slovenski kongres o cestah in prometu (6 <sup>th</sup> Slovene Road and Traffic Congress), Portorož, 2002 | V                          | End 2004                    |
| <b>9</b>        | H, I                          | FREE FLOW ELECTRONIC TOLL COLLECTION  | free flow tolling  | Robert Rijavec<br>University of Ljubljana, Faculty of Civil and Geodetic Engineering<br>Traffic Technical Institute<br>+386 1 476 85 70, +386 1 425 07 01<br>rrijavec@fgg.uni-lj.si | /   | III                        | 2008                        |



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| <b>SLOVENIA</b> |                        |  |                                |  |                |                     |                             |
| <b>10</b>       | A, B                   | ROAD SURFACE RIBBING for more efficiently leading water off the road surface | road drainage, surface ribbing | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | /              | VI                  | 2002                        |



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| <b>SLOVENIA</b> |                        |  |   |   |   |                     |                             |
| <b>11</b>       | E                      | ROAD TRAFFIC SYSTEMS safer for the user<br><br>Includes a system (measuring vehicle, hardware, software) for digital video recording and measuring of road infrastructure. The system can be used to monitor the state of the road network and plan its maintenance. The results are stored in a database. | road surveying, road infrastructure, digital video recording, distance measuring, measuring vehicle | Samo Zupan, Miha Ambrož, Ivan Prebil<br>University of Ljubljana, Faculty of mechanical engineering<br>+386 1 4771509, +386 1 4771127, +386 1 4771508<br>samo.zupan@fs.uni-lj.si,<br>miha.ambroz@fs.uni-lj.si,<br>ivan.prebil@fs.uni-lj.si | PREBIL, Ivan, ZUPAN, Samo, CIGLARIČ, Iztok, KAIBA, Pavel, KUNC, Robert, LUKANČIČ, Boštjan, ČEŠAREK, Metod, NOVAK, Aleksander, AMBROŽ, Miha. Uporabniku varnejši cestno prometni sistemi : raziskovalni projekt, Protokol o izvajanju meritev z opremo za meritve in snemanje cestnih odsekov (št. pogodb DRSC 2415-99-000852 in 2415-99-01207/0). Ljubljana: Fakulteta za strojništvo, CEMEK, 2000. 9 str., ilustr. [COBISS.SI-ID 3609627]<br><br>PREBIL, Ivan, AMBROŽ, Miha, KRAŠNA, Simon, NOVAK, Aleksander, ROZMAN, Matej, ŠUŠTERŠIČ, Gašper. Merjenje in snemanje cest z merilno opremo na območju CP LJ in KP : zaključno poročilo o rezultatih meritev. Ljubljana: Fakulteta za strojništvo, CEMEK, 2000. 8 str., ilustr. [COBISS.SI-ID 4330523] | IV                  | September 2000              |



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| Innovation Nr   | Field Nr – see Table 1 | Title and short description (max. 300 char)  | Keywords  | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)  | Publication(s)   | Phase – see Table 2 | Date of initial application |
| <b>SLOVENIA</b> |                        |  |   |   |  |                     |                             |
| <b>12</b>       | H, I, J                | ROAD TRAFFIC SITUATION MODELLING<br><br>Software tools for presenting the results of vehicle dynamics simulation in virtual 3D environment. Includes interactive driving simulations with visibility analyses. | vehicle simulation, virtual 3D presentation, interactive animation, visibility analysis | Miha Ambrož, Ivan Prebil<br>University of Ljubljana, Faculty of mechanical engineering<br>+386 1 4771127, +386 1 4771508<br>miha.ambroz@fs.uni-lj.si,<br>ivan.prebil@fs.uni-lj.si | AMBROŽ, Miha, PREBIL, Ivan. Presenting the results of vehicle dynamics simulation in virtual 3D environment. V: 17th International technical conference on the enhanced safety of vehicles, Amsterdam, June 4-7, 2001. [S.l.: s.n.], 2001, 6 str. [COBISS.SI-ID 6992918]<br><br>AMBROŽ, Miha, PREBIL, Ivan. System for 3D vehicle dynamics simulation with virtual 3D display. V: 1st International Conference From Scientific Computing to Computational Engineering, Athens, 8-10 September, 2004 : IC-SCCE. [s.l.]: [s.n.], 2004, 8 str. [COBISS.SI-ID 7470107] | III                 | 2004                        |



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| Innovation Nr   | Field Nr – see Table 1 | Title and short description (max. 300 char)   | Keywords  | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)   | Publication(s)   | Phase – see Table 2 | Date of initial application |
| <b>SLOVENIA</b> |                        |   |   |  |  |                     |                             |
| <b>13</b>       | J, K                   | <b>HUMAN BODY MODELLING FOR OCCUPANT SAFETY ANALYSIS</b><br><br>Tools for simulating and presenting loads on human body in various traffic situations. Studies occupant response during ride on various surfaces and during crash. Includes procedures and tools for individual human body parameter identification by measurement. | human body modelling, human body load analysis, occupant response, parameter identification | Simon Krašna<br>University of Ljubljana, Faculty of mechanical engineering<br>+386 1 4771127<br>simon.krasna@fs.uni-lj.si            | KRAŠNA, Simon, AMBROŽ, Miha, PREBIL, Ivan, RAVNIK, Dean, HRIBERNIK, Marija. Parameter identification of human body joint characteristic. V: 1st International Conference From Scientific Computing to Computational Engineering, Athens, 8-10 September, 2004 : IC-SCCE. [s.l.]: [s.n.], 2004, 7 str. [COBISS.SI-ID 7470363] | III                 | 2004                        |
| <b>14</b>       | A                      | design, project and technology of <b>HIGH VALLEY VIADUCT</b> with 90m high ramified supports, to 21m deep foundation of the high columns on elliptic wells, carriageway structure span over 140m, assurance of local and global stability considering north wind strokes and differential exposure to sun                           | high valley viaduct, ramified supports, deep foundation, elliptic wells                     | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | Pipenbaher, M. Viadukt Črni Kal – izziv slovenski gradbeni stroki = Viaduct Crni Kal – challenge for the Slovene civil construction profession. 6 slovenski kongres o cestah in prometu (6 <sup>th</sup> Slovene Road and Traffic Congress), Portorož, 2002  | V                   | 2004                        |



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| <b>SLOVENIA</b> |                               |   |   |  |   |                            |                             |
| <b>15</b>       | E, F                          | FOAMED BITUMEN “IN-SITU” COLD RECYCLING for low cost long-lasting construction maintenance, with minimum of new material used | foamed bitumen, cold recycling  | Darko Kokot<br>ZAG Ljubljana Institute<br>Slovenian National Building and Civil Engineering<br>+386 1 2804 301<br>darko.kokot@zag.si     | Planinc, J., Willenpart, B., Šuštar, J. Recikliranje na licu mesta po hladnem postopku z uporabo penjenega bitumna = Foamed bitumen “in-situ” cold recycling. 6 slovenski kongres o cestah in prometu (6 <sup>th</sup> Slovene Road and Traffic Congress), Portorož, 2002 | VI                         | 2001                        |
| <b>16</b>       | I, J                          | SiWIM – Slovenian bridge WEIGH-IN-MOTION SYSTEM for collecting vehicles’ gross weights and axle loads at normal highway speed | SiWIM, WIM, weigh-in-motion, WAVE, bridge WIM system, FAD, free-of-axle detector, loading | Aleš Žnidarič<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 207<br>ales.znidaric@zag.si | www.zag.si/~znidaric/bibliography.htm   | VII                        | 1998                        |



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| <b>SLOVENIA</b> |                        |   |   |  |   |                     |                             |
| <b>17</b>       | I, J                   | ECODUCT-GREEN BRIDGE for safer crossing of the highway sections by the brown bear and other large mammals | ecoduct, green bridge, highway overpasses, safer overcrossing by wildlife | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | Adamič, M., Jerina, K., Kobler, A.: Pomen uporabe senzorsko proženih fotokamer pri monitoringu primernosti avtocestnih objektov za prehajanje prostoživečih živali = The importance of infrared-triggered cameras in the monitoring of the suitability of highway facilities as wildlife crossings. 6 slovenski kongres o cestah in prometu (6 <sup>th</sup> Slovene Road and Traffic Congress), Portorož, 2002 | III                 | 1999                        |



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| <b>SLOVENIA</b> |                        |   |   |  |   |                     |                             |
| <b>18</b>       | F                      | VEGETATED BIOFILTER systems for more efficient collection, retention and treatment of highway run-off | vegetated biofilter, surface run-off, run-off retention | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | Bulc, T., Vrhovšek, D., Kompore, B. Delovanje rastlinskega filtra za čiščenje padavinskega odtoka na avtocestnem odseku Arja vas – Celje = Performance of vegetated biofilter for run-off treatment on motorway section Arja vas-Celje. 6 slovenski kongres o cestah in prometu (6 <sup>th</sup> Slovene Road and Traffic Congress), Portorož, 2002<br><br>Bulc, T. Čiščenje odpadnih voda s cestišča z rastlinsko čistilno napravo = Surface run-off waste water filtering with vegetated biofilter. R&D project, LIMNOS d.o.o., Ljubljana, November 1999. | V                   | autumn 2001                 |



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| <b>SLOVENIA</b> |                        |  |   |  |   |                     |                             |
| <b>19</b>       | H                      | Slovenian ELECTRONIC TOLL COLLECTING SYSTEM (ETC) used for travel times data collecting  | ETC, electronic toll collecting systems, ABC, travel time | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | Lipar, P., Juvanc, A., Kostanjšek, J., Velkavrh, J., Rus, I. Sistem zbiranja podatkov o potovalnih časih na cestni mreži = Road network travel times data collecting system. R&D project, University of Ljubljana, Faculty of Civil and Geodetic Engineering, Traffic Technical Institute, Ljubljana, Februar 2000                | VI                  | 2001                        |
| <b>20</b>       | A                      | 3D LEADING OF THE ROAD LAYING OUT using traffic-technical data, traffic psychology, theory of information, computer simulation, landscape architecture and technical cybernetics | 3D leading of laying out, road design                     | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | Kastelic, T., Lipar, P., Juvanc, A., Kostanjšek, J. Vizualno vodenje cestne osi in geometrijsko oblikovanje obcestja = Visual leading of the road axis and geometrical landscape shaping. R&D project, University of Ljubljana, Faculty of Civil and Geodetic Engineering, Traffic Technical Institute, Ljubljana, September 1999 | VI                  | 2000                        |



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| <b>SLOVENIA</b> |                        |   |   |  |  |                     |                             |
| <b>21</b>       | E                      | METHODOLOGY FOR THE EVALUATION of road monitoring equipment and methods, derived from equipment and methods' economic estimation, road condition and performance and relation of their costs to serviceability on network level | road management, evaluation tools, cost models              | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | Erbežnik, C., Kokot, D., Leben, B., Žorga, M., Miljevič, J., Gregorc, C., Kočevar, H., Krmelj, N., Kristl, M. Metodologija meritev za vrednotenje stanja cest = Methodology for the evaluation of road monitoring equipment and methods. R&D project, ZAG Ljubljana, Ljubljana, March 2002 | V                   | 2002                        |
| <b>22</b>       | C                      | HIGH PERFORMANCE and HIGH STRENGTH CONCRETE for building bridging structures  | HPC, high performance concrete, HSC, high strength concrete | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | Završki, M., Ačanski, V., Bradač, J., Korpar, L., Peteršič, T., Supič, V., Drobež, J. Premostitveni objekti iz visokovrednega betona = Bridging structures built of high performance concrete. R&D project, Gradis Biro za projektiranje, Maribor, October 2000                            | VI                  | 1999                        |



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| <b>SLOVENIA</b> |                        |   |   |  |  |                     |                             |
| <b>23</b>       | A, J                   | METHODOLOGY FOR THE EVALUATION of effectiveness and suitability of investments to achieve the LOS of state road infrastructure according to users' road safety requirements | roads, traffic accidents, before-after analysis, evaluation | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | Miljevič, J., Bensa, B., Kočevar, H., Krivec, D., Dolinar, M., Rupar, R., Kristl, M. Vrednotenje ukrepov za izboljšanje prometne varnosti = Evaluation of measures for improvement of road safety. R&D project, OmegaConsult, Ljubljana, October 2001  | V                   | 2001                        |
| <b>24</b>       | A                      | FWD measurements as a basis for designing road pavement maintenance and upgrading measures  | road pavement design, FWD                                   | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | Henigman, S., Jamnik, J., Lipoglavšek, B., Bajec, J., Marinko, B., Cezar, J., Žmavc, J., Podgoršek, F., Stock, T., Prosen, J. Meritve nosilnosti voziščnih konstrukcij z deflektometrom s padajočo utežjo kot osnova za dimenzioniranje obstoječih voziščnih konstrukcij = Deflection measurements with Falling weight deflectometer as a basis for road pavement structural design. R&D project, DDC, Ljubljana, October 2000 | VI                  | 2001                        |



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| <b>SLOVENIA</b> |                        |   |   |  |  |                     |                             |
| <b>25</b>       | A                      | RESTRICTION OF PERMITTED AXLE LOADING during spring thaw period   | bearing capacity, FWD, deflectograph Lacroix, axle loads, remaining structural life, pavement upgrading, costs and benefits | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | Jamnik, J. Gospodarne letne in pomladne osne obremenitve na državnih cestah = Economically endurable axle loadings in spring thaw period on national roads. R&D project, DDC, Ljubljana, June 2002 | VI                  | 2003                        |
| <b>26</b>       | A                      | MINIMAL ROAD STRUCTURE DIMENSIONS (layer thickness)   | pavement design, layer thickness  | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | /  | VI                  | 2003                        |
| <b>27</b>       | A                      | ROAD AXIS ROTATION, SUPERELEVATION TRANSITION<br>Use of transition curves (mostly clothoid or Euler spiral) to join straights and circular curves for providing a comfortable transition between two elements with a different curvature and room for transition from crossfall to the full superelevation. | road layout design, road axis rotation, superelevation transition, transition curves  | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | /  | VI                  | 2000                        |



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| <b>SLOVENIA</b> |                        |  |  |  |                |                     |                             |
| <b>28</b>       | A                      | use of RIGID PAVEMENT for slow traffic lanes                               | rigid pavement, pavement design                                      | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | /              | VI                  | 2000                        |
| <b>29</b>       | C, D                   | LOW NOISE EMITTING asphalt mixture SMA 8                                   | noise emission, noise reduction, asphalt mixtures                    | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | /              | VI                  | 1997                        |
| <b>30</b>       | B                      | IN-SITU PLACING of cement stabilised layers                                | stabilised layer, cement stabilisation, in-situ placement            | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | /              | VI                  | 2000                        |
| <b>31</b>       | B, F                   | GROUND ANCHORAGING, CABLE ANCHORAGING for slope stabilisation              | cable anchorage, ground anchorage, anchor cable, slope stabilisation | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | /              | VI                  | 2000                        |
| <b>32</b>       | A, B                   | INVERTED ROAD PAVEMENT cement stabilised layer is laid under unbound layer | road pavement, inverted pavement                                     | Darko Kokot<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301<br>darko.kokot@zag.si | /              | IV                  | 1999                        |



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| <b>SLOVENIA</b> |                        |   |   |   |   |                     |                             |
| <b>33</b>       | E                      | use of EXPANDED CLAY in hot sealing compound for surface sealing treatment, intended to improve skid resistance after treatment | sealing treatment, skid resistance, expanded clay   | Darko Kokot and Marjan Tušar<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 301, +386 1 2804 497<br>darko.kokot@zag.si<br>marjan.tusar@zag.si | Tušar, M., Kokot, D., Leben, B., Kovačević, S., Klopčič, P., Starič, T., Žorga, M. Vpliv bitumenskih zalivk vzdolžnih razpok na torno sposobnost vozišč = The effect of sealing treatment on skid resistance of pavement. R&D project, ZAG Ljubljana, Ljubljana, May 2004   | IV                  | 2003                        |
| <b>34</b>       | F                      | use of NOISE BARRIERS for reducing road traffic noise emissions   | noise barriers, road traffic noise reducing devices | Mihael Ramšak<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 434<br>mihael.ramsak@zag.si  | Ramsak, M. Frekvenčna analiza vzajemnega vpliva obrabnih plasti vozišč ter protihrupnih ograj na emisijo hrupa cestnega prometa v okolje = Frequency analysis of simultaneous noise control effect of wearing courses and noise barriers on traffic noise emission. 7 slovenski kongres o cestah in prometu (7 <sup>th</sup> Slovene Road and Traffic Congress), Portorož, 2004 | VI                  | 2000                        |



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| <b>SLOVENIA</b> |                        |  |  |  |                |                     |                             |
| <b>35</b>       | C                      | use of POLYMER MODIFIED BITUME type I in asphalt mixtures for base courses | PmB, polymer modified bitume type I, road pavement base course | Marjan Tušar<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 497<br>marjan.tusar@zag.si | /              | VI                  | 1999                        |
| <b>36</b>       | A                      | mechanical placement (laying down) of waterproof membrane                  | waterproof membrane, road pavement                             | Marjan Tušar<br>ZAG Ljubljana<br>Slovenian National Building and Civil Engineering Institute<br>+386 1 2804 497<br>marjan.tusar@zag.si | /              | VI                  | End 2001                    |



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| <b>SWEDEN</b> |                        |   |  |  |   |                     |                             |
| <b>1</b>      | C                      | <b>Flow mixing Technique, KGO-III</b><br><i>A new mixing procedure has been developed recently, (KGO-III) that gives rise to a decrease in mixing temperature by 30 degree Celsius and a decrease of bitumen content by 0.5% in surface mixes. The new mixing technology is used in three recently constructed road sections and compared with a reference road section. Cores have been taken from bituminous layers for control of homogeneity and mechanical properties of asphalt mixtures. The evaluation is based on laboratory test as well as pavement performance.</i> | <i>durability, mechanical properties, mixture design, segregation, stiffness, save in energy and bitumen</i> | Leif Viman, VTI, +4613204253, <a href="mailto:leif.viman@vti.se">leif.viman@vti.se</a><br>Mats Wendel, VV, +4616157247, <a href="mailto:mats.wendel@vv.se">mats.wendel@vv.se</a>           | <i>3rd Euroasphalt &amp; Eurobitume Congress i n Vienna 2004. Paper Effect of flow mixing technique, KGO-III, on characteristics of bituminous surfacing. Viman L.; Wendel M.; Said S.F. (ISBN 90-802884-4-6, 2004)</i><br><br><i>Flödesblandning av slitlager enligt KGO-II metoden. VTI notat 19-2004. Leif Viman, Safwat Said, Hassan Hakim. (only in Swedish)</i> | II                  | 2000?                       |
| <b>2</b>      | B                      | <b>Poroeleastic Road Surface</b><br><i>Developing of prefab sheets for noise reduction. Laboratory and field test.</i>  | <i>noise reduction, prefab sheets, recycling</i>   | Björn Kalman, VTI, +4613204255, <a href="mailto:bjorn.kalman@vti.se">bjorn.kalman@vti.se</a><br>Ulf Sandberg, VTI, +46204131, <a href="mailto:ulf.sandberg@vti.se">ulf.sandberg@vti.se</a> |   | II                  | 2004?                       |



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| Innovation Nr | Field Nr – see Table 1 | Title and short description (max. 300 char)   | Keywords  | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)         | Publication(s)             | Phase – see Table 2 | Date of initial application |
| <b>SWEDEN</b> |                        |   |   |  |                            |                     |                             |
| <b>3</b>      | A                      | <b>Predicting of flow rutting</b><br><i>A theoretical viscoelastic approach for predicting rut formation in asphalt concrete materials subjected to traffic loading. Input data are traffic parameters, shear modulus of asphalt concrete and thickness of asphalt layer. The approach is evaluated by using a large-size Wheel Tracking Machine.</i> | <i>asphalt concrete, flow rutting, shear test, wheel tracking test</i>                      | Safwat Said, VTI, +4613204248,<br><a href="mailto:safwat.said@vti.se">safwat.said@vti.se</a> | ISAP sym Auburn June, 2004 | II                  | 2004?                       |
| <b>4</b>      | C                      | <b>Shear test</b><br><i>Developing of a new equipment and method for determination of shear modulus.</i>  | <i>asphalt concrete, shear test</i>   | Safwat Said, VTI, +4613204248,<br><a href="mailto:safwat.said@vti.se">safwat.said@vti.se</a> | ?                          | II                  | 2002?                       |
| <b>5</b>      | C                      | <b>Wheel Tracking test</b><br><i>Developing of a new equipment and method for determination of rutting and durability performance of asphalt pavements</i>  | <i>asphalt concrete, durability, rutting, wheel tracking test, tyre pressure, tyre load</i> | Safwat Said, VTI, +4613204248,<br><a href="mailto:safwat.said@vti.se">safwat.said@vti.se</a> | ?                          | II                  | 1998?                       |



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| <b>SWEDEN</b> |                               |   |   |  |  |                            |                             |
| <b>6</b>      | C                             | <b>Evaluation of pavement structure reinforced with steel fabrics</b><br><i>Different road sections have been reinforced with steel fabrics. The sections are instrumented and different measurement has been done during 2000-2004</i>   | <i>steel reinforcement, asphalt concrete, Falling Weight Deflectometer</i>                                    | Safwat Said, VTI, +4613204248,<br><a href="mailto:safwat.said@vti.se">safwat.said@vti.se</a>     | <a href="#">Report T6:03 performance of Full Scale Test Roads VTI report 30-2003</a><br>Stålarmering av väg 600, Sundom<br><a href="#">VTI report 33-2003</a><br>Stålarmering av väg E6 Ljungskile, Brattforsån-Lyckorna | II                         | 2000                        |
| <b>7</b>      | C                             | <b>HVS - Heavy Vehicle Simulator</b><br>A program for research co-operation in the area of accelerated pavement testing has been agreed between Finland and Sweden covering the years 1997–2003. The general objective of the research co-operation is to learn more about pavement response and pavement performance. A second but most important objective is to learn about the HVS-machine itself and the way it simulate traffic and deteriorate the pavements and how this is related to real pavement performance. | <i>flexible pavement, road base, permeability, drainage, load, performance, cracking, rutting, durability</i> | Leif G. Wiman, VTI, +4613204270,<br><a href="mailto:leif.g.wiman@vti.se">leif.g.wiman@vti.se</a> | VTI Rapport 447A<br>Accelererad provning av vägbeläggningar  | II                         | 1997                        |



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| <b>FINLAND</b> |                        |  |  |  |  |                     |                             |
| <b>1</b>       | A                      | Decreasing the rutting by development of road structure. Development of calculation tool for rutting                                     | road structure, permanent deformation, rutting, permanent deformation, moisture, stiffness, design program         | Rainer Laaksonen, VTT, Building and Transport, ph. +358 9 456 4692, rainer.laaksonen@vtt.fi          | A Finnish research report is in print, it will be published in Finnra's webpage and in Finnra's publication series (English abstract attached) | II/III              | 2005                        |
| <b>2</b>       | B, C, E                | EFFECT OF STEEL GRIDS ON THE DURABILITY OF THE ROAD  | low volume road, rehabilitation, accelerated pavement test, rutting, permanent deformation, steel grid, geotextile | Leena Korkiala-Tanttu, VTT, Building and Transport ph. +358 9 456 4943, leena.korkiala-tanttu@vtt.fi | An English executive summary has been published in Finnra Engineering News 13  | III                 | 2004                        |
| <b>3</b>       | A                      | The calculation of the continuous settlement profile with TSARPIX program with the help of electric resistance measurements and sampling | settlement, continuous profile, electric resistance measurement  | Jouko Törnqvist, VTT Building and Transport, ph. +358 400 605 482, jouko.tornqvist@vtt.fi            | Finnish reports in the TPPT research programme, Menetelmäkuvaus TPPT9 and Menetelmäkuvaus TPPT 19, 2001  | III / VI            | 2001, piloting 2004         |
| <b>4</b>       | F                      | Pilot projects for life cycle studies in road maintenance  | life cycle assessment, life cycle cost, road maintenance, acquisition method, pilot project                        | Leena Korkiala-Tanttu, VTT, Building and Transport ph. +358 9 456 4943, leena.korkiala-tanttu@vtt.fi | A Finnish report will be published in 2005. Some English articles in the future  | II                  | 2003 - 2004                 |



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| <b>FINLAND</b> |                        |   |  |  |   |                     |                             |
| <b>5</b>       | F                      | Environmental values and ecoindicators of the infra constructions   | Environmental impacts, ecoindicators, road and rail constructions  | Leena Korkiala-Tanttu, VTT, Building and Transport<br>ph. +358 9 456 4943,<br>leena.korkiala-tanttu@vtt.fi | A Finnish report will be published in 2006. Some English articles in the future | I                   | 2005 - 2006                 |
| <b>6</b>       | A, C, E                | 'Reinforcement of the edge of a steep-sloped pavement' HVS-Nordic Heavy Vehicle Simulator test structures | low volume road, rehabilitation, accelerated pavement test, rutting, permanent deformation, steel grid, geotextile | Leena Korkiala-Tanttu, VTT, Building and Transport<br>ph. +358 9 456 4943,<br>leena.korkiala-tanttu@vtt.fi | Finnra Reports 38/2003 'Reinforcement of the edge of a steep-sloped pavement'   | III                 | 2003                        |



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| <b>NORWAY</b> |                        |  |   |   |                    |                     |                             |
| 1             | A                      | Cross section design for narrow roads. Four lane road with 16 m total width for ADT of 8000-12000, and 20 m for ADT 12000-20000              | Cross section design, lane widths   | <a href="mailto:bjarte.skogheim@vegvesen.no">bjarte.skogheim@vegvesen.no</a>  |                    | V                   |                             |
| 2             | A                      | Pavement strengthening design based on pavement life time. The need for strengthening is determined based on the concept of life time factor | Strengthening, life time factor, rutting evenness, road data bank   | Geir Refsdal, Norwegian public roads administration, Eastern region<br>e-mail: <a href="mailto:geir.refsdal@vegvesen.no">geir.refsdal@vegvesen.no</a><br><a href="mailto:torleif.haugodegard@vegvesen.no">torleif.haugodegard@vegvesen.no</a> |                    | VII                 | 1995                        |
| 3             | C                      | Thermal aspects of corrosion of steel in concrete. Effect of low temperature on resistivity and cathodic reaction rate                       | Concrete technology, corrosion, ice formation, moisture, resistivity, activation energy, cathodic behaviour | <a href="mailto:jan-magnus.ostvik@vegvesen.no">jan-magnus.ostvik@vegvesen.no</a><br><a href="mailto:claus.larsen@vegvesen.no">claus.larsen@vegvesen.no</a>  | ISBN 82-471-6869-3 | I                   | ?                           |
| 4             | C                      | Use of cellular glass as lightweight embankment fill material and frost protection layers  | Lightweight materials, cellular glass, granules, recycled glass, frost protection, insulation               | <a href="mailto:geir.refsdal@vegvesen.no">geir.refsdal@vegvesen.no</a><br><a href="mailto:roald.aaboe@vegvesen.no">roald.aaboe@vegvesen.no</a><br><a href="mailto:oystein.myhre@vegvesen.no">oystein.myhre@vegvesen.no</a>                    |                    | VII                 | 1999 (approx.)              |



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| <b>NORWAY</b> |                        |   |  |   |   |                     |                             |
| <b>5</b>      | C                      | Use of care tires as light weight fill material   | Recycled materials, car tires, light weight fill | <a href="mailto:roald.aaboe@vegvesen.no">roald.aaboe@vegvesen.no</a><br><a href="mailto:gordana.petkovic@vegvesen.no">gordana.petkovic@vegvesen.no</a>                                    |   | VI                  | 1990 (approx.)              |
| <b>6</b>      | C                      | Use of large sized (0 – 100mm) recycled concrete aggregate in sub-base construction. Recycled concrete with wide range of sizes was used in construction of sub-base                                | Recycled concrete, particle size distribution    | Gordana Petkovic, Center for road and traffic technology, Norwegian public roads administration<br>e-mail: <a href="mailto:gordana.petkovic@vegvesen.no">gordana.petkovic@vegvesen.no</a> | For articles and reports see: <a href="http://www.gjenbruksprosjektet.net/">http://www.gjenbruksprosjektet.net/</a> | II                  |                             |
| <b>7</b>      | C                      | Asphalt milling (cold recycling) and its use in base course construction. On-site milling and reuse of asphalt in base construction   | Asphalt, milling, in-place recycling             | Jostein Aksnes, Center for road and traffic technology, Norwegian public roads administration<br>e-mail: <a href="mailto:Jostein.aksnes@vegvesen.no">Jostein.aksnes@vegvesen.no</a>       |   | VII                 | 1995                        |
| <b>8</b>      | C                      | Asphalt mix design and control system. A mix design and control system which takes into account local climatic and traffic conditions. Takes functional properties of asphalt mixtures into account | Binder selection system, quality control system  | Leif Bakløkk, Center for road and traffic technology, Norwegian public roads administration<br>e-mail: <a href="mailto:leif.baklokk@vegvesen.no">leif.baklokk@vegvesen.no</a>             |   | I                   |                             |



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| <b>NORWAY</b> |                        |   |                                      |  |  |                     |                             |
| 9             | E                      | Water surveillance along main roads consideration for sustainable de-icing (salt)   | Sustainable de-icing                 | <a href="mailto:paal.rosland@vegvesen.no">paal.rosland@vegvesen.no</a>               | -  | IV                  | 2005                        |
| 10            | E                      | Caring avenues (line of woods) along edges of roadway using optimal management  | Avenues                              | <a href="mailto:paal.rosland@vegvesen.no">paal.rosland@vegvesen.no</a>               | Teaching supervisor  | II                  | 2004                        |
| 11            | E/J                    | Establish flowery edges of roadway using optimal moment time for clipping and removing of biological substance                        | Flowery meadow<br>Edge of roadway    | <a href="mailto:paal.rosland@vegvesen.no">paal.rosland@vegvesen.no</a>               | Teaching supervisor  | II                  | 2003                        |
| 12            | F                      | Improve urban air using information and surveillance web-systems  | Urban air quality                    | <a href="mailto:paal.rosland@vegvesen.no">paal.rosland@vegvesen.no</a>               | <a href="http://www.luftkvalitet.info">www.luftkvalitet.info</a> | V                   | 2000                        |
| 13            | F                      | Develop chemicals (salt etc ) as dust adhesive medium for the road surface (and tunnels) consideration for the coarse fraction (PM10) | Dust adhesive medium<br>Dust problem | <a href="mailto:paal.rosland@vegvesen.no">paal.rosland@vegvesen.no</a>               | <a href="http://www.luftkvalitet.info">www.luftkvalitet.info</a> | II                  | 2002                        |



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| <b>NORWAY</b> |                        |   |  |   |                |                     |                             |
| 14            | F                      | Characterization of dust in suspension (suspended matter) from the wear of pavements from studded tires   | Dust in suspension, suspended matter, mineral particles, PM, studded tires, pavements, air quality | <a href="mailto:brynhild.snilsberg@vegvesen.no">brynhild.snilsberg@vegvesen.no</a>  |                | II                  |                             |
| 15            | F                      | Tautra. The road to the island and Ramsar-site Tautra was built on a stone-fill embankment. Foxes, badgers and martens migrated to the island. Several of the bird populations decreased rapidly. In 2003 a part of the embankment was replaced with a bridge, restoring the water currents, and a wildlife barrier was built. Project costs: 50 million NOK.   | Ramsar, protected wetlands, embankment, bridge, restoration, wildlife barrier                      | Bjørn Iuell, Environmental Section, Norwegian Public Roads Administration, Tel. +47 22 07 30 19, e-mail: <a href="mailto:bjorn.iuell@vegvesen.no">bjorn.iuell@vegvesen.no</a> |                | IV                  | 2003                        |
| 16            | F                      | Wild reindeer surveillance. Hw 7 across the Hardangervidda mountain plateau is said to divide the winter grazing areas of the wild reindeer, and to be a hindrance for seasonal migration. The effect of the highway may be detected 5 – 7 km from the road. A 5 year study is carried out, using GPS-technology and satellite data, checking the wild reindeer movements correlated to the lichen cover. | Wild reindeer, barrier, fragmentation, disturbance   | Bjørn Iuell, Environmental Section, Norwegian Public Roads Administration, Tel. +47 22 07 30 19, e-mail: <a href="mailto:bjorn.iuell@vegvesen.no">bjorn.iuell@vegvesen.no</a> |                | II                  | 2002-2006                   |



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| <b>NORWAY</b> |                        |   |   |   |  |                     |                             |
| <b>17</b>     | F                      | Testing coffer dams consideration for salt-spill (de-icing) and buffer against flood water  | Coffer dams<br>Water pollution            | <a href="mailto:paal.rosland@vegvesen.no">paal.rosland@vegvesen.no</a>  | Interconsult report  | IV                  | 2000                        |
| <b>18</b>     | F                      | Limnological mapping of some lakes consideration for water quality and biological condition | Limnology<br>Water pollution              | <a href="mailto:paal.rosland@vegvesen.no">paal.rosland@vegvesen.no</a>  |  | I                   | 2004                        |
| <b>19</b>     | H                      | Dynamic optimization of the transport sector  | Fleet management, realistic driving speed | Atle Riise<br>SINTEF<br>+47 22067586/92248389<br><a href="mailto:atle.rise@sintef.no">atle.rise@sintef.no</a>                             | <a href="http://www.doit.sintef.no">www.doit.sintef.no</a> | I                   | Possibly 2006               |
| <b>20</b>     | H                      | Design optimization for toll collection/road pricing  | Operation cost, design, prices            | Erik Amdal<br>Norwegian Public Roads Administration<br>+47 73934675<br><a href="mailto:erik.amdal@vegvesen.no">erik.amdal@vegvesen.no</a> |  | I                   |                             |



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| <b>NORWAY</b> |                        |   |  |  |                |                     |                             |
| 21            | I                      | <b>Regional transport model (RTM)</b><br>During the past years there has been developed a regional transport model. The model is now being implemented into the 5 regions. The model is handling intermodal transport (person). | Transport modelling  | Oskar Andreas Kleven, National Transport Plan, Transport analysis, +47 22 07 37 69, <a href="mailto:oskar.kleven@vegvesen.no">oskar.kleven@vegvesen.no</a> |                | IV                  | During 2005                 |
| 22            | J                      | Effect of painkiller medicines on performance of drivers tested by using driving simulator  | Safety, driver performance, effect of medicines, driving simulator | Halvard Nilsen, <a href="mailto:hans.skjelbred@vegvesen.no">hans.skjelbred@vegvesen.no</a>   |                | II                  |                             |
| 23            | J                      | Driver behaviour in fatigue tested by using driving simulator   | Safety, driver behaviour, fatigue, driving simulator               | Gunnar Jenssen, NTNU/SINTEF, <a href="mailto:hans.skjelbred@vegvesen.no">hans.skjelbred@vegvesen.no</a>  |                | II                  |                             |
| 24            | J                      | Driver support systems  | Driving simulator, driver support                                  | Gunnar Jenssen, NTNU/SINTEF, <a href="mailto:hans.skjelbred@vegvesen.no">hans.skjelbred@vegvesen.no</a>  |                | II                  |                             |



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| <b>NORWAY</b> |                        |  |   |  |  |                     |                             |
| 25            | J                      | Driver training course<br>Use of driving simulator in driving training for new drivers.  | Driver training, cost effective training methods                    | <a href="mailto:rolf.robertsen@vegvesen.no">rolf.robertsen@vegvesen.no</a>   |  | II                  |                             |
| 26            | J                      | Implement existing road network in the driving simulator   | Instrumented vehicle, use of real road network in driving simulator | <a href="mailto:hans..skjelbred@vegvesen.no">hans..skjelbred@vegvesen.no</a>   |  | II                  |                             |
| 27            | K                      | ALFRED Surface measuring system. The system measures evenness (IRI), rutting, crossfall texture and radius of curvature. Takes digital images every 10 to 20 m, which helps to visualize pavement condition and road side appurtenances (signs, guards, etc) | Surface characteristics, evenness, rutting, crossfall               | Toreleif Haugødegård, Center for road and traffic technology, Norwegian public roads administration<br>e-mail:<br><a href="mailto:torleif.haugodegard@vegvesen.no">torleif.haugodegard@vegvesen.no</a> | T. Haugødegård (2004) Measuring and calculating the transverse profile of narrow roads, proceedings 2 <sup>nd</sup> European pavement and asset management conference, Berlin, Germany<br>T. A. Hetland (1998), ALFRED, a Norwegian road monitoring system, proceedings of the 5 <sup>th</sup> international conference on bearing capacity of roads and air fields, Trondheim, Norway | VII                 | 1989                        |



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| <b>NORWAY</b> |                        |  |  |  |  |                     |  |
| 28            | J                      | “Road Safety Lillehammer – Towards Vision Zero”<br>A national demonstration project that focus on approaches to, and testing of, measures for improvement of road safety. The project addresses the entire traffic system, the road, vehicles and road user. It use both surveillance-, information- and injury reduction measures | Road safety  | Anders Godal Holt<br>Center for road and traffic technology, Norwegian public roads administration,<br>P.O.Box 8142 Dep,<br>N-0033 Oslo<br>Phone +47 22 07 35 00<br><a href="mailto:anders-godal.holt@vegvesen.no">anders-godal.holt@vegvesen.no</a> | Will be written later (too early)  | IV                  | Planning 2003<br>Application 2004-2006 |
| 29            | M                      | A new sanding method for winter operation of roads. The method consists of use of sand in combination with hot water. The method is considered to be a significant development in winter operation of roads.   | Sand gradation, water temperature, application rate, winter friction | Roar Støtterud, Center for road and traffic technology, Norwegian public roads administration<br>e-mail : <a href="mailto:roar.stotterud@vegvesen.no">roar.stotterud@vegvesen.no</a>   | Torgeir Vaa (2004), Implementation of the new sanding method in Norway, Proceedings of the 6 <sup>th</sup> international symposium on snow removal and ice control technology, Spokane, Washington | VI                  | 2002/2203                              |



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| <b>NORWAY</b> |                        |  |   |  |  |                     |                             |
| <b>30</b>     | M                      | Alternative salting methods-Use of Magnesium Chloride. This is an ongoing research project that aims to find alternative salting methods with objective of reducing the consumption of salt. | Magnesium Chloride, pre- wetting, winter friction | Roar Støtterud, Center for road and traffic technology, Norwegian public roads administration<br>e-mail : <a href="mailto:roar.stotterud@vegvesen.no">roar.stotterud@vegvesen.no</a> | Torgeir Vaa (2004), Norwegian experiences with the use of magnesium chloride, Proceedings of the 6 <sup>th</sup> international symposium on snow removal and ice control technology, Spokane, Washington | II                  |                             |



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| <b>SERBIA &amp; MONTENEGRO</b> |                        |   |  |   |                |                     |                             |
| 1                              | C                      | Polymer-modified bitumen based on SBS – polymer used in asphalt-concrete and SMA mixtures for wearing course  | Polymer, bitumen, SBS,   | Dr Pap Imre, Highway Institute, +381 11 24.66.355<br><a href="mailto:papp@yubc.net">papp@yubc.net</a><br><a href="mailto:asfalt@yubc.net">asfalt@yubc.net</a> |                | VII                 | 2000                        |
| 2                              | C                      | Polymer-modified asphalt based on PE and EVA – polymer used for wearing and base course layers. Asphalt modification are performed by direct addition of polymer granulates into the asphalt mixer. | Polymer, asphalt, PE, EVA  | Dr Pap Imre, Highway Institute, +381 11 24.66.355<br><a href="mailto:papp@yubc.net">papp@yubc.net</a><br><a href="mailto:asfalt@yubc.net">asfalt@yubc.net</a> |                | VII                 | 2002                        |
| 3                              | C                      | Additive ASPHALT-MIN for reducing asphalt mix temperature of production and compaction  | Additive, zeolithe, lowering production and compaction temperature | Dr Pap Imre, Highway Institute, +381 11 24.66.355<br><a href="mailto:papp@yubc.net">papp@yubc.net</a><br><a href="mailto:asfalt@yubc.net">asfalt@yubc.net</a> |                | II                  | 2005                        |
| 4                              | C                      | Cold applied waterproofing membrane based on MMA for waterproofing of concrete and steel bridges  | Waterproofing, bridge, MMA   | Dr Pap Imre, Highway Institute, +381 11 24.66.355<br><a href="mailto:papp@yubc.net">papp@yubc.net</a><br><a href="mailto:asfalt@yubc.net">asfalt@yubc.net</a> |                | II                  | 2005                        |



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| <b>SERBIA &amp; MONTENEGRO</b> |                               |   |   |   |                |                            |                             |
| <b>5</b>                       | <b>C</b>                      | Surface dressing, micro-asphalt using cationic modified emulsion  | Micro surfacing   | Dr Pap Imre, Highway Institute, +381 11 24.66.355<br><a href="mailto:papp@yubc.net">papp@yubc.net</a><br><a href="mailto:asfalt@yubc.net">asfalt@yubc.net</a> |                | <b>VII</b>                 | 2002                        |
| <b>6</b>                       | <b>E</b>                      | Hot and cold recycling in place techniques for road rehabilitation  | Remix-plus recycling, cold recycling, foam bitumen  | Dr Pap Imre, Highway Institute, +381 11 24.66.355<br><a href="mailto:papp@yubc.net">papp@yubc.net</a><br><a href="mailto:asfalt@yubc.net">asfalt@yubc.net</a> |                | <b>VII</b>                 | 2002                        |
| <b>7</b>                       | <b>K</b>                      | Testing dynamic characteristics of asphalt mixes using NAT-14   | Dynamic stiffness modulus, Repeated axial load test, Indirect tensile test, Triaxial test, Fatigue test | Dr Pap Imre, Highway Institute, +381 11 24.66.355<br><a href="mailto:papp@yubc.net">papp@yubc.net</a><br><a href="mailto:asfalt@yubc.net">asfalt@yubc.net</a> |                | <b>VI</b>                  | 2005                        |
| <b>8</b>                       | <b>K</b>                      | Preparing asphalt samples, measuring density and air voids as well as shearing stress during gyratory compactions | Gyratory compactor  | Dr Pap Imre, Highway Institute, +381 11 24.66.355<br><a href="mailto:papp@yubc.net">papp@yubc.net</a><br><a href="mailto:asfalt@yubc.net">asfalt@yubc.net</a> |                | <b>VI</b>                  | 2005                        |



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| <b>ITALY</b>  |                        |  |  |  |   |                     |                             |
| 1             | B/C/F                  | <p><b>Porous bituminous multi layers low noise road pavements Concept, structural design, material and construction process and technique.</b></p> <p>This multi layer pavement type, obtained by an emission reducing double porous surface layer together with an energy absorbing lower layer, are realised by specialised modified bituminous binders, lightweight aggregates and bituminous mixtures.</p> | <ul style="list-style-type: none"> <li>✓ Low noise road pavements</li> <li>✓ Bituminous multilayer,</li> <li>✓ Porous,</li> <li>✓ Lightweight,</li> <li>✓ Antidumping,</li> <li>✓ Urban/suburban expressway and extraurban motorway</li> </ul> | <p>Gabriele Camomilla<br/>0039-06-43632583tel/tel-43634712/fax,<br/><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Marcello Luminari,<br/>Autostrade per l'Italia,<br/>0039-06-43632845tel/64telfax,<br/><a href="mailto:mluminari@autostrade.it">mluminari@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Mario Bonola<br/>0039-06- 06-88176225tel/06-88176211fax,<br/><a href="mailto:mario.bonola@pavimental.it">mario.bonola@pavimental.it</a><br/>Piazza F. De Lucia, 23, I-00100 Roma</p> <p>Domenico Sandulli,<br/>Pavimental,<br/>0039-06- 06-88176316tel/06-88176231fax,<br/><a href="mailto:domenico.sandulli@pavimental.it">domenico.sandulli@pavimental.it</a><br/>Piazza F. De Lucia, 23, I-00100 Roma</p> | <p>v<br/>. Luminari: "Final Technical Report", SIRUUS.FP R.TE.001.02, Giugno 2003.</p> <p>v<br/>. Camomilla, M. Luminari: "Silent Road for Urban and extra-urban Use (SI.R.U.US. Project) – The innovative resilient and resonant pavements", SURF 2004 5th Symposium on pavement surface characteristics roads and airports by the World Road Association AIPCR held in Toronto (Canada) on 6 June 2004.</p> | IV                  | 2001                        |



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| <b>ITALY</b>  |                        |  |   |  |   |                     |                             |
| 2             | A/B/F                  | <p><b>Euphonic or silent road pavement Concept, structural design, material and construction process and technique.</b></p> <p>This multi layer pavement type, able to support high volumes of heavy freight vehicles, is realised by specialised modified bituminous mixes for the porous layers and by structural elements of lightweight aggregates or by continuously concrete slabs including frequency selected systems for the resonant layer.</p> <p>The concerned technical process requires an high level of technical execution mainly due to the its articulated structure (porous and resonant layers) and the specialisation of the constituent materials (bituminous and cement ones) and the equipments (to laying not only the above mentioned materials but also the elements realising the resonant systems).</p> | <ul style="list-style-type: none"> <li>✓ Silent pavement,</li> <li>✓ Composite pavement,</li> <li>✓ Resonant layer system,</li> <li>✓ Sound absorption,</li> <li>✓ Porous,</li> <li>✓ Durability,</li> <li>✓ Urban/suburban expressway and extraurban motorway</li> </ul> | <p>Gabriele Camomilla<br/>0039-06-43632583tel/tel-43634712/fax,<br/><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Marcello Luminari,<br/>Autostrade per l'Italia,<br/>0039-06-43632845tel/64telfax,<br/><a href="mailto:mluminari@autostrade.it">mluminari@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Mario Bonola<br/>0039-06- 06-88176225tel/06-88176211fax,<br/><a href="mailto:mario.bonola@pavimental.it">mario.bonola@pavimental.it</a><br/>Piazza F. De Lucia, 23, I-00100 Roma</p> <p>Domenico Sandulli,<br/>Pavimental,<br/>0039-06- 06-88176316tel/06-88176231fax,<br/><a href="mailto:domenico.sandulli@pavimental.it">domenico.sandulli@pavimental.it</a><br/>Piazza F. De Lucia, 23, I-00100 Roma</p> | <p>v Patent Italy n. 1256.936 PCT/IT94/00011 (priority 13.08.92 TO92A000689), Norwegian 308175, USA 5730548, Japan 2896607, Europe 0743997.</p> <p>v G. Camomilla, M. Luminari, "SI.R.U.US. project: the anti-noise pavements of the SI.R.U.US. research", paper presented on "Intermodality, environment and safety session" and published on proceedings of the XXVIII Study and Information Days of A.S.E.C.A.P., Rome (Italy), 4-7 June 2000.</p> <p>v M. Luminari: "Final Technical Report", SIRUUS.FPR.TE.00 1.02, Giugno 2003.</p> <p>v G. Camomilla, M. Luminari: "Silent Road for Urban and extra-urban Use (SI.R.U.US. Project) – The innovative resilient and resonant pavements", SURF 2004 5th Symposium on pavement surface characteristics roads and airports by the World Road Association AIPCR held in Toronto (Canada) on 6 June 2004.</p> | IV                  | 2001                        |



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| Innovation Nr | Field Nr – see Table 1 | Title and short description (max. 300 char)   | Keywords   | Contact person(s): Name(s), Organisation(s), Telephone Number(s), e-mail address(es)   | Publication(s)  | Phase – see Table 2 | Date of initial application |
| <b>ITALY</b>  |                        |   |  |  |   |                     |                             |
| 3             | A/B/F                  | <p><b>Ecotechnic road pavement Concept, structural design, material and construction process and technique.</b></p> <p>This multi layer pavement type realises a special surface (using special aggregates, binder and mixes), a collaborating disconnection layer (obtained by a special steel or plastic precasted structural elements and by porous bituminous or concrete lightweight mixtures) and a bearing layer (using on site cold stabilisation of local material).</p> <p>This multi layer pavement type is realised by specialised modified light weight bituminous and cement mixes for the porous layers and by metallic or plastic structural elements as frequency selected systems for the resonant layer.</p> | <ul style="list-style-type: none"> <li>✓ Low noise pavement,</li> <li>✓ Composite pavement,</li> <li>✓ Resonant layer system,</li> <li>✓ Sound absorption,</li> <li>✓ Porous,</li> <li>✓ Drainability,</li> <li>✓ Reservoir pavement,</li> <li>✓ Ecotechnical pavement, Urban/suburban expressway and extraurban motorway</li> </ul> | <p>Gabriele Camomilla<br/>0039-06-43632583tel/tel-43634712/fax,<br/><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Marcello Luminari,<br/>Autostrade per l'Italia,<br/>0039-06-43632845tel/64telfax,<br/><a href="mailto:mluminari@autostrade.it">mluminari@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Mario Bonola<br/>0039-06- 06-88176225tel/06-88176211fax,<br/><a href="mailto:mario.bonola@pavimental.it">mario.bonola@pavimental.it</a><br/>Piazza F. De Lucia, 23, I-00100 Roma</p> <p>Domenico Sandulli,<br/>Pavimental,<br/>0039-06- 06-88176316tel/06-88176231fax,<br/><a href="mailto:domenico.sandulli@pavimental.it">domenico.sandulli@pavimental.it</a><br/>Piazza F. De Lucia, 23, I-00100 Roma</p> | <p>v Patent Italy n. 1299.412 PCT/IT98/00362 (priority 10.04.98 RM98A000230), USA 6379079.</p> <p>v G. Camomilla, M. Luminari, "SI.R.U.US. project: the anti-noise pavements of the SI.R.U.US. research", paper presented on "Intermodality, environment and safety session" and published on proceedings of the XXVIII Study and Information Days of A.S.E.C.A.P., Rome (Italy), 4-7 June 2000.</p> <p>v M. Luminari: "Final Technical Report", SIRUUS.FPR.TE.001.02, Giugno 2003.</p> <p>v G. Camomilla, M. Luminari: "Silent Road for Urban and extra-urban Use (SI.R.U.US. Project) – The innovative resilient and resonant pavements", SURF 2004 5th Symposium on pavement surface characteristics roads and airports by the World Road Association AIPCR held in Toronto (Canada) on 6 June 2004.</p> | IV                  | 2001                        |



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| <b>ITALY</b>  |                        |  |   |  |  |                     |                             |
| 4             | E/F                    | <p><b>Porous asphalt on site hot recycling.</b> In this new construction process and technique, the innovation concerns</p> <ul style="list-style-type: none"> <li>v the whole recycling train.</li> </ul> <p>This means the execution of the loosening by warm milling and the thermal regeneration in a drum mixer of the aged asphalt layer in such a way to optimise the associated heat exchanges and at the same time minimise the use of virgin materials.</p> <p>The technology is based upon the set up of working procedures and machinery capable to:</p> <ul style="list-style-type: none"> <li>v safeguard the original grading especially in the fine fraction,</li> <li>v define the virgin materials quantity by a weigh continuously electronically controlled,</li> <li>v manufacture recycled mixes performing at least like or better than the original asphalt layer main characteristics (i.e. mechanical strength, drainage capacity, skid resistance, sound absorption).</li> </ul> <p>Innovative objectives:</p> <ul style="list-style-type: none"> <li>v extension of the working period in the winter season,</li> <li>v development of more effective rejuvenation of the aged bitumen such as to enable further recycling of the already recycled mixes.</li> </ul> <p>Technological improvements:</p> <ul style="list-style-type: none"> <li>v materials</li> <li>v equipment/machinery,</li> </ul> <p>Managerial improvements:</p> <ul style="list-style-type: none"> <li>v strategy of the motorway pavement management,</li> <li>v organisation of the job site.</li> </ul> | <ul style="list-style-type: none"> <li>v On site hot recycling porous pavement,</li> <li>v modified bitumen,</li> <li>v pavement operation and management.</li> </ul> | <p>Gabriele Camomilla<br/>0039-06-43632583tel/tel-43634712/fax,<br/><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Marcello Luminari,<br/>Autostrade per l'Italia,<br/>0039-06-43632845tel/64telfax,<br/><a href="mailto:mluminari@autostrade.it">mluminari@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Mario Bonola<br/>0039-06- 06-88176225tel/06-88176211fax,<br/><a href="mailto:mario.bonola@pavimental.it">mario.bonola@pavimental.it</a><br/>Piazza F. De Lucia, 23, I-00100 Roma</p> <p>Domenico Sandulli,<br/>Pavimental,<br/>0039-06- 06-88176316tel/06-88176231fax,<br/><a href="mailto:domenico.sandulli@pavimental.it">domenico.sandulli@pavimental.it</a><br/>Piazza F. De Lucia, 23, I-00100 Roma</p> | <ul style="list-style-type: none"> <li>✓ “Article 5.4 – On site hot recycling of porous asphalt”, update 1998 of Technical Tender Specification for the Pavement Maintenance Works on Autostrade toll motorway network, Autostrade S.p.A./DG/MSM.</li> <li>✓ G. Camomilla “Development and management of porous, draining, noise and pollution attenuating pavements”, Asphalt and Innovation in Europe, Asphaltica 2003.</li> <li>✓ M. Bonola, R. Foschi, G. Guadagno “In-situ hot recycling: recent developments in Italy”, Asphalt and Innovation in Europe, Asphaltica 2003 and published also on Rassegna del Bitume Magazine, 45, 2003 (special issue for Asphaltica 2003).</li> <li>✓ R. Foschi, M. Bonola “Integrazioni e innovazioni nelle tecniche in situ per un &lt;Riciclaggio Globale&gt; delle pavimentazioni autostradali flessibili”, Strade ed Autostrade magazine, March-April, 2004.</li> <li>✓ R. Foschi, M. Bonola “In situ hot recycling of porous asphalt pavement: first results”, Le Strade Magazine, April 2004.</li> </ul> | VI                  | 2003                        |



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| <b>ITALY</b>  |                        |   |  |  |  |                     |                             |
| 5             | E/F                    | <p><b>Cold in place recycling of bituminous binder and base course using modified bitumen emulsion and cement.</b></p> <p>In this new construction process and technique of dense asphalt pavement, the innovation, in order to obtain the recycled material with same characteristics of the original one, concerns:</p> <ul style="list-style-type: none"> <li>v the whole recycling train (including removal, mixing and laying phases).</li> </ul> <p>This means the execution of the loosening with appropriate cold milling and the regeneration of the aged dense asphalt layers in a double shaft mixer minimising the use of virgin materials. The technology is based upon the set up of working procedures and machinery capable to:</p> <ul style="list-style-type: none"> <li>v keep under control the grading of the milled material ( ex. the coarse fraction),</li> <li>v dose the virgin materials by weighing continuously electronically controlled,</li> <li>v manufacture recycled mixes performing at least like or better than the original asphalt layers. This last aspect has been tested on the field by experimenting different types of emulsion and rejuvenators, cement and slaked lime.</li> </ul> <p>Innovative objectives:</p> <ul style="list-style-type: none"> <li>v extension of the working period in the winter season,</li> <li>v one pass recycling of final thick layer,</li> <li>v development of rejuvenation of the aged bitumen such as to enable further recycling of the already recycled mixes, as shorter as possible time for reopening the recycled layer to traffic.</li> </ul> <p>Technological improvements affect:</p> <ul style="list-style-type: none"> <li>v materials/equipment/machinery (mixer, electronics-systems, mobile crusher),</li> </ul> <p>Managerial improvements concerns:</p> <ul style="list-style-type: none"> <li>v the strategy of the PMS,</li> <li>v the work organisation of the job site.</li> </ul> | <ul style="list-style-type: none"> <li>v On site cold recycling, modified bitumen,</li> <li>v pavement operation and management</li> </ul> | <p>Gabriele Camomilla<br/>0039-06-43632583tel/43634712/fax,<br/><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Marcello Luminari,<br/>Autostrade per l'Italia,<br/>0039-06-43632845tel/64telfax,<br/><a href="mailto:mluminari@autostrade.it">mluminari@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Mario Bonola<br/>0039-06- 06-88176225tel/06-88176211fax,<br/><a href="mailto:mario.bonola@pavimental.it">mario.bonola@pavimental.it</a><br/>Piazza F. De Lucia, 23, I-00100 Roma</p> <p>Domenico Sandulli,<br/>Pavimental,<br/>0039-06- 06-88176316tel/06-88176231fax,<br/><a href="mailto:domenico.sandulli@pavimental.it">domenico.sandulli@pavimental.it</a><br/>Piazza F. De Lucia, 23, I-00100 Roma</p> | <ul style="list-style-type: none"> <li>✓ “Article 2.7 – On site cold recycling of bituminous road base and base course layer using modified bituminous emulsion and cement (experimental technique)”, update 2001 of Technical Tender Specification for the Pavement Maintenance Works on Autostrade toll motorway network, Autostrade S.p.A./DG/SRC.</li> <li>✓ R. Foschi, M. Bonola, D. Sandulli: “In place recycling of road pavements with modified bitumen emulsions – Pavimental’s experience with Autostrade’s motorway network”, paper presented for the SITEB award during the 3<sup>rd</sup> World Congress on Emulsions, 24-27 September 2002, Lyon, France and published also on Le Strade Review, N. 1-2, January/February 2003.</li> </ul> | VI                  | 2001                        |



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| <b>ITALY</b>  |                        |  |  |  |   |                     |                             |
| 6             | E/F                    | <p><b>On site cold recycling of base layer with foamed bitumen and cement. New construction process and technique.</b></p> <p>The cold recycling innovation is based on the engineering processes design and the integration of the foamed bitumen and modified bitumen emulsion techniques.</p> <p>The evolution of the these techniques allowed the improvement of</p> <ul style="list-style-type: none"> <li>v materials (mixes, aggregates, bitumen modifier)</li> <li>v operation design,</li> <li>v operation engineering processes,</li> <li>v production plant/laying train.</li> </ul> <p>Further developments are related to the performances improvements of the bitumen binders and modifiers, additive and the recycling machinery and process.</p> | <ul style="list-style-type: none"> <li>v On site cold recycling,</li> <li>v modified foamed bitumen,</li> <li>v pavement operation and management</li> </ul> | <p>Gabriele Camomilla<br/>0039-06-43632583tel/tel-43634712/fax,<br/><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Marcello Luminari,<br/>Autostrade per l'Italia,<br/>0039-06-43632845tel/64telfax,<br/><a href="mailto:mluminari@autostrade.it">mluminari@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Mario Bonola<br/>0039-06- 06-88176225tel/06-88176211fax,<br/><a href="mailto:mario.bonola@pavimental.it">mario.bonola@pavimental.it</a><br/>Piazza F. De Lucia, 23, I-00100 Roma</p> <p>Domenico Sandulli,<br/>Pavimental,<br/>0039-06- 06-88176316tel/06-88176231fax,<br/><a href="mailto:domenico.sandulli@pavimental.it">domenico.sandulli@pavimental.it</a><br/>Piazza F. De Lucia, 23, I-00100 Roma</p> | <ul style="list-style-type: none"> <li>✓ “Article 2.6 – On site cold recycling of base and /or foundation layer with foamed bitumen and cement or lime (experimental technique)”, update 1998 of Technical Tender Specification for the Pavement Maintenance Works on Autostrade toll motorway network Autostrade S.p.A./DG/MSM/CRD.</li> <li>✓ G. Camomilla, R. Bernardinetti and R. Lanucara “On site cold recycling of motorway pavement using modified bituminous emulsion and foamed bitumen - The experiences carried out on 2000 and 2001”, Autostrade magazine, 1/2002</li> <li>✓ R. Foschi, M. Bonola, D. Sandulli “Il bitume schiumato nell’esperienza di Pavimental nella rete della società Autostrade”, paper presented for the Sintexcal award during Asphaltica 2003, the annual exhibition of equipment &amp; technologies for the asphalt industry and published also on Rassegna del Bitume, 45, 2003 (special issue for Asphaltica 2003).</li> </ul> | VI                  | 2000                        |



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| <b>ITALY</b>  |                               |  |   |  |  |                            |                             |
| 7             | A, B, F                       | <b>Ecological Road Unit.</b><br>The unit or modulus for tunnel and U section, natural and artificial, is a road infrastructure which is land/environment protective. This road infrastructure presenting a low environmental impacts (regarding noise, vibration, air and liquid pollutants) deriving from a modulus integrating nuisance mitigating pavement, barriers, equipment and other subsystem.  | <ul style="list-style-type: none"> <li>v Silent pavement,</li> <li>v active, partial passive and passive nuisance mitigating subsystems,</li> <li>v air and liquid depollution,</li> <li>v Urban, suburban, Interurban field of application,</li> <li>v Tunnel and U-section field of application,</li> <li>v Resilient/Antidumpig road pavement,</li> <li>v Pollutants emission/generation, propagation and control/abatement</li> </ul> | Gabriele Camomilla<br>0039-06-43632583tel/tel-43634712/fax,<br><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br>Via A. Bergamini 50, I-00159 Roma<br><br>Marcello Luminari,<br>Autostrade per l'Italia,<br>0039-06-43632845tel/64telfax,<br><a href="mailto:mluminari@autostrade.it">mluminari@autostrade.it</a><br>Via A. Bergamini 50, I-00159 Roma | <ul style="list-style-type: none"> <li>v Ecological Road Unit patent Italy request n. RM2003A000515.</li> <li>v Internal Confidential report of Autostrade per l'Italia</li> </ul> | II                         | -                           |
| 8             | E, J, M                       | <b>Winter porous asphalt (self protective porous asphalt vs safety).</b><br>Modified porous asphalt, produced using special bituminous mortar including chloride-based chemical agent/admixture, performing self protection against ice and snow. This special bituminous mortar permits the porous asphalt characteristics: <ul style="list-style-type: none"> <li>• decrease of the icing temperature</li> <li>• decrease of the adhesion between the snow and the material</li> </ul> | <ul style="list-style-type: none"> <li>v Protective asphalt, de icing and de snowing,</li> <li>v winter maintenance, safety,</li> <li>v special bituminous mortar,</li> <li>v chemical agent/admixture</li> </ul>   | Gabriele Camomilla<br>0039-06-43632583tel/tel-43634712/fax,<br><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br>Via A. Bergamini 50, I-00159 Roma<br><br>Marcello Luminari,<br>Autostrade per l'Italia,<br>0039-06-43632845tel/64telfax,<br><a href="mailto:mluminari@autostrade.it">mluminari@autostrade.it</a><br>Via A. Bergamini 50, I-00159 Roma | <ul style="list-style-type: none"> <li>v Internal Confidential report of Autostrade per l'Italia</li> </ul>  | IV                         | October 2004                |



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| <b>ITALY</b>  |                        |  |  |  |   |                     |                             |
| 9             | B, E, J                | <b>Road restraint systems</b><br>Road restraints systems as safety barriers (i.e. including the ecological and containment characteristics) including new raw materials, design, and criteria to assess the impact indexes   | v Safety, restraints<br>v road systems,<br>v ecological,<br>v containment, | Gabriele Camomilla<br>0039-06-43632583tel/tel-43634712/fax,<br><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br>Via A. Bergamini 50, I-00159 Roma<br><br>Marcello Luminari,<br>Autostrade per l'Italia,<br>0039-06-43632845tel/64telfax,<br><a href="mailto:mluminari@autostrade.it">mluminari@autostrade.it</a><br>Via A. Bergamini 50, I-00159 Roma | v Proceedings of National and International Congresses    | VII                 | Various                     |
| 10            | D                      | <b>Integrated systems of methodologies and techniques to monitor the road traffic noise.</b><br>Environment (acoustical) and functional indicators for monitoring reviewing and measurement of the pavement and road infrastructures performances in order to facilitate the decision making system for the maintenance processes. | Road traffic noise, RIMA,  | Gabriele Camomilla<br>0039-06-43632583tel/tel-43634712/fax,<br><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br>Via A. Bergamini 50, I-00159 Roma<br><br>Marcello Luminari,<br>Autostrade per l'Italia,<br>0039-06-43632845tel/64telfax,<br><a href="mailto:mluminari@autostrade.it">mluminari@autostrade.it</a><br>Via A. Bergamini 50, I-00159 Roma | v Internal Confidential report of Autostrade per l'Italia | II, III, IV, VII    | Various                     |



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| <b>ITALY</b>  |                        |  |  |  |   |                     |                             |
| 11            | C, E, F                | <p><b>Reuse of existing asphalt concrete as aggregate for concrete mixes.</b></p> <p>Mix design of cement concrete mixes including Recycled Asphalt Pavement (RAP) deriving from the cold milling of old bituminous pavements.</p> <p>Further studies on the physical properties of thermal, electric and hydraulic conductivity as well as on the acoustic properties will be made in order to contribute to the drawing up the appropriate technical specifications.</p> <p>Compliance with the current technical standard are expected.</p> | <ul style="list-style-type: none"> <li>v Environment,</li> <li>v road construction,</li> <li>v pavement,</li> <li>v recycling,</li> <li>v bituminous mixture,</li> <li>v aggregate,</li> <li>v concrete</li> </ul> | <p>Gabriele Camomilla<br/>0039-06-43632583tel/tel-43634712/fax,<br/><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Marcello Luminari,<br/>Autostrade per l'Italia,<br/>0039-06-43632845tel/64telfax,<br/><a href="mailto:mluminari@autostrade.it">mluminari@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> | <ul style="list-style-type: none"> <li>✓ G. Peroni, M.Luminari e G. Bastianelli. "Reuse of existing asphalt concrete as aggregate for concrete mixes: mechanical behaviour and durability." XX congres mondial de la route</li> <li>✓ M. Luminari, G Bastianelli: "Articolo 15 - Lastra in calcestruzzo ad armatura continua per interventi di rafforzamento limitati ad una o più' corsie di una carreggiata autostradale", aggiornamento 1998 delle Norme Tecniche d'Appalto Autostrade S.p.A. ed. 1995.), rapporto interno Autostrade S.p.A./DG/MSM/CRD, novembre 1997;</li> </ul> | II                  |                             |



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| <b>ITALY</b>  |                        |  |  |   |   |                     |                             |
| 12            | E, F, J                | <p><b>UDB System</b><br/>The UDB system draws on sunlight, using a reflecting technology installed outside of the tunnel, in order to channel sunlight from the tunnel entry to the corresponding inside, in order to create visibility conditions which can be equal to those on the outside.</p> <p>The economic advantages can be generated by energy and operating savings, as well as for the positive environmental and social side-effects.</p> <p>In fact this system approach has a positive effect on the psycho-physical condition of the driver and on driving performance, eliminating the trauma of going from full daylight into the darkness of the tunnel</p> | <ul style="list-style-type: none"> <li>v Tunnel,</li> <li>v safety,</li> <li>v solar energy,</li> <li>v energy saving,</li> <li>v tunnel,</li> <li>v software</li> </ul> | <ul style="list-style-type: none"> <li>v Gabriele Camomilla<br/>0039-06-43632583tel/tel-43634712/fax,<br/><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</li> <li>v Marcello Luminari,<br/>Autostrade per l'Italia,<br/>0039-06-43632845tel/64telfax,<br/><a href="mailto:mluminari@autostrade.it">mluminari@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</li> </ul> | <ul style="list-style-type: none"> <li>v M. Battaglia, E. Barlocco:<br/>“Le gallerie solari della Torino-Savona,<br/>Autostrade Magazine,<br/>Aprile, 2002</li> <li>v M.Battaglia: “La luce si specchia nelle gallerie”,<br/>Rivista degli Ingegneri della Liguria, 05/06/2001</li> </ul> | VII                 | 2000                        |



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| <b>ITALY</b>  |                        |  |   |   |                                      |                     |                             |
| 13            | E, F, J                | <p><b>SICURMORE anti-noise and safety restrain system.</b></p> <p>An innovative system that integrates containment and anti-noise components/capacities in a single barrier. Thanks to this system the space is spared which would otherwise be needed for separate safety and anti-noise barriers, thereby enhancing the efficiency of the lateral carriageway/lane space.. This system, which also includes a mechanism to prevent the panels from falling, increases anti-noise performance (i.e. height reduction) and makes significant cost reductions (i.e. installation costs). This road restraint system has been installed on sites in suburban expressways and extra-urban motorways for lateral and bridge/viaduct applications (barrier class H2, H3 and H4 for containment levels of respectively 288, 485 and 743 KJ).</p> | <ul style="list-style-type: none"> <li>v Environment,</li> <li>v Antinoise &amp; Safety restraint systems,</li> </ul> | <p>Gabriele Camomilla<br/>0039-06-43632583tel/tel-43634712/fax,<br/><a href="mailto:gcamomilla@autostrade.it">gcamomilla@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Stefano Bruschi<br/>0039-06-43632532tel/tel/2559fax,<br/><a href="mailto:sbruschi@autostrada.it">sbruschi@autostrada.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> <p>Enzo D'Andrea<br/>Autostrade per l'Italia,<br/>0039-06-43632533tel/2559fax,<br/><a href="mailto:enzo.dandrea@autostrade.it">enzo.dandrea@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> | To be publish on Autostrade Magazine | VI                  | 2004                        |



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| <b>ITALY</b>  |                        |   |   |   |   |                     |                             |
| 14            | H, I, J                | <p><b>Electronic toll collection (ETC)</b></p> <p>1. THE FREE FLOW<br/>Electronic system without canalisation (multi lane). The toll collection is performed through:</p> <ul style="list-style-type: none"> <li>✓ the installation on every vehicle of an On-Board Unit (OBU)</li> <li>✓ the roadside infrastructure (antenna, loops, laser camera, control system, illuminator, OCR)</li> </ul> <p>The portals for the toll collection are not positioned to the entry and the exit of every road section, but along the motorway route.</p> <p>2. THE APPLICATIONS IN URBAN AREA (LIMITED TRAFFIC ZONES) ACCESS CONTROL SYSTEM<br/>The Telepass System, based on the radio communication, is used to facilitate the management of the traffic in urban circle (Italian acronym ZTL which means Limited Traffic Zone) and, in general, in areas and situations where the punctual control of the vehicles is required such as parking, industrial areas, harbours, transport terminals.</p> | Telepass, Electronic Toll Collection, Access Control, Multilane Security, | Giuliano Trenta<br>Autostrade per l'Italia S.p.A.<br>Tel. +39 06 43632038<br>Email: <a href="mailto:gtrenta@autostrade.it">gtrenta@autostrade.it</a><br>Via A. Bergamini 50, I-00159 Roma | Proceedings of International congresses | (1) IV,<br>(2) VII  | (2) 2001                    |



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| <b>ITALY</b>  |                        |  |                        |  |   |                     |                             |
| 15            | H, I, J                | <p><b>Traffic monitoring and travel time</b></p> <p>1. AUTOTRAF<br/>Real time calculation of travel time require, in addition to the "classic" traffic sensors, the "Telepass" technology to detect the transits of vehicles equipped with a Telepass OBU along the route at consecutive road sections and, therefore, to calculate travel time and determine the overall traffic status on the motorway network (Telepass is the Italian standard for electronic toll collection; currently, around 4.000.000 vehicles are equipped with activated Telepass on board units, that ensures a reliable travel time calculation at all times). If the calculated travel time is higher than a pre-defined threshold, an alert is automatically provided to the operators.</p> <p>2. S.I.C.VE.<br/>The "Speed Control Information System ", allows to detect both the punctual and the average speed among two road or motorway sections without any on board equipment but simply through an innovative detection system (enforcement) that allows to monitor (control) the overcoming of the speed limit in relation to the class of the vehicle.<br/>This system, currently installed in experimental phase on the A11, induces a behaviour of respect of the speed limits on long road section and not only on points as today it happens for the traditional autovelox, with the positive consequence in safety terms.<br/>It deals with the first homologation in Italy for a system of telecontrol of the speed .</p> | Speed control, Safety, | <p>Giuliano Trenta<br/>Autostrade per l'Italia S.p.A.<br/>Tel. +39 06 43632038<br/>Email: <a href="mailto:gtrenta@autostrade.it">gtrenta@autostrade.it</a><br/>Via A. Bergamini 50, I-00159 Roma</p> | <p>Piero Bergamini<br/>ITS in Europe - Budapest,<br/>24-26 May 2004</p> | VII, VII            | 2003                        |



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| <b>ITALY</b>  |                        |   |          |   |                |                     |                             |
| 16            | H, I, J                | <p><b>Road accident survey (location detection)</b></p> <p>This system permits to increase the motorway safety level by decreasing the time of the data collection so to remove the vehicles and replacing the traditional manual methodology. This system permits the metric survey of the accident location through the digital pictures without ground measurement, thanks to the geometric representation as a back office activity.</p> <p>The system is an open system which must be integrated with other road safety systems having an high measurement precision deriving from the high quality optical used. The system has two macro components:</p> <ol style="list-style-type: none"> <li>1. the metric collection kit (digital picture camera, reference calibrated device and reference cone;</li> <li>2. management system utilising a PC with original software and integrating a cartography engine with a geographical investigation utility.</li> </ol> <p>The system is able also to collect data on a large area interested by:</p> <ul style="list-style-type: none"> <li>✓ speedily and simply use (three different users profilers)</li> <li>✓ measurement precision (high quality and certified opticals)</li> <li>✓ data security ( digital picture camera permitting the non rewritable recording)</li> <li>✓ data repeatability</li> </ul> | Safety,  | Giuliano Trenta<br>Autostrade per l'Italia S.p.A.<br>Tel. +39 06 43632038<br>Email: <a href="mailto:gtrenta@autostrade.it">gtrenta@autostrade.it</a><br>Via A. Bergamini 50, I-00159 Roma | No             | II                  | -                           |



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| <b>AUSTRIA</b> |                        |  |  |   |   |                     |                             |
| <b>1</b>       | A,C                    | Performance Based Testing of Bituminous Materials for high trafficked Road Pavements, Prediction of permanent deformation, fatigue and low temperature behaviour of flexible road pavements by means of fundamental material tests | Fundamental Asphalt Tests, Triaxial Testing, Fatigue Testing, Low Temperature Testing  | Ronald Blab, ISTU Vienna<br><a href="mailto:rblab@istu.tuwien.ac.at">rblab@istu.tuwien.ac.at</a>  | Several publications, see homepage:<br><a href="http://www.istulab.tuwien.ac.at">www.istulab.tuwien.ac.at</a> | II                  | 2005                        |
| <b>2</b>       | C, D                   | Development of a noise reducing StoneMastixAsphalt by use of rubber modified bitumen from car tire recycling   | Rubber modified asphalt, noise reducing road surface   | Ronald Blab, ISTU Vienna<br><a href="mailto:rblab@istu.tuwien.ac.at">rblab@istu.tuwien.ac.at</a><br><br>Thomas Schinkinger, Asamer Holding, Ohlsdorf, Upper Austria<br><a href="mailto:t.schinkinger@asamer.at">t.schinkinger@asamer.at</a> | Unpublished report for Asamer Holding   | II                  | 2005                        |
| <b>3</b>       | B                      | White Topping of high trafficked urban areas, reconstruction of rutted asphalt pavements with thin layers of 8 – 12 cm thick concrete layers of high performing concrete   | White Topping,   | Ronald Blab, ISTU Vienna<br><a href="mailto:rblab@istu.tuwien.ac.at">rblab@istu.tuwien.ac.at</a><br><br>Johannes Steigenberger, VÖZI, Reisnerstraße, Vienna<br><a href="mailto:Steigenberger@voezfi.at">Steigenberger@voezfi.at</a>         | Unpublished report for VÖZI   | IV                  | 2005                        |
| <b>4</b>       | D, F                   | Austrian measurements on noise reducing pavements (in connection with EU- Project SILVIA) and test section of noise reducing pavements on A12 motorway   | Porous asphalt, twin layer porous asphalt, noise reducing stone mastic asphalt, exposed aggregate concrete, concrete surface treatment | Johann Litzka, ISTU Vienna<br><a href="mailto:jlitzka@istu.tuwien.ac.at">jlitzka@istu.tuwien.ac.at</a><br><br>Jürgen Haberl, ISTU Vienna<br><a href="mailto:jhaberl@istu.tuwien.ac.at">jhaberl@istu.tuwien.ac.at</a>                        | Unpublished report, Research concept  | II                  | 2005                        |



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| <b>BULGARIA</b> |                        |  |   |   |   |                     |                             |
| <b>1</b>        | A, C                   | <b>High modulus asphalt mixtures</b> – The purpose of this project is the implementation of high modulus asphalt mixtures in Bulgaria with high bearing capacity and creep resistance. It's foreseen to construct trial sections on heavy loaded roads; to measure bearing capacity with FWD; to study (in laboratory) high modulus asphalt mixtures properties for pavement design. | Modified bitumen<br>High modulus asphalt mixtures pavements | Eng. Vesela Filipova<br>Eng. Lazar Lazarov<br>CRBL<br>Tel. 359 2 945 07 54<br>e-mail: crbl@ttm.bg | High modulus asphalt mixtures - Roads 3/99<br>Assessment of effect from using polymer modified bitumen on the behaviour of asphalt mixtures in laboratory conditions – Roads 5/2002 | II                  |                             |
| <b>2</b>        | A, C, F                | <b>Asphalt mixtures with crumb rubber</b> – The purpose of this project is to assess the possibility of using crumb rubber in traditional asphalt mixtures. Trial sections will be constructed and executed laboratory tests for asphalt mixtures modified with crumb rubber and without to find out the appropriate application.  | Asphalt mixtures<br>Crumb rubber                            | Eng. Vesela Filipova<br>CRBL<br>Tel. 359 2 945 07 54<br>e-mail: crbl@ttm.bg                       | Too early   | I                   |                             |



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| <b>BULGARIA</b> |                        |   |   |  |   |                     |                             |
| <b>3</b>        | A, C                   | <b>Performance based specification for asphalt mixtures</b> – The specifications for asphalt mixtures in Bulgaria are based on empirical properties. The performance of pavement constructions is not assessed. The purpose of this project is to specify requirements for performance based properties.  | Performance based properties of asphalt mixtures  | Eng. Vesela Filipova<br>CRBL<br>Tel. 359 2 945 07 54<br>e-mail: crbl@ttm.bg          | Assessment of effect from using polymer modified bitumen on the behaviour of asphalt mixtures in laboratory conditions – Roads 5/2002 | II                  |                             |
| <b>4</b>        | J                      | <b>Public Perceptibility of Road Marking Visibility</b><br>The main task is establishment of the threshold values for road marking visibility to improve road safety and create a data base for road marking maintenance management - by climate factors estimation; trial sections (different traffic volume and types of markings); characteristics of markings measurement; visibility assessment by drivers of different type of cars and ages; | Road safety<br>Road marking visibility thresholds | Dafina Pangarova<br>CRBL<br>Tel. +359 2 945 07 54<br>e-mail: crbl@ttm.bg             |   | I                   |                             |



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| <b>BULGARIA</b> |                        |  |  |  |                |                     |                             |
| <b>5</b>        | H                      | <b>WeBRIS</b> (Web Based Road Information Services) The project aims to create real open model of cross-border transport corridors information services. The public data will be used in real time and via Internet by the commercial sector and officials in Europe, and the public at large (insurance companies, tourists, haulage companies, etc.)   | Spatial analysis, traffic, telematics, road facilities, web user interface                 | Eng. Todor Anastassov<br>CRBL<br>Tel. +359 2 847 12 47<br>e-mail: crbl@ttm.bg        | Too early      | I                   |                             |
| <b>6</b>        | C                      | <b>Investigation of the influence of the bitumen generic composition on the asphalt mixtures performance</b><br>In order to establish new quality requirements, different rheological types of binders will be investigated, results of binder aging in laboratory and in-situ will be compared and analysed. Bitumen generic composition properties and binder aging correlations will be obtained. | bitumen generic composition properties – binder aging correlations durability, performance | Dafina Pangarova<br>CRBL<br>Tel. +359 2 945 07 54<br>e-mail: crbl@ttm.bg             |                | I                   |                             |



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| <b>BULGARIA</b> |                        |   |   |  |  |                     |                             |
| <b>7</b>        | B, C                   | <p><b>Stabilization of low bearing capacity soils using polymer chemical and mechanical additives</b></p> <p>The purpose of this project is to study the influence of different chemical additives and poly-propylene fibres on low bearing capacity soils aiming their implementation in road construction. Extended laboratory research is foreseen to study the performance of the stabilisers. Working out of recommended compositions for the road practice.</p> | Soils stabilization, Chemical additives, Poly-propylene fibres Consolid, Perma Zyme 22X | Eng. Albena Radeva<br>CRBL<br>Tel.: + 359 2 847 59 01<br>E-mail: crbl@ttm.bg         | Investigation of chemical and mechanical additives (fibres) for stabilization of low bearing capacity soils – Magazine “Roads”, 3/1999 | I                   |                             |
| <b>8</b>        | B, C                   | <p><b>Construction and investigation of soil stabilized trial sections</b></p> <p>The purpose of this project is to check the performance in-situ (in Bulgaria). Road trial sections for observation and measurements with recommended compositions will be constructed on different road classes using new for our country technologies. Summary of the results and proposal for the most appropriate technology to be used in practice.</p>                         | Trial section, Stabilized soil, Polymer material  | Eng. Albena Radeva<br>CRBL<br>Tel.: + 359 2 847 59 01<br>E-mail: crbl@ttm.bg         |  | I                   |                             |



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| <b>BULGARIA</b> |                        |  |  |  |                |                     |                             |
| <b>9</b>        | B, C                   | <p><b>Mechanical stabilisation of soils for embankments and road base pavements construction</b></p> <p>The purpose of this project is to find out a way to improve the properties of soil types A-4, 5,6 &amp; 7 acc. to AASHTO 145 adding local and waste materials (as gravel, quarry wastes and reclaimed asphalt material). Extended laboratory research. Practical implementation.</p> | Soils mechanical stabilization, Local and Waste materials,                           | Eng. Albena Radeva<br>CRBL<br>Tel.: + 359 2 847 59 01<br>E-mail: crbl@ttm.bg         |                | I                   |                             |
| <b>10</b>       | A, C                   | <p><b>Implementation of new types asphalt mixtures</b></p> <p>The purpose of this project is the implementation of noise reducing porous asphalt layers in Bulgaria. It's foreseen to conduct laboratory tests to specify appropriate receipts and determine their performance based characteristics. Trial sections have to be constructed to observe their performance in pavements.</p>   | noise reducing asphalt layers<br>porous asphalt<br>performance based characteristics | Eng. Veselin Dimitrov<br>CRBL<br>Tel. 359 2 945 07 54<br>e-mail: crbl@ttm.bg         | Too early      | II                  |                             |



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| <b>BULGARIA</b> |                        |   |   |  |                |                     |                             |
| <b>11</b>       | D, E                   | <b>Spatial analysis and visualization of road pavements characteristics.</b> Design and modelling of road geo-data base as part of Geographic information system (GIS) implementation at CRBL. Thematic maps as a result of spatial analysis will be used to visualize road surface characteristics, traffic data, black spots, etc.  | road geo-data base, GIS analysis, thematic maps             | Eng. Marieta Pandilova<br>CRBL<br>Tel. +359 2 847 12 47<br>e-mail: crbl@ttm.bg       | Too early      | IV                  |                             |
| <b>12</b>       | B, K                   | <b>Working out of Methodology for processing and analysis of the information, obtained by GPR SIR-10H, based on NDT surveys of road constructions – at first in Bulgaria to use this NDT type for surveys, monitoring of road layers, localization of buried pies, cables, voids, etc. Preparing Data Base for the PMS, aiming to spend resources for roads construction, management &amp; maintenance.</b> | NDT Surveys;<br>GPR system SIR-10H;<br>Software processing; | Eng. Vladimir Tomov<br>CRBL<br>Tel.: + 359 2 847 59 01<br>E-mail: crbl@ttm.bg        | Too early      | II                  |                             |



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| <b>BULGARIA</b> |                        |   |   |  |                |                     |                             |
| <b>13</b>       | C, K                   | <b>Investigation of stone-pits quarries for roads construction in Bulgaria</b><br>Investigation of quarries – sampling; laboratory tests; data analysis & systematization; Preparing an Information Data Bank with the recommended materials suitable to be implemented in exactly road layer | Quarries; Stone-pits materials; New road constructions decision making facilitation; Information Data Bank; | Eng. Vladimir Uzunov<br>CRBL<br>Tel.: + 359 2 847 59 01<br>E-mail: crbl@ttm.bg       | Too early      | I                   |                             |



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| <b>COST ACTIONS</b> |                        |  |  |   |   |                     |                             |
| <b>1</b>            | B                      | COST 348: REINFORCEMENT OF PAVEMENTS WITH STEEL MESHES AND GEOSYNTHETICS<br>reinforcement applied not only to unbound but also to bound layers   | reinforcement, steel meshes, geosynthetics, glass grid | Hans RATHMAYER<br>VTT - Technical Research Center of Finland, Building and Transport<br>P.O. Box 19031, FIN-02044 VTT, Finland<br>Tel: +358 9 456 4681<br>Hans.Rathmayer@vtt.fi | <a href="http://cost348.zag.si">http://cost348.zag.si</a>   | II                  | January 2002                |
| <b>2</b>            | M                      | COST 344: IMPROVEMENTS TO SNOW AND ICE CONTROL ON EUROPEAN ROADS<br>guidelines for improving winter maintenance and measures, lowering operational costs and reducing adverse effects on highway infrastructure and the environment. | winter maintenance, winter measures                    | Chairman: Mrs. Marilyn Burtwell<br>Transport Research Laboratory, UK<br>Fax: +44 1 344 77 0748<br>mburtwell@trl.co.uk   | <a href="http://www.cordis.lu/cost-transport/src/cost-344.htm">http://www.cordis.lu/cost-transport/src/cost-344.htm</a> | III                 | April 2002                  |



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